

## SOUTH COAST LANDFILL FINAL CLOSURE - ROWD UPDATES

### SOUTH COAST LANDFILL (SWIS NO. 23-AA-0018)

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The below is a listing of known updates to the South Coast Landfill (SCLF) ROWD documents dated December 2016.

- June 1, 2017: In response to comments of Phil Chou, Mendocino County Environmental Health. ROWD Volumes 1 & 2.
- August 14, 2017: In response to comments of Terri Cia, NCRWQCB. ROWD Volume 1, Water Board Table 3
- January 18, 2019: In response to comments by Alex Straessle, MCDOT. ROWD Volume 2, Section 7 (Engineers Stamp was outdated)
- January 2019: In response to comments by Alex Straessle, MCDOT. Updated Plans.
  - ROWD Volume I- No substantial changes.
  - ROWD Volume II- Drawings and Plans dated 11-2016 are superseded by Plans dated 01-2019
- June 2019: In response to comments by Alex Straessle, MCDOT. Technical Specifications for construction polished up and updated with new plans dated January 2019 and Closure Turf Specifications dated December 2018.
  - ROWD Volume I- No substantial changes.
- June 2019: General- Engineers Cost Estimate updated
  - ROWD Volume II- Updates Table 4. South Coast Landfill Final Closure Construction Engineering Cost Opinion

Phil Chou  
County of Mendocino  
Public Health Department  
Division of Environmental Health  
860 N. Bush Street  
Ukiah, CA 95482

DATE: June 1, 2017

**RE: SOUTH COAST LANDFILL (23-AA-0018)  
RESPONSE TO LEA COMMENTS  
FINAL CLOSURE AND POST CLOSURE PLANS REVIEW (DATED DECEMBER 2016)**

Dear Mr. Chou:

On behalf of Mendocino County Department of Transportation, SWT Engineering (SWT) hereby electronically (i.e., PDF) submits replacement pages for the Final Closure/Post-Closure Maintenance Plan (FCPCMP) (dated December 2016) for the South Coast Landfill. The revisions were made to address the comment letter (dated April 11, 2017) from the County of Mendocino Division of Environmental Health, acting as the Local Enforcement Agency (LEA). Response to the LEA's comments are included as Attachment 1. In addition the Replacement Page Instruction Table is attached as part of this submittal, with reference to Final Format pages to identify the pages to be removed and replaced within the FCPCMP.

The following items have been revised to address the LEA's comments noted above.

- ◆ Revised Text (Pages 1-3 and 5-3 of the FCPCMP)
- ◆ Revised PDF (Section 2-1, Page 3 within Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012])

In addition, the "Track Changes" version (i.e., red strikethrough and underline) of the FCPCMP is also included so you can easily identify the amended language.

Should you need hard copy of this submittal or have any questions, please do not hesitate to contact me at (909) 390-1328 or by email at mac@swteng.com.

Respectfully Submitted,



Michael A. Cullinane, P.E.  
Principal

cc: Howard Dashiell, Director - County of Mendocino, Department of Transportation  
Geoffrey Brunet, County of Mendocino, Department of Transportation  
Andy Marino, CalRecycle, Closure and Technical Support Section  
Terri Cia, Engineering Geologist, North Coast Regional Water Quality Control Board

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**SOUTH COAST LANDFILL  
REPLACEMENT PAGE INSTRUCTIONS TABLE**

South Coast Landfill  
Final Closure/Post-Closure Maintenance Plan (FCPCMP)  
Response to LEA Comment Letter (April 11, 2017)  
Replacement Page Instructions Table

Remove/Discard	Insert Item Description	Insert/Replacement
<b>Volume I</b>		
Remove pages 1-3 and 5-3 of Volume I FCPCMP	Insert revised pages 1-3 and 5-3 of Volume I FCPCMP	Remove previous pages 1-3 and 5-3 of Volume I FCPCMP and replace with revised pages 1-3 and 5-3 of Volume I FCPCMP provided.
<b>Volume II</b>		
Remove page 3 of Volume II Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012])	Insert revised page 3 of Volume II Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012])	Remove previous page 3 of Volume II Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012]) and replace with revised page 3 of Volume II Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012]) provided.

Note: This submittal includes "Track Changes" version of revised text pages for readers to identify changes.



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**ATTACHMENT 1**

**RESPONSE TO COUNTY OF MENDOCINO**  
**DIVISION OF ENVIRONMENTAL HEALTH COMMENTS**

**MENDOCINO COUNTY  
DIVISION OF ENVIRONMENTAL HEALTH  
COMMENTS (LETTER DATED APRIL 11, 2017)  
SOUTH COAST LANDFILL (36-AA-0057)  
2016 SOUTH COAST LANDFILL FINAL CLOSURE AND POST CLOSURE PLANS REVIEW**

**Comment 1:**

The LEA agrees with CalRecycle's determination that the passive gas system would have the capability to be converted to an active system should an active system is needed in the future. On January 2017 the operator submitted a Gas Remediation Plan to satisfy gas violation 27 CCR 29037 of the current Compliance Schedule.

**Response:** Your comment has been duly noted.

**Comment 2: Various names and phone numbers are outdated**

**2a:** Operator should verify that all emergency/contact information is up to date. Examples can be found in Volume I, section 5-3 the office of Environmental Health is now (707) 234-6625, and

**2b:** Volume II, section 2-1 landfill operator is not current.

**2a Response:** Volume I, Section 5.4.1 of the Final Closure/Post-Closure Maintenance Plan has been revised to provide the requested clarification. Operator has verified all other contact information is correct and accurate.

**2b Response:** Volume I, Section 1.3.2 and Volume II, Section 2-1, Page 3 within Appendix E (Geotechnical Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the Final Cover System [GLA, November 2012]) of the Final Closure/Post-Closure Maintenance Plan has been revised to provide the requested clarification.

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**SOUTH COAST LANDFILL  
FINAL CLOSURE/POST-CLOSURE MAINTENANCE PLAN (FCPCMP)  
(DATED DECEMBER, 2016)  
FINAL FORMAT**

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**VOLUME I**  
**FINAL FORMAT PAGES**

groundwater is interpreted to flow from the northeast to the southwest at a hydraulic gradient of approximately 0.08 ft/ft. However, this pattern is expected to be locally interrupted by well-developed shears within the gouge zone matrix with resultant anisotropic flow directed in a more southerly direction (GLA, 2003).

### **1.3 Facility Information**

#### **1.3.1 Historic Background**

The SCL is a Class III solid waste disposal facility. The DOT began landfill operations in 1970. The SCL ceased landfill operations in 2000. The SCL is owned and was operated by the DOT. The SCL served the residents of Mendocino County South Coast Area, which is the State Route 1 corridor from the Sonoma County Line to the Navarro River. This area includes the towns of Elk, Irish Beach, Manchester, Point Arena and Gualala. The landfill was constructed in a shallow ravine, using the area fill method to place, compact and cover refuse on a daily basis.

The site operated in accordance with State Minimum Standards for a Class III disposal facility as established by the State Water Resources Control Board (SWRCB) and CalRecycle. The site accepted mixed municipal refuse, classified nonhazardous solid waste and inert waste as defined in the 27 CCR, Sections 20220 and 20230. No liquid or hazardous waste was knowingly accepted at the site. Wastes at the landfill generally consisted of municipal refuse including residential refuse (90 percent), commercial refuse (5 percent), and demolition refuse (5 percent) (SWD, 1996).

#### **1.3.2 Responsible Parties**

The following is a listing of the responsible party who will be involved in post-closure maintenance and monitoring activities at the SCL.

##### Landfill Owner/Operator

County of Mendocino Department of Transportation  
340 Lake Mendocino Drive  
Ukiah, CA 95482  
(707) 463-4363

The DOT Site Representative (i.e., third party representative) will be responsible for the overall monitoring/maintenance of the SCL. Should the title to the site be transferred during closure and/or post-closure maintenance, the new owner shall be notified by the previous owner or his agent of the existence of the 27 CCR standards and of the conditions and agreements assigned to assure compliance. In accordance with 27 CCR, Section 21200, the previous owner shall notify the LEA of the change in writing within 30 days and shall provide the name, firm, mailing address and telephone number of the new owner.

### 5.4.1 Fire and/or Explosions

The following procedures will be followed during incidents of fire and/or explosions:

- ◆ Contact the South Coast Fire Protection District, even if on-site capabilities are deemed adequate to extinguish fires or control future explosions. On-site personnel will be instructed to follow the fire department's directions and give their full cooperation.
- ◆ In the event of an off-site fire near the landfill, such as a forest fire, the operator will lend its personnel and equipment, if available, to the South Coast Fire Protection District to fight the fire.
- ◆ The fire will be extinguished and the effects of the fire or explosion will be mitigated.

The following are the general telephone numbers for emergency response agencies:

- |   |                |
|---|----------------|
| ◆ South Coast Fire Protection District                | (707) 884-4700 |
| ◆ California Department of Forestry, Howard Forest    | (707) 459-7408 |
| ◆ Pacific Gas & Electric (24-Hour Emergency)          | (800) 743-5000 |
| ◆ Pacific Gas & Electric (24-Hour Electrical Outages) | (800) 743-5002 |
| ◆ Sheriff   | (707) 463-4086 |
| ◆ Mendocino County Animal Control (contact Sheriff)   | (707) 463-4086 |
| ◆ Office of Emergency Services (Spills)               | (800) 852-7550 |
| ◆ Mendocino County Department of Transportation       | (707) 463-4363 |
| ◆ Mendocino County Environmental Health               | (707) 234-6625 |

### 5.4.2 Flood

If the site's existing stormwater system is inadequate in diverting flood waters away from the site, the following procedures will be followed:

- ◆ Additional berms may be constructed in areas prone to flooding.
- ◆ If additional berms are ineffective, the operator may cut a diversion channel to avoid inundation of the refuse cell.
- ◆ Sandbags may be used in conjunction with berms or diversion channels.
- ◆ If the emergency is due to a flood that is from a 100-year/24-hour storm event or less, this is an indication that the drainage and flood protection design for the facility may be inadequate. A design review shall be performed and, if appropriate, all necessary modifications to drainage and flood protection facilities will be made.

### 5.4.3 Earthquake

The following procedures will be performed following an earthquake incident:

- ◆ Employees driving in the field during an earthquake should stop their vehicle and get out, if it can be done in a safe manner.
- ◆ After the earthquake has subsided, site personnel shall report to the site entrance gate. If medical care is required, the procedures in Section 5.7 shall be followed. An inspection of the site shall then be made and a report given to the SE.

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**VOLUME II**  
**FINAL FORMAT PAGES**

- A 60-mil thick Super Gripnet linear low-density polyethylene (LLDPE) geomembrane liner overlying the foundation layer and serving as the low-permeability barrier layer for the final cover system.
- A 12-ounce per square yard non-woven geotextile placed as a separator between the geomembrane and overlying cover soils.
- A two (2) foot thick protective soil cover layer placed on deck and slope areas. The protective soil cover will be composed of select materials derived from the on-site borrow source.

All materials used to construct the final cover system must meet or exceed the criteria established for each particular component of the system as indicated on the Project Plans and Specifications. Any deviation from the Specifications must be pre-approved by the Engineer under procedures set forth in the changes clause of the General Conditions.

## **2.0 RESPONSIBLE PARTIES AND DEFINITIONS**

### **2.1 RESPONSIBLE PARTIES**

The responsible parties for all South Coast Landfill final cover construction activities, as set forth herein, are as follows:

Landfill Owner/Operator:

County of Mendocino

Department of Transportation

340 Lake Mendocino Drive

Ukiah, California 95482

Phone: (707) 463-4363

Contact: Mr. Howard Dashiell, Director Dept. of Transportation

Landfill Engineer:

SWT Engineering

800-C South Rochester Avenue

Ontario, California 91761

Phone: (909) 390-1328

Contact: Mr. Michael Cullinane

Construction Quality Assurance (CQA) Consultant:

To be Determined



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**SOUTH COAST LANDFILL  
FINAL CLOSURE/POST-CLOSURE MAINTENANCE PLAN (FCPCMP)  
(DATED DECEMBER, 2016)  
TRACK CHANGES (RED STRIKETHROUGH AND UNDERLINE)**

groundwater is interpreted to flow from the northeast to the southwest at a hydraulic gradient of approximately 0.08 ft/ft. However, this pattern is expected to be locally interrupted by well-developed shears within the gouge zone matrix with resultant anisotropic flow directed in a more southerly direction (GLA, 2003).

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~~Solid Waste Division~~

340 Lake Mendocino Drive

Ukiah, CA 95482

(707) 463-~~40784363~~

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| ◆ Pacific Gas & Electric (24-Hour Electrical Outages) | (800) 743-5002                              |
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| ◆ Office of Emergency Services (Spills)               | (800) 852-7550                              |
| ◆ Mendocino County Department of Transportation       | (707) 463-4363                              |
| ◆ Mendocino County Environmental Health               | (707) <del>463234-</del><br><u>44666625</u> |

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## TRANSMITTAL

**TO:** Amber Muñoz  
County of Mendocino  
Department of Transportation  
340 Lake Mendocino Drive  
Ukiah, CA 95482

**DATE:** August 14, 2017

**SUBJECT:** SOUTH COAST LANDFILL (SWIS NO. 23-AA-0018)  
STATE WATER RESOURCE CONTROL BOARD (SWRCB) INDEX

**HEREWITH PLEASE FIND THE FOLLOWING:**

- ◆ Updated Table of Contents (TOC) (pages ii & iii) for Report of Waste Discharge (ROWD) (dated, December 2016) Volume I.
- ◆ New table, SWRCB Index (ROWD Table 3)

**TRANSMITTED VIA:** ☐ Email ☐ Fax ☐ Hand Deliver ☒ Mail ☒ Overnight

**COMMENTS:** At the request of Terri Cia, from the North Coast Regional Water Quality Control Board (RWQCB), the attached SWRCB Index (Table 3) and updated TOC (pages ii & iii) for the South Coast Landfill (SCL) 2016 ROWD have been prepared.

Please feel free to disseminate these attachments as you deem appropriate.

If you should have any questions regarding these items, please advise.

Respectfully submitted,



Michael A. Cullinane, P.E.

c: Lori Olin, SWT Engineering  
Aaron Garcia, SWT Engineering

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**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
<b>Chapter 1. General</b>			
Article 1. Purpose, Scope and Applicability of this Subdivision			
'20080. General Requirements. [engineered alternatives to prescriptive standards]	20080(b-c)		Sec. 3.2.1.3, 3.3.1
<b>Chapter 3. Criteria for All Waste Management Units, Facilities, and Disposal Sites **</b>			
Subchapter 2. Siting and Design **			
Article 2. SWRCB - Waste Classification and Management **			
'20200. SWRCB - Applicability and Classification Criteria.			
Concept (& describes possible exemption)	20200(a)		Sec 1.4
Demonstration proposing to allow discharge of a particular waste to a particular landfill of lower classification	20200(a)(1)		If proposed: N/A to SCL.
Dedicated units/cells for certain wastes	20200(b)-(b)(2)(C)		If proposed: N/A to SCL
Waste characterization	20200(c)		Sec 1.5
Management of liquids	20200(d)-(d)(3)		Sec 1.5
'20220. Nonhazardous Solid Waste.			Sec 1.5
Demonstration by discharger	20220(b)-(b)(2)		Sec 1.5
Dewatered sludge (describes conditions for discharge)	20220(c)-(c)(3)		If sludge: N/A to SCL.
Ash (allows discharge of non-hazardous ash to Class III landfills w/o determining if ash is designated waste)	20220(d)		If ash: N/A to SCL
Article 3. Waste Management Unit, Facility, or Disposal Site Classification and Siting **			
'20240. Classification and Siting Criteria.	20240		Sec 1.0, 3.1.1, 3.1.3, 3.4, Fig 2, App A - FCPCMP
'20250. Class II: Waste Management Units for Designated Waste.	20250		If Class II: N/A to SCL.
'20260. Class III: Landfills for Nonhazardous Solid Waste.	20260		Sec 1.4
Article 4. SWRCB - Waste Management Unit Construction Standards **			
'20310. General Construction Criteria.	20310		Sec 3.1

Note: Section, Tables, Figures, or Appendix references which follow Final Closure/Post-Closure Maintenance Plan (FCPCMP) are included in FCPCMP document. All other references to Section, Tables, Figures, or Appendix are in ROWD.

**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
'20320. General Criteria for Containment Structures.	20320		Sec 3.1
'20323 & '20324. CQA Plan & Requirements	20323 & 20324		FCPCMP - Sec 3.6
'20330. Liners.	20330		N/A to SCL.
'20340. Leachate Collection and Removal Systems (LCRS).	20340		Sec 3.1.4
'20360. Subsurface Barriers.	20360		If proposed: N/A to SCL.
'20365. Precipitation and Drainage Controls.	20365		Sec 3.2.1
'20370. Seismic Design.	20370		App. A – FCPCMP, App J.
'20375. Special Requirements for Surface Impoundments.	20375		If LF facility has SI: N/A to SCL.
<b>Subchapter 3. Water Monitoring **</b> <b>Article 1. SWRCB - Water Quality Monitoring and Response Programs for Solid Waste Management Units **</b> <b>'20380. SWRCB - Applicability.</b>			
Corrective action financial assurance	20380(b)		FCPCMP - Sec 6.7
Duration of applicability	20380(c)-(c)(2)	21900	
Limitations on engineered alternatives	20380(e)-(e)(3)		Sec. 3.3.1
'20385. Required Programs.	20385		WDR/M&RP in App. C.
'20390. Water Quality Protection Standard (Water Standard).	20390		WDR/M&RP in App. C.
<b>'20395. Constituents of Concern (COCs).</b>			
COCs	20395(a)		WDR/M&RP in App. C.
MSW COCs	20395(b)		WDR/M&RP in App. C.
<b>'20400. Concentration Limits.</b>			
Proposing	20400(a)-(a)(3)		WDR/M&RP in App. C.
Adoption of concentration limits	20400(b)-(b)(3)		WDR/M&RP in App. C.
Establishing a CLGB (for corrective action only)	20400(c-h)		N/A to SCL
Decreasing a CLGB (in DMP following a CAP)	20400(i)		N/A to SCL
'20405. Monitoring Points and the Point of Compliance.	20405(a-b)		Sec 2.3, WDR/M&RP in App. C.

Note: Section, Tables, Figures, or Appendix references which follow Final Closure/Post-Closure Maintenance Plan (FCPCMP) are included in FCPCMP document. All other references to Section, Tables, Figures, or Appendix are in ROWD.



**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
'20410. Compliance Period.	20410(a-c)		Sec 2.3, WDR/M&RP in App. C.
'20415. General Water Quality Monitoring and System Requirements.			
Section applies to all monitoring programs	20415(a)		Sec 2.3, 2.5, 2.6, WDR/M&RP in App. C.
G.W. Mon. System (general)	20415(b)-(b)(4)(D)		Sec 2.3, 2.5, 2.6, WDR/M&RP in App. C.
Sfc. Water Mon. (general)	20415(c)-(c)(2)(D)		Sec 2.3.4, WDR/M&RP in App. C.
U.Z. Mon. (general)	20415(d)-(d)(4)		N/A to SCL
Mon. systems designed by RG or RCE	20415(e)(1)		Sec 2.3
Logging of borings	20415(e)(2)-(e)(2)(C)		FCPCMP – App C
Shared monitoring system demonstration for contiguous Units	20415(e)(3)		N/A to SCL
Monitoring sample QA/QC	20415(e)(4)-(e)(4)(D)		FCPCMP – Sec 2.3
Sampling & analytical methods (perf. std. for)	20415(e)(5)		WDR/M&RP in App. C.
Monitoring data procurement, analysis, and submittal	20415(e)(6)-(c)(15)		WDR/M&RP in App. C.
'20420. Detection Monitoring Program.	20420		Sec 2.3, WDR/M&RP in App. C.
'20425. SWRCB - Evaluation Monitoring Program.	20425	re &(d)(3): 20919 et seq., 21600(b)(8)(E), 21790(b)(8)(E), 21800(c)	Sec 2.3, WDR/M&RP in App. C.
'20430. Corrective Action Program.	20430		Sec 2.3, WDR/M&RP in App. C.
Subchapter 4. Criteria for Landfills and Disposal Sites Article 2. CalRecycle - Daily and Intermediate Cover			
'20705. Standards for Daily and Intermediate (Interim) Cover.	20705		Sec 3.1.3

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**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Subchapter 5. Closure and Post-Closure Maintenance **			
Article 1. General Standards For All Waste Management Units **			
'20950. General Closure and Post-Closure Maintenance Standards Applicable to Waste Management Units (Units) for Solid Waste.	20950	re &(f): 21780(a)(3), 21790(b)(1), 21800(c), 21820, 21840	FCPCMP - Sec 3.0, 4.0, Tables 1-6.
Article 2. Closure and Post-Closure Maintenance Standards for Disposal Sites and Landfills			
'21090. Closure and Post-Closure Maintenance Requirements for Solid Waste Landfills.			
Final cover requirements (general)	21090(a)-(a)(2)	21140, 21790(b)(8)(B), 21800(c)	Sec 3.3, FCPCMP – 3.2.1
Erosion control layer	21090(a)(3)-(a)(3)(A)3.	21140, 21150, 21790(b)(8)(D), 21800(c)	Sec 3.2, FCPCMP – Sec 3.7
Maintenance (& plan for)	21090(a)(4)-(a)(4)(D)		FCPCMP - Sec 4.6
Discharges of liquids to covers (leachate & condensate)	21090(a)(5)(A)		N/A to SCL
Discharges of liquids to covers (other liquids)	21090(a)(5)(B)	20800, 21600(b)(8)(D)	N/A to SCL
Stability analysis	21090(a)(6)	21145, 21790(b)(8)(B)	Fig 7, FCPCMP – Sec 3.5
Grading requirements (performance standards)	21090(b)-(b)(3)	20650, 21142(a), 21150, 21600(b)(4)(D), 21790(b)(8)(B)	FCPCMP - Sec 3.2, Fig 6
General post-closure duties	21090(c)-(c)(5)	<b>re (c)(2):</b> 21150, 21160, 21180, 21790(b)(8)(F) <b>// re (c)(4):</b> 21600(b)(8)(F)	FCPCMP - Sec 4.0; Tables 2, 3
Landfill closure deadline & extension	21090(d)	21110, 21790(b)(8), 21800(c)	Any closure deadline extension approvals granted by the LEA will only be implemented after concurrence with the RWQCB.
Final cover survey(s)	21090(e)-(e)(4)	21142(b)	FCPCMP - Sec 3.4.2, 4.7.2

Note: Section, Tables, Figures, or Appendix references which follow Final Closure/Post-Closure Maintenance Plan (FCPCMP) are included in FCPCMP document. All other references to Section, Tables, Figures, or Appendix are in ROWD.

**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Optional clean closure	21090(f)-(f)(2)	21810	N/A to SCL.
'21132. Landfill Emergency Response Plan Review.	'21132		Sec 5.0
'21400. Closure Requirements for Surface Impoundments.	'21400		If LF facility has SI: Not applicable to SCL.
'21410. SWRCB - Closure Requirements for Waste Piles.	'21410		If LF facility has WP: Not applicable to SCL.
<b>Chapter 4. Documentation and Reporting For Regulatory Tiers, Permits, WDRs, and Plans</b> <b>Subchapter 3. Development of Waste Discharge Requirements (WDRs) and Solid Waste Facility Permits</b> <b>Article 2. CalRecycle - Applicant Requirements.</b>			
'21585. SWRCB - Joint Technical Document (JTD). [format for submittal of '21710, '21750, '21760 information]	21585		N/A to SCL
<b>Article 4. SWRCB - Development of Waste Discharge Requirements (WDRs) **</b>			
'21710. SWRCB - Report Of Waste Discharge (ROWD) and Other Reporting Requirements. [see also '21585]	21710	re &(c)(1-2): 21145(b), 21200, 21630	Sec 1.2
'21720. SWRCB - Waste Discharge Requirements (WDRs).	21720(d-f)	re &(f): 20510, 20515	WDR and M&RP in App C
'21730. SWRCB - Public Participation. [proposed listing of potentially interested parties]	21730(a)		RWQCB to notify public.
'21740. SWRCB - Waste Characteristics.	21740	re & (a)(1): 21600(b)(2)(A) & (b)(7)(E)	Sec 2.0
'21750. SWRCB - Waste Management Unit (Unit) Characteristics and Attributes to be Described in the ROWD.			
Analysis of potential for impairment	21750(a)	21600(b)(4)(A)	FCPCMP – Sec 6.6, 6.7
Support for proposed Unit classification	21750(b)	21600(b)(4)(A)	Sec 1.0 – 5.0
Listing & incorporation of supporting documents	21750(c)	21600(b)(4)(A)	Sec 5.0
Topographic map	21750(d)(1)	21600(b)(4)(A)	Sec 2.1, Fig. 2
Floodplain analysis	21750(d)(2)-(d)(2)(C)2.	21600(b)(4)(A)	Sec 2.7

Note: Section, Tables, Figures, or Appendix references which follow Final Closure/Post-Closure Maintenance Plan (FCPCMP) are included in FCPCMP document. All other references to Section, Tables, Figures, or Appendix are in ROWD.

**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
Climate	21750(e)-(e)(6)	21600(b)(4)(A)	Sec 2.2
Geology	21750(f)-(f)(7)	21600(b)(4)(A) // re (f)(5): 21145, 21790(b)(8)(B)	Sec 2.4, Fig 6
Hydrogeology	21750(g)-(g)(7)(D)	21600(b)(4)(A)	Sec 2.5
Land/Water Use	21750(h)-(h)(5)	21600(b)(4)(A) re ¶(h)(4): 21600(b)(3)(E)	Sec 2.6, Fig 10
Preliminary closure plan	21750(i)		N/A to SCL
'21760. SWRCB - Design Report and Operations Plan.			
Design Report - preliminary and as-built plans	21760(a)(1)		Sec 3.0
Design Report	21760(a)(3)-(a)(4)		Sec 3.1
Operation Plan	21760(b)-(b)(3)		Sec 4.0
<b>Subchapter 4. Development of Closure/Post-Closure Maintenance Plans</b> '21769. SWRCB - Closure and Post-Closure Maintenance Plan Requirements.			
Prelim. CI/P-CI Plan - purpose	21769(b)(1)		N/A to SCL
Prelim. CI/P-CI Plan Contents - cost analysis	21769(b)(2)-(b)(2)(B)5.		N/A to SCL
Final CI/P-CI Plan	21769(c)-(c)(2)(H)3.		Entire doc; FCPCMP - Tables 4-6
<b>Chapter 5. Enforcement</b> <b>Article 4. Enforcement by Regional Water Quality Control Board (RWQCB) **</b>			
'22190. SWRCB - Mandatory Closure (Cease and Desist Orders).	22190(b)		If early closure mandated: will comply with RWQCB orders.

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**TABLE 3  
SOUTH COAST LANDFILL  
SWRCB INDEX**

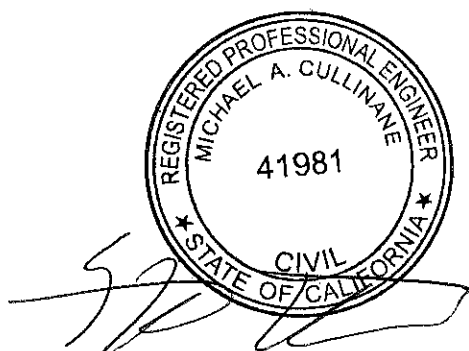
SWRCB Requirement	SWRCB Citation	Related CalRecycle Citation	JTD Page Range(s) Fulfilling SWRCB Citation
<b>Chapter 6. Financial Assurances at Solid Waste Facilities and at Waste Management Units for Solid Waste</b> <b>Subchapter 2. Financial Assurance Requirements</b> <b>Article 1. Financial Assurance for Closure</b>			
'22207. SWRCB - Closure Funding Requirements.	22207(a)		Sec 6.2, 6.3; Tables 4, 5; App J
<b>Article 2. Financial Assurance for Postclosure Maintenance</b>			
'22212. SWRCB - Post-Closure Funding Requirements.	22212(a)		Sec 6.4; Table 6; App J
<b>Article 4. Financial Assurance Requirements for Corrective Action</b>			
'22222. SWRCB - Corrective Action Funding Requirements.	22222		Sec 6.5, 6.6, 6.7, App J

Note: Section, Tables, Figures, or Appendix references which follow Final Closure/Post-Closure Maintenance Plan (FCPCMP) are included in FCPCMP document. All other references to Section, Tables, Figures, or Appendix are in ROWD.

## 7.0 PROFESSIONAL CERTIFICATION OF ACCURACY

Current regulations require that a registered civil engineer or a certified engineering geologist prepare and certify the accuracy of closure plans for all Class III landfills. The South Coast Landfill Final Closure/Post-Closure Maintenance Plan (dated November 2016) has been prepared in accordance with 27 CCR, Chapters 3 and 4 and 40 CFR, Part 258 under the supervision of Mr. Michael A. Cullinane, a California Registered Civil Engineer, Registration No. 41981.

Respectfully Submitted:



Michael A. Cullinane, P.E.  
R.C.E. No. 41981  
SWT Engineering

**Engineering Cost Opinion**  
**South Coast Landfill Final Closure Construction**

Const. Note	Item No.	Description	QTY	Unit	Cost	Total
	1	MOBILIZATION	1	LS	\$300,000	\$ 300,000.00
	2	TIME AND MATERIAL ALLOCATION	1	T&M	\$150,000	\$ 150,000.00
	3A	DIESEL FUEL PRICE ADJUSTMENT	1	T&M	\$50,000	\$ 50,000.00
	3B	CONSTRUCTION SUPPORT TASKS - SWPPP COMPLIANCE - CONSTRUCTION ACTIVITIES STORMWATER MANAGEMENT PLAN (CASMP) - INTERIM EROSION CONTROL AND BMP'S	1	LS	\$50,000	\$ 50,000.00
	4	PROJECT SURVEY	1	LS	\$40,000	\$ 40,000.00
<b>BID ITEMS 1 THROUGH 4 SUBTOTAL =</b>				<b>\$</b>	<b>590,000.00</b>	
1	5	CLEARING AND GRUBBING (8.3 AC)	1	LS	\$25,000.00	\$ 25,000.00
5, 12	6	REFUSE EXCAVATION & RECONSOLIDATION	10,000	CY	\$10.00	\$ 100,000.00
7, 8, 13, 14, 17, 18	7A	UNCLASSIFIED FILL/FOUNDATION FILL SOIL MATERIAL (19,600 CY + 2,300 CY TO MAKE GRADES)	21,900	CY	\$2.50	\$ 54,750.00
7, 8, 13, 14, 17, 18	7B	FOUNDATION SOIL LAYER PLACEMENT	294,000	SF	\$0.40	\$ 117,600.00
7, 8, 13, 14, 17, 18	7C	UNCLASSIFIED EXCAVATION	17,600	CY	\$2.00	\$ 35,200.00
7, 8, 13, 14, 17, 18	7D	IMPORT SOIL MATERIAL	5,900	CY	\$25.00	\$ 147,500.00
7	9A	60 mil LLDPE SUPER GRIP NET GEOMEMBRANE-SLOPE (PER DETAIL 1/D1)	210,000	SF	\$0.85	\$ 178,500.00
8	9B	60 mil LLDPE SUPER GRIP NET GEOMEMBRANE-DECK (PER DETAIL 2/D1)	80,000	SF	\$0.85	\$ 68,000.00
25	10	CONSTRUCT BENTONITE PLUG AT EDGE DRAIN OUTLET (PER DETAIL 7/D1)	5	EA	\$1,000.00	\$ 5,000.00
7	11A	CLOSURETURF - SLOPE	210,000	SF	\$0.25	\$ 52,500.00
8	11B	CLOSURETURF - DECK	80,000	SF	\$0.22	\$ 17,600.00
24	11C	INSTALL SAND IN-FILL PER MANUFACTURE'S RECOMMENDATIONS (PER DETAILS 1/D1 AND 2/D1)	280,000	SF	\$0.35	\$ 98,000.00
45	11D	ARMOR FILL EMULSION APPLIED TO SAND INFILL 10' WIDTH ABOVE HYDRO BINDER	20,000	SF	\$0.15	\$ 3,000.00
46	11E	HYDRO BINDER INFILL	10,000	SF	\$0.80	\$ 8,000.00
9	12A	CONSTRUCT HDPE EDGE DRAIN COLLECTOR - ACCESS ROAD, BENCH, AND SLOPE (BELOW LLDPE GEOMEMBRANE) (PER DETAILS 3/D1, 5/D1, 6/D1, 4/D2, AND 6/D3)	2,200	LF	\$10.00	\$ 22,000.00
26	12B	4-INCH HDPE PIPE SDR 17 OUTLET	700	LF	\$20.00	\$ 14,000.00
10	12C	DRAINAGE COLLECTOR (PER DETAIL 4/D1)	350	LF	\$28.00	\$ 9,800.00
27	12D	EXTEND 4-INCH SOLID HDPE PIPE (SDR 17) AND JOIN TO EXISTING LEACHATE OUTFALL/TANK	340	LF	\$28.00	\$ 9,520.00
14	13A	PROTECTIVE SOIL COVER - NORTHEAST ROAD	1,540	CY	\$0.50	\$ 770.00
17	13B	PROTECTIVE SOIL COVER - SOUTH AND WEST ROAD	1,000	CY	\$0.50	\$ 500.00
18	13C	PROTECTIVE SOIL COVER - DECK ACCESS ROAD	140	CY	\$0.50	\$ 70.00

**Engineering Cost Opinion**  
**South Coast Landfill Final Closure Construction**

Const. Note	Item No.	Description	QTY	Unit	Cost	Total
11, 13	14A	CONSTRUCT ANCHOR TRENCH EXCAVATION WITH SOIL BACKFILL (FINAL COVER TERMINATION SLOPE - DETAIL 5/D1; BENCH LINER TERMINATION - DETAIL 6/D3)	730	LF	\$25.00	\$ 18,250.00
17	14B	CONSTRUCT ANCHOR TRENCH EXCAVATION WITH CONCRETE BACKFILL/ROCK PLACEMENT (FINAL COVER TERMINATION SLOPE - DETAIL 11/D1; FINAL COVER TERMINATION SOUTH AND WEST PERIMETER ROAD - DETAIL 4/D2)	820	LF	\$35.00	\$ 28,700.00
15	15	CONSTRUCT CONCRETE ACCESS RAMP TO BASIN WITH INTEGRAL CONCRETE CURB PER CALTRANS STD. PLAN A87A TYPE A2-6 (PER DETAIL 4/D3)	2,610	SF	\$9.00	\$ 23,490.00
22	16A	CONCRETE DOWNDRAIN INLET AT STORMWATER BASIN (PER DETAIL 3/D3)	2	EA	\$3,000.00	\$ 6,000.00
42	16B	CONCRETE INLET TO DOWNDRAIN (PER DETAIL 7/D3)	4	EA	\$4,000.00	\$ 16,000.00
20	17	CONCRETE DOWNDRAIN (b=1.0, D=1.5, Z=1) (PER DETAIL 5/D2)	1,800	SF	\$8.00	\$ 14,400.00
21	18	CONSTRUCT RIP RAP PAD (PER DETAIL 1/D2)	600	SF	\$6.00	\$ 3,600.00
32	19	CONSTRUCT SPLASHWALL (PER DETAIL 5/D3)	30	LF	\$50.00	\$ 1,500.00
18, 31	20	CONSTRUCT 3" AC OVER PROTECTIVE SOIL COVER ACCESS ROAD - COMPACTED TO 95% OF ASTM D1557 (PER DETAILS 6/D1, 4/D2, AND 9/D1)	27,500	SF	\$2.50	\$ 68,750.00
29	21	CONSTRUCT TYPE A AC DIKE PER CALTRANS STD PLAN A87B	1,100	LF	\$8.00	\$ 8,800.00
23	22	INSTALL POST-CLOSURE SURVEY/SETTLEMENT MONUMENTS (PER DETAIL 2/D3)	2	EA	PAID PER ITEM 4	
43	23	INSTALL CABLE GATE (PER DETAIL 5/D2)	1	EA	\$1,600.00	\$ 1,600.00
19	24	INSTALL PIPE BOLLARD (PER DETAIL 8/6)	14	EA	\$350.00	\$ 4,900.00
30	25A	CONSTRUCT 12" x 12" DEEP LIFT CONCRETE TERMINATION	100	LF	PAID PER ITEM 15	
30	25B	CONSTRUCT 12" x 12" DEEP LIFT ASPHALT CONCRETE TERMINATION	105	LF	PAID PER ITEM 20	
LANDFILL GAS SYSTEM						
33	26	PROTECTION/ADJUSTMENT OF LFG MONITORING PROBES DURING FINAL COVER SYSTEM INSTALLATION (PER DETAILS 4/6 AND 8/6)	3	EA	\$2,500.00	\$ 7,500.00
34	27	CONSTRUCT LFG PASSIVE VERTICAL WELL (PER DETAIL 3/6)	310	VF	\$200.00	\$ 62,000.00
35, 36	28A	CONSTRUCT LFG PASSIVE TRENCH/COLLECTION GALLERY/WELL/VENT (PER DETAIL 1/6)	1,350	LF	\$25.00	\$ 33,750.00
16, 28	28B	ANCHOR TRENCH/LFG COLLECTION TRENCH (PER DETAIL 8/D1)	1,190	LF	\$27.00	\$ 32,130.00
38	28C	LFG/SEEP COLLECTOR (PER DETAIL 10/D1)	5,000	LF	\$2.25	\$ 11,250.00
37	29	CONSTRUCT LLDPE SKIRT AND SLEEVE (PER DETAIL 7/6)	34	EA	\$1,250.00	\$ 42,500.00
FINAL EROSION CONTROL						
39	30	HYDROSEEDING	1.60	AC	\$4,500.00	\$ 7,200.00
40	31	INSTALL FIBER ROLLS (PER DETAILS 2/D4 AND 3/D4)	2,930	LF	\$3.00	\$ 8,790.00



**Engineering Cost Opinion**  
**South Coast Landfill Final Closure Construction**

Const. Note	Item No.	Description	QTY	Unit	Cost	Total
41	32	INSTALL GRAVEL BAG CHEVRON (PER DETAIL 1/D4)	250	LF	\$25.00	\$ 6,250.00
BID ITEMS 5 THROUGH 32 SUBTOTAL =				\$	1,374,670.00	
SUBTOTAL BID ITEMS 1 THROUGH 32 =				\$	1,964,670.00	
10% CONTINGENCY =				\$	196,467.00	
TOTAL BID AMOUNT =				\$	2,161,137.00	

**TIME IS OF ESSENCE TO THIS CONTRACT. THE CONTRACTOR SHALL COMPLETE THE FINAL CLOSURE CONSTRUCTION PROJECT AT THE SOUTHCOAST LANDFILL NO LATER THAN TWO HUNDRED SEVENTY (270) CALENDAR DAYS FOLLOWING THE ISSUANCE OF NOTICE TO PROCEED. FAILURE TO MEET THIS TIME LIMIT WILL EXPOSE CONTRACTOR TO LIABILITY FOR LIQUIDATED DAMAGES PURSUANT TO THE AGREEMENT.**

**NOTES:**

The project will be bid on a unit price basis. For bidding purposes quantities will be as represented on the bid schedule. Final pay quantities will be based on field measurements, consistent with the project specifications, and as approved by the engineer. Material, or work, completed beyond the limits indicated on the drawings, or as represented on the bid schedule will not be compensated unless the additional work has been authorized, in advance, by the engineer.

Item 2 - Time and Material Allocation and Item 3A-Diesel Fuel Price Adjustment are time-and-materials items payable only upon written authorization by County of Mendocino. The Contractor is advised that actual earthwork quantities (Bid Items 6, 7A, 7B, 7C, 7D, 13A, 13B and 13C) may vary from those indicated. Actual quantities shall be measured for final payment by comparing before and after survey information as defined in these Specifications, or as approved by the Engineer. Item 12D Extend 4" Solid HDPE Pipe and Join to Existing Leachate Outfall/Tank length may vary from the bid quantity listed on bid schedule. SSPWC Section 3-2.1 shall not apply to the contract unit price work for these Bid Items performed under this paragraph. The Contractor shall be compensated for the noted Bid Items at the contract unit price regardless of any Bids in which the total cost calculated for the individual bid item does not correspond to the unit price quoted may be rejected as non-responsive. County of Mendocino reserves the right to waive any non-material defects of irregularities that do not result in any unfair competitive advantage. Any conflict between the unit price and the total cost calculated for an individual item will be resolved by reference to the unit price.

Include all costs for the items set forth above and called for by the Contract Documents. No other line items of cost, prices, or quotes for other activities may be included in this bid. **Bidders are reminded that this Proposal must be signed.**

The Bidder shall hereinafter state that any Subcontractor(s) who will be the Subcontractor(s) on the job for each particular trade or subdivision of the work and will state the firm name and principal location of the mill, shop, or office of each. Failure to list all Subcontractors or if the prime contractor specifies more than one subcontractor for the same portion of work to be performed under the contract in excess of one-half of 1 percent of the prime contractor's total bid, the prime contractor agrees that he or she is fully qualified to perform that portion himself or herself, and that the prime contractor shall perform that portion himself or herself.

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TECHNICAL SPECIFICATIONS FOR THE  
FINAL CLOSURE CONSTRUCTION PROJECT AT THE  
SOUTH COAST LANDFILL – MENDOCINO COUNTY, CA



Prepared for:  
County of Mendocino  
Department of Transportation  
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Prepared by:  
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Ontario, CA 91761

June 2019



**TECHNICAL SPECIFICATIONS  
FOR THE  
FINAL CLOSURE CONSTRUCTION PROJECT  
AT THE  
SOUTH COAST LANDFILL –  
MENDOCINO COUNTY, CA**

**June 2019**



**TECHNICAL SPECIFICATIONS  
FOR THE  
FINAL CLOSURE CONSTRUCTION PROJECT AT THE  
SOUTH COAST LANDFILL – MENDOCINO COUNTY, CA**

**SECTION 2 TECHNICAL SPECIFICATIONS**

Section 2A	Mobilization .....	2A-1
Section 2B	Construction Support Tasks .....	2B-1
Section 2C	Earthwork .....	2C-1
Section 2D	LLDPE Geomembrane .....	2D-1
Section 2E	Closure Turf/Geotextile.....	2E-1
Section 2F	HDPE Edge Drain - Drainage System .....	2F-1
Section 2G	Miscellaneous Civil and Drainage Improvements .....	2G-1
Section 2H	Protective Soil Cover.....	2H-1
Section 2I	Erosion Control Improvements .....	2I-1
Section 2J	Landfill Gas Improvements.....	2J-1

**APPENDICES**

Appendix A – Construction Drawings for the South Coast Final Closure Construction Project

Appendix B – Health and Safety Plan Requirements

Appendix C – Earthwork and Geosynthetic Quality Assurance Plan for the Construction of the  
Final Cover System at the South Coast Landfill I

Appendix D – Site Industrial Storm Water Pollution Prevention Plan (SWPPP)

Appendix E – Refuse Removal/Reconsolidation Clean Closure Work Plan

**ATTACHMENTS**

Attachment 1 – Closure Turf Installation Guidelines Manual

Attachment 2 – Closure Turf Design Guidelines Manual

**SECTION 2**  
**TECHNICAL SPECIFICATIONS**  
**FOR THE**  
**SOUTH COAST LANDFILL**  
**FINAL CLOSURE CONSTRUCTION PROJECT**

## **SECTION 2A**

### **MOBILIZATION**

#### **1.0 GENERAL**

The work covered by this section consists of furnishing all labor, equipment and supervision, and performing all operations necessary for mobilization. This section also outlines provisions of the Time and Material Allocation Bid Item.

##### **1.1 Mobilization**

Mobilization shall consist of expenditures for all preparatory work and operations, including but not limited to, bond and insurance costs; those costs deemed necessary for the movement of personnel, equipment, supplies, and incidentals to the project sites; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site as well as the related demobilization costs anticipated at the completion of the project.

#### **2.0 PRODUCTS (Not Used)**

#### **3.0 EXECUTION (Not Used)**

#### **4.0 MEASUREMENT AND PAYMENT**

##### **4.1 Mobilization - Item No. 1**

- 4.1.1** When 5 percent of the original contract amount is earned, 50 percent of the bid amount for mobilization, or 5 percent of the original contract amount, whichever is lesser, may be paid.
- 4.1.2** When 10 percent of the original contract amount is earned, 75 percent of the bid amount for mobilization, or 7.55 percent of the original contract amount, whichever is lesser, may be paid.
- 4.1.3** When 20 percent of the original contract amount is earned, 95 percent of the bid amount for mobilization, or 9.55 percent of the original contract amount, whichever is lesser, may be paid.
- 4.1.4** When 50 percent of the original contract amount is earned, 100 percent of the bid amount for mobilization, or 10 percent of the original contract amount, whichever is lesser, may be paid.
- 4.1.5** Upon completion of all work on the project, payment of any bid amount for mobilization in excess of 10 percent of the original contract amount will be paid.



Payment of the lump sum price for mobilization shall constitute full compensation for all labor, materials, equipment, and all other items necessary and incidental to completion of this item of work. The deletion of work or the addition of extra work as provided for herein shall not affect the price for mobilization.

#### **4.2     Time and Material Allocation - Item No. 2**

The Contractor shall provide a rate schedule for all labor and equipment that may reasonably be anticipated for use authorized time-and-materials work during the project. Labor rates shall be consistent with those required by the prevailing wage rate requirements of the contract and shall reflect all benefits and employer costs. Once the labor and equipment rates have been approved by the engineer, they will become the basis for compensation for any Time and Material work requested by the County. The Contractor is advised, however, that there will be no compensation from the Time and Material Allocation unless the work has been authorized in writing by the engineer. Additionally, use of the Time and Material Allocation will be at the sole discretion of the County. All or any portion of the allocation amount may be deleted from the Contract.

**END OF SECTION 2A**

## **SECTION 2B**

### **CONSTRUCTION SUPPORT TASKS**

#### **1.0 GENERAL**

##### **1.1 Temporary Facilities for Own Use**

- Provide offices and sanitary facilities as required for own use.
- Furnish utilities as required for own use. Coordinate with landfill operator and servicing utility agencies for use of existing facilities on site.
- Pay for utility service.
- Remove the above on completion of the work.

##### **1.2 Contractor Supplied Biologist for CEQA Mitigation Requirements**

The requirements of this work shall be pursuant to Section 10-1.05A of Book 1 and Section 11.

##### **1.3 Storm Water Pollution Control Compliance - Construction Activities Stormwater Management Plan (CASMP)**

The Contractor is advised that work under this contract shall be subject to the requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Industrial Activities Order No. 2014-057-DWQ, NPDES No. CAS000001 (hereinafter referred to as the “IAO”). Pursuant to the General Terms and Conditions and this Section, the Contractor is also required to prepare and submit for review a Construction SWPPP to demonstrate compliance with NPDES, Site Industrial SWPPP and to provide BMP’s for interim erosion control as required per Order No. 2009-0009-DWQ amended by 2010-0014-DWQ and 2012-0006-DWQ, NPDES No. CAS000002 (Construction General Permit) (hereinafter referred to as the “Order”). A Construction General Storm Water Permit is required for this project and is the responsibility of the Contractor to obtain the permit for the construction.

The Construction Activities Stormwater Management Plan (CASMP) shall include but not be limited to the following information:

- The CASMP shall include a construction activity BMP plan (consistent with the latest CASQA Construction BMP Handbook and the Order) developed to work in conjunction with the site’s in-place industrial SWPPP and as required to eliminate both non-storm water pollution and storm water run-off related pollution resulting from the construction activities.
- A detailed narrative with a general description of the contractor’s Stormwater Management Protocol, implementation procedures, BMP’s, pre-and post Storm inspection activities, and record keeping in sufficient detail to indicate to the Owner that the contractor understands his responsibilities for providing BMP’s consistent with the Order.

- Name and emergency contact information of Contractor's responsible site personnel.
- The Contractor is responsible for installing BMPs, and for providing BMP inspections and repair before, during and after a storm event.
- Contractor shall not be entitled to any time extensions or compensation for any cost due to any action required as a result of Contractor's compliance or failure to comply with those provisions of the SWPPP within Contractor's control. Contractor will be responsible for ensuring that Contractor's subcontractor(s) comply with the provisions of this Section. Contractor shall be liable for any action or fine imposed by the regulatory agencies for any incidents of non-compliance.
- The Contractor shall at all times exercise reasonable precaution to protect channels, storm drains and bodies of water from pollution, including siltation arising from Contractor's operations, or erosion siltation from completed areas. Pollution control work shall consist of implementing Best Management Practices or constructing facilities in accordance with local, state, or federal regulations which may be required to provide for control of pollutants.

#### **1.4 Survey**

The County will establish benchmarks and primary control points outside the Work limits. The Contractor shall employ a licensed Land Surveyor or a qualified Registered Civil Engineer licensed in the State of California to: remove and re-establish any horizontal/vertical control point designated as such; provide all lines and grades necessary to perform the Work; perform all survey required for quantity verification; perform all survey necessary to obtain as-constructed data required for Record Drawings and certification of Soil Material Layer Thickness as indicated in these Contract Documents.

##### **1.4.1 Survey Data Submittal**

All Contractor survey information shall be submitted to the Engineer no later than five (5) working days from the date the survey was conducted. The data shall be provided on a Compact Disc with hard copy printout in accordance with Section 1.4.7.

##### **A. Pre-Construction Survey**

Prior to initiation of site work, the contractor shall perform a pre-construction survey of all project areas. The Contractor is advised that the County has stockpiled soil on the landfill deck and that the pre-construction survey performed by the contractor's surveyor shall serve as the basis for measurement and payment for all volumetric payment to the Contractor. The contractor's survey will also confirm that site conditions are representative of the information contained in the project Plans (for those areas not within the borrow limits), including survey verification of subdrain, and drainage pipe join locations and elevations. The contractor shall submit a written report of any/all discrepancies to the Engineer at least one week in advance of work commencement. The report shall include a topographic map which clearly indicates the discrepancies. Contract work paid to the contractor on a volume basis shall require the contractor's surveyor to perform an independent topographical survey of the work area for

comparison with the contract documents. All discrepancies between the contractor's topographical pre-construction survey and contract drawings shall be reported to the Engineer prior to initiation of work.

The contractor shall generate an electronic pre-construction survey surface. The surface shall be generated using approved pre-construction aerial or ground survey data. All electronic surfaces shall be generated using raw survey data (i.e., mass points and break lines) and shall not rely on contours or digitization methods to generate surfaces except with the consent of the Engineer. Surfaces shall be comprised of a Triangulated Irregular Network (TIN), also being the basis for a Digital Terrain Model (DTM). All such surfaces shall be created commensurate with National Mapping Accuracy Standards equal to that matching the scale and contour interval of the contract drawings.

#### **B. Survey Control Plan**

The contractor shall submit a survey control plan indicating proposed control points provided in the construction drawings. The plan shall be submitted to the Engineer at least 10 days in advance of beginning any construction and the Engineer shall respond with comments or approval within 5 days of receipt. Contractor's secondary control shall be based on and tied to at least three primary control stations provided by the Owner. The establishment of all future primary control points (including the removal and re-establishment of Horizontal/Vertical Control Points within the work area by the contractor) shall be tied to the same control stations or to the previously established primary control stations. No work shall commence until any/all discrepancies between the survey information contained in the construction documents and the field conditions at the start of work are resolved. Any changes to the survey control plan during the project shall be submitted to the Engineer for approval prior to implementation.

#### **1.4.2 Survey Notification**

The Contractor shall notify the Engineer in writing (e-mail is acceptable) at least two days prior to performance of any QC survey work. Upon completion of the QC survey work for each construction element, or daily at a minimum, the results shall be forwarded to the Engineer. A QA check survey may immediately follow the QC surveys. The Engineer will then compare the data and advise the Contractor whether work can continue.

#### **1.4.3 Primary and Secondary Survey Control**

A system of primary survey control (basis for setting out) has been established in the construction documents by the Engineer for use by the Contractor. The Contractor shall verify the accuracy of the primary control provided and establish a survey control plan for secondary control points necessary for construction work layout. All secondary survey control shall be established proximate to the work site and used for developing subsequent control and/or laying out the work. Layout lines for use in constructing the work shall be taken directly from the secondary control. Secondary control shall be established by the Contractor's surveyor with due diligence in accordance with local survey industry standards to enable a third party surveyor to retrace the steps of the Contractor's surveyor for the QA check survey.

#### **1.4.4 Survey of Buried or Concealed Work**

The Contractor's measurements of lines, grades and distances are subject to check surveys by the Engineer/ QA check surveyor. All underground and other subgrade work shall not be buried until the following are satisfied:

- Contractor has informed the Engineer in writing that the work is complete and ready for inspection and check survey.
- Contractor has provided Engineer with the survey data prepared by Contractor's surveyor for review.
- Engineer has performed any necessary check surveys.
- Contractor has received a written notice from the Engineer to proceed.

#### **1.4.5 Protection of Monuments, Stakes and Marks**

The Contractor shall preserve and protect all survey monuments and related marks at the site and shall maintain the primary control points per the Survey Control Plan (Section 1.4.1 B).

Any removal, removal and replacement, disturbance or destruction of monuments shall be conducted in accordance with the contract documents and Survey Control Plan.

All stakes or otherwise deleterious material originating for construction activities shall be collected and disposed of properly, in particular for earthwork scheduled to receive or be placed/compacted on top of or come in contact with geomembrane materials.

#### **1.4.6 Survey Timing/Frequency**

The Contractor's surveyor shall complete the survey of each constructed element in a timely manner so as not to delay any of the work. For grade sensitive elements (e.g., ditch or road subgrade), the QC survey must be presented to and accepted by the Engineer prior to proceeding with the next work element (e.g., Channel, or access road construction).

For long linear elements such as roads and drainage ditches, the QC survey shall be completed in segments as the work progresses (i.e., not when the entire length has been graded) to prevent grade errors from compounding and causing major rework. The survey shall be performed immediately after completing each 200-foot-long segment or as determined practical by the Engineer prior to recording said data. The Engineer shall review the data and notify the Contractor immediately of any discrepancies noted.

In all cases, the Engineer shall be afforded the opportunity to conduct a QA check survey of all aforementioned Contractor QC survey segments prior to the contractor proceeding with construction in these areas.

#### **1.4.7 Survey Deliverables**

##### **A. Survey Recordkeeping**

Survey records consisting of copies of original field notebooks, field/office calculations, survey notes, sketches, field drawings, CAD drawings, surveyor's red line as-built drawings and data from electronic data collectors, contractor's drawings for incremental liner elements based on

surveyed information shall be stored digitally on CD or DVD, hard copy in a survey field notebook/binder or plan rack as appropriate. Any contractor's or surveyor's red line "mark-up" drawings, digital files and plots, and survey field notebook(s) will become the property of the Engineer upon project completion.

## **B. As-Built Survey Data**

The Contractor's survey data shall be collected throughout the project to show as-built conditions. This includes all underground as well as surface elements. In addition to a hard copy printout, this data shall be provided in an ASCII format and shall include: point number, northing and easting, elevations, and descriptions of point.

The ASCII format shall be as follows:

PPPP,NNNNNN.NNN,EEEEEEE.EEE,ELEV,Description

Where P is the point number, N is the Northing, E is the Easting, Elev is the elevation and Description is the description or type of point.

The Contractor shall, upon 24-hour advance notice, provide access to any equipment, files and personnel used for logging and processing survey data (including earthwork volume computations) to Engineer for verification purposes.

The Contractor's surveyor shall merge design drawings and as-built data into original survey as-built drawings. Data shall include:

Coordinates and elevations of all constructed areas finish subgrade and completed surfaces.

Curve data including center line stationing, elevation offsets to edge, cross slope (percent) as well as longitudinal slope (percent) for all drainage structures, roadways (paved and temporary).

Elevations and coordinates at beginning, end, and changes in alignment and grade breaks should be located during original survey work.

Coordinates and elevation of all corners for drainage facilities including drop structures to properly locate the as-built position on record drawings.

Coordinates and elevations for top of interceptor drain piping, HDPE Edge Drain, drainage ditches, at a center to center spacing not to exceed 25 feet or otherwise approved in writing by the Engineer. The edge of the channel where it adjoins any other structure (e.g., perimeter access road) shall be surveyed at the same spacing.

Elevations and coordinates for transition structures at spacing not to exceed 10 feet or two shots, whichever provides a more accurate location.

Coordinates and elevations necessary to locate all new and/or relocated infrastructure including but not limited to gas lines, condensate lines, power poles, and guy wire supports. Vertical clearance and location in plan shall be provided for all above ground utility lines installed as well as existing lines where vertical clearance has been changed due to cut and/or fill placement.

All newly installed, exposed or modified existing above or below ground utilities (drainage systems (channels, ditches or pipes), Landfill Gas wells, collectors, and vents, electrical lines, leachate lines, etc. shall be located in plan by elevation and coordinates at 25-foot spacing, prior to covering with soil as applicable.

All components of the final cover system including, sub-drains and sub-drain outlet piping, interim cover and foundation soil thickness verification, HDPE edge drain collectors (above and below the 60-mil LLDPE Geomembrane, and HDPE edge drain outlet piping, finish grade of the Protective Soil Cover layer for thickness verification, the location of liner terminations, and all improvements associated with the final cover system shall be located in plan by elevation and coordinates. Survey for each successive operation or final cover system component must be point over point (i.e., the same coordinate northing and easting, with new component elevation).

### **C. Record Drawings**

The Contractor shall maintain a set of full-size Contract Drawings in his/her site office and shall mark, on these Drawings, all changes made during construction. A complete set of Record Drawings with survey information shall be performed in ACAD Release 2016 (or prior) format; the Drawings shall be corrected weekly and reviewed with the Engineer on a bi-weekly basis. At a minimum, the Drawings shall include the as-constructed horizontal location and elevation of All components of the final cover system including, Drainage Collector and Drainage Collector outlet piping, interim cover and foundation soil thickness verification, HDPE edge drain collectors (above and below the 60-mil LLDPE Geomembrane, and HDPE edge drain outlet piping, finish grade of the Protective Soil Cover layer for thickness verification, the location of liner terminations, and all improvements associated with the final cover system shall be located in plan by elevation and coordinates. Survey for each successive operation or final cover system component must be point over point (i.e., the same coordinate northing and easting, with new component elevation).

The Contractor shall merge all survey data, design drawings, survey verification drawings, and as-built data into original as-built drawings. Data shall include:

#### **1. Verification Survey**

The County, at its option, may conduct verification surveys of any element of the Work. County survey work shall not relieve the Contractor of any responsibility for completion of all survey requirements identified in the Specifications.

#### **2. Contractor's Red-line Plan Set**

The Contractor shall maintain a hard copy set of full-size Contract Drawings in his/her site office and shall mark, on these Drawings, all changes made during construction. A complete set of Record Drawings with survey information shall be performed in ACAD Release 2016 format; the Drawings shall be corrected weekly and reviewed with the Engineer on a bi-weekly basis. At a minimum, the Drawings shall include the as-constructed horizontal location and elevation of All components of the final cover system including, Drainage Collector and Drainage Collector outlet piping, interim cover and foundation soil thickness verification, HDPE edge drain collectors, and HDPE edge drain outlet piping, finish grade of the Protective Soil Cover layer for thickness verification, the location of liner terminations, and all improvements associated with the final cover system shall be located in plan by elevation and coordinates. Survey for each successive operation or final cover system component must be point over point (i.e., the same coordinate northing and easting, with new component elevation).

Based on the hard copy set of full-size Contract Drawings, and the Survey Record Drawings, the

Contractor shall update the Project AutoCAD drawings with revision clouds and revision numbers to reflect the as-constructed conditions. All corrections and as-constructed information transferred to the AutoCAD drawings shall be done in color and shall be done in a professional, draftsman-like manner. The AutoCAD drawings shall be submitted to the Owner/Owner's Engineer at the completion of the Project. A reproducible mylar "hard copy" of the drawings shall also be provided by the contractor to the County.

### **3. Survey Verification Drawings**

Additionally, separate "Survey Verification Drawings" showing the information contained in the following paragraphs, including a table with, or point numbers in plan view, with elevations and differential thicknesses of material from one surface to the next (for ease of review and verification), prepared, stamped and signed by a land surveyor licensed in the State of California or Licensed Civil Engineer registered in the State of California that may (pursuant to the State of California Professional Engineer's Act) practice Land Surveying. A Surveyor Certification Statement with the following statement shall be included on each Survey Verification Drawing:

"The Undersigned California Licensed Professional Engineer/Land Surveyor responsible for surveying for this project hereby certifies that the thicknesses of the soil layers, and alignment of features shown on these drawings represent the as-constructed condition of the Final Closure Construction Project for the South Coast Landfill – Mendocino County, CA, and that the minimum thicknesses as required by the Final Closure Construction Details have been constructed."

Only a California Registered Professional Engineer with licensure allowing the practice of Land Surveying may sign in lieu of a California Licensed Land Surveyor.

The Licensed Professional Engineer/Land Surveyor shall also provide his/her signature over professional stamp on each drawing at the end of the Surveyor Certification Statement for each of the following drawings prepared and submitted on Mylar with accompanying compact disk containing the AutoCAD Drawing Files:

- **Pre-Construction Survey** - Drawing shall show the contractor's pre-construction survey of all areas of project work, consistent with Paragraph 1.4.1A – Pre-Construction Survey above.
- **Drainage Collector** - Drawing shall show the top of pipe locations and elevations for all Drainage Collector piping at a 25-foot maximum spacing, including all grade breaks, angle points, and points of connection.
- **Interim Cover/Prepared Subgrade Layer** - Drawing shall show the thickness of the existing Interim Cover and the thickness of additional foundation fill material placed and completed as prepared subgrade to effectuate the total 1-foot thick interim cover soil layer within the prepared subgrade/final cover limits. Contractor shall use a **Survey Grid** (50-foot maximum, closer where field conditions dictate, to identify top, toe, bench or road top and toe, HDPE Edge Drain, intermediate slope points including any slope high points that will enable verification of the successive landfill final cover layer minimum required



thickness). This **Survey Grid** point over point location shall be used for thickness verification of all successive landfill closure soil material layers. The Drawings shall reflect the completed Prepared Subgrade Layer for the Final Cover System Placement.

- **Top of Foundation Layer**

Top of Foundation Layer (the additional 12-inches of Foundation Soil Material placed over the total 1-foot thick interim cover soil layer within the prepared subgrade/final cover limits. The two-foot total thickness (interim cover plus foundation fill and the 1-foot of additional foundation soil) will serve as the Subgrade for geosynthetics material. Verification of thickness using the same **Survey Grid** for survey point over point used previously for the Interim Soil plus Foundation Fill shall be utilized. The drawing shall include a thickness verification table with point on point from top of prepared subgrade to top of Foundation Soil layer elevation, and elevation differential. A separate drawing showing the below LLDPE Geomembrane HDPE Edge Drain top of pipe locations and elevations at 25-feet on center, including all grade breaks, angle points, riser tops and toes, outlet piping to points of connection shall also be prepared.

- **Protective Soil Cover Layer Drawing** - Drawing shall show the thickness of the protective soil cover layer using the same **Survey Grid** for survey point over point to verify the 24-inch minimum thickness of the protective soil cover layer. The drawing shall include a thickness verification table with point on point from top of liner elevation to top of protective soil cover elevation, and elevation differential.

#### **4. Surface Improvements, Drainage Improvements, Roadways and Final Contours.**

The contractor shall provide record drawings of all surface improvements, drainage improvements, roadways and final contours. Survey of surface improvements shall be at a 50-foot interval maximum with grade breaks, tops and toes of slopes and angle points included. Final contours may be in the form of an aerial topographic map.

#### **5. Scanned PDF File of All Record drawings**

The Contractor shall also scan all final signed record drawings to create a reproducible of all Record Drawings in PDF file format and submit this information on a compact disk or DVD for the County's use. The following is a list of Record drawings that at a minimum shall be included in this submittal:

- Contractor's Red-line Plan Set; Updated AutoCAD Drawings
- Survey Verification Drawings as described above
- Surface Improvements, Drainage Improvements, Roadways and Final Contour Drawings

Progress payments for those work elements that require survey and record drawing preparation will require progress on record drawings commensurate with the portion of work completed for which progress payment is being requested.

The Project will not be considered to be substantially complete unless all survey verification, record, and as-built drawings (stamped and signed with certifications required by these Specifications) have been received, reviewed, and accepted as complete by the Engineer.

Final payment to the Contractor will not be made until the Record Drawings have been reviewed and approved by the Engineer.

All costs associated with development of data to be included on the Record Drawings, scanning in PDF format, transferring to compact disk or DVD and the maintenance and production of the Drawings shall be considered as included in the various items of Work.

Upon completion of work, one complete set of Record Drawings shall be delivered to the Engineer within 15 working days of project completion as a condition of final acceptance of the work.

#### **1.4.8 Earthwork Quantities**

##### **A. As-Built Data**

For purposes of payment on earthwork quantities, the Contractor shall conduct a comprehensive as-built survey which complies with all aforementioned requirements. The Contractor may determine as-built topography using aerial photogrammetry methods, ground survey methods, or a combination thereof. The method used shall be submitted in writing to and pre-approved by the Engineer.

The National Map Accuracy Standards shall be adhered to at a minimum. Scale and contour intervals shall be at least equal to that of the design drawings. At a minimum the following intervals shall apply: For earthwork areas less than 10 acres, the maximum contour mapping interval shall be one foot; otherwise larger areas shall use two-foot contour interval mapping.

The Contractor shall produce a complete electronic as-built surface in conformance with the requirements set forth in Section 1.4.2 of these specifications. The generated electronic surface file shall be provided to the Engineer for verification.

The Contractor shall produce an electronic boundary file which accurately conforms to the project site boundary depicted on the plans or as modified during construction by approved change order. The electronic boundary file shall be provided to the Engineer for verification prior to use in any earthwork computations or map generation.

##### **B. Earthwork Volume Computations**

The Contractor shall submit the pre-and post construction topography to the Engineer in electronic digital format that is compatible with AutoCAD release 2016 format. The Engineer will compute the earthwork volumes using AutoCAD Civil 3D 2016, based on a tin to tin comparison of the two surfaces (pre-and post construction topography) provided by the Contractor. The Contractor may perform an independent calculation for comparison; however, the methodology for computation must be the same for an actual comparison.

Any interim or soon to be buried (or otherwise obstructed) earthwork shall be surveyed and quantified as the project progresses to enable timely verification by the Engineer.

### **1.5 Preliminary Submittals List**

The following is a preliminary list of submittals to be reviewed, updated and completed by the Contractor and submitted during the pre-construction meeting, the Contractor shall provide to the County for the Engineer's review a complete listing of all anticipated Contractor submittals and the proposed submittal dates for each, including but not limited to the following:

#### **General Submittals:**

- Injury & Illness Prevention Program
- Preconstruction Survey
- Record Drawings
- As-Built Surface
- Health and Safety Program
- Earthwork Volumes Calculation
- Code of Safe Practices
- Progress Schedule
- Const. Schedule - Installation schedule for Completion of the Work – Schedule shall address the installation of LLDPE Geomembrane and other geosynthetic components to be performed in conjunction with earthwork phasing, on an iterative basis as described in Section 2C – Earthwork. Installation schedule shall also address any multiple move-ins, multiple deployments, multiple piping and collection system installation, and geosynthetic operations i.e. Drainage Collector, HDPE Edge Drain (Below Geomembrane), LFG Vents and LFG Trench/Collection Gallery/Well/Vents, Anchor Trench/LFG Collection Trench, LLDPE Geomembrane, Closure Turf, LLDPE boots, and outlet piping, etc) over portions of the total LLDPE Geomembrane installation area that are a requirement of this project.
- Water Pollution Control Program – Storm Water Management Plan

#### **Subdrain / HDPE Edge Drain Submittals:**

- Drainage Collector Gravel Samples
- Drainage Collector Pipe Certificate of Compliance
- Drainage Collector Gravel Certified Test Results for Sieve Analysis, Permeability, Aggregate Carbonate Content and Durability
- HDPE Edge Drain Collector Pipe Certificate of Compliance
- HDPE Outlet Pipe and Fittings

#### **Earthwork Submittals:**

- Existing Limit of Refuse/Final Cover Limit Survey
- Thickness of Waste and Bottom Profile of Waste Removal Areas verification survey
- Earthwork Operations Plan

- Settlement Monument Shop Drawing
- Settlement Monument Placement and Monitoring Plan
- Project Sequencing Plan
- Post Construction Survey
- Select Foundation Soil sieve analysis

**Geomembrane Submittals:**

- Product Data – 60-mil LLDPE Super Grip Net
- Manufacturer's Quality Control Testing
- Geomembrane Samples - 60-mil LLDPE Super Grip Net
- Geomembrane Certification - 60-mil LLDPE Super Grip Net
- Seam Samples - HD Extrusion Weld
- Seam Samples - HD Fusion Weld
- Certified conformance and destructive seam test results.
- Manufacturer's 5 Year Warranty Sample
- Manufacturer's 5 Year Warranty
- Manufacturer's Certification Attachment 10-1.19
- Independent Testing Laboratory GAI Certification
- Manufacturer's Certification of Extrudate Rod or Bead
- Geomembrane Delivery Notification
- Subgrade Maintenance Plan.
- Subgrade Certification
- LLDPE Proposed Panel Layout
- Contractor's LLDPE Geomembrane Installation Procedures
- Contractor's Installer Resume
- Quality Control Technician Resume
- Manufacturing Conformance Testing - 60-mil LLDPE Super Grip Net
- Record Drawings (As-built)
- Geomembrane Installer's Daily Documentation
- Manufacturer's Quality Assurance Plan
- Manufacturer's Installation Quality Assurance Plan
- As built panel layout
- Contractor Final Quality Control Records
- Contractor's Installation Quality Control Plan
- Quality Control (QC) cost breakdown.

**Closure Turf Submittals:**

- Product Data – Closure Turf
- Manufacturer's Quality Control Testing
- Closure Turf Delivery Notification
- Subgrade Certification
- Contractor's Closure Turf Installation Procedures

- Contractor's Installer Resume
- Quality Control Technician Resume
- Record Drawings (As-built)
- Closure Turf Installer's Daily Documentation
- Manufacturer's Quality Assurance Plan
- Manufacturer's Installation Quality Assurance Plan
- Contractor Final Quality Control Records
- Contractor's Installation Quality Control Plan
- Certificate of Compliance for Sand Infill
- Certificate of Compliance for HydroBinder®

### **Geotextile Submittals:**

- Manufacturer's Product Data
- Manufacturer's Production List
- Manufacturer's Certified Test Data
- Shipping, Handling, & Storage Procedures
- Installation Procedures, Including Seam and Repairs
- Contractor's Installation Quality Control Procedures
- Manufacturer's Quality Control Plan
- Manufacturer's 5 Year Warranty Sample
- Manufacturer's 5 Year Warranty
- Product Samples

### **Miscellaneous Civil Submittals:**

- Asphalt Concrete Mix Designs
- Rip Rap Certification of Compliance
- Hydro-Seed Certification
- Reinforcing Steel/Welded Wire Mesh Certificate of Compliance
- Geotextile Manufacturer's Product Data
- 12 oz./sy Geotextile
- Portland Cement Concrete Design Mix
- Class 2 Base Certificate of Compliance
- LFG Pipe and Fittings Certificate of Compliance
- Collection Pipe Gravel Certificate of Compliance
- Curing Compound Certificate of Compliance
- Grout mix
- Certificate of compliance – masonry materials
- Settlement Monument Survey Data

## **2.0 PRODUCTS (Not Used)**

## **3.0 EXECUTION (Not Used)**

#### **4.0 MEASUREMENT AND PAYMENT**

##### **4.1 Contractor-Supplied Biologist for CEQA Mitigation Requirements- Item No. 3A**

The contract hourly price paid for Contractor Supplied Biologist includes conducting surveys listed in various permit conditions, full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in Contractor Supplied Biologist as shown on the plans, as specified in the Standard Specifications and these special provisions, and as directed by the Engineer.

##### **4.2 Construction Support Tasks - Item No. 3B**

Construction Support Tasks - Contractor Stormwater Compliance (Item 3B) as described above shall be considered as included in the contract lump sum price paid for Construction Support Tasks.

To facilitate progress payments the Contractor shall submit for the approval of the Engineer, a "Schedule of Values" for costs associated with the applicable items reflected in Part 2, Construction Support Tasks. Final acceptance and approval of the cost allocation presented in the "Schedule of Values" will be at the sole discretion of the County. As an alternative, measurement for progress payments may be determined based on the percentage completion of the overall contract work.

Payment of the lump sum price for Construction Support Tasks shall constitute full compensation for all labor, material, equipment and all other items and arrangement necessary and incidental to comply with the requirements of this section and no additional payment shall be allowed.

##### **4.3 Project Survey - Item No. 4**

Full compensation for all labor, material, and equipment required for project survey as outlined above shall be included in the Contractor's lump sum price for Survey.

To facilitate progress payments, the Contractor may submit, for the review of the Engineer, a Schedule of Values, outlining those items included under the survey item. Approval of the Schedule of Values will be at the sole discretion of the Engineer. Alternately, the lump sum bid price will be paid uniformly, on a monthly basis during the projected life of the Contract

#### **END OF SECTION 2B**

## **SECTION 2C**

### **EARTHWORK**

#### **1.0 GENERAL**

This section sets forth the requirements for unclassified excavation, unclassified fill, soil import, and processing and placement of soil material for the Final Cover System Construction.

A Construction Quality Assurance (CQA) Plan (Appendix C) has been developed in conjunction with this Project and is included with these Technical Specifications for the Contractor's reference. The Contractor shall assure that the Engineer shall, at all times, have safe access to the work for the purpose of monitoring, observation, and QA Plan implementation.

#### **1.1 Work Included**

Clearing, grubbing, and removal of existing surface improvements within the borrow areas and limits of Final Cover Construction Project.

Unclassified excavation and Unclassified Fill, import of soil, including purchase, load, haul, and delivery, as required to effectuate the Final Cover System thickness and gradient as indicated on the Plans. Excavate, transport, mix, moisture condition, place, compact, and finish grade the Foundation Fill material (placement of the initial one-foot-six-inches (18-inches) of foundation soil layer, and the supplemental additional 6-inches of foundation soil layer of one-inch minus material; the top of foundation layer shall be prepared to receive geosynthetics pursuant to Section 2D – Geomembrane/Closure Turf, and Protective Soil Cover (PSC) (locations per project details) shall be placed pursuant to Section 2F of these specifications) to the thickness and gradient shown on the Final Closure Construction Drawings, consistent with these specifications and the Project Construction Drawings and Details. Screening of soil to 1-inch minus particle size for use within 6-inches of geosynthetics is included work pursuant to project material requirements.

Contractor shall be responsible for maintaining existing access to the Transfer Station so that a fully operational status is maintained at all times. Contractor shall plan haul routes to avoid conflicts with Transfer Station Traffic. Contractor shall include haul route detail information in the Earthwork Operations Plan Submittal identified In Section 1.3 Earthwork Operations Plan.

Compliance with surveying and storm water pollution control methods as specified in Section 2B – Construction Support Tasks and as required in the General Conditions.

#### **1.2 Introduction/Special Conditions**

##### **1.2.1 Design Drawings**

The Design Drawings were prepared based on aerial topographic maps of the landfill. The surface of the landfill at present and for the duration of this Contract is not necessarily that shown as existing contours on the grading plan due to differential settlement of the landfill mass and any re-grading of benches for maintenance purposes. Prior to Construction of any improvement, the Contractor shall verify actual field conditions, as appropriate, to meet the design intent.

Topographic differences as described above, clearing and grubbing of vegetation, and settlement during construction may require placement of additional earthwork volume. Such modifications do not constitute a change in the "Character" of the work, as these adjustments are anticipated, and are typical of landfill closure construction.

**AS SUCH, THE CONTRACTOR ACKNOWLEDGES BY EXECUTING THE AGREEMENT, THAT IT IS AWARE THAT SUCH MODIFICATIONS AND ADJUSTMENTS WILL OCCUR AND THAT THIS OCCURRENCE IS FACTORED INTO THE BID PRICE PER SQUARE FOOT OF FINAL COVER PLACEMENT.**

### **1.2.2 Design Intent - General Sequence of Earthwork/Final Cover System Construction Operations**

It is the intent of the Drawings and these Specifications to provide for the construction of a final cover system, consisting of (from bottom to top) of:

- Placement of foundation fill soil (i.e. that soil necessary to be placed below and in excess of the 2-foot thick total foundation soil layer for final cover system - Closure Turf) as shown on the construction drawings as required to effectuate a modified slope ratio, or the horizontal configuration of and gradient for bench drainage;
- Placement of One-foot-six-inches (18-inches) of three-inch minus material as initial Foundation Soil Layer placement;
- Placement of an additional 6-inches of Foundation Soil Layer of one-inch minus material in preparation for geosynthetic materials (Closure Turf) placement;
- Placement of a 60-mil LLDPE Super Grip Net Geomembrane with overlying Closure Turf, and PSC for Roadway/other areas, pursuant to Section 2D and 2E of the Project Specifications respectively;

The Final Cover Section shall be placed to the thickness and gradient indicated on the Drawings. The full two-foot thick (measured vertically) foundation soil layer for final cover system - Closure Turf shall be placed over existing landfill waste, and placement of any foundation fill (i.e. that soil necessary to be placed in excess of the 2-foot thick foundation soil layer for final cover system - Closure Turf and 2-foot total of Protective Soil Cover (in roadway areas only) as shown on the construction drawings as required to effectuate a modified slope ratio, or the horizontal configuration of and gradient for bench/roadway drainage.

The Contractor shall process and moisture condition the upper 6-inches of existing material and place unclassified fill pursuant to the project specification, prior to placing the foundation soil layer for the final cover system. In all cases, the minimum thickness of the foundation soil layer for the final cover system (that portion above the interim cover i.e. the foundation soil layer) shall be 2-feet.



When completed, the final landfill surface shall be graded such that no slope area within the landfill footprint exceeds a ratio of 2-foot horizontal to 1-foot vertical, nor shall any areas have a gradient less than 3 percent unless specifically designated or shown on the Drawings.

Modification of line and grades indicated on the Drawings, which conform to the design intent, may be recommended by the Contractor or directed by the Engineer. All modifications recommended by the Contractor shall be submitted to the Engineer for approval at least seven working days prior to the intended operation. This requirement may be waived or reduced, at the discretion of the Engineer, if the adjustment is considered minor and does not require detailed evaluation.

Contract time extensions will not be granted during the review periods of proposed line and grade modifications. The Contractor shall coordinate its work such that preparation and construction of adjacent areas can proceed while proposed modifications are being reviewed.

### **1.3 Earthwork Operations Plan**

The Contractor's activities shall not interfere with the operation of the Landfill Transfer Station. The Contractor shall sequence construction so that landfill traffic and operations will at all times have uninterrupted access to the Transfer Station Area. Contractor shall be responsible for protection of existing utilities so that the lines remain in place, and a fully operational status is maintained. Contractor shall plan haul routes to avoid conflicts with Transfer Station Traffic. The haul routes shall be included in the Earthwork Operations Plan Submittal described below.

The Contractor shall submit for the approval of the Engineer, an earthwork operation plan that reflects the proposed sequencing of construction, including traffic control measures and haul routes to be used and maintained during construction.

The plan shall also include construction procedures and methods for the following operations:

- Limit of refuse location and thickness (top and bottom elevations of existing waste placed) of refuse in waste removal areas potholing and verification methods;
- Waste removal and reconsolidation operations; Drainage Collector placement;
- Backfill of waste removal areas;
- foundation fill placement;
- the use of hike-up stakes and any other data pertinent to control of the foundation fill/foundation soil layer placement operation;
- foundation layer placement/preparation/thickness verification;
- HDPE Edge Drain (below Geomembrane) installation;
- final cover geosynthetics placement – super grip net and closure turf;
- Closure Turf Ballast placement;
- Placement of PSC under pavement or base material over the super grip net and closure turf; and
- Final Erosion Control/Final BMP component placement.

The submittal shall also include timing and operations for installation of collection drain, HDPE Edge Drain and drain outlet placement indicating the areas where and at which point during the construction sequencing these items and specific drainage system materials will be installed. The plan shall be of sufficient detail and shall be updated as necessary, to reflect the Contractor's Earthwork Operations and specific component installation.

All costs associated with development of the Earthwork Operations Plan shall be included in the various bid items, and no additional compensation shall be warranted or made. The approved plan shall not be modified without prior authorization of the Engineer.

### **1.3.1 Earthwork Operations Plan – Use of Settlement Monuments or Hike-up Stakes**

The plan shall include construction procedures and methods (i.e., for subgrade preparation, unclassified fill/foundation fill material placement, and 2-foot total thickness of foundation soil layer placement thickness (hike-up from subgrade) via the use of settlement monuments or Hike-up Stakes, foundation soil placement sequencing and thickness verification survey, import operations management, reconsolidation of waste, placement of interim cover, and foundation soil, thickness verification, considerations to account for settlement of the landfill mass during placement of Final Cover System, using settlement monuments and any other data pertinent to control, and verification of required final cover system thickness for the operations of the Contractor. The submittal shall also include a proposed placement plan schedule in general compliance with Paragraph 1.2.2 - Design Intent – General Sequence of Earthwork/Final Cover System Construction Operations above. The plan shall be of sufficient detail and shall be updated as necessary, so that the thickness and limits of each material (subgrade, foundation fill, foundation soil layer, geosynthetics placement limits, top of PSC in roadway areas) can be defined, and the necessary verification survey information obtained.

The plan shall include provisions for monitoring of settlement during construction by placement of settlement monuments. The settlement monument shall consist of a steel plate measuring approximately one-foot by one-foot, placed on a grid so that potholing with an auger down to the plate can be used to verify thickness of foundation soil layer. The location and elevation of each settlement station shall be surveyed by the Contractor after foundation fill placement, and then potholing with a power auger after foundation soil placement pursuant to the settlement monument location plan shown on Sheet 4 of the Project Drawings (to ensure that the foundation soil layer has the required 2-foot total thickness). At the completion of verification of the thickness of foundation soil layer, (or when directed by the Engineer) the potholes shall be backfilled and compacted to top of foundation soil layer. All costs associated with development and implementation of the Cover Thickness Verification and Earthwork Operations Plan shall be included in the various bid items, and no additional compensation shall be warranted or made. The approved plan shall not be modified without prior authorization of the Engineer.

### **1.4 Limit of Refuse/Refuse Removal Bottom Profile Exploratory Excavations and Survey Verification**

The Contractor shall perform exploratory excavations (trenching as indicated) at the trench location as shown on Drawing Number 3 of the Construction Drawings and the applicable drawing notes. Contractor shall recover soil cover at trench areas for use for the 6-inches of interim cover soil described below. Trenching perpendicular to the approximate limit of waste at those locations shown to determine the limit of refuse or for bottom of refuse profile within the

trench shall be performed at the locations indicated on the Construction Drawings. The location of the actual limit of refuse shall be verified by Contractor survey. The location and profile of bottom of refuse at the refuse removal area trenches shall also be verified by Contractor survey. Following completion of the limit of refuse location and bottom of waste excavation area profile verification and submittal of the limit of refuse location and bottom of waste excavation area verification drawing to the Engineer, the Contractor shall allow a minimum of seven working days for the Engineer to review and, if necessary, revise the grading plan to reflect the actual limits and adjust the Final Cover. Trench excavations shall be backfilled with the trenched material and covered with a minimum of 6-inches of salvaged interim soil cover from the trench location. All costs associated with the exploratory excavations and survey shall be deemed to be included in the various items of work.

### **1.5 Submittals Required**

The Contractor shall thoroughly review the Technical Specifications and identify all required Project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Thickness of waste/bottom profile of waste in Refuse Removal Areas verification survey;
- Settlement Monument Shop Drawing;
- Settlement Monument Placement and Monitoring Plan
- Earthwork Operations Plan;
- Existing Limit of Refuse/Final Cover Limit Survey
- Project Sequencing Plan;
- Post Construction Survey;
- Select Foundation Soil sieve analysis.

### **1.6 Minimum Contractor Qualifications**

The County of Mendocino Department of Transportation will consider only bidders who have demonstrated as a "Prime Contractor" experience and qualifications in the construction of one landfill closure project of similar scope and similar size or larger or have demonstrated as a "Prime Contractor" experience and qualifications on any construction project in which the contractor performed the major tasks of work below;

1. Excavation (minimum 100,000 cubic yards), screening, placement (on slopes at 2 feet horizontal to 1 foot vertical), moisture conditioning, compaction, and grading of select soils.
2. Be Prime Contractor on a contract that included the placement of geosynthetic material to prevent water infiltration (e.g. HDPE or LLDPE liner system, synthetic cap, etc.).
3. Be Prime Contractor on a contract that included the installation of landfill gas system improvements.

Only successfully completed projects that can be verified will be considered as demonstration of a contractor's experience. Contractors are required to submit their qualifications with Client references with their Bid Proposal.

## **MATERIAL**

### **2.1 Unclassified Fill Material – Foundation Fill**

Native material from the excavation or from stockpiles indicated on the Plans shall be used in the construction of engineered fills (Foundation Fill). Rocks or rock fragments greater than three inches in any dimension shall be removed from the unclassified fill and disposed of as directed by the Engineer. Rocks or rock fragments less than three inches shall be distributed evenly throughout the fill.

"Nesting" of rock or rock fragments will not be permitted. The Contractor may use Import Soil Material for Unclassified Fill - Foundation Fill per Section 2.2 below provided the gradation requirements of the specific soil layer are met.

These provisions, allowing incorporation of rock or rock fragments within the fill shall not relieve the Contractor of the responsibility to prepare the final cover subgrade surface for the Final Cover System installation in accordance with other provisions of these Technical Specifications.

### **2.2 Foundation Soil Layer**

#### **2.2.1 Initial Foundation Soil Layer**

Rocks or rock fragments greater than three inches in any dimension shall be removed from the initial 18-inches of Foundation Soil Layer placement and shall be disposed of as directed by the Engineer. Rocks or rock fragments less than three inches shall be distributed evenly throughout the fill. "Nesting" of rock or rock fragments will not be permitted. The Contractor may use Import Soil Material for Foundation Soil layer provided the gradation requirements of the specific soil layer are met.

These provisions, allowing incorporation of rock or rock fragments within the fill shall not relieve the Contractor of the responsibility to prepare the final cover subgrade surface for the Final Cover System installation in accordance with other provisions of these Technical Specifications.

#### **2.2.2 Foundation Soil Layer (within 6-Inches of Geosynthetic Materials)**

Rock, rock fragments, and/or clods greater than 1-inch in the greatest dimension shall not be used for the foundation soil layer or PSC within 6-inches of geosynthetic materials. Materials that do not meet the gradation requirements of the project for the foundation soil layer or PSC (within 6-inches of geosynthetic materials) may be used for unclassified fill material, provided the gradation requirements of the material meets the particular material specification for the intended use.

### 2.2.3 Foundation Soil Material CQA

A Construction Quality Assurance (CQA) Plan describing the materials testing methods and procedures, and testing frequencies for the foundation soil material at the South Coast Landfill has been included in Appendix C.

Selective excavation, screening, rock picking, or rock raking, will be necessary to generate foundation soil material from the on-site borrow areas. Import soil consistent with Section 2.4 below may also be utilized for foundation soil layer construction. The material shall be screened, rock picked or rock raked, dried, and/or moisture conditioned until uniformly blended material characteristics and moisture conditions are attained.

Rock and rock fragments greater than three-inches in the greatest dimension (Initial Foundation Soil Placement) and one-inch in the greatest dimension (Foundation Soil within 6-inches of geosynthetic materials) shall be removed from the Final Cover material during the processing operation. The material shall be processed in accordance with the provisions of Subsection 3.7.

### 2.4 Import Soil Material Properties

All import soil shall have the following minimum properties:

Table 1 – Soil Material Properties			
Material	Unit Weight (pcf)	Friction Angle (degrees)	Cohesion (psf)
Compacted Fill Soils	130	35	150

All soil shall be free of debris and meet the following gradation tested in accordance with ASTM D422:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inch	100-75
3/4 inch	100-75
No. 40	0-60
No. 200	0-35

The soil Plasticity Index (PI) shall be less than 15 and the Liquid Limit shall be less than 40 per ASTM D4318. Unsuitable soils (high plastic clays or organic soils) shall not be imported to the site. Import soil shall meet the particle size requirements for material intended use.

## 3.0 CONSTRUCTION METHODS

### 3.1 Clearing, Grubbing, and Demolition

Clearing and grubbing shall be performed in accordance with Section 17-2 of the Standard Specifications. Clearing, grubbing, and demolition activities shall consist of removing and disposing of all natural and man-made objectionable material from within the limits of work as shown on the Drawings, including the following:

- Removal of all vegetative material prior to earthwork operations; removed vegetation shall be stored in a stockpile within the refuse reconsolidation area for use as interim daily refuse cover.
- Demolition and removal of interfering improvements and plastic material at existing cover seeps not designated to be protected.
- Clearing and grubbing of all other existing improvements not designated for protection, adjustment to grade, or removal and salvage.

Vegetation within the limits of work shall be stripped to a sufficient depth to remove all vegetation including roots. All material generated from the clearing and grubbing operation shall be transported to, and utilized as daily cover soil in the refuse removal and reconsolidation area or as directed by the Engineer. All waste material shall be placed within the reconsolidation area and covered by 6-inches minimum of daily cover soil. Vegetative stripings in excess of daily cover needs shall then be spread in lifts within the reconsolidation area and over the reconsolidated waste not to exceed 12-inches and compacted with a minimum of four passes with an 836 Landfill Compactor, or equivalent.

Contractor will be responsible for incurring all costs for material taken to the transfer station for disposal.

Material designated by the Owner to be removed and salvaged, shall be transported to the Owner's material storage area located adjacent to the operations office, or to other locations, on the site, as directed by the Owner.

### **3.2 Refuse Excavation and Reconsolidation – Clean Closure Testing Requirements**

The Contractor will encounter refuse during the exploratory excavation operations (Section 1.4, above), for the Final Cover/Limit of Refuse/Refuse Removal Bottom Profile Exploratory Excavations, and for the 2-foot sub grade excavation areas indicated on the subgrade drawing. Any excess trench material (refuse) not replaced in trenches, and all refuse generated from the 2-foot sub grade excavation areas shall be transported to the Waste Reconsolidation Area and disposed of (any salvaged interim cover soil may be used for interim cover for waste removal areas). All refuse within the limits of proposed work designated for removal shall be excavated, transported to the refuse reconsolidation area, and compacted in accordance with the requirements of Paragraph 3.1 above. At the conclusion of each day's operation, all exposed waste material shall be covered with a minimum of 6-inches of salvaged clearing and grubbing materials, or other material (tarps) as approved by the Engineer. At clean closure areas after refuse is removed, the sub-refuse soil is to be tested and removed if contamination is found, pursuant to Appendix E – "Refuse Removal and Reconsolidation Clean Closure Work Plan – South Coast Landfill, Mendocino County, CA". All costs associated with the testing, record keeping and reporting required for the clean closure of refuse removal areas shall be included in the Contractor's unit price for refuse excavation. Soil from borrow areas, or final cover import soil shall not be used for daily cover for the refuse removal/reconsolidation operation. At the conclusion of the waste removal and contaminated soil removal/clean closure verification operations, all waste reconsolidation areas shall be brought to the required plan gradient and covered with a total of 12-inches of interim cover soil. Contaminated soil removed in the clean closure process may be utilized for interim cover soil.

The Contractor is advised that the quantity of waste material may vary from that indicated in the bid schedule. The top Deck elevation will be adjusted up or down depending on amount of Refuse reconsolidation material available for disposal. Section 4-1.05 B(1) and 4-1.05 B(2) of the Standard Specifications referencing increases/decreases of more the 25-percent are not applicable for this item. The Contractor shall be compensated at the Unit Price, regardless of any increase or decrease in the volume of waste removed.

The Contractor shall be responsible for all implementation and monitoring requirements of the local AQMD.

### **3.3    General**

All earthwork shall conform to the following requirements, where applicable, unless otherwise noted in these Technical Specifications:

- A.    The Contractor shall be solely responsible for the satisfactory completion of all earthwork in accordance with the Project Drawings and Specifications.
- B.    Equipment used in the excavation, transport, mixing, stockpiling, processing, installation and compaction of all materials used in construction of the alternative final cover improvements will be standard of practice grading machinery of known specifications suitable for performing the required work in a timely and efficient manner.
- C.    All clearing, grubbing, stripping, and site preparation for the project shall be accomplished to the satisfaction of the Geotechnical CQA Consultant and the Construction Manager.
- D.    The ground surface to receive fill shall be prepared (cleared, grubbed, or stripped) to the satisfaction of the Geotechnical CQA Consultant and the Construction Manager and the fill shall be placed, spread, mixed, watered, and compacted in accordance with the project specifications and as recommended by the Geotechnical CQA Consultant.
- E.    The ground surface prepared to receive the initial foundation fill (for interim cover augmentation or final cover gradient/slope ratio correction), or the foundation soil layer shall be scarified, disked, or bladed until it is uniform and free from uneven features which may prevent uniform compaction. The scarified ground surface shall then be brought to approximately optimum moisture content, mixed as required, and compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557. If the scarified zone is greater than 12 inches in depth, the excess shall be removed and placed in lifts of six to eight inches in thickness. Prior to fill placement, the ground surface to receive fill shall be inspected by the Geotechnical CQA Consultant.
- F.    Prior to construction in any given zone, the Contractor shall (if necessary) selectively excavate on-site native and/or stockpiled soils identified by the Construction Manager or CQA Manager (or his representative) and transport these soils to a separate processing and/or stockpile area approved by the Construction Manager.
- G.    In the designated processing area, select soils shall be screened and dried and/or moisture conditioned (if necessary) to facilitate fill placement operations.

- H. All material considered by the Geotechnical CQA Consultant to be unsuitable for use in the construction of the final cover improvements shall be disposed of in the Refuse Reconsolidation Area. All materials incorporated as part of the compacted fill must be inspected and tested and placement must be observed by the CQA Consultant (or his representative).
- I. Suitable and sufficient processing and compaction equipment shall be on the job site to handle the amount of fill being stockpiled, processed, mixed, and/or placed. If necessary, excavation or import equipment will be shut down temporarily in order to allow time for proper preparation and/or compaction of fills. Sufficient watering apparatus shall be provided with due consideration to the type of fill material, curing characteristics, rate of placement, and time of year.
- J. Material deemed unlikely to meet the performance specifications and not disposed of during clearing and grubbing or demolition shall be removed from the work area and/or fill and shall be transported to the refuse Reconsolidation area for disposal or use as interim cover as directed by the CQA Manager and/or the Construction Manager.
- K. Irreducible rock or rock fragments in excess of three (3) inches in maximum dimension shall not be utilized for the alternative final cover improvements. Soil placed within 6-inches below and two-feet above the LLDPE Geomembrane shall be select material with the maximum particle size less than one (1) inch in the maximum dimension.
- L. With the exception of the Protective Soil Cover material placed in roadway or other areas, fill material shall be placed in thin lifts with a maximum uncompacted thickness of six to eight inches. Each layer shall be spread evenly and thoroughly mixed to obtain a near uniform condition in each layer. In areas of excess lift thickness, regrading of the surface to the maximum lift thickness will be completed prior to construction of additional lifts. Protective Soil Cover Layer materials placed over the LLDPE Geomembrane in roadway areas shall be placed with Low Ground Pressure (LGP) equipment with a maximum ground pressure of 5.3 psi. The minimum lift thickness over the LLDPE Geomembrane shall be one (1) foot.
- M. The minimum compaction for the interim cover soil, foundation fill soils, foundation layer and all engineered fill materials placed is specified as 90 percent of the maximum dry density as determined by ASTM D1557 and the specified moisture content is 2% of optimum moisture content as determined by ASTM D1557. Given the yielding nature of the underlying refuse, a compaction of slightly less than 90-percent may be acceptable based on the field conditions encountered and the discretion of the CQA Manager. PSC material shall be moisture conditioned to +/- 2% of optimum moisture content. The lower 1-foot of the Protective Soil Cover shall be compacted to a minimum of 85 percent per ASTM D1557. The upper 12 inches of the PSC shall be compacted to a minimum of 90-percent of the maximum dry density as determined by ASTM D1557 (testing frequency of one test per acre per lift, or one per day, whichever is greater).
- N. Where tests indicate the moisture content, density, saturated hydraulic conductivity, and/or other required soils characteristics of any fill or portion thereof is below the project requirements, the particular layer or portion shall be retested and if necessary



reworked and/or removed and replaced until the required condition has been attained. No additional fill shall be placed over an area until the last fill has been tested horizontally and vertically and meets the requirements of this document to the satisfaction of the CQA Manager.

- O. Where work is interrupted by heavy rains, fill operations shall not be resumed until observations and field tests by the CQA Monitor indicate the moisture content and density of the in-place fills and/or materials intended for placement are within the limits previously specified.
- P. At the beginning of each grading day, the active fill pad will be inspected. Any previously placed soils which a moisture content below the specified minimum shall be thoroughly watered and processed in preparation for receiving additional fill. Additional moisture shall be added until the moisture content is with the limits required so as to assure an adequate bonding and compaction of all fill materials. As stated above, the maximum allowable moisture content as determined by ASTM D1557, the fill material shall be aerated by blading or other satisfactory methods until the moisture content is with the specified moisture content range. Any previously compacted materials which are disturbed (aerated, bladed etc.) to reduce or increase the moisture content must be recompacted to the project specifications and to the satisfaction of CQA Monitor once specified moisture contents are attained.
- Q. Drainage provisions shall be constructed in compliance with the recommendations of the Landfill Engineer and as shown on the project drawings.
- R. Fill over cut slopes shall be properly keyed through top soils, colluviums or creep material into rock or firm materials as approved by the Landfill Engineer and/or CQA Manager. All transitions shall be stripped of all loose soil prior to placing fill.
- S. If earth conditions of adverse or potentially adverse nature are encountered during grading, the CQA Manager and Landfill Engineer shall investigate, analyze and make recommendation to mitigate these conditions.
- T. Unless otherwise specified by the CQA Manager, no permanent cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.
- U. All excavated or fill surfaces shall be graded to provide good drainage and prevent ponding of water. Surface water shall be controlled to avoid damage to adjoining properties or to finish work on the site.
- V. All slopes shall be planted for erosion protection in accordance with the Project Drawings and Specifications.
- W. The Contractor shall selectively excavate soils from pre-approved off-site or on-site borrow sources approved by the Landfill Engineer and Geotechnical CQA Consultant (or his representative) during the grading operations. The cover soils shall contain sufficient fine-grained constituents such that gravel size and larger fragments do not cluster during

construction. All import soils shall be free of potentially hazardous environmental pollutants.

### **3.4 Excavation**

The Contractor shall complete all excavations as indicated on the Plans, as directed by the Engineer, and as specified herein. Unauthorized excavation below the design subgrade will not be permitted.

Excavated material shall be transported to the designated fill areas (for stockpile) as indicated on the Plans. All material transported to the designated fill or stockpile area(s) shall be compacted to 90-percent of the maximum dry density as determined by ASTM D 1557.

### **3.5 Unclassified Fill/Foundation Fill**

Material generated from the excavation shall be incorporated into unclassified fills/foundation fill, in accordance with the requirements of Subsection 2.0, Materials and Section 3.3, above.

### **3.6 Develop Foundation Layer/Final Cover Subgrade Surface Preparation**

Foundation layer/final cover subgrade surface preparation shall consist of backfill and compaction of erosion gullies and rills, grading and placement of fill material to remove surface irregularities, placement and compaction of additional fill material to achieve foundation fill (that thickness of soil in excess of the 2-foot thick total foundation soil layer for final cover system – Closure Turf) shown on the construction drawings as required to effectuate a modified slope ratio, or the horizontal configuration of and gradient for bench drainage, and the conditioning of the existing surface in preparation for receiving the final cover.

The Contractor shall refer to Subsection 1.2 of this Section of the Specifications regarding design intent for development of final cover grades and gradients.

The foundation layer/final cover subgrade surface shall be prepared to create a generally uniform surface, between benches, upon which the final cover system can be constructed and its final thickness accurately verified. The Contractor's proposed sequencing and methods for achieving the design intent for development of the foundation layer/final cover subgrade surface shall be outlined in the submitted Earthwork Operations Plan identified in Section 1.3 of these Specifications.

### **3.7 Foundation Soil Layer**

#### **3.7.1 Processing**

Foundation Soil Material shall be processed to obtain a uniform soil condition, and moisture conditioned (or dried) to a moisture content of 2-percent above or below optimum moisture content as determined by ASTM D 1557. Rock and rock fragments greater than 3-inches in the greatest dimension shall be removed during the processing operation for the initial eighteen-inches of foundation soil layer placement; however, rock, rock fragments, and/or clods greater than 1-inch in the greatest dimension shall not be used for the foundation soil layer or PSC (for roadway areas) within 6-inches of geosynthetic materials (i.e. the balance of the two-foot total foundation soil layer, and the first 6-inches of soil over the final cover geosynthetics in roadway or other areas).

Suitable and sufficient processing equipment shall be onsite to adequately screen, disc, mix, blend, moisture condition, and/or dry the quantity of material being transported and placed in the Contractor's area of processing. Sufficient watering apparatus shall be provided with due consideration to the type of fill material, rate of placement, and time of year.

During processing and/or grading for Foundation Soil Layer Placement operations, no soils or soil types other than those defined in Section 2.2 – Foundation Soil Material may be used.

### **3.7.2 Placement**

Processed Foundation Soil Material shall be transported, placed, and compacted in lifts, not to exceed 8 inches in loose thickness, to a minimum density of 90 percent of the maximum dry density and a moisture content of 2 percent above or below optimum moisture content as determined by ASTM D 1557.

At the beginning of each grading day, the active fill pad will be inspected by the Engineer. Soils which have dried to a point less than the required moisture levels shall be thoroughly watered and reprocessed in preparation for receiving additional fill.

Where the moisture content of Foundation Soil Material is below 2 percent above or below optimum moisture content as determined by ASTM D1557, additional moisture shall be added until the moisture content is within the limits required so as to assure an adequate bonding and compaction of all fill materials.

In the event of rain or for any other reason, if the moisture content of previously placed fill material or processed soils intended for placement is greater than +5 percent of optimum moisture content as determined by ASTM D1557, the Foundation Soil Material shall be aerated by blading, disking, or other satisfactory method until the moisture content is 2 percent above or below optimum moisture content as determined by ASTM D1557. Any previously compacted materials which are disturbed (aerated, bladed, etc.) to reduce or increase the moisture content must be recompacted, in accordance with these Technical Specifications and to the satisfaction of the Engineer, once specified moisture contents are attained.

All recompacted or replaced soils shall be placed in accordance with these Technical Specifications and to the satisfaction of the Engineer.

### **3.7.3 Tolerances**

The Foundation Soil Layer materials shall be final graded to a tolerance of plus 0.20 foot to minus 0.00 foot of the specified thickness.

## **4.0 MEASUREMENT AND PAYMENT**

### **4.1 Clearing and Grubbing - Item No. 5**

The contract lump sum price paid for clearing, grubbing, and demolition shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all work involved in clearing, grubbing, and demolition, including all saw cutting and removal of AC pavement; removal or demolition of existing surface and sub-surface drainage improvements, piping, concrete improvements, chain link and litter fencing, and/or other operations incidental and required to complete clearing, grubbing, removal, and or demolition as required to complete

the work shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the Engineer

The final pay quantities will be determined by field verification that the work has been completed in accordance with the Plans and these Technical Specifications. Interim progress payments will be based on the Engineers evaluation of the estimated percentage of work completed during the subject period.

#### **4.2 Refuse Excavation and Reconsolidation-Item No. 6**

The contract unit price for refuse excavation and reconsolidation shall include full compensation for furnishing all labor, tools, equipment, and incidentals required to excavate and transport waste material to the active area of the landfill, place daily cover material or tarps, and place and compact fill material in the resulting void.

Final pay quantities will be determined by comparing the volumetric difference between the pre-construction topographic survey and the post removal survey performed by the Contractor, or by field measurements approved by the Engineer. Excavation beyond required limits will not be compensated unless previously approved by the Engineer.

The Contractor is advised that the quantity of waste material may vary from that indicated in the bid schedule. Section 4-1.05 B(1) and 4-1.05 B(2) of the Standard Specifications referencing increases/decreases of more the 25-percent are not applicable for this item. The Contractor shall be compensated at the Unit Price, regardless of any increase or decrease in the volume of waste removed.

#### **4.3 Develop Foundation Layer/Geomembrane Subgrade Surface Preparation**

All Costs for Developing Foundation Layer/Geomembrane Subgrade Surface Preparation shall include full compensation for all labor, material, and equipment required for scarifying, grading, processing, compaction and smooth drum rolling of foundation layer material. These costs shall be based on the actual square footage of surface area of Geomembrane Subgrade Surface Preparation performed in accordance with these specifications, to the limits indicated on the drawings. Work performed outside of these limits will not be compensated unless the work has been authorized by the Engineer. The estimated quantity of foundation soil in cubic yards has been provided on the bid schedule as a means for the contractor to include the cost of this material in the unit cost per square foot for Foundation Soil Placement. Costs for this item of work shall be included in the unit price per square foot for Foundation Soil Placement under Bid Item No. 7, and no additional compensation will be made.

#### **4.4 Unclassified Fill/Foundation Fill Soil Material - Item No. 7A**

The Contract unit price per cubic yard for Unclassified Fill/Foundation Fill Soil Material shall include full compensation for all labor, material, and equipment required for excavation, transport, screening, placement, rock picking, and compaction of Unclassified Fills.

Final pay quantities will be paid on a unit price basis. Measurement for payment shall be the actual cubic yardage of material to be placed and compacted based on Foundation Fill Grades and topographic surveys of the placement area. Contractor shall be responsible to meet the gradient and foundation fill thickness indicated below the final cover section as shown on the Drawings, and shall be responsible for placement and compaction of all soil necessary to meet the Design intent pursuant to Paragraph 1.2.2 above.

#### **4.5 Foundation Soil Layer Placement - Item No. 7B**

The contract unit price for Foundation Soil Layer Placement shall include full compensation for all labor, materials, and equipment required to Develop Foundation Layer/Geomembrane Subgrade Surface Preparation (per Paragraph 4.3 above) screen, process, transport, moisture condition, place, compact, and finish grade the foundation soil layer in accordance with the Drawings and these Specifications.

Final pay quantities will be based on the actual square footage of foundation soil layer placed in accordance with these specifications, to the limits indicated on the drawings.

Material placed beyond the limits indicated on the drawings will not be compensated, unless those limits have been modified by the Engineer.

#### **4.6 Unclassified Excavation - Item No. 7C**

The Contract unit price for Unclassified Excavation shall include full compensation for all labor, material, and equipment required for excavating to grade the on-site borrow areas. Processing, screening, moisture conditioning, placement and compaction shall be per Item No. 7 above - Foundation Soil Layer Placement.

Final pay quantities will be based on the actual cubic yardage of material excavated based on before and after topographic surveys of the on-site borrow areas. Work performed outside of these limits will not be compensated unless the work has been authorized by the Engineer.

#### **4.7 Import Soil Material - Item No. 7D**

The contract price per cubic yard for Import Soil (based on cubic yard delivered per truck load) shall include full compensation for all labor, materials, and equipment required for purchase, loading, hauling/transport, receiving, knock down, stockpiling (if necessary based on operation), as required for the Import Soil in accordance with the Drawings and these Specifications. Processing, screening, moisture conditioning, placement and compaction shall be per Item No. 7 above - Foundation Soil Layer Placement.

#### **4.8 Grading for Miscellaneous Terminations and Transitions - Final Cover Termination – Slope (Per Detail 5/D1); Final Cover Termination – Northeast Perimeter Road (Per Detail 6/D1); Final Cover Termination – South and West Perimeter Road (Per Detail 4/D2); Bench Liner Termination (Per Detail 6/D3)**

All Costs for Grading for Miscellaneous Terminations and Transitions - Top Deck Transition (Per Detail 8/D1); Final Cover Termination – Slope (Per Detail 5/D1); Final Cover Termination – North Perimeter Road (Per Detail 6/D1); South and West Liner Termination (Per Detail 4/D2); Bench Liner Termination (Per Detail 6/D3) shall be included in the unit price per square foot for Foundation Soil Placement under Bid Item No. 7B, and no additional compensation will be made.

Measurement and Payment for all geosynthetic work for terminations and transitions shall be pursuant to Section 2E – LLDPE Geomembrane.

### **END OF SECTION 2C**

## **SECTION 2D**

### **LLDPE GEOMEMBRANE**

#### **1.0 GENERAL**

This section sets forth the requirements for installation of the linear low-density polyethylene (LLDPE) geomembrane component of the Final Cover System.

A Construction Quality Assurance (QA) Plan (Appendix C) has been developed in conjunction with this Project and is included with these Technical Specifications for the Contractor's reference. The Contractor shall assure that the Engineer/CQA Monitor or the Engineer/CQA Monitor's designated representative, shall at all times have safe access to the work for the purpose of monitoring, observation, and QA Plan implementation.

An independent Engineer/CQA Monitoring firm, under contract to the Owner, will conduct Quality Assurance (QA) monitoring, observation, and documentation. The Contractor shall coordinate and cooperate with the Engineer/CQA Monitor during all sampling, testing, and certification required by these Technical Specifications.

#### **1.1 Work Included**

The specified LLDPE geomembrane shall be furnished and installed as shown on the Plans and as required herein for proper installation and functioning of a final cover system for partial final closure of a municipal solid waste landfill. The specified geomembrane consists of a 60-mil thick, linear low-density polyethylene (LLDPE) geomembrane, Super Grip Net manufactured by Agru America (or approved equivalent) that will be placed in intimate contact with an underlying prepared foundation soil layer constructed in accordance with Section 2C - Earthwork, of these Technical Specifications.

The Contractor is advised that acceptance and approval of the geomembrane is a phased process that includes manufacturer's certifications, manufacturer's quality control testing, conformance testing, and destructive seam testing. In addition, the installation of LLDPE Geomembrane and other geosynthetic components must be performed in conjunction with earthwork phasing, on an iterative basis as described in Section 2C- Earthwork. As such, multiple move-ins, multiple deployments, and multiple piping and collection system installation, geosynthetic operations (i.e. Drainage Collector, HDPE Edge Drain (Below Geomembrane), LFG Vents and LFG Trench/Collection Gallery/Well/Vents, Anchor Trench/LFG Collection Trench, LLDPE Geomembrane, Separator Geotextile, HDPE Edge Drain (Above Geomembrane); LLDPE boots, and outlet piping, etc) over portions of the total LLDPE Geomembrane installation area are a requirement of this project. This shall require substantial schedule coordination between Contractor and liner installation sub-contractor. By executing the Contract for which these Technical Specifications are Contract Documents, both the Contractor and his designated Liner Sub-Contractor recognize that the responsibility for coordination, scheduling, and cost for the aforementioned multiple move-ins, multiple deployments, and multiple geosynthetic operations are shared by the Contractor and his designated Liner Sub-Contractor. There will be no schedule adjustments or extension of contract days resulting from failure by either party to perform. Liquidated damages for each calendar day beyond the specified number of working days will be assessed in accordance with Book 1, Section 4-1.02. It is also a requirement of these Technical

Specifications that the manufacturer's certification(s), and quality control test results for the geomembrane, raw resin, and extrudate rod or bead shall be received (by official submittal), reviewed, and approved by the Engineer/CQA Monitor prior to shipment of these materials to the site. It is the Contractor's responsibility to provide the Engineer/CQA Monitor with all the required documentation and test results specified herein.

## **1.2 Quality Control (QC) Testing**

Quality Control (QC) testing is the responsibility of the Contractor and shall consist of manufacturer's certification testing, conformance testing (including direct shear testing for interface strength), and destructive seam testing. All QC testing and certification shall be performed in accordance with these Technical Specifications and all costs associated with QC testing shall be borne by the Contractor.

## **1.3 Submittals Required**

The Contractor shall thoroughly review the Technical Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Product Data – 60-mil LLDPE Super Grip Net
- Manufacturer's Quality Control Testing
- Manufacturer's Certification of Extrudate Rod or Bead
- Geomembrane Certification - 60-mil LLDPE Super Grip Net
- Contractor's LLDPE Geomembrane Installation Procedures
- Contractor's Installer Resume
- Contractor Final Quality Control Records
- Contractor's Installation Quality Control Plan
- LLDPE Proposed Panel Layout
- Record Drawings (As-built)
- As built panel layout
- Installation schedule for Completion of the Work – Schedule shall address the installation of LLDPE Geomembrane and other geosynthetic components to be performed in conjunction with earthwork phasing, on an iterative basis as described in Section 2C – Earthwork. Installation schedule shall also address any multiple move-ins, multiple deployments, multiple piping and collection system installation, and geosynthetic operations i.e. Drainage Collector, HDPE Edge Drain (Below Geomembrane), LFG Vents and LFG Trench/Collection Gallery/Well/Vents, Anchor Trench/LFG Collection Trench, LLDPE Geomembrane, Closure Turf, LLDPE boots, and outlet piping, etc) over portions of the total LLDPE Geomembrane installation area that are a requirement of this project.
- Geomembrane Samples - 60-mil LLDPE Super Grip Net
- Seam Samples - HD Extrusion Weld
- Seam Samples - HD Fusion Weld
- Independent Testing Laboratory GAI Certification
- Certified conformance and destructive seam test results.
- Manufacturer's 5 Year Warranty Sample
- Manufacturer's 5 Year Warranty

- Subgrade Certification
- Geomembrane Installer's Daily Documentation
- Contractor's Installer Resume
- Quality Control Technician Resume
- Subgrade Maintenance Plan.
- Quality Control (QC) cost breakdown.
- Record Drawings (As-built).

## **2.0 MATERIALS**

### **2.1 Geomembrane Resin**

#### **2.1.1 General**

Resin for the geomembrane shall be virgin, first quality linear low density polyethylene (LLDPE) resin produced in North America and compounded and manufactured specifically for the purpose of producing LLDPE geomembranes for landfill closures. There shall be no intermixing with other resin types. Reclaimed polymer shall not be added to the geomembrane resin. The manufacturer may recycle edge trim from the roll being produced. Edge trim shall be returned immediately to the process but shall not exceed 2 percent of the total resin required. Edge trim which has been stored and edge trim from other manufacturing lines shall not be recycled.

#### **2.1.2 Physical Properties**

LLDPE resin shall meet the following minimum specifications:

TEST	TEST METHOD	UNIT	REQUIREMENTS
Density*	ASTM D-1505	g/cc	0.939
Resin Properties	ASTM D1248	% virgin polymers	97
Melt Flow Index	ASTM D-1238 Condition E	g/10 min	<1.0
ASTM - American Society for Testing and Material			
* Base resin density without carbon black added.			

#### **2.1.3 Resin Manufacturer Certification and Testing**

One set of tests shall be performed per batch of resin. At a minimum, the geomembrane manufacturer shall sample and test each compartment of each rail car or truck to ensure that product purity was maintained during shipment. Certified test results shall be submitted to and approved by the Engineer/CQA Monitor at least 15 working days prior to shipping geomembrane to the site.

### **2.2 Geomembrane Rolls**

#### **2.2.1 General**

Geomembrane rolls shall be new, first quality seamless linear low-density polyethylene (LLDPE) manufactured in North America specifically for the purpose of this project. The geomembrane rolls shall have no holes, pinholes, bubbles, blisters, gels, nicks, cuts on liner edges, or contamination by foreign matter. Geomembrane shall be supplied in rolls; folding shall not be permitted. All additives shall be thoroughly dispersed throughout the geomembrane.



## 2.2.2 Geomembrane - Super Grip Net

60-mil LLDPE Super Grip Net shall have physical properties that equal or exceed the minimum average roll values specified in Table 2.2.2, (must meet or exceed the most recent GRI GM 17 values). The texturing shall be micro-spike with a minimum Asperity Height of 175 mil (4.45 mm.), and Drainage stud height of 130 mil (3.30 mm.), or approved equivalent, with the texturing and drainage stud uniformly distributed on the surface of the sheet.

Textured geomembrane, if produced by co-extrusion secondary attachment, shall consist of textured material attached to a base sheet. The base sheet shall have physical properties that meet or exceed those specified in Table 2.2.2. The coextruded secondary attachment sheet shall remain intact and shall be resistant to separation from the base sheet as a result of abrasion and contact with chemicals encountered in solid waste landfill applications. All work associated with secondary attachment shall be performed by the manufacturer of the base sheet.

**TABLE 2.2.2**

<b>SUMMARY OF 60 mil Super Gripnet LLDPE GEOMEMBRANE MANUFACTURER'S QUALITY ASSURANCE (MQA)</b>				
<b>PHYSICAL PROPERTY</b>	<b>METHOD</b>	<b>UNIT</b>	<b>REQUIREMENT</b>	<b>FREQUENCY</b>
Thickness mils(min. ave) Lowest individual	ASTM D-5994	mils	60 54	Per Roll
Drainage Stud Height (min. ave.)	ASTM D7466	Mils	130	Every 2 <sup>nd</sup> Roll
Spike Height mils (min ave.) (1)	GRI GM 12	Mils	175 MARV (2)	Every 2 <sup>nd</sup> Roll
Density (maximum)	ASTM D-792 Method B	g/cc	0.939	Every 50,000 square feet
Tensile Properties (ave. both directions) <ul style="list-style-type: none"> <li>Break strength – lb/in. (2 in/min)</li> <li>Break elongation - % (5 specimens in each direction)</li> </ul>	ASTM D-6693 Type IV	lb/in %	126 300	Every 50,000 square feet
Tear Resistance – lb (min. ave.)	ASTM D-1004	lb	40	Every 50,000 square feet
Puncture Resistance (min. ave.)	ASTM D-4833	lb	70	Every 50,000 square feet
Carbon black content %	ASTM D-4218	%	2 to 3	Every 50,000 square feet
Carbon black dispersion (Category)	ASTM D-5596	N/A	Note (1)	Every 50,000 square feet
Oxidative Induction Time (OIT) (min. ave.) <sup>(2)</sup> (a) Standard OIT	ASTM D-3895	min.	100	200,000 lbs
Melt Flow Index	ASTM D1238	(g/10 min.)	≤ 1.0	Per formulation
Oven Aging at 85°C (3) (b) High Pressure OIT (min. ave.) % retained after 90 days	ASTM D-5721 ASTM D-5885	%	60	Per formulation
UV Resistance (4) (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (5)	ASTM D-5885	%	35	Per formulation
2% Secant Modulus (max)	ASTM D5323	lb/in	3600	Per formulation
Axi-Symmetric Break Resistance (min)	ASTM 5617	%	30	Per formulation

- (1) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3

- (2) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (3) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- (4) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. dark condensation at 60°C.
- (5) UV resistance is based on percent retained value regardless of the original HP-OTT value.

### **2.2.3 Quality Control – Minimum Lot/Batch**

Geomembrane shall be monitored throughout the manufacturing process for product integrity and consistency. The manufacturer shall sample rolls for the following physical properties and at the minimum frequency, or per batch of resin, in accordance with GRI –GM 17, whichever results in the greatest number of tests:

- o Geomembrane Density
- o Geomembrane Thickness
- o Carbon Black Content
- o Carbon Black Dispersion
- o Tensile characteristics (break strength, break elongation)
- o Puncture resistance
- o Tear Resistance
- o Asperity Height

In order to minimize the number of conformance samples and tests, the minimum batch or lot size allowed for geomembrane rolls furnished on this project will be 50,000 square feet.

Certified test results shall be submitted to and approved by the Engineer/CQA Monitor at least fifteen (15) working days prior to geomembrane delivery to site. The Contractor shall submit a list which indicates date of production, plant location, resin batch number, manufacturing line number and identification number and square footage of each geomembrane roll. Rolls shall be listed in the order of production with the status of the roll (rejected or approved for shipment). All rolls shall be included in the list whether or not approved for shipment to the project. This information will be used by the Engineer/CQA Monitor to affix rolls to a specific 50,000 square foot, or smaller, lot for conformance testing per applicable portions of this Section.

### **2.2.4 Roll Identification**

Each roll shall be labeled or tagged with the roll identification number, product identification number, name of manufacturer, date and location of production, product type and grade, lot number, and physical dimensions. The label or tag information shall be affixed or attached to the roll at all times during deployment of the roll.

### **2.2.5 Geomembrane Samples**

The Contractor shall submit for approval by the Engineer/CQA Monitor samples of geomembrane material(s) and field seams prior to the start of construction. The Contractor shall submit six 8-inch x 10-inch samples of geomembrane material(s) and six samples of field seams which have been made in conformance with these Technical Specifications. The field seam samples shall be fabricated by the Contractor using the same materials, equipment, and

procedures proposed for the geomembrane installation. Samples shall be 12-inches wide, plus the seam width, and 19-inches long. The samples shall be numbered and dated.

Where optional procedures are noted in the test method, the requirements of the Project Specifications shall prevail. Material property values and/or test methods shall be in accordance with the latest revision of GRI GM17 (or as otherwise noted).

#### **2.2.6 Quality Control (QC) Program**

The geomembrane manufacturer and the Contractor, each, shall submit a complete description of their quality control program, as applicable, for manufacturing, handling, installing, testing, repairing, and providing a completed lining in accordance with requirements of these Technical Specifications. The description shall include, but not be limited to:

- Polymer resin supplier.
- Product identification.
- Acceptance testing.
- Fabrication and production testing.
- Installation testing.
- Documentation of changes.
- Alterations and repairs.
- Retests and acceptance.

#### **2.2.7 Plant Inspection**

A representative of the Owner or Engineer/CQA Monitor may visit the manufacturing plant at any time during the project to observe and inspect the manufacturing process and quality control monitoring, sampling and testing. The Contractor shall notify the Engineer/CQA Monitor at least five working days prior to the start of manufacturing. The Engineer/CQA Monitor will notify the Contractor at least 48 hours in advance of all visits. The Contractor shall be responsible for making all necessary arrangements for the visits with the manufacturer. All costs of travel, lodging and meals incurred by the Owner or Engineer/CQA Monitor will be borne by the respective party. The purpose of the manufacturing plant inspection will be to observe the manufacturing process and the quality control procedures instituted at the manufacturing plant and not for monitoring or observing conformance sampling.

It is also a requirement of these Technical Specifications that conformance sampling will be performed at the manufacturing plant. Costs associated with conformance sampling at the manufacturing plant shall include travel and per diem expenses incurred by the Engineer/CQA Monitor in the performance of such testing and all costs for transporting the samples to the independent testing laboratory.

In lieu of the Engineer/CQA Monitor witnessing all conformance sampling, the Contractor may utilize the services of an independent laboratory accredited by the Geosynthetic Accreditation Institute (GAI) to perform conformance sampling and inspections at the manufacturing plant.

### 2.2.8 Sampling and Testing Frequency

Unless otherwise specified above, conformance samples shall be taken and tested at a rate of one per lot or one per 50,000 square feet, whichever results in the greater number of tests, as outlined in Table 2.2.2.

### 2.2.9 Warranty

The geomembrane manufacturer shall furnish a written liner warranty on a prorata basis for a period of five years. The warranty shall be against manufacturing defects or workmanship and against deterioration due to ozone, ultraviolet light rays, and/or other normal weather aging.

The warranty shall be limited to replacement of material only and shall not cover installation of said material. It shall not cover damage due to vandalism, acts of animals, earthquakes, and other unusual acts of God.

### 2.2.10 Manufacturer's Certification

The Contractor shall submit, to the Engineer/CQA Monitor for approval, written Manufacturer's Certification (Attachment 2D) that the geomembrane:

1. Conforms to the material requirements of these Technical Specifications;
2. is similar to and of the same formulation as that for which certification is submitted;
3. Has been demonstrated by actual usage to be satisfactory for the intended application.

Manufacturer's certification shall include the minimum average roll values for material to be furnished on this project. The Contractor shall obtain Engineer/CQA Monitor's approval of the geomembrane prior to shipment to the site. The Contractor will not be allowed to unload or store on site any geomembrane that is delivered prior to obtaining such approval.

## 2.3 Extrudate Rod or Bead

### 2.3.1 General

The extrudate rod or bead shall be linear low-density polyethylene (LLDPE) and shall be of the same formulation and same supplier as the resin used to produce the geomembrane. All additives shall be thoroughly dispersed throughout the extrudate rod or bead. There shall be no contamination by foreign matter in the extrudate rod or bead.

### 2.3.2 Physical Properties

The extrudate rod or bead shall meet the following specifications:

TEST	TEST METHOD	UNITS	REQUIREMENT
Density	ASTM D-1505	g/cc	0.939 (minimum)
Low Temperature Brittleness	ASTM D-746 Procedure B	F	-40
Carbon Black Content	ASTM D-1603 Procedure B	%	2 to 3
Melt Flow Index	ASTM D-1238, Condition E	g/10 min	0.1 - 0.3
ASTM - American Society for Testing and Materials			

### **2.3.3 Manufacturer Certification and Testing**

One set of tests shall be performed per batch of extrudate rod or bead. Certified test results shall be submitted to and approved by the Engineer/CQA Monitor at least fifteen (15) working days prior to shipping the extrudate rod or bead to the site.

## **3.0 CONSTRUCTION METHODS**

### **3.1 Shipping, Handling and Storage**

#### **3.1.1 General**

Geomembrane shall be shipped, stored, and handled in accordance with the manufacturer's recommendations and as specified herein. The Contractor shall be completely responsible for shipping, handling, and storage of all geomembrane. The geomembrane rolls shall be delivered to the site only after the Engineer/CQA Monitor receives and approves, in writing, the submittal information required in these Technical Specifications.

#### **3.1.2 Shipping**

The Contractor shall notify the Engineer/CQA Monitor at least twenty-four (24) hours prior to scheduled delivery of materials on site. All deliveries shall be made during normal working hours, Monday through Friday, unless specifically authorized by the Engineer/CQA Monitor. No materials shall be unloaded except in the presence of the Engineer/CQA Monitor or the Engineer/CQA Monitor's representative. Geomembrane delivered to the site shall be inspected for damage and unloaded and stored with minimal handling.

Subsequent to delivery, the Contractor, Geomembrane Installer, and the Engineer/CQA Monitor shall complete a surface observation of all rolls for defects or damage. Damaged rolls shall be separated from undamaged rolls until proper disposition of material is determined by the Engineer/CQA Monitor. The Engineer/CQA Monitor will be the final authority on the determination of damage.

#### **3.1.3 Handling**

No hooks, tongs, or other sharp tools or instruments shall be used for handling geomembrane. Contractor shall use cloth chokers and spreader bars for loading and unloading and spreader bars and roll bars for deployment. Geomembrane shall not be folded or dragged along the ground.

#### **3.1.4 Storage**

Geomembrane shall be protected from soil, mud, dirt, debris, puncture, cutting, or other damaging or deleterious conditions. Geomembrane rolls shall not be stored on wooden pallets. Geomembrane shall not be stacked more than three (3) rolls high. Storage shall be in accordance with the manufacturer's recommendations.

### **3.2 Supporting Surface**

#### **3.2.1 Acceptance of Soil Subgrade**

No geomembrane shall be installed until the supporting surface has been inspected and approved for geomembrane installation by the Engineer/CQA Monitor. The Contractor shall correct all deficiencies found in the subgrade prior to deployment of the geomembrane at no additional cost to the Owner. In addition, the geomembrane installer shall inspect the subgrade and shall certify,

in writing, that the subgrade is acceptable for geomembrane installation. The Contractor shall maintain responsibility for subgrade maintenance in accordance with the Specification requirements until completion of the liner installation.

### **3.2.2 Maintenance**

The Contractor shall maintain the surface suitability and integrity of the foundation soil finished grade until installation of the geomembrane is completed and accepted by the Engineer/CQA Monitor. The foundation soil finished grade shall be maintained in a condition that maintains moisture content and provides for a firm and unyielding condition. Vehicle tracking, disruption of foundation soil finished grade surface, etc., caused by driving of equipment over the prepared foundation soil finished grade shall be repaired by the contractor prior to placement of geomembrane. Once finished grade of the foundation layer is obtained, geomembrane placement over the finished section is required to commence within 24 hours.

## **3.3 Geomembrane Installation**

### **3.3.1 Installation Submittals**

The Contractor shall submit the following:

- Installation drawings.
- Description of installation procedures including subgrade maintenance.
- Installation schedule for Completion of the Work – Schedule shall address the installation of LLDPE Geomembrane and other geosynthetic components to be performed in conjunction with earthwork phasing, on an iterative basis as described in Section 2C – Earthwork. Installation schedule shall also address any multiple move-ins, multiple deployments, multiple piping and collection system installation, and geosynthetic operations (i.e. multiple move-ins, multiple deployments, and multiple piping and collection system installation, geosynthetic operations (i.e. Drainage Collector, HDPE Edge Drain (Below Geomembrane), LFG Passive Vents and LFG Trench/Well Vents, LLDPE Geomembrane, ClosureTurf, LLDPE boots, and outlet piping, etc) over portions of the total LLDPE Geomembrane installation area that are a requirement of this project.

Installation drawings shall show a field panel lining sheet layout with proposed size, number, position, and placement sequence of all sheets and indicating the location of all field seams and anchors. Installation drawings shall also show complete details and/or methods for anchoring the liner at its perimeter, making field seams and making anchors/seals to pipes and structures penetrating the liner.

A field panel (sheet) is an area of geomembrane which is to be seamed in the field (i.e., a field panel is a roll or a portion of roll cut in the field). The geomembrane installer shall assign each panel over 25 square feet an identification code which shall be agreed to and used by the Engineer/CQA Monitor and the Contractor. The Contractor shall locate the code with roll number near the middle of the panels less than 50 feet in length and at both ends of panels over 50 feet in length.

### **3.3.2 Material Inspection**

Prior to installation, the Contractor shall visually inspect all geomembrane for imperfections, faulty or suspect areas and possible damage. All such defective geomembrane shall be marked, repaired, and/or tested. Geomembrane that cannot be repaired shall be removed from the work area and replaced at no additional cost to the Owner. Contractor shall inspect and replace faulty material that requires more than one patch per 2,000 square feet of geomembrane deployed at no additional cost to the Owner. Patches required for destructive testing will not be included in this tabulation.

### **3.3.3 General**

The Contractor shall thoroughly review the manufacturer's recommendations for proper installation procedures of the specified material. The Contractor shall consult with the manufacturer's representatives regarding site specific and environmental impacts which may affect the installation. Such items as adequate or allowable slack, timing of anchor completion to minimize creep, and temperature considerations shall be reviewed, and appropriate action shall be taken by the Contractor to assure intimate contact between subgrade and geomembrane upon placement of overlying material.

The number of panels deployed on one day shall be limited to the number of panels which can be seamed or tack welded on the same day.

Contractor shall use equipment which does not damage geomembrane or the supporting subgrade surface.

All personnel working on geomembrane shall wear shoes that do not damage the geomembrane. No personnel shall be allowed to engage in activities that could damage the geomembrane.

Clamps and other metal tools used in the work area shall have rounded edges with no sharp corners. Clamps and other metal tools shall not be tossed or thrown.

Panels shall be unrolled using a method that protects geomembrane from scratches and crimps and protects the foundation soil finished grade from damage.

Contractor shall minimize wrinkles, especially differential wrinkles between panels.

Contractor shall place adequate temporary hold-downs to prevent uplift by wind. Hold-downs shall not damage geomembrane and shall be continuous along edges to minimize risk of wind flow under panels.

Contractor shall protect geomembrane in heavy traffic areas using geotextile, extra geomembrane (sacrificial), or other suitable materials. Material used for protection shall be temporary and shall not be used as any part of the permanent installation.

Contractor shall not allow vehicle traffic on geomembrane surface.

### **3.3.4 Weather Conditions**

#### **3.3.4.1 Temperature**

Ambient temperature, measured six inches above geomembrane surface, shall be logged every two hours. Geomembrane shall be deployed between ambient temperatures of 40 degrees F to 105 degrees F and when the relative humidity is less than 80 percent. Deployment of

geomembrane below 40 degrees F shall only be allowed after it has been verified that the material can be seamed according to these Technical Specifications, and is approved by the Engineer/CQA Monitor. When the temperature is below 50 degrees F, preheating by hot air device one inch in front of the extruder shall be provided. Special test welds may be required to verify that weather conditions are not adversely impacting seam quality.

#### **3.3.4.2 Precipitation / Moisture**

The geomembrane shall not be deployed during precipitation, in the presence of excessive moisture, or in areas of ponded water. Exceptions to these restrictions may be granted with approval of the Engineer/CQA Monitor and on condition that adequate steps (such as shelters) are taken by the Contractor to produce high quality seams meeting the requirements of this Section.

#### **3.3.4.3 Wind Protection**

The geomembrane shall not be deployed in the presence of excessive winds. The Contractor shall protect the geomembrane against adverse effects of high winds (such as uplift). Sandbags may be used for this purpose. Sandbags shall be sufficiently close knit to preclude fines from working free of the bottom, sides, or seams. Paper bags, whether or not lined with plastic, shall not be permitted. Burlap bags, if used, shall be lined with plastic. Sandbags shall contain not less than 40, nor more than 60, pounds of sand having 100 percent passing a #8 screen. Sandbags shall be tied closed after filling, using only plastic ties. Metal or wire ties shall not be allowed. Sandbags that are split, torn, or otherwise losing their contents shall be immediately removed from the work area and replaced and any spills immediately cleaned up.

### **3.3.5 Miscellaneous Liner Details**

Installation of the Final Cover System includes the construction of various terminations, anchors, berms, interceptor trenches, tie-downs, and other appurtenances as indicated on the Plans. All work associated with, and required for, the completion of these items is to be considered as included in the Contractor's unit prices.

## **3.4 Seams**

### **3.4.1 General**

Seams shall be oriented vertically up and down the slopes; not horizontally across the slopes. Each seam shall be numbered and seam numbering system compatible with the panel numbering system shall be used. The number of field seams in corners, off-shaped geometric locations, and outside corners shall be minimized.

Panels shall be overlapped as recommended by the manufacturer. Only procedures that do not damage the geomembrane and that are not detrimental to seam weld material shall be used to temporarily bond adjacent panels together.

All edges, laps, junctions, shall be welded, whether or not a specific note or detail on the drawings indicates a weld.



### 3.4.2 Physical Properties

Geomembrane seams shall be tested in accordance with ASTM D-6392 and shall meet or exceed the following minimum requirements:

TEST	TEST METHOD	REQUIREMENTS
Fusion Welds Shear Strength (ppi) Shear Elongation (%) Peel strength (ppi) Peel Separation (%)	ASTM D-6392	90 50 75 25
Extrusion Fillet Seams Shear Strength (ppi) Shear Elongation (%) Peel strength (ppi) Peel Separation (%)	ASTM D-6392	90 50 66 25

### 3.4.3 Seam Preparation

The following steps shall be followed in preparing seams:

- Clean surface of grease, moisture, dust, dirt, debris or other foreign material.
- Clean surface of oxidation by disc grinder or equivalent not more than 1 hour before seaming (not required for wedge welding).
- Use No. 80 grit sandpaper for disc grinder.
- All areas where grinding is evident shall be repaired with a method approved by the Engineer/CQA Monitor.
- Cover with single extrudate any bead grooves.
- Use soft bristle brush after grinding, if brushing required.
- Do not use wire brush after grinding.
- Cut wrinkles and "fishmouths" along ridge.
- Overlap and seam wrinkles and fishmouths.
- Patch wrinkles and fishmouths where overlap is less than three (3) inches.
- Use firm, dry substrate (piece of geomembrane or other material) directly under seam overlap where subgrade is soft.
- Use plywood or other firm material under seam overlap when welding over anchor trench.

### 3.4.4 Extrusion Welding

As necessary, welding apparatus shall be purged of heat-degraded extrudate before welding if extruder is stopped for longer than three minutes. All purged extrudate shall be disposed of off

the geomembrane. Extrudate rod shall be removed from welder when welder is idle for over two hours.

Each extruder shoe shall be inspected daily for wear to ensure that its offset is the same as the liner thickness. Worn shoes, damaged or misaligned armature brushes, nozzle contamination, or other worn or damaged parts shall be repaired or replaced prior to further usage.

Stop-start welding shall be avoided. Existing welds or welds more than five minutes old shall be ground two inches back from point of stoppage or two inches on each side of identified leaks before welding. Weld shall be restarted two inches on each side of identified leaks or two inches back from point of stoppage.

No equipment will be allowed to commence welding on liner until the trial weld, made by that equipment, has been approved by the Engineer/CQA Monitor.

Components shall be mounted on a mobile unit for interface extrudate welding. The following accessories shall be included as a minimum:

- Variable speed control.
- Wheels with non-skid surface on LLDPE.
- Directional control.
- Automatic hot air system for preheating welding surfaces.
- Extruder system with appropriate die.
- Four adjustable contact pressure rollers.

The "hot air system" shall be tested and set up using scrap material each day prior to commencing seaming. Hot air velocity shall be adjusted to account for wind effects. Contact pressure rollers shall be adjusted to prevent surface ripples in sheet.

### **3.4.5 Hot Wedge Welding**

Welding apparatus shall be automated vehicular mounted device equipped with gauges giving applicable temperatures. The welding apparatus shall be equipped with a temperature gauge.

A smooth insulating plate or fabric shall be placed beneath to hold welding apparatus after usage. Protective fabric or piece of geomembrane shall be placed beneath hot welding apparatus when resting on geomembrane.

Moisture build up between sheets shall be prevented.

No equipment will be allowed to commence welding on liner until the trial seam, made by that equipment, has been approved by the Engineer/CQA Monitor. All welding conducted at the Contractor's discretion, prior to trial seam results, shall be at the Contractor's risk. Trial seam failures shall be tracked as outlined under "Trial Seams".

A minimum of one spare operable welding apparatus shall be maintained for each three seaming teams.

An electric generator shall be provided that is capable of providing a constant voltage for the anticipated combined line load. The electric generator shall generally be located outside the liner

limit. Protective lining and splash pads large enough to catch spilled fuel shall be placed under electric generator when located on the liner.

### **3.4.6 Trial Seams**

Trial seams shall be demonstrated on pieces of geomembrane liner to verify adequate seaming conditions. Trial seams shall be conducted on each piece of equipment in service, at the following frequency:

- At beginning of each seaming shift (5 hours maximum start of day and mid-day).
- Any time a piece of equipment is shut down for more than thirty minutes.
- At least one per shift for each welding technician performing seaming.
- As weather conditions dictate, and at Engineer/CQA Monitor's request.

Welding technicians shall not change parameters (temperature, speed, wheel adjustment) without successfully performing another trial weld.

Trial weld shall be constructed adjacent to the area to be seamed. Trial welds shall be in contact with subgrade or geotextile (same condition as the liner to be seamed).

The trial weld sample shall be at least 3-feet long and 12-inches wide with the seam centered lengthwise. Two 1-inch wide specimens shall be cut by the Contractor in the presence of the Engineer/CQA Monitor and the specimens obtained near each opposite end of trial weld seam. Specimens shall be quantitatively tested first, for peel adhesion, and then for bonded seam strength (shear).

Seam breaks will be analyzed for shear and peel strength in accordance with the requirements of GRI Test Method GM19 Table 2(a) and the requirements of Section 3.4.2 of these Technical Specifications. A trial weld passes when both test specimens pass peel and shear tests.

Testing shall be repeated in its entirety if one or more of the specimens fails the peel or shear tests. If trial weld testing fails, the seaming apparatus and operator shall not be used for welding until deficiencies or conditions are corrected and two consecutive successful field test seams are achieved (two specimens in peel and two specimens in shear). All weld seams made by seaming apparatus prior to failure of trial weld shall be checked. Starting back from last seam made, check seams at minimum 10-foot intervals until two consecutive seam tests pass. Seam shall be reconstructed to the satisfaction of the Engineer/CQA Monitor.

### **3.4.7 Repairs**

Holes smaller than 1/4-inch shall be repaired by extrusion welding. The surface of the geomembrane shall be ground to a minimum one inch around hole immediately before welding. Seams shall be vacuum tested after each welding. Result of test, date of test, and name of quality control technician shall be marked on the geomembrane adjacent to the seam.

Holes larger than 1/4-inch, tears, blisters, undispersed raw material, and contamination by foreign matter shall be patched. Patches shall be round or oval in shape and made of the same material as the geomembrane. Patches shall extend a minimum of six (inches beyond the edge of defect and shall be a minimum of 12 inches in diameter. Edge of the patch shall be beveled. Patch shall not be cut with repair sheet in contact with geomembrane. Patch shall be welded to the

geomembrane with an approved method and vacuum tested. Result of test, date of test, and name of quality control technician shall be marked on the patch.

Contractor's daily documentation of non-destructive and destructive testing shall be provided to the Engineer/CQA Monitor's on-site representative. The documentation shall identify seams which were repaired and retested successfully.

### **3.5 Construction Quality Control (QC)**

#### **3.5.1 General**

The Contractor shall designate a full-time Quality Control (QC) Technician to be responsible for supervising and/or conducting the construction QC program. The QC Technician shall have quality control experience on five million square feet of geomembrane. The resume for the QC Technician shall be included in the qualifications package submitted for the Engineer/CQA Monitor's review. The QC Technician shall not be replaced without written authorization by the Engineer/CQA Monitor. All field QC testing shall be performed in the presence of the Engineer/CQA Monitor.

#### **3.5.2 Visual Inspection**

All seams shall be visually evaluated by the Contractor as the installation progresses and again at completion of the installation. Defective and questionable sections shall be clearly marked and repaired as necessary.

#### **3.5.3 Vacuum Box Testing**

The continuity of extruded field seams, beads, and patches shall be tested over their entire length using vacuum box test units. The vacuum test shall be performed concurrently with seaming work, not at completion of seaming.

The vacuum box shall be an American Vacuum Seam Tester, Series A100 as manufactured by American Parts and Service Company, Alhambra, California, or an approved equal. The vacuum box assembly shall consist of the following:

- Rigid housing.
- Transparent viewing window.
- Soft rubber gasket attached to bottom of housing.
- Porthole or valve assembly.
- Vacuum gage.

A vacuum pump and tank equipped with pressure controller and pipe connections, rubber pressure/vacuum hose with fittings and connections, clean, dry, soft rags, plastic bucket and applicator, water, and detergent to produce soapy solution shall also be provided.

The vacuum testing procedure shall be as follows:

- Clean window, gasket surfaces, and check for leaks.
- Energize vacuum pump and reduce tank pressure to a minimum of five (5) psi.

- Wet a strip of geomembrane weld approximately 12-inches by 30-inches (length of box) with soapy solution.
- Place box over wetted area and compress.
- Close bleed valve and open vacuum valve.
- Ensure that a leak-tight seal is created.
- For a period of not less than fifteen seconds, examine length of weld through viewing window for presence of soap bubbles.
- If no bubbles appear after fifteen seconds, close vacuum valve and open bleed valve, move box over next adjoining area with minimum 3-inch overlap of previous test section and repeat process.
- Areas where soap bubbles appear shall be marked, repaired, and retested.

The following procedures shall be used at locations where seams cannot be vacuum tested:

- Where possible and/or required, cap-strip seams with same geomembrane.
- If seam is accessible to testing equipment prior to final installation, vacuum test seam prior to final installation.
- Seaming and cap-stripping operations shall be observed by the Engineer/CQA Monitor for uniformity and completeness.

#### **3.5.4 Air Pressure Testing**

The Contractor shall test all dual-hot wedge seams in the LLDPE geomembrane by using the air pressure test which consists of inserting a needle with gauge in the air space between welds. Air shall be pumped to 40 psi within the weld void and held for at least five minutes. If the pressure loss exceeds 2 psi within the weld void during air pressure testing, the outside weld edge (not free edge) shall be sprayed with a soap solution and visually examined for bubbles. If no bubbles appear, the problem is with the inside weld and the seam is acceptable. If any bubbles appear, the defect shall be repaired by extrusion welding and tested by vacuum box and/or spark detector.

If pressure loss is not more than 2 psi, the opposite end of the seam will be punctured to release the air. If a blockage is present, it will be located and tests on both sides of the blockage will be completed. All penetration holes created during testing shall be sealed by patching and extrusion welding.

Equipment shall be as follows:

- Air pumps equipped with pressure gauge capable of generating and sustaining a pressure at 40 psi and mounted on cushion to protect geomembrane.
- Rubber hose with fittings and connections.
- Sharp hollow needle or other pressure feed device approved by the Engineer/CQA Monitor.

The air pressure testing shall be as follows:

- Seal both ends of the seam to be tested.

- Insert a needle or other approved pressure feed device into tunnel created by double hot wedge seaming and insert a protective cushion beneath air pump above geomembrane.
- Pressurize air chamber to 40 psi, and sustain pressure for a minimum of five minutes.
- Demonstrate air test seam continuity by puncturing end opposite pressure-feed device.
- If loss of pressure exceeds 2 psi or does not stabilize, locate faulty area and repair as appropriate.
- Retest failed areas as appropriate.
- Remove approved pressure feed device and patch.

### **3.5.5 Spark Testing**

If a fillet weld is used to weld seams, the Contractor may, in lieu of vacuum box testing, test seams and repairs in the geomembrane by using a high voltage spark detector, similar to Tinker and Rasor Holiday Detector (Model AP-W). The setting of the detector shall be 20,000 volts. All seams to be tested shall be provided with 24-30 gauge copper wires properly embedded in the seams and grounded. All spark testing shall be done in the presence of the Engineer/CQA Monitor. All defective areas shall be marked for repair.

### **3.5.6 Final Seam Inspection**

For final seaming inspection, seams and surface of geomembrane shall be checked for defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. The geomembrane surface shall be brushed, blown, and/or washed if dirt inhibits inspection. The Engineer/CQA Monitor shall decide if cleaning of geomembrane surface and welds is needed to facilitate inspection. The Contractor shall distinctively mark, preferably with paint, repair areas and indicate required type of repair.

## **3.6 Construction Quality Control/Conformance Testing**

Conformance and destructive seam testing will be conducted by an independent testing laboratory certified by the Geosynthetic Accreditation Institute (GAI), selected by the Contractor and approved by the Engineer/CQA Monitor. Test results of the independent testing laboratory will be considered final. All costs associated with conformance and destructive seam testing sampling, shipping, and testing by the independent testing laboratory will be borne by the Contractor.

### **3.6.1 Conformance Sampling, Testing and Reporting**

The Contractor shall obtain all conformance samples directly from the manufacturing plant, under the observation of the Engineer/CQA Monitor, or as approved by the Engineer/CQA Monitor, pursuant to Section 2.2.10. Conformance samples shall be taken and tested at a rate of one per lot, or one per 50,000 square feet, whichever results in the greater number of tests.

Samples shall be taken across the entire width of the roll and shall not include the first three (3) feet. Unless otherwise specified, samples shall be three (3) feet long by the roll width. The Engineer/CQA Monitor shall mark the machine direction on the samples with an arrow, and the geomembrane manufacturer's roll identification number.

At a minimum, conformance tests will include determination of the following characteristics for the LLDPE:

- Thickness (ASTM D5994)
- Tensile characteristics (break strength, elongation at break) (ASTM D6693)
- Puncture resistance (ASTM D4833).
- Tear Resistance (ASTM D1004)
- Density (ASTM D1505/D792)
- Carbon black content (ASTM D1603)
- Carbon Black Dispersion (ASTM D5596)
- Asperity (GM 12)

Where optional procedures are noted in the test method, the requirements of the Project Specifications shall prevail.

A conformance sample that yields any tested property less than the specified average minimum roll property will be recorded as a failure. The portion of the manufactured lot represented by the failing conformance sample/test will be considered non-conformant with the Project Specifications and the material rejected for use on the project.

The minimum number of specimens tested will be determined in accordance with ASTM Standards. Certified test results of the independent laboratory shall be submitted for approval by the Engineer/CQA Monitor following the requirements set forth in these Specifications. Final approval of the geomembrane shall be contingent upon certification of test results which meet or exceed the requirements of these Technical Specifications.

### **3.6.2 Destructive Seam Testing**

The Contractor shall visually inspect, mark and repair suspicious-looking welds before release of a section to the Engineer/CQA Monitor for destructive seam testing. The Contractor shall provide the Engineer/CQA Monitor with a minimum of one destructive sample per 500 linear feet of seam length for destructive seam testing. Destructive seam testing will be performed by the GAI certified, independent testing laboratory, and all testing costs will be paid by the Contractor. The sample location shall be selected by the Engineer/CQA Monitor and the Contractor shall not be informed in advance of the sample location. Samples shall be cut as seaming and non-destructive testing progresses, and prior to completion of liner installation. Samples shall be marked with consecutive number and location seam number. Contractor shall record, in written form, the date, time, location, seam number corresponding roll number, welding apparatus identification number, and ambient temperatures at time seam was welded. This information shall be delivered to the Engineer/CQA Monitor with the destructive samples. The Engineer/CQA Monitor shall observe acquisition of all destructive samples. The Contractor shall immediately repair holes in geomembrane resulting from obtaining destructive samples and vacuum box test the patches.

The size of destructive samples shall be as follows:

- Two 1-inch wide by 12-inch long (plus seam width) for field testing
- One 12-inch wide by 36-inch long for laboratory testing

The sample shall be cut into three equal parts and distributed as follows:

- Independent Lab
- Contractor
- Engineer/CQA Monitor (Archive)

The destructive seam testing will be as follows. The two 1-inch wide samples shall be tested in the field for peel adhesion and bonded seam strength (shear) by the Contractor and shall pass the strength requirements established in Section 3.4.2. If one or both of the samples fails in either peel or shear, the Contractor can, at his/her discretion, either: (1) reconstruct or cap strip the seam between passed test locations or, (2) take another test sample 10 feet from the point of the failed test and repeat this procedure.

If the second test passes, the Contractor shall reconstruct or cap strip the seam between the two passed test locations.

If subsequent tests fail, the procedure is repeated until the length of the poor quality seam is established. Repeated failures indicate that either the seaming equipment and/or operator is not performing properly, and appropriate action shall be taken.

Once the field tests have passed, the lab sample shall be recovered from between passing field sample locations for testing by the independent testing laboratory.

All specimens of a field weld sample tested by the independent testing laboratory shall pass. If any specimen fails, the entire sample shall be considered as a failure and the field weld shall be rejected. In this event, the field seam(s) shall be rejected as being non-conformant with the Technical Specifications and corrective measures shall be implemented.

For destructive samples which have failed, corrective measures shall include a rerun of the weld test using the same sample. If the second test passes, the Engineer/CQA Monitor may assume an error was made in the first test and the field seam may be accepted. If the second test fails, the Contractor shall reconstruct or cap strip the field seam between any two previous passed seam locations which include the failed seam or shall go on both sides of the failed seam location (10-foot minimum), take another sample each side and test both in the independent laboratory.

If both samples pass, the Contractor shall reconstruct or cap strip the field seam between the two passing locations. If either fails, the Contractor shall repeat the process of taking samples for testing by the independent testing laboratory. In all cases, acceptable field seams must be bounded by two passed test locations. In cases involving more than 50 feet of reconstructed or cap stripped seam, the reconstructed or cap stripped seam shall also be tested. The results of the independent testing laboratory governs seam acceptance. In no case shall field testing of installed seams be used for final acceptance.

Testing shall include peel and shear strength (ASTM D6392). At least five specimens each shall be tested for peel and shear. Minimum test values are presented in Section 3.4.2 of these Technical Specifications.



The Contractor's laboratory test results shall be presented to the Engineer/CQA Monitor for comments.

### **3.7 Record Drawing**

In addition to providing survey data from which final pay quantities shall be determined, the Contractor shall submit information required in the preparation of the record drawings for the final cover system (See Section 2B-Construction Support Tasks, Paragraph 1.4 Survey for additional project survey requirements). This data shall include:

- Coordinates and elevations of all constructed area finish subgrade, top of foundation soil layer placement, (prior to placement of final cover system) and completed final cover surfaces to enable surveyor to verify soil component layer thicknesses and to develop final cover certification drawings.
- Coordinates and elevations of all LFG facilities to properly locate the as-built position on record drawings.
- Coordinates and elevation of all limits of LLDPE Geomembrane to properly locate the as-built position on record drawings.
- Coordinates and elevation of all HDPE Boots, HDPE Edge Drain Outlet Pipes to properly locate the as-built position on record drawings.
- Coordinates and elevation of all corners for drainage facilities to properly locate the as-built position on record drawings.
- Coordinates and elevations for flow line of interceptor drains, drainage ditches, at a center to center spacing not to exceed 25 feet or otherwise approved by Engineer. The edge of the channel where it adjoins any other structure (e.g., perimeter access road) shall be surveyed at the same spacing.

**The survey and record drawing requirement for this project will necessitate that the Contractor be prepared to perform survey work on a daily basis during the Geomembrane installation phase of the work, to accurately document the as-built condition of the various components of the system. (See Section 2B – Construction Support Tasks, Paragraph 1.4 Survey and required deliverables under Paragraph 1.4.7).**

## **4.0 MEASUREMENT AND PAYMENT**

### **4.1 60 mil LLDPE Super Grip Net Geomembrane – Slope (Per Detail 1/D1) - Item No. 9A**

The contract unit price paid per square foot for 60 mil LLDPE Geomembrane – Slope shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved with installation of 60 mil LLDPE Geomembrane - Slope, complete and in place, as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the Engineer/CQA Monitor

Final pay quantities will be determined by verifying the actual surface area, from approved Record Drawings of the 60 mil LLDPE Geomembrane - Slope placed to the limits indicated on the Plans (Overlap at seams and material in the anchor trench will not be measured separately for payment). All transitions are considered to be included in the contractor's unit price. Work

performed outside the limits indicated on the Plans, or reflected in the Technical Specifications, will not be compensated unless previously approved by the Engineer/CQA Monitor. Interim progress payments will be based on the Construction Manager's evaluation of the estimated percentage of work completed during the subject period.

**4.2     60 mil LLDPE Super Grip Net Geomembrane – Deck (Per Detail 2/D1) - Item No. 9B**

The contract unit price paid per square foot for 60 mil LLDPE Geomembrane - Deck shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved with installation of 60 mil LLDPE Geomembrane - Deck, complete and in place, as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the Engineer/CQA Monitor

Final pay quantities will be determined by verifying the actual surface area, from approved Record Drawings of the 60 mil LLDPE Geomembrane - Deck placed to the limits indicated on the Plans (Overlap at seams and in anchor trenches will not be measured separately for payment). All transitions are considered to be included in the contractor's unit price. Work performed outside the limits indicated on the Plans, or reflected in the Technical Specifications, will not be compensated unless previously approved by the Engineer/CQA Monitor. Interim progress payments will be based on the Construction Manager's evaluation of the estimated percentage of work completed during the subject period.

**4.3     Bentonite Plug/Edge Drain Outlet Per Detail 7/D1 - Item No. 10**

The contract unit price paid per each Bentonite Plug/Edge Drain Outlet shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in Bentonite Plug/Edge Drain Outlet, complete in place, subgrade preparation, placement/compaction of bentonite plug around HDPE pipe, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the Engineer/CQA Monitor.

Final pay quantities shall be determined from the actual number of Bentonite Plug/Edge Drain Outlets placed as indicated on the Plans.

**END OF SECTION 2D**

## ATTACHMENT 2D

SUMMARY OF 60 mil Super Gripnet LLDPE GEOMEMBRANE MANUFACTURER'S QUALITY ASSURANCE (MQA)				
PHYSICAL PROPERTY	METHOD	UNIT	REQUIREMENT	FREQUENCY
Thickness mils(min. ave) Lowest individual	ASTM D-5994	mils	60 54	Per Roll
Drainage Stud Height (min. ave.)	ASTM D7466	Mils	130	Every 2 <sup>nd</sup> Roll
Spike Height mils (min ave.) (1)	GRI GM 12	Mils	175 MARV (2)	Every 2 <sup>nd</sup> Roll
Density (maximum)	ASTM D-792 Method B	g/cc	0.939	Every 50,000 square feet
Tensile Properties (ave. both directions) <ul style="list-style-type: none"> <li>Break strength – lb/in. (2 in/min)</li> <li>Break elongation - % (5 specimens in each direction)</li> </ul>	ASTM D-6693 Type IV	lb/in %	126 300	Every 50,000 square feet
Tear Resistance – lb (min. ave.)	ASTM D-1004	lb	40	Every 50,000 square feet
Puncture Resistance (min. ave.)	ASTM D-4833	lb	70	Every 50,000 square feet
Carbon black content %	ASTM D-4218	%	2 to 3	Every 50,000 square feet
Carbon black dispersion (Category)	ASTM D-5596	N/A	Note (1)	Every 50,000 square feet
Oxidative Induction Time (OIT) (min. ave.) <sup>(2)</sup> (a) Standard OIT	ASTM D-3895	min.	100	200,000 lbs
Melt Flow Index	ASTM D1238	(g/10 min.)	≤ 1.0	Per formulation
Oven Aging at 85°C (3) (b) High Pressure OIT (min. ave.) % retained after 90 days	ASTM D-5721 ASTM D-5885	%	60	Per formulation
UV Resistance (4) (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (5)	ASTM D-5885	%	35	Per formulation
2% Secant Modulus (max)	ASTM D5323	lb/in	3600	Per formulation
Axi-Symmetric Break Resistance (min)	ASTM 5617	%	30	Per formulation

- (1) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
- 9 in Categories 1 or 2 and 1 in Category 3
- (2) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
- (3) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
- (4) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. dark condensation at 60°C.
- (5) UV resistance is based on percent retained value regardless of the original HP-OTT value.

\_\_\_\_\_  
Manufacturer

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Print Name

## **SECTION 2E**

### **CLOSURE TURF/GEOTEXTILE**

#### **1.0 GENERAL**

This section sets forth the requirements for installation of Closure Turf and non-woven geotextiles. A Construction Quality Assurance (QA) Plan has been developed in conjunction with this Project and the ClosureTurf Manufacturer's Installation Manual are included with these Technical Specifications (Appendix C) for the Contractor's reference. The Contractor shall assure that the Engineer has, at all times, safe access to the work for the purpose of monitoring, observation, and QA Plan implementation.

An independent engineering firm, under Contract to the County, will conduct Quality Assurance (QA) monitoring, observation, and documentation. The Contractor shall coordinate and cooperate with the Engineer during all manufacturer's quality control sampling, testing, and certification required by these Technical Specifications.

#### **1.1 Work Included**

The specified geotextiles shall be furnished and installed as shown on the Plans for separation of the gravel around the Drainage collector piping from the overlying soils. The Closure Turf shall be furnished to cover the 60-mil LLDPE Super Grip Net Geomembrane.

#### **1.2 Manufacturer Certification and Quality Control (QC)**

Quality Control (QC) is the responsibility of the Contractor and shall consist of manufacturer's certification, manufacturer's quality control testing, installation quality control, All QC sampling and testing shall be performed in accordance with these Technical Specifications and all costs associated with quality control shall be borne by the Contractor. The Contractor shall submit, for approval by the Engineer, a breakdown of costs for the specified testing.

#### **1.3 Submittals Required**

The Contractor shall thoroughly review the Technical Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Manufacturer's Certified Test Data
- Manufacturer's Quality Control Testing
- Product Data – Closure Turf
- Product Samples
- Installation Procedures, Including Seam and Repairs
- Contractor's Closure Turf Installation Procedures
- Contractor's Installation Quality Control Procedures
- Contractor's Closure Turf Installation Procedures
- Contractor's Installer Resume
- Quality Control Technician Resume

- o Record Drawings (As-built)
- o Closure Turf Installer's Daily Documentation
- o Manufacturer's Quality Control Plan
- o Manufacturer's Quality Assurance Plan
- o Manufacturer's Installation Quality Assurance Plan
- o Contractor Final Quality Control Records
- o Contractor's Installation Quality Control Plan
- o Manufacturer's 5 Year Warranty Sample
- o Manufacturer's 5 Year Warranty
- o Subgrade Certification
- o Certificate of Compliance for Sand Infill.
- o Certificate of Compliance for HydroBinder®

#### **1.4 ArmorFill® – Submittals and Testing**

##### **A. MANUFACTURING:**

1. Pre-Production Manufacturer's Quality Control (MQC) Data – ArmorFill® Infill Component.
  - a. Submit to the OWNER'S REPRESENTATIVE prior to installation of the ArmorFill® component;
    1. Certificate of Compliance that shows proposed material for this project will meet the Manufacture's internal Certificate of Analysis.
    2. Certificate of Analysis from the MANUFACTURER will show;
      - a. Product Description;
      - b. Batch Number;
      - c. Date of Manufacture;
      - d. Test Method;
      - e. Units Used;
      - f. And Results as compared to;
        - i. The Manufacture's Lower Specification Limit, and;
        - ii. The Manufacture's Upper Specification Limit.
    3. The specific characteristic to be tested are;
      - a. Density;
      - b. pH;
      - c. Solid Content (Non-Volatiles), and;
      - d. Viscosity;

## 2.0 MATERIALS

### 2.1 Closure Turf

**2.1.1 General (Definition) -** Engineered Turf: A component of the ClosureTurf® System. A synthetic structured material consisting of one or more geotextiles tufted with polyethylene yarns that resemble grass blades. Closure Turf is proprietary property of Watershed Geosynthetics, LLC.

The Engineered Turf component of the Final Cover System shall be new, first quality products designed and manufactured in North America by AgruAmerica, or an approved equal. Closure Turf shall be suitable and durable for the intended application as satisfactorily demonstrated by similar and prior applications.

**2.1.2 Physical Properties:** Closure Turf shall meet or exceed the following minimum average roll values (weakest principle direction):

#### ENGINEERED TURF COMPONENT

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	800 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb./ft. min. (MARV)
Rainfall Induced Erosion	ASTM D6459	0.04% Infill Loss 6 in./hr.
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft <sup>3</sup> /ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft <sup>3</sup> /s/ft
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolan Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥19 oz. / sq. yd. (≥ 24 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

#### SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft <sup>2</sup>	m <sup>2</sup>	lbs	kg
Super Gripnet®	60	1.50	23	7	300	91.4	6,900	640	~3000	~1360
Turf Component	N/A	N/A	15	4.6	300	91.4	4,500	418	840	381

ClosureTurf® and HydroTurf® products (US Patent No. 7,682,105, 8,585,322, 9,163,375, and 9,199,287; Canadian Patent No. 2,663,170; and other Patents Pending) and trademarks are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

### 2.1.2 Sewing Equipment/Thread - ClosureTurf

Thread used to sew panels of ClosureTurf together shall be Polyester or equivalent thread with physical and chemical-resistance properties that equal or exceed those of the geotextile. The

thread color shall contrast with the ClosureTurf color and shall be approved for use by the ClosureTurf manufacturer.

A single stitch prayer type seam is constructed using an American Newlong sewing machine or equivalent. Sewing will occur between the 1<sup>st</sup> and 2<sup>nd</sup> row of tufts from the edge.

## 2.2 Non-Woven Geotextile

**2.2.1 General** Non-woven geotextile materials shall be new, first quality products designed and manufactured in North America specifically for this project. Non-woven geotextile shall be mildew, insect and rodent resistant, and needle free. Geotextile shall be suitable and durable for the intended application as satisfactorily demonstrated by similar and prior applications. Geotextile shall be 100-percent polyester or polypropylene (with the exception of inhibitors and/or carbon black added for UV resistance), non-woven and needle-punched materials. Polypropylene materials shall be UV stabilized.

**2.2.2 Physical Properties:** Geotextile shall meet or exceed the following minimum average roll values (weakest principle direction):

GEOTEXTILE MANUFACTURING QUALITY ASSURANCE (MQA)					
PHYSICAL PROPERTY	TEST METHOD	FREQUENCY	UNITS	REQUIREMENT	
				12 oz. Cushion	16 oz. Cushion
Weight (mass/unit area)	ASTM D-5261	100,000 ft <sup>2</sup> or 1 per lot	oz/yd <sup>2</sup>	12*	16
Trapezoidal Tear	ASTM D-4533	100,000 ft <sup>2</sup> or 1 per lot	lbs	115	145
Mullen Burst Strength	ASTM D-3786	100,000 ft <sup>2</sup> or 1 per lot	psi	N/A	N/A
Puncture Resistance	ASTM D-4833	100,000 ft <sup>2</sup> or 1 per lot	lbs	140	170
Permittivity	ASTM D-4491	100,000 ft <sup>2</sup> or 1 per lot	sec <sup>-1</sup>	N/A	N/A
Grab Tensile	ASTM D-4632	100,000 ft <sup>2</sup> or 1 per lot	lbs	300	370
Grab Elongation	ASTM D-4632	100,000 ft <sup>2</sup> or 1 per lot	%	50	50
AOS	ASTM D-4751	100,000 ft <sup>2</sup> or 1 per lot	U.S. Standard Sieve	N/A	N/A
UV Resistance	ASTM D-4355	See Note (2)	% strength retained	N/A	70
<b>Notes:</b> 1. * - Minimum values. 2. Evaluation to be on 2.0-inch strip tensile specimens after 500 hours exposure.					

### 2.2.3 Welding Equipment/Thread - Geotextile

Welding equipment shall be commercial grade quality manufactured for the specific purpose of seaming adjacent geotextile panels, and adhering geotextile straps to underlying geotextile, respectively.

Thread used to sew panels of geotextile together shall be polymeric thread with physical and chemical-resistance properties that equal or exceed those of the geotextile. The thread color shall contrast with the geotextile color and shall be approved for use by the geotextile manufacturer.

## **2.3 Manufacturing Quality Control**

### **2.3.1 Roll Identification**

Each roll shall be labeled or tagged with roll identification number, lot, name of manufacturer, date and location of production, product type and grade, and physical dimensions. The label or tag information shall be affixed or attached to the roll at all times during deployment of the roll. The roll identification number and manufacturer name shall also be marked on the protective covering.

### **2.3.2 Quality Control**

The manufacturer shall follow a quality control program during all phases of the manufacturing process. Geotextile shall be monitored throughout the manufacturing process for product integrity and consistency. Manufacturer shall sample rolls in accordance with ASTM D-4354 and test for the physical properties reflected in Table under Section 2.2.2 at the indicated minimum frequencies, or per lot, whichever results in the greatest number of tests:

The minimum frequency includes the square footage of all manufactured rolls on the production line whether or not the roll is designated for shipment to the Project. The minimum lot size allowed for geotextile furnished on this Project will be 75,000 square feet.

Certified test data (actual quality control reports) shall be submitted to, and approved by, the Engineer prior to installation of geotextile. The Contractor shall submit a list which indicates date of production, date of testing, plant location, manufacturing line number, roll identification number, lot number, test results, and square footage of each geotextile roll. Rolls shall be listed in the order of production with the status of the roll (designated for shipment to project or not designated for shipment to project). All rolls shall be included in the list whether or not designated for shipment to the Project.

## **2.4 Drawings and Data**

Complete specifications, data, and detailed drawings covering the material furnished under this Section shall be submitted for approval in accordance with the procedures set forth in the General Conditions. Data and specifications shall include, but shall not be limited to, the following:

- Manufacturer's written certification that the geotextile conforms to the material requirements of these Technical Specifications.
- Samples of geotextile.
- Complete description of geotextile shipping, handling and storage procedures to be followed during Project.
- Complete description of installation procedures and procedures for seams and repairs to be followed throughout the duration of the Project.
- Samples of welded and/or sewn seams.
- Complete description of quality control procedures and QC Plan to be followed by the Contractor throughout the duration of the Project.
- Installation drawings which show geotextile panel layout, seaming, and anchor details.
- Complete description of the Manufacturer's quality control program and test data.



Manufacturing quality control test data shall be submitted to, and approved by, the Engineer prior to delivery of geotextiles to the site.

## **2.5 Warranty**

The geotextile manufacturer shall furnish a written warranty on a prorata basis for a period of 5 years. The warranty shall be against manufacturing defects of workmanship and against deterioration due to ozone, ultraviolet and/or other normal weather aging.

The warranty shall be limited to replacement of material only and shall not cover installation of said material. It shall not cover damage due to vandalism, acts of animals, earthquakes, and other unusual acts of God.

## **2.6 Sand Infill**

### **2.6.1 Description**

Sand Infill Component of the ClosureTurf® System will meet Particle Size Parameters of ASTM C-33 for fine aggregates as shown in the table below:

ASTM C-33-03	
Sieve	Percent Passing
9.5 mm (3/8) in.)	100
4.75 mm (No. 4)	95 to 100
2.36 mm (No. 8)	80 to 100
1.18 mm (No. 16)	50 to 85
600 µm (No. 30)	25 to 60
300 µm (No 50)	5 to 30
150 µm (No. 100)	0 to 10

Table 1: ASTM C-33-03 Particle Size Parameters

## **2.7 HydroBinder®**

### **2.7.1 Description**

HydroBinder® is a proprietary cementitious product used as an alternate infill component of the ClosureTurf® system.

### **2.7.2 Materials**

- A. The infill will be HydroBinder® Cementitious Infill. The infill material may be delivered in either pallet form of 80 lb. bag or 3,000 lb. bulk super sacks.
- B. Cement, except as otherwise specified herein, will be brand of Portland Cement, meeting ASTM C 150 and will be Type I or Type II.
- C. Only one brand of cement will be used throughout the duration of this Contract.

- D. The cementitious infill mix design will conform to the requirements of ASTM C 387 for high strength mortars.
- E. The cementitious infill mix will have a minimum 28 day compressive strength of 5,000 psi per ASTM C109/C109M.
  1. Verification of the compressive strength will be completed by the manufacturer and a certified test report supplied with each batch/lot of HydroBinder® material delivered to the site.

## **2.8 ArmorFill®**

### **2.8.1 Description**

ArmorFill® is a proprietary polymer-based product developed by Watershed Geosynthetics specifically to bind the ASTM-C33 sand infill component of the ClosureTurf® system for long-term performance applications.

### **2.8.2 Materials**

When required, the ASTM-C33 Sand Infill will be hydrated with ArmorFill®. The ArmorFill® is delivered in totes; full strength (typically 275 gallons).

### **2.8.3 Mixes**

Mix the full strength ArmorFill® at a rate of 6 (six) parts water to 1 (one) part full strength ArmorFill® by volume.

- a. Application rate: 3,400 gallons mixed per acre.

## **3.0 CONSTRUCTION METHODS**

### **3.1 Installation – Engineered Turf**

Qualification requirements for the personnel who the Engineered Turf component are shown in WatershedGeo Installation Specification 01 73 19.

#### **3.1.1 Delivery – Engineered Turf**

Box trucks will deliver 27 rolls per truck. Rolls will be strapped in groups of 9 allowing equipment (i.e. pick-up truck, skid steer) to pull the grouped rolls to the front of the truck. Rolls can be pulled directly to the ground or carpet stingers can move the rolls to a designated area. Observe the following:

- The engineered turf is wrapped in rolls with protective covering.
- The rolls are not stacked more than 3 high.
- The rolls are not damaged during unloading.
- Protect the engineered turf from mud, soil, dirt, dust, debris, cutting, or impact forces.
- Each roll must be marked or tagged with proper identification.
- Rolls that have been rejected due to damage are to be removed from the site or stored at a location separate from accepted rolls, designated by the Owner/Operator.
- Rolls that do not have proper manufacturer's documentation will be stored at a separate location until documentation has been received and approved.

### **3.2 Installation – Engineered Turf - Surface Preparation**

Prior to installation of Engineered Turf, observe the following:

- ClosureTurf® geomembrane has been installed in accordance with the contract specifications.
- The geomembrane installation documentation has been completed and approved by the POR for areas where the Engineered Turf is to be installed.
- The supporting surface (i.e., the geomembrane) does not contain stones, debris, membrane grindings or large scraps left over from the installation process that could damage or impede surface water flow through the Engineered Turf.

#### **3.2.1 Installation – Engineered Turf – Deployment & Field Seaming**

During deployment of Engineered Turf, observe the following:

- Observe the turf as it is deployed.
- Verify that equipment used does not damage the turf or underlying geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that during deployment, the Engineered Turf filaments point upslope a majority of the time.
- Verify that the turf is anchored to prevent movement by the wind (the contractor is responsible for any damage resulting to or from windblown Engineered Turf).
- Verify that the turf remains free of contaminants such as soil, grease, fuel, etc.
- Observe that the turf is laid substantially smooth and substantially free of tension, stress, folds, wrinkles, or creases.
- Observe the deployment of the panels to insure proper flipping in order to expose the turf surface up after seaming operations. After the first panel of the project is deployed, deployment will be done on the adjacent turf panel to avoid damage.

##### **3.2.1.1 Installation – Engineered Turf – Sewn Seam Method**

- A single stitch prayer type seam is constructed using an American Newlong sewing machine or equivalent.
- The thread will be Polyester or equivalent.
- Sewing will occur between the 1<sup>st</sup> and 2<sup>nd</sup> row of tufts from the edge.

##### **3.2.1.2 Installation – Engineered Turf – Fusion Seaming Method**

- Engineered Turf fusion seaming device will be a DemTech VM20/4/A fusion welder only.
- Fusion seams require a minimum of 5 inches of overlap.
- Frayed or loose geotextile strands will be cut off or removed.
- Prior to starting the production fusion seaming, trial seams must be performed as outlined in Section 3.2.1.3 below.
- Demonstrate the preparation methods and equipment utilized for removal of the salvage from the outside edge of the rolls of turf (i.e. trimming & cutting devices).
- Mechanical trimming and cutting devices will be utilized for salvage trimming.
- Demonstrate and control the fraying of geotextile strands when performing the removal of salvage.

- Any damage that occurs due to production seaming will be repaired as outlined in WG Installation Guidance Documents.
- Any defects will be repaired as outlined in 3.2.2.

### 3.2.1.3 Installation – Engineered Turf – Fusion Seaming Method Trial Seam Requirements

1. Prior to turf component welding, CQA personnel shall observe and document the following:
  - a. Turf welding apparatus are tested;
  - b. at daily start-up; and
  - c. immediately after any break; or anytime the machine is turned off for more than 30 minutes.
2. Procedures:
  - a. The turf trial weld will be completed under conditions similar to those under the panels that will be welded.
  - b. If at any time, the CQA Personnel believe that an operator or fusion welding apparatus is not functioning properly, a Field Trial Seam Test must be performed.
  - c. Any dispute concerning proper installation techniques or the proper function of fusion welding equipment will be resolved by the OWNER’S REPRESENTATIVE.
  - d. The trial weld must be allowed to cool to ambient temperature before seam snapping or panel adjustments are applied.
3. Trial Sample Test Results:
  - a. Trial weld samples must comply with “VISUAL PASSING CRITERIA” Visual passing criteria is verified when a manual peel/pull test is performed and the top turf panel tufts transfer to the bottom turf panel. The transfer of approx. 75% of the tufts constitutes a passing trial weld.
4. Field Seam Test Failure:
  - a. Less than approx. 75% of the top turf panel tufts do not transfer to the bottom turf panel.
5. Additional Trial Sample Testing Requirements:
  - a. Two consecutive trial welds meet the visual passing criteria.
6. The trial weld sample must be a minimum of 3 feet long and 12 inches wide, with the seam centered lengthwise.
7. If a welding apparatus exceeds 5 hours in the second half of the day, another trial seam must be performed.
8. CQA documentation of trial seam procedures will include the following:
  - a. The names of the seaming personnel;
  - b. The name of the fusion seaming technician;
  - c. the welding apparatus number, time, date;
  - d. ambient air temperature; and
  - e. welding apparatus temperature & speed setting.

### **3.2.2 Installation – Engineered Turf Repairs and Tie-In Procedures**

When Repairs and Tie-Ins to Engineered Turf occur, observe the following:

- Tie-In's to Engineered Turf will be completed by using a fusion seam.
- Seaming equipment for Engineered Turf will be a DemTech VM 20/4/A welder.
- A hand held heat gun should be used in smaller/concentrated areas.

### **3.2.3 Installation – Equipment on Engineered Turf**

No equipment will be allowed on slopes exceeding 15% until Sand Infill is in place. On slopes less than 15%, such as top decks, ATV type vehicles will be allowed prior to infill placement if the rubber tire or track pressure is less than 5 psi. Post construction (full specified sand infill thickness) drivability tire pressures on slopes greater than 10% should be limited on the ClosureTurf® system to less than 35 psi.

Allowable rubber tire or track pressures on top decks may increase to as much as 120 psi as long as sustained traffic load is not expected.

In all phases of construction, equipment used on the ClosureTurf® product will not be allowed to change speed or direction in a manner that could displace or damage the ClosureTurf® system.

High traffic areas will require sand to be placed at the full height of the turf. ArmorFill™ may also be utilized in high traffic areas to reduce sand migration due to the increased sand thickness.

### **3.3 Installation – Sand Infill**

This component of the ClosureTurf® system is a specialized mixture of sand infill that is placed between the tufts of the Engineered Turf component.

Observe that the following general requirements regarding Sand Infill are met:

- Sand Infill will meet ASTM C-33 sand specifications.
- Areas that are to receive sand infill must be inspected and accepted by the POR or CQA Personnel before placement of sand infill takes place.

#### **3.3.1 Submittals and Testing – Sand Infill**

Sand Infill will meet ASTM C-33 sand specifications.

#### **3.3.2 Installation – Sand Infill Deployment**

Observe that the following installation guidelines regarding the Sand Infill:

- Sand infill thickness will be verified at a frequency of 20 measurements per acre of final cover installed.
- The sand infill layer will be placed to a ½ inch minimum thickness not to exceed ¾ inch thick.
- The sand infill will be worked into Engineered Turf as infill between the synthetic yarn blades.
- No equipment will be allowed on slopes exceeding 15% until the sand infill is in place.

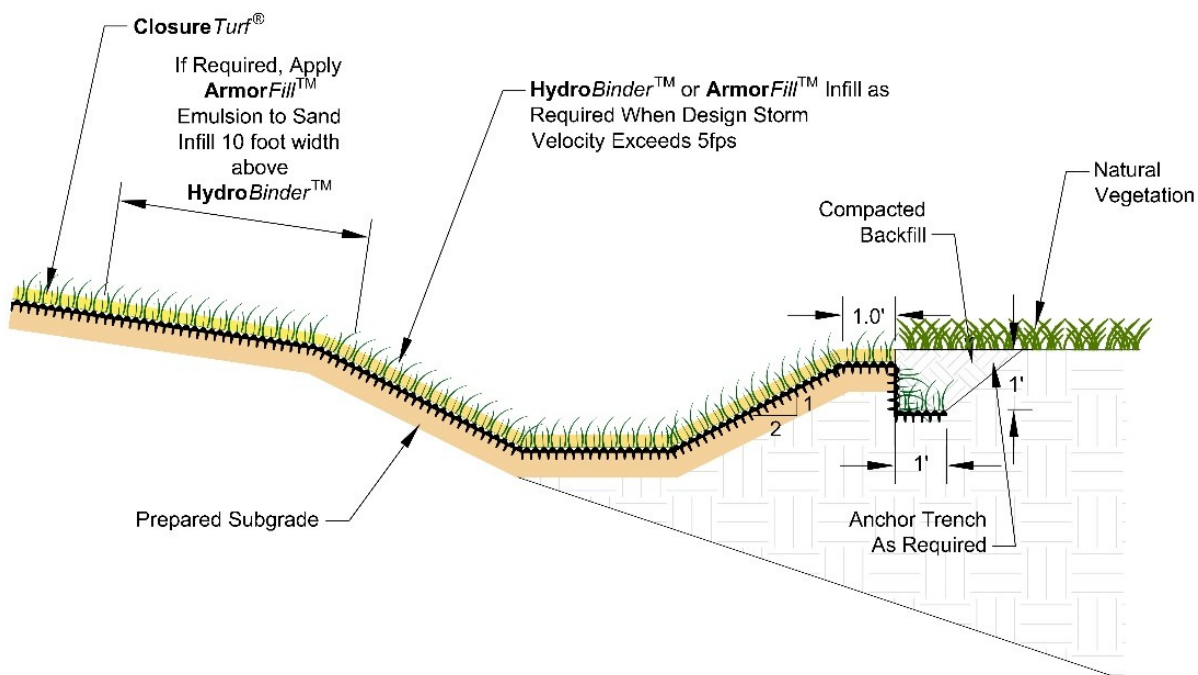
- Conveyor systems and/or Express Blowers are the preferred method to spread and place the sand infill.
- Contractor shall explain in detail in the pre-construction meeting the method of sand infill deployment to be used.
- The sand infill deployment method will be approved prior to installation of the sand infill.
- For slopes 3H: 1V or steeper the sand infill shall be placed using long reach conveyor belts or using water or air express blower methods that demonstrate achievable results.
- The sand infill placement will be done in front of the deployment equipment to improve the bearing capacity of the previously installed ClosureTurf® components.
- Sand infill placement cannot occur with snow or ice on the Engineered Turf component.
- Verify that underlying geosynthetics installations are not damaged during placement operations. Mark damaged geosynthetics and verify that damage is repaired.

The method for measuring the Sand Infill thickness will be performed utilizing a digital caliper with depth rod capabilities, or a POR approved alternate measuring device.

### 3.4 Alternate Infill - Closureturf® With HydroBinder® Infill For Ditches And Downslope Channels

Alternate Infill - HydroBinder® is provided by Watershed Geosynthetics or approved supplier. When the ClosureTurf® system is installed and HydroBinder® infill is placed in lieu of sand infill, it creates a ditch/downslope lining armor that will allow high flow velocities to convey without damage or maintenance to the underlying ClosureTurf® components. Typical ClosureTurf® installation procedures are used for the first three ClosureTurf® components, and then the HydroBinder® infill is placed dry and hydrated after placement. Figure 4 shows a typical ClosureTurf® with HydroBinder® infilled ditch section.

Figure 4: Typical ClosureTurf® with HydroBinder® Infilled Ditch Section



### **3.4.1 Installation – Alternate Infill - HydroBinder®**

Verify the following regarding installation of HydroBinder® Infill:

- The HydroBinder® infill layer may be placed using any appropriate equipment capable of completing the work while meeting loading requirements specified herein.
- Manual hand spreading is acceptable when equipment isn't practical.
- Contractor / Installer will explain in detail in the pre-construction meeting the method of HydroBinder® infill deployment.
- Installation of HydroBinder® infill will only be performed by a Watershed Geosynthetics' licensed and approved installer using techniques and equipment approved by Watershed Geosynthetics.
- The HydroBinder® will be installed into the turf while it is in a dry state.
- The HydroBinder® will be worked into the tufts so the tufts are in an upright position.
- The HydroBinder® infill layer will be placed to a ¾ inch minimum thickness not to exceed 1 inch thick.
- Do not backfill anchor trenches until turf has been installed with HydroBinder® infill.
- The hydration process must occur the day of the HydroBinder® infill placement.
- The desired HydroBinder® infill thickness will be achieved prior to the hydration process.
- The cemented infill is hydrated thoroughly however care must be taken to avoid displacement of the non-hydrated infill.
- The objective is to soak the area to start the hydration process but not to inundate with water beyond saturation.
- Once hydration is completed as described, backfill and compaction of the vertical anchor trenches should take place.
- The HydroBinder® will be at minimum performance levels within 24 hours.

### **3.4.2 ArmorFill® Installation**

#### **A. INSTALLERS**

1. Installation of ArmorFill® will be completed by an installer approved by Watershed Geosynthetics.

## B. EXAMINATION

1. ArmorFill® should be shipped to site within one (1) month of anticipated use.
2. Apply ArmorFill® under dry weather conditions and when precipitation is not expected for at least 72 hours after installation.
3. ArmorFill® cure time is dependent on ambient temperature, humidity and any rainfall that may occur while product is curing.
4. Apply ArmorFill® on a previously installed ClosureTurf® system that the ArmorFill® into the sand component.
5. Apply ArmorFill® only after approval of the finished ClosureTurf® product installation.
6. Construction Quality Control (CQC) personnel will document ArmorFill® and water mix ratio by logging volume mixed of each component.
7. Construction Quality Control (CQC) personnel will verify that ArmorFill® has fully saturated the sand by inserting a probe and displacing a 1 sq. inch area of sand.
  - a. Check saturation randomly at a rate of 20 probes per acre.
8. Verify proper application rate by marking a known area and applying the proper volume to that area.
  - a. Adjust delivery rate to match the delivery volume per area.

## C. SPECIAL TECHNIQUES

1. Mix in a hydraulic conveyance system such as a water truck, HydroSeeder or portable tank.
  - a. Place the water component in the tank, then add the full strength ArmorFill®.
  - b. Mechanically agitate initially, and each day prior to use.
  - c. Do not utilize continuous agitation techniques that may introduce excess air into the system.
2. ArmorFill® application equipment will have a hose with a spray adjustment nozzle and cut off function in the nozzle head.
3. Reduce the number of equipment set-ups required and take care with the application hose so as previously applied ArmorFill® is not displaced by dragging of the hose.
4. Spray product evenly.
5. Apply marking features to edge of sprayed area to assure proper overlap of material.
6. Each stopping point will require visual marking locations to assure the continued application has the proper overlap.



7. Deploy catch cups at a rate of 20 per acre to help determine if proper application rate is being achieved.
8. Apply ArmorFill® at a rate of approximately 3400 gallons of the mixed product per acre (Approx. 90 ounces per square yard)
9. Do not apply ArmorFill® in inclement weather or in freezing temperatures.
10. One Thousand Six Hundred Fifty (1650) gallons of water per Two Hundred Seventy Five (275) gallon ArmorFill® tote is the proper mixture for a 6:1 ratio.

#### D. CLOSE OUT ACTIVITIES

1. At the completion of ArmorFill® placement activities, clean the equipment thoroughly and purge the tank and hoses of the product.
2. All waste product will be disposed of in accordance to site regulations and specifications.
3. Left over mixed product may be evenly sprayed over previously applied ArmorFill® areas.
4. Avoid unnecessary foot traffic on the applied product for 48 hours.
5. No vehicle traffic is allowed on the applied product for 7 calendar days.

### **3.5 Post Installation - Maintenance and Monitoring**

The ClosureTurf® System is designed to be a very low maintenance final cover. If maintenance issues or damage occurs to the ClosureTurf® System, please refer to the following guidelines.

#### **3.5.1 Exposed Geotextiles**

If the engineered turf backing becomes exposed, then the ASTM C-33 graded infill is to be placed and brushed into the exposed turf backing areas. WG suggested guidance is to evaluate the closure system at a frequency of no less than once every 5 years.

Additionally, UV resistant coating can be applied to the exposed area and sand immediately applied onto the coating material, this provides a flexible UV barrier for the underlying geotextiles. The UV coating product is manufactured by Quikrete, product number 8640 and Sakrete, product number 60205006, concrete sealants and can be purchased at most Lowes & Home Depot Home Improvement stores. ArmorFill™ can also be utilized for this purpose.

#### **3.5.2 Damage to the Geomembrane or Engineered Turf Components**

If damage occurs to the geomembrane or geotextile Components, call an approved ClosureTurf® installer for repairs. Contact WatershedGeo® at 770-777-0386 for a list.

### **3.6 Shipping, Handling and Storage - Geotextile**

#### **3.6.1 General**

Geotextile shall be shipped, stored and handled in accordance with ASTM D-4873, the manufacturer's recommendations, and as specified herein. Contractor shall be completely responsible for shipping, storage, and handling of all geotextile.

### **3.6.2 Shipping**

Geotextile shall be shipped and stored in opaque and water tight protective coverings. Contractor shall notify the Engineer at least 24 hours prior to scheduled delivery of materials onsite. All deliveries shall be made during normal working hours, Monday through Friday, unless specifically authorized by the Engineer. No materials shall be unloaded except in the presence of the Engineer or County representative. Geotextile delivered to the site shall be inspected for damage and unloaded and stored with minimal handling. Upon delivery, Contractor shall assist the Engineer in conducting inventory, handling, and sampling of geotextile at no additional cost to County.

### **3.6.3 Handling**

No hooks, tongs, or other sharp tools or instruments shall be used for handling geotextile. Contractor shall use manufacturer's approved methods and equipment to unload or handle geotextile. Geotextile shall not be dragged along the ground.

### **3.6.4 Storage**

Geotextile shall be protected from ultraviolet light exposure, precipitation or other inundation, soil, mud, dirt, debris, puncture, cutting, or other damaging or deleterious conditions. Geotextile shall not be stored directly on the ground, unless approved by the manufacturer.

## **3.7 Supporting Surface Inspection**

### **3.7.1 Acceptance of Subgrade Surfaces**

The Engineer and Contractor/Installer will conduct a walk-through of all areas to receive geotextile, at which time, the Contractor/Installer shall verify in writing that the supporting surface is acceptable for installation of geotextile and that all required installation, testing, etc, of underlying geosynthetic, or other supporting surface, has been performed. The areas to be covered will be turned over to the Contractor/Installer upon such acceptance. The Contractor shall be responsible for maintenance of these areas in accordance with Specification requirements until completion of the geotextile installation.

### **3.7.2 Pre-Deployment Inspection**

No geotextile shall be installed until the supporting surface has been inspected and approved for geotextile installation by the Engineer and Contractor. The Contractor shall correct all deficiencies in the supporting surface to the satisfaction of the Engineer at no additional cost to County.

## **3.8 Geotextile Installation**

### **3.8.1 Material Inspection**

The Contractor shall visually inspect all geotextile for imperfections, faulty areas, and possible damage prior to installation. All such defective geotextile shall be marked and repaired in accordance with approved methods. Geotextile that cannot be repaired shall be removed from the work area and replaced at no additional cost to County.

### **3.8.2 General**

Geotextile shall be installed as shown on the Plans and approved installation details, and as specified herein, or in accordance with the approved manufacturer's installation procedures. No geotextile roll shall be installed without approval of the Engineer.

Geotextile rolls shall be of such lengths and widths and shall be placed in such a manner as to minimize field sewing and/or welding.

Geotextile shall be cut only with an approved geotextile cutter. Geotextile shall not be torn or ripped.

Geotextile shall be anchored at the top of the slopes and other places as shown on the Plans.

All changes to approved installation Plans and procedures shall be approved by the Engineer prior to implementation.

The Contractor shall exercise extreme care during geotextile installation to prevent damage to the prepared supporting subgrade surface or the installed LLDPE geomembrane. The Contractor shall exercise care to prevent entrapment of rocks, clods of earth, or other material which could damage the LLDPE geomembrane or geotextile, clog the geotextile, or hamper seaming. Any geotextile surface showing injury due to penetration by foreign objects or distress shall be replaced or repaired by the Contractor at no additional cost to County. All underlying geosynthetic materials, in damaged areas, shall be inspected and approved by the Engineer prior to repair and/or replacement of overlying materials.

No foot traffic shall be allowed on the geotextile except with approved smooth-sole shoes. No vehicular traffic shall be allowed on the geotextile. The Contractor shall not use the geotextile as a work area or storage area for tools and supplies.

The Engineer shall have the authority to order the immediate stoppage of work as a result of improper installation procedures or for any reason which may result in defective and improper installation.

Clean up within the work area shall be an on-going responsibility of the Contractor. Particular care shall be taken to ensure that no trash, tools, or other objectionable materials are trapped beneath the geotextile.

### **3.8.3 Seams**

All geotextile seams shall be formed by welding, or by mating the edges of the geotextile panels, and sewing together with continuous stitches located a minimum of three (3) inches from the mated edges. A 2-thread, double-locked stitch shall be used. Sewing procedures shall conform to the latest procedures recommended by the geotextile manufacturer. Spot sewing shall not be allowed. Seams shall provide seam strength which equals or exceeds 60 percent of required material strength when tested in accordance with ASTM D-4595 (required material strength) and ASTM D-4884 (seam strength).

A minimum of one (1) destructive seam strength samples will be obtained for each geotextile material. Sample locations will be determined by the Engineer from the installed production seams and tested by the Contractor's independent testing laboratory.

Horizontal seams on slopes shall not be allowed.

Adjacent geotextile panels in pipe trenches shall be overlapped a minimum of 18-inches unless otherwise shown on the Plans.

#### **3.8.4 Wind Protection**

The Contractor shall protect the geotextile against adverse effects of high winds such as uplift. Sandbags may be used for this purpose. Sandbags shall be sufficiently close knit to preclude loss of fines from the bottom, sides or seams. Paper bags, whether or not lined with plastic, shall not be permitted. All sandbags used on this Project shall be U.V. protected. Sandbags shall contain not less than 40, nor more than 60 pounds, of clean, uniform sand having 100 percent passing a No. 8 screen, and no more than five (5) percent fines, and shall be tied closed after filling using only plastic ties. Metal or wire ties shall not be allowed. Sandbags that are split, torn, or otherwise losing their contents shall be immediately removed from the work area and replaced and any spills immediately cleaned up.

#### **3.8.5 Repairs**

Geotextile repairs shall be made with patches of the same geotextile material using approved sewing methods, equipment, and techniques. The patch size shall be 24-inches larger in all directions than the area to be repaired. All corners shall be rounded. Should any tear exceed 10 percent of the width of the geotextile panel, the Contractor shall remove and replace that panel.

### **3.9 Construction Quality Control**

The Contractor shall institute and follow a quality control plan as recommended by the geotextile manufacturer throughout the duration of the Project to ensure compliance with the Plans and these Technical Specifications.

## **4.0 MEASUREMENT AND PAYMENT**

### **4.1 ClosureTurf - Slope - Item No. 11A**

The contract unit price for ClosureTurf - Slope shall include full compensation for all labor, material, and equipment required to furnish and install the ClosureTurf in accordance with the details and notes shown on the Plans, and as indicated in the Technical Specifications, and manufacturer's recommendations.

Final pay quantities shall be determined by computing the actual surface area of ClosureTurf placed to the limits indicated on the Plans (Overlap at seams will not be measured for payment). ClosureTurf placed beyond those limits will not be compensated unless previously authorized by the Engineer.

### **4.2 ClosureTurf – Deck - Item No. 11B**

The contract unit price for ClosureTurf - Deck shall include full compensation for all labor, material, and equipment required to furnish and install the ClosureTurf in accordance with the details and notes shown on the Plans, and as indicated in the Technical Specifications, and manufacturer's recommendations.

Final pay quantities shall be determined by computing the actual surface area of ClosureTurf placed to the limits indicated on the Plans (Overlap at seams will not be measured for payment).

ClosureTurf placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.3 Install Sand In-Fill Per Manufacture's Recommendations (Per Details 1/D1 and 2/D1) – Item No. 11C**

The contract unit price for Sand In-Fill shall include full compensation for all labor, material, and equipment required to furnish and install the Sand In-Fill in accordance with the details and notes shown on the Plans, and as indicated in the Technical Specifications, and manufacturer's recommendations (Sand Infill should be measured for payment under item 11A above).

Final pay quantities shall be determined by computing the actual surface area of Sand In-Fill per plan. Sand In-Fill placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.4 ArmorFill® Emulsion Applied to Sand Infill 10' width above HydroBinder® – Item No. 11D**

The contract unit price for ArmorFill® shall include full compensation for all labor, material, and equipment required to furnish and install the ArmorFill® Emulsion over Sand Infill in accordance with the details and notes shown on the Plans, and as indicated in the Technical Specifications, and manufacturer's recommendations (Sand Infill should be measured for payment under item 11C above).

Final pay quantities shall be determined by computing the actual surface area of armor fill emulsion (i.e., 10 feet wide x length of drainage swales, per plan). ArmorFill® placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.5 HydroBinder® Infill - Item No. 11E**

The contract unit price for HydroBinder® Infill shall include full compensation for all labor, material, and equipment required to furnish and install the HydroBinder® Infill in accordance with the details and notes shown on the Plans, and as indicated in the Technical Specifications, and manufacturer's recommendations.

Final pay quantities shall be determined by computing the actual surface area of HydroBinder® Infill placed to the limits indicated on the Plans. HydroBinder® Infill placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.6 Geotextile – Wrapped Gravel Drainage Elements and Rip Rap Pads**

Compensation for Geotextile – Wrapped Gravel Drainage Elements, LFG Passive Trench/Well/Vent, Anchor Trench/LFG Collection Trench, LFG/Seep Collector, other LFG Construction Elements, and Rip Rap Pads, shall be included in the cost of various Drainage elements, no separate payment shall be made.

#### **4.7 Miscellaneous Anchor Details, Terminations, and Joins**

Compensation for Miscellaneous Anchor Details, Terminations and Joins are defined in Section 2D – LLPDE Geomembrane.

**END OF SECTION 2E**

## **SECTION 2F**

### **HDPE EDGE DRAIN - DRAINAGE SYSTEM**

#### **1.0 GENERAL**

This section sets forth the requirements for the construction of the HDPE Edge Drain - Drainage System.

##### **1.1 Work Included**

In general, construction of the various collection systems shall include installation of HDPE Edge Drain, and slotted and solid HDPE piping and other incidentals and appurtenances as required to complete the work in accordance with the Plans, these Technical Specifications, and material manufacturer's recommendations.

##### **1.2 Submittals**

The Contractor shall thoroughly review the Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- o Drainage Collector Gravel Samples
- o Drainage Collector Pipe Certificate of Compliance
- o Drainage Collector Gravel Certified Test Results for Sieve Analysis, Permeability, Aggregate Carbonate Content and Durability
- o HDPE Edge Drain Collector Pipe Certificate of Compliance
- o HDPE Outlet Pipe and Fittings
- o Record Drawings

#### **2.0 MATERIALS**

##### **2.1 HDPE Edge Drain and Fittings**

The 12-inch HDPE Edge Drain shall be oblong corrugated pipe for use in subsurface drainage applications, shall meet ASTM D7001, and shall have annular interior and exterior corrugations.

Outside dimensions shall be 1.5" thick by 13" wide with internal bracing adjoining each long wall. The 12-inch HDPE Edge Drain shall include an external geotextile wrap.

All HDPE Solid and perforated pipe and fittings shall be made of polyethylene with a minimum cell classification of 424420C as defined and described in ASTM D3350.

Slotted pipe shall be factory-fabricated as indicated in Paragraph 2.2 below. Slots shall be free of any burrs or debris, inside or outside of the pipe.

##### **2.2 HDPE Edge Drain Perforations**

Perforations for the 12-inch HDPE Edge Drain (oblong corrugated pipe) shall be factory fabricated pursuant to the following table, and shall be free of any burrs or debris, inside or outside of the edge drain:

Nominal Pipe Size, in. (mm)	12 (300)
Slot Length (Avg), in. (mm)	1.125 (29)
Slot Width (Avg), in. (mm)	0.125 (3.2)
Water Inlet Area (Approx), in <sup>2</sup> /ft	15

### 2.3 **HDPE Edge Drain Geotextile Fabric**

Geotextile for HDPE Edge Drain Pipe shall be Class A geotextile per AASHTO M-288, shall be factory-fabricated, placed over the Edge Drain, and shall have the following minimum Physical Properties:

<b>Fabric Properties</b>	<b>Test Method</b>	<b>Minimum Average Roll Values</b>
Grab Tensile Strength (lbs.) (weakest principle direction)	ASTM D4632	180
Grab Elongation (%) (weakest principle direction)	ASTM D4633	60
Trapezoidal Tear (lbs.) (weakest principle direction)	ASTM D4533	50
Puncture (lbs.)	ASTM D3786	80
Permittivity (sec-1)	ASTM D4491	0.7
AOS (U.S. Sieve Size)	ASTM D4751	60
U.V. Resistance	ASTM D4355	70

### 2.4 **HDPE Pipe and Fittings**

Piping and fittings for the various piping systems shall consist of 6-inch diameter, (SDR 11) high density polyethylene (HDPE) conforming to the requirements of ASTM 3350.

Slotted pipe shall be factory-fabricated as shown on the Plans. Slots shall be free of any burrs or debris, inside or outside of the pipe.

#### 2.4.1 **Physical Properties**

HDPE pipe shall meet the following minimum specifications:

<b>TEST</b>	<b>TEST METHOD</b>	<b>UNIT</b>	<b>REQUIREMENTS</b>
Density*	ASTM D-1505	g/cc	0.955
Melt Flow Index (1)	ASTM D-1238 Condition E	g/10 min	13
Tensile Properties	ASTM D-638	psi psi %	3,300 @ yield 4,500 @ break ≥800 elongation @ break
Flexural Modulus (2)	ASTM D-790	psi	120,000



Environmental Stress Crack Resistance	ASTM D 1693	hrs	≥10,000 (3) ≥5,000 (4)
(1) 190° C/21600g (2) 2% Secant-Method 1 (3) Condition B, 10% (4) Condition C			

The Contractor shall submit two (2) samples of each type of piping proposed for use. The submittal shall also include manufacturer's catalog cut sheets, manufacturer's quality control test results, recommended methods of jointing, and a Certificate of Compliance for each class of pipe. The submittal shall be provided to the Engineer at least 15 working days prior to intended use.

## **2.5 Collector Gravel**

Collector Gravel shall consist of a clean, hard, durable, uniform product, free of limestone, organic, and other deleterious material.

### **2.5.1 Sieve Analysis**

Collector gravel shall be rounded to sub-rounded, and shall conform to the following gradation as determined by Sieve Analysis (ASTM D 422) and Visual-Manual Soil Classification (ASTM D 2488). The Contractor may, at their option, use approved Collector gravel for the Drainage Collector system.

#### **COLLECTOR GRAVEL**

<b>U.S. STANDARD SIEVE</b>	<b>PERCENT PASSING BY WEIGHT</b>
1-1/2 inch	100
1 inch	90-100
¾ inch	30-60
½ inch	0-20
No. 4	0-10
No. 200	0-3

The Contractor shall submit to the Engineer for approval, certified results of a sieve analysis on the proposed material, signed by a State of California registered Civil Engineer or Geotechnical Engineer.

### **2.5.2 Permeability**

Collector Gravel shall have a minimum permeability of 1 cm/sec. The Contractor shall submit, to the Engineer for approval, certified results of a permeability test (ASTM D-2434) on the proposed material (one test per 5000 cubic yards), signed by a State of California registered Civil Engineer or Geotechnical Engineer.

### 2.5.3 Aggregate Carbonate Content and Durability Testing

Collector Gravel shall conform to the following Aggregate Carbonate Content and durability requirements:

TEST	REQUIREMENT
Aggregate Carbonate Content (ASTM Standard D 3024)	Less than 5 percent Carbonate Content by Weight @ pH = 4.0
Los Angeles Abrasion (ASTM C-131)	Percent shall be no greater than 50 after 500 Revolutions

The Contractor shall submit to the Engineer for approval, certified laboratory test results of the Aggregate Carbonate Content and durability, signed by a State of California registered Civil Engineer or Geotechnical Engineer.

### 2.5.4 Gravel Source Certification

The Contractor shall identify the potential source and provide Certificates of Compliance at least 15 working days prior to intended use. Should the Engineer determine that confirmation testing is warranted, the Engineer will bear the responsibility of costs for such additional testing. The Contractor shall reimburse the Engineer for the confirmation tests, if such tests indicate that the proposed material does not conform to the Technical Specifications. The Contractor shall bear the responsibility for the cost of tests specified in 2.5.1, 2.5.2, and 2.5.3 of this Section.

## 3.0 CONSTRUCTION METHODS

### 3.1 Collection System Piping

Installation of the various collection systems shall conform to the lines, grades, details, and notes shown on the Plans and as referenced in these Technical Specifications.

#### 3.1.1 Excavation

Excavation for, and installation of the 6-inch HDPE Pipe Outlet shall be performed at the locations of the pipe outlet indicated on the Contract Drawings. Prior to placement of any back-fill above the outlet piping, the Contractor shall survey the installed piping, as required for preparation of the Record Drawings.

Placement of back-fill material will not be allowed until the Record Drawing survey information has been submitted to the Engineer and approved.

#### 3.1.2 Pipe Installation

HDPE Pipe Outlet piping shall be placed as indicated on the Plans.

Installation of HDPE fittings and joints shall conform to manufacturer's recommendations.

Slotted HDPE pipe serving as the collector pipe within liner termination areas shall be butt-fusion welded to solid pipe as recommended by the manufacturer.

The pipe shall not be concealed until a final record survey has been completed and the Engineer has approved the pipe installation.

Pipe and fittings shall be held firmly in position and protected from damage while PSC or backfill is being placed. All pipe and fittings shall be cleaned upon installation and kept so during the progress of the work.

Any pipe that becomes either partially or fully clogged and/or damaged before final acceptance shall be cleaned/repaired to the satisfaction of the Engineer, and/or replaced at the Contractor's expense.

### **3.2 HDPE Edge Drain Geotextile**

HDPE Edge Drain Geotextile shall be installed pursuant to Manufacturer's recommendations. Prior to installation, the receiving surface shall be cleaned of loose material and any sharp objects or protrusions that may damage the geotextile.

Geotextile shall be lapped in accordance with the Manufacturer's recommendations to provide a separation between soil and pipe along the entire length of collection piping.

Contractor shall take precautions to protect the geotextile during placement of the PSC. Any portion of the geotextile damaged during the project will be repaired or replaced at Contractor's expense.

## **4.0 MEASUREMENT AND PAYMENT**

### **4.1 HDPE Edge Drain Collector – Access Road, Bench, and Slope (Below LLDPE Geomembrane) (Per Details 3/D1, 5/D1, 6D1, 4/D2, and 6/D3) - Item No. 12A**

The contract unit price for HDPE Edge Drain – Access Road (Below LLDPE Geomembrane) shall include full compensation for all labor, material, and equipment required to construct the edge drain collector in accordance with the Contract Documents and manufacturer's recommendations.

All grading, excavation, Edge Drain, Edge Drain Fittings, transitions pipes, fittings, caps, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications shall be considered as incidental to completing the Work and shall be included in the Contractor's unit price.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual lineal footage installed to the limits indicated on the Plans. HDPE Edge Drain –Access Road (Below LLDPE Geomembrane) installed beyond those limits will not be compensated unless previously authorized by the Engineer.

### **4.2 4-inch HDPE Pipe SDR 17 with Bentonite Plug at LLDPE Final Cover Limit (Per Detail 7/D1) - Item No. 12B**

The contract unit price for 4-inch HDPE Pipe SDR 17 with Bentonite Plug at LLDPE Final Cover Limit shall include full compensation for all labor, material, and equipment required to construct the outlet in accordance with the Contract Documents and manufacturer's recommendations.

All grading, excavation, bentonite (including placement and hydration), pipes, fittings, caps, and other appurtenances as shown on the plans, as specified in the Standard Specifications and these

Technical Specifications shall be considered as incidental to completing the Work and shall be included in the Contractor's unit price.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual lineal footage installed to the limits indicated on the Plans. 4-inch HDPE Pipe SDR 17 with Bentonite Plug at LLDPE Final Cover Limit installed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.3 Drainage Collector (Per Detail 4/D1) - Item No. 12C**

The contract unit price per linear foot for Drainage Collector shall include full compensation for all labor, material, and equipment required to construct the Drainage Collector in accordance with the Contract Documents and manufacturer's recommendations.

All grading, excavation, drainage collector pipe, drainage collector fittings, transitions, caps, collector gravel, geotextile wrap, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications shall be considered as incidental to completing the Work and shall be included in the Contractor's unit price.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual lineal footage installed to the limits indicated on the Plans. Drainage Collector installed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.4 Extend 4" Solid HDPE Pipe (SDR 17) and Join to Existing Leachate Outfall/Tank – Item No. 12D**

The contract unit price per linear foot for Extend 4" Solid HDPE Pipe shall include full compensation for all labor, material, and equipment required to construct the Extend 4" Solid HDPE Pipe in accordance with the Contract Documents and manufacturer's recommendations.

All grading, excavation, drainage collector pipe, drainage collector fittings, transitions, caps, collector gravel, geotextile wrap, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications shall be considered as incidental to completing the Work and shall be included in the Contractor's unit price.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual lineal footage installed to the limits indicated on the Plans. Extension of 4" Solid HDPE Pipe installed beyond those limits will not be compensated unless previously authorized by the Engineer.

### **END OF SECTION 2F**

## **SECTION 2G**

### **MISCELLANEOUS CIVIL IMPROVEMENTS**

#### **1.0 GENERAL**

This section sets forth the requirements for miscellaneous civil and drainage improvements indicated on the Drawings.

#### **1.1 Work Included**

In general, miscellaneous civil and drainage improvements shall include:

- Asphalt Concrete Berms; Transitions to Down Drains;
- AC Concrete Perimeter Access Road;
- Concrete and reinforcing steel for drainage improvements;
- Concrete Drainage Improvements, including Trapezoidal Channel/Down drain, and Drainage Inlets;
- Masonry Splash Walls.

#### **1.2 Submittals Required**

The Contractor shall thoroughly review the Technical Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Asphalt Concrete Design Mix
- Class 2 Base Certificate of compliance
- Portland Cement Concrete mix design.
- Certificates of Compliance – Reinforcing Steel/Welded Wire Mesh.
- Curing Compound Certificate of Compliance
- Geotextile Manufacturer's Product Data
- 12 oz./sy Geotextile
- Certificates of Compliance – Rip Rap
- Hydro-Seed Certification
- Grout mix
- Certificate of compliance – masonry materials
- Settlement Monument Survey Data

## **2.0 MATERIALS**

### **2.1 Asphalt Concrete (AC)**

Asphalt Concrete for driving surfaces shall be Type A-Grade PG 64-10 and shall conform to the requirements for Asphalt Concrete Pavement in accordance with Section 39 “ASPHALT CONCRETE” of the Standard Specifications. The grade of Asphalt Binder to be mixed with aggregate shall conform to the provisions in Section 92 – Asphalt Binders of the Standard Specifications.

Asphalt Concrete for Trapezoidal Down Drains (non-driving surfaces) shall be Open Graded – 3/8-inch maximum and shall conform to the requirements for Asphalt Concrete Pavement in accordance with Section 39 “ASPHALT CONCRETE” of the Standard Specifications. The grade of Asphalt Binder to be mixed with aggregate shall be Grade PG 64-10 conforming to the provisions in Section 92 – Asphalt Binders of the Standard Specifications.

The Contractor shall submit the proposed mix design and Certificates of Compliance indicating that the material supplied is in accordance with the project Specifications.

### **2.2 Class 2 Base**

Class 2 base shall conform to the requirements of Section 26 “Aggregate Bases” of the Standard Specifications, unless otherwise shown. The Contractor shall submit Certificates of Compliance indicating that the material supplied is in accordance with the Specifications.

### **2.3 Portland Cement Concrete**

PCC for drainage improvements shall be either Class 1 concrete conforming to the requirements of Section 90 of the Standard Specifications; or shall be pneumatically or mechanically applied concrete in accordance with the requirements of Section 53 – Shotcrete. The Contractor shall submit Certificates of Compliance indicating that the material supplied is in accordance with the project Specifications. Batch mix designs shall be submitted for both cast-in-place concrete and shotcrete.

### **2.4 Reinforcing Steel /Welded Wire Mesh**

Reinforcement for concrete improvements shall conform to ASTM A 615 Grade 60 and the requirements of Section 52 of the Standard Specifications, unless otherwise shown. The Contractor shall submit Certificates of Compliance indicating that the material supplied is in accordance with the Specifications.

### **2.5 Curing Compound**

Curing compound shall conform to the requirements of Section 90-1.03B(3) of the Standard Specifications.

### **2.6 Riprap**

Stone for rip rap pads shall conform to the requirements of Section 72 of the Standard Specifications, One-Quarter Ton Class. The Contractor shall submit a Certificate of Compliance for the material intended for use.

## **2.7 Masonry**

Masonry units for the splash walls shall conform to ASTM C 90 for Type 1 units. The net size of the units shall be as indicated on the Drawings.

Mortar shall consist of 1 part Portland cement concrete, 2½ to 3 parts sand, ¼ to ½ hydrate lime or lime putty, and water. Grout shall be 1 part Portland cement concrete to which 1/10 hydrate lime or lime putty may be added, 2 to 3 parts sand, and water.

## **2.8 Steel Pipe and Concrete for Pipe Bollards**

Steel pipe for Pipe Bollards shall be 4-inch diameter Schedule 40 circular steel pipe. Bollards shall be painted with Iron-Oxide Primer, and finished with High-Vis Yellow Paint. Concrete shall be the same strength as the nearest adjacent concrete placement.

## **3.0 CONSTRUCTION METHODS**

### **3.1 Asphalt Concrete Pavement (AC)**

AC pavement shall be constructed to the lines and grades indicated on the Drawings and in accordance with Section 39 of the Standard Specifications.

### **3.2 Class 2 Base**

Placement and compaction of Class 2 base shall conform to Section 26 Aggregate Bases of the Standard Specifications.

### **3.3 Portland Cement Concrete**

PCC improvements shall be constructed to the line and grade indicated on the Drawings and shall be placed in accordance with the requirements of Sections 51 or 73 of the Standard Specifications, as applicable. Reinforcement for PCC improvements shall be installed in accordance with Section 52 of the Standard Specifications.

### **3.4 Riprap**

Excavate subgrade to conform to the requirements of the Drawings. Place geotextile pursuant to the requirements of Section 72 of the Standard Specifications. Rip-rap stone shall be placed pursuant to the applicable requirements of Section 72 of the Standard Specifications.

### **3.5 Splash Walls**

Splash Walls shall be constructed to the lines, grades, and depths indicated on the Drawings.

### **3.6 Install Settlement Monuments**

Settlement monuments shall be constructed at the locations indicated on the Construction Drawings and in accordance with the details indicated.

#### **4.0 MEASUREMENT AND PAYMENT**

##### **4.1 Anchor Trench Excavation with Soil Backfill – (Final Cover Termination Slope - Detail 5/D1; Bench Liner Termination – Detail 6/D3) Item No. 14A**

The contract price paid per lineal foot for Anchor Trench Excavation with Soil Backfill shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in construction of Anchor Trench Excavation with Soil Backfill, complete in place, including and all excavation, grading, geosynthetic materials and seaming, backfill and compaction, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the engineer.

Final pay quantities shall be determined by computing the actual lineal footage of Anchor Trench Excavation with Soil Backfill completed to the limits indicated on the Plans (Overlap at seams and material extended into the anchor trench will not be measured separately for payment). Anchor Trench Excavation with Soil Backfill placed beyond those limits will not be compensated unless previously authorized by the Engineer.

##### **4.2 Anchor Trench Excavation with Concrete Backfill/Rock Placement – (Final Cover Termination Slope - Detail 11/D1; Final Cover Termination South and West Perimeter Road– Detail 4/D2) Item No. 14B**

The contract price paid per lineal foot for Anchor Trench Excavation with Concrete Backfill/Rock Placement shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in construction of Anchor Trench Excavation with Concrete Backfill/Rock Placement, complete in place, including and all excavation, grading, geosynthetic materials and seaming, backfill and compaction, and other appurtenances as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the engineer.

Final pay quantities shall be determined by computing the actual lineal footage of Anchor Trench Excavation with Concrete Backfill/Rock Placement completed to the limits indicated on the Plans (Overlap at seams and material extended into the anchor trench will not be measured separately for payment). Anchor Trench Excavation with Concrete Backfill/Rock Placement placed beyond those limits will not be compensated unless previously authorized by the Engineer.

##### **4.3 Final Cover Termination Northeast Perimeter Road - (Per Detail 6/D1)**

All Costs for Final Cover Termination Northeast Perimeter Road (Per Detail 6/D1) shall be included in the unit price per square foot for Foundation Soil Placement under Bid Item No. 7B, and no additional compensation will be made.

##### **4.4 Concrete Access Ramp to Basin with Integral Concrete Curb per Caltrans Std. Plan A87A Type A2-6 (Per Detail No. 4/D3) - Item No. 15**

The contract price paid per square foot for Concrete Access Ramp to Basin with Integral Concrete Curb per Caltrans Std. A87A Type A2-6, shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Concrete



Access Ramp to Basin with Integral Concrete Curb per Caltrans Std.A87A Type A2-6, complete in place, including all excavation, grading, forming, reinforcement, concrete, finishing, curing compound tie-ins to existing drainage improvements, and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from field verification of the actual square footage of Concrete Access Ramp to Basin with Integral Concrete Curb per Caltrans Std. A87A Type A2-6, installed in accordance with the Drawings.

#### **4.5 Concrete Down Drain Inlet at Storm Water Basin (Per Detail 3/D3) - Item No. 16A**

The contract price paid for Concrete Down drain Inlet at Storm water Basin shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in construction of the Concrete Down Drain Inlet at Storm water Basin, complete in place, including all excavation, construction of fill berm, grading, concrete, concrete cut-off, concrete slope paving through the berm and other appurtenances as required shall be considered as included in the Contractor's unit price.

Final pay quantities shall be determined from field verification of each Down Drain Inlet at Storm Water Basin completed in accordance with the Drawings.

#### **4.6 Concrete Inlet to Down Drain (Per Detail 7/D3) - Item No. 16B**

The contract price paid for Concrete Inlet to Down Drain shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in construction of the Concrete Inlet to Down Drain, complete in place, including all excavation, grading, reinforcing, concrete, concrete cut-off wall at inlet side of structure, finishing, curing compound, and other appurtenances as required shall be considered as included in the Contractor's unit price.

Final pay quantities shall be determined from field verification of each Concrete Inlet to Down Drain completed in accordance with the Drawings.

#### **4.7 Concrete Down Drain – b=1.0', D=1.5', Z=1 (Per Detail 5/D2) - Item No. 17**

The contract price paid per square foot for Concrete Down Drain/Trapezoidal Channel shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Concrete Down Drain/Trapezoidal Channel, complete in place, including all excavation, grading, concrete, curing compound, tie-ins to existing drainage improvements, and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from field verification of the actual square footage of Concrete Down Drain /Trapezoidal Channel installed in accordance with the Drawings.

#### **4.8 Rip-Rap Pad (Per Detail 1/D2) - Item No. 18**

The contract price paid per square foot for rip-rap pad shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in rip-rap pad including all excavation, grading, 16-ounce geotextile, rip-rap, and other

appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from field verification of the actual square footage installed in accordance with the Drawings. Rip-rap pad placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **4.9     Splash Wall – (Per Detail 5/D3) – Item No. 19**

The contract price paid per linear foot for Splash Wall shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Splash Wall, complete in place, including all excavation, grading, reinforcing steel, concrete footing, masonry, mortar, grout, and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from field verification of the lineal footage of splash wall installed in accordance with the Drawings.

#### **4.10     3-inch AC over Protective Soil Cover Access Road - Compacted to 95% of ASTM D1557 – (Per Details 6/D1, 4/D2, and 9/D1) - Item No. 20**

The contract price paid per square foot of 3-inch AC over Protective Soil Cover access road shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in construction of the 3-inch AC over Protective Soil Cover access road, complete in place, including all finish grading, asphalt concrete, Protective Soil Cover material, and other appurtenances as required shall be considered as included in the Contractor's unit price.

Final pay quantities shall be determined from field verification of the actual square footage of 3-inch AC over Protective Soil Cover access road completed in accordance with the limits indicated on the Drawings.

#### **4.11     Type A AC Dike (Per Cal Trans Std. No. A87B) – Item No. 21**

The contract price paid per linear foot for Type A AC Dike shall include full compensation for furnishing all materials, labor, tools, equipment, and incidentals and for doing all the work involved in Type A AC Dike, complete in place, including all excavation, backfill, grading, Asphalt Concrete and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from field verification of the lineal footage of Type A AC Dike installed in accordance with the Drawings.

#### **4.12     Post-Closure Settlement Monument (Per Detail 2/D3) - Item No. 22**

All grading, concrete, bollards, survey work, and other appurtenances as required, shall be considered as included in the Contractor's unit price.

Final pay quantities shall be determined from field verification that the monuments have been installed in accordance with the Construction Drawings and these specifications.

#### **4.13 Cable Gate (Per Detail 5/D2) (Item No. 23)**

Cable Gate shall include all excavation, concrete backfill, pipe bollards, concrete infill within pipe, eye bolt (weld nut to pipe), locks, ½” galvanized steel cable, Landfill Closed Sign, and all other operations, equipment, or materials incidental to completing the work as represented by the Drawings and Specifications.

All costs for Cable Gate shall be included in the Unit Price per each Cable Gate Installed.

#### **4.14 Pipe Bollard (Per Detail 8/6) (Item No. 24)**

Pipe Bollards shall include all excavation, concrete backfill, concrete infill within pipe, and all other operations, equipment, or materials incidental to completing the work as represented by the Drawings and Specifications.

All costs for Pipe Bollards shall be included in the Unit Price per each Pipe Bollard Installed.

#### **4.15 12-Inch by 12-Inch Deep Lift Concrete Termination (Item No. 25A)**

All Costs for 12 Inch by 12 Inch Deep Lift Concrete Termination shall be included in the unit price per square foot for Concrete Access Ramp to Basin with Integral Concrete Curb per Caltrans Std. A87A Type A2-6 under Bid Item No. 15, and no additional compensation will be made.

#### **4.16 12-Inch by 12-Inch Deep Lift Asphalt Concrete Termination (Item No. 25B)**

All Costs for 12 Inch by 12 Inch Deep Lift Asphalt Concrete Termination shall be included in the unit price per square foot for 3-inch AC over Protective Soil Cover Access Road under Bid Item No. 20, and no additional compensation will be made.

**END OF SECTION 2G**

## **SECTION 2H**

### **PROTECTIVE SOIL COVER**

#### **1.0 GENERAL**

This section sets forth the requirements for construction of the Protective Soil Cover (PSC).

##### **1.1 Work Included**

Screen, rock pick or rock rake, process, transport, and place Protective Soil Cover material to the line, grade, depth, and limits as shown on the Plans and as referenced in these Technical Specifications.

##### **1.2 Submittals Required**

The Contractor shall thoroughly review the Technical Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Placement Plan

#### **2.0 MATERIAL**

##### **2.1 Protective Soil Cover Material**

The upper eighteen-inches of Protective Soil Cover material shall be screened, rock picked or rock raked, as necessary from designated stockpiles or import soil as shown on the Plans, or as otherwise designated by the Engineer to 3-inch minus material size. Protective Soil Cover material within six-inches of geosynthetics shall be screened to 1-inch minus material size.

Protective Soil Cover material within six-inches of geosynthetics shall not contain rock particles in excess of one inch in the greatest dimension – screening is required. The upper eighteen-inches of PSC shall consist of granular material with no rock particles in excess of three inches in the greatest dimension this material may be screened, rock picked or rock raked.

#### **3.0 CONSTRUCTION METHOD**

##### **3.1 General**

The PSC shall be placed to the lines and grades shown on the Plans in accordance with these Technical Specifications.

##### **3.2 Protective Soil Cover Placement**

Placement of PSC shall proceed upward, from the lowest to highest elevation along the slope (depending on location of material supply). Low ground pressure equipment (less than 5 psi) shall be utilized and in no instance shall equipment be operated on final cover areas with less than 24-inches of PSC between geosynthetics and the equipment. Equipment used to place the cover soil shall not stop abruptly, make sharp turns, spin their wheels, or travel at speeds exceeding 10 miles per hour as this may damage the underlying geosynthetics.

Care shall be taken during placement to avoid damaging the underlying composite liner components, HDPE Edge Drain, and drainage outlet piping. Folds present in the geomembrane/geocomposite shall be removed and the liner repaired prior to placement of the PSC. Any damage to the geomembrane or geocomposite shall be repaired by the Contractor at no additional cost to the Owner. The Contractor is responsible for all work associated with placement of the PSC.

### **3.3 Placement**

Protective Soil Cover material shall be placed in a manner, and with appropriate equipment, such that damage does not occur to the underlying surface or materials. The Contractor shall submit to the Engineer a plan which indicates the proposed sequence of work, estimated schedule, and type of equipment to be utilized in the PSC placement operation. Equipment loading shall not exceed that recommended by the geosynthetic manufacturer or the HDPE Edge Drain, and drainage outlet piping manufacturer, or as recommended in Section 3.2 of these Specifications.

### **3.4 Compaction**

PSC material shall be moisture conditioned to +/- 2% of optimum moisture content. The lower 1-foot of the Protective Soil Cover shall be compacted to a minimum of 85 percent per ASTM D1557. The upper 12 inches of the PSC shall be compacted to a minimum of 90-percent of the maximum dry density (95-percent in AC Access Road Placement subgrade areas) as determined by ASTM D1557 (testing frequency of one test per acre per lift, or one per day, whichever is greater).

### **3.5 Protection of Geosynthetics during Construction Operations**

The Contractor shall protect drainage geocomposite, underlying geosynthetics, and HDPE Edge Drain drainage system against damage, separation, creep movement, etc., resulting from mechanical loading from construction vehicles, or equipment. Steep gradients on benches, perimeter and access roads, and top deck areas inherent to the project require slower equipment speeds, and longer braking distances to prevent the adverse effects of mechanical loading from construction equipment from damaging the drainage geocomposite and underlying geosynthetics. The contractor shall take due precautionary measures including but not limited to posting speed limits, instructing equipment operators, material delivery truck drivers, and personnel at or visiting the site of the limitation on vehicle or equipment speed, the requirement for longer braking distances, etc.; due precautionary measures may also include placement of an additional interim thickness of Protective Soil Cover to be removed by the contractor at a later date after construction traffic over the area has been minimized thereby reducing the risk of damage to the drainage geocomposite and underlying geosynthetics. The contractor shall be responsible for repair of all damage to the drainage geocomposite, underlying geosynthetics, and HDPE Edge Drain drainage system, including removal and replacement of overlying soil, HDPE Edge Drain, drainage geocomposite, LLDPE Geomembrane, and repairs to the Foundation Soil Layer resulting from construction operations.

#### **4.0 MEASUREMENT AND PAYMENT**

##### **4.1 Protective Soil Cover – Northeast Road - Item No. 13A**

The contract unit price paid per cubic yard for Protective Soil Cover – Northeast Road shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Protective Soil Cover – Northeast Road, including rock picking, raking, and screening as required to meet the material requirements pursuant to Section 2.0 Materials, transport, placement, distribution, grading, and compacting Protective Soil Cover as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the engineer.

Final pay quantities shall be determined by computing the neat volume of PSC – Northeast Road placed to the limits indicated on the Plans. PSC – Northeast Road placed beyond those limits will not be compensated unless previously authorized by the Engineer.

##### **4.2 Protective Soil Cover – South and West Road - Item No. 13B**

The contract unit price paid per cubic yard for Protective Soil Cover – South and West Road shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Protective Soil Cover - South and West Road, including rock picking, raking, and screening as required to meet the material requirements pursuant to Section 2.0 Materials, transport, placement, distribution, grading, and compacting Protective Soil Cover as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the engineer.

Final pay quantities shall be determined by computing neat volume of PSC - South and West Road placed to the limits indicated on the Plans. PSC - South and West Road placed beyond those limits will not be compensated unless previously authorized by the Engineer.

##### **4.3 Protective Soil Cover – Deck Access Road - Item No. 13C**

The contract unit price paid per cubic yard for Protective Soil Cover – Deck Access Road shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Protective Soil Cover – Deck Access Road, including rock picking, raking, and screening as required to meet the material requirements pursuant to Section 2.0 Materials, transport, placement, distribution, grading, and compacting Protective Soil Cover as shown on the Plans, as specified in the Standard Specifications and these Technical Specifications, and as directed by the engineer.

Final pay quantities shall be determined by computing the neat volume of PSC – Deck Access Road placed to the limits indicated on the Plans. PSC – Deck Access Road placed beyond those limits will not be compensated unless previously authorized by the Engineer.

#### **END OF SECTION 2H**

## SECTION 21

### FINAL EROSION CONTROL IMPROVEMENTS

#### 1.0 GENERAL

This section sets forth the requirements for final erosion control improvements and seeding for the Final Closure Construction Project at the South Coast Landfill in Mendocino County, CA.

##### 1.1 Work Included

Erosion control work shall include preparation and application of a hydroseed mix over the disturbed construction area, and installation of miscellaneous erosion control improvements, pursuant to the Project Construction Drawings.

##### 1.2 Submittals Required

The Contractor shall thoroughly review the Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

- Erosion and Storm Water Control Plan
- Certificates of Compliance for Seed Mixes.
- Manufacturer's labels for all materials used in the hydroseeding application.
- Manufacturer's literature/catalog cuts for all erosion control materials

#### 2.0 MATERIAL

##### 2.1 Seed Mix

Scientific Name	Common Name	Bulk Lbs./acre
<i>Bromus hordeaceus</i>	Blando Brome	60
<i>Festuca megalura</i>	Zorro Annual Fescue	20
<i>Trifolium hirtum</i>	"RK" Rose Clover	10
<i>Trifolium incarnatum</i>	"RK" Crimson Clover	10
<b>TOTAL LBS./ACRE</b>		<b>100</b>
<b>Slurry Mix</b>		
Wood Fiber Mulch		2,500
Organic Soil Stabilant (Tackifier)		140
Endomycorrhizal Inoculum	3,600,000 propagules/acre	
Ureaform (38-0-0)		300

Before seeding, the Contractor shall furnish written evidence (seed label or letter) to the Engineer that the seed is required to be labeled under the California Food and Agricultural Code and that it conforms to the purity and germination requirements herein.

Seed (per seed type) shall be a minimum of 50 percent pure live seed (PLS) content. Pure live seed content is defined as the product of, 1) the percentage of tested purity and 2) the percentage of tested germination of the specified seed (pure live seed content = percent purity x percent germination = 50 percent) unless otherwise stated. The pure live seed content minimum may be reduced by the Engineer if the specified minimum is not available.

Seed shall be mixed at the project site in the presence of the Engineer. A one-ounce sample may be requested by the Engineer.

## **2.2 Fiber**

Organic cellulose shall be produced from wood chips or similar wood materials and shall be of such character that the fiber will disperse into a uniform slurry when mixed with water. Fiber produced from selected recycled newsprint or corrugated cardboard may be used or mixed with the wood fiber upon approval and as directed by the Engineer.

Fiber shall be colored to contrast with the area in which the fiber is to be applied, shall be non-toxic to plants and animal life, and shall not stain concrete or painted surfaces.

## **2.3 Stabilizing Emulsion**

Stabilizing emulsion shall be Ecology Controls M-Binder, Ecotack, Terra Tack III, or an approved equal.

## **2.4 Fertilizer**

Fertilizer shall be blended in the hydroseed mix to provide the following coverage: 300 pounds per acre Ureaform (38-0-0) and 215 pounds per acre of Potassium Sulfate (0-0-50).

## **2.5 Fiber Rolls**

Fiber rolls, i.e. fiber wattles, shall be 9-inches in diameter, and shall be manufactured from certified 100-percent weed-free rice straw and wrapped in a tubular plastic netting. Fiber rolls shall be as manufactured by Earth Saver, or an approved equal.

## **2.6 Gravel Bag Chevrons**

### **2.6.1 Bag Material**

Bags should be woven polypropylene, polyethylene or polyamide fabric or burlap, minimum unit weight of 4 ounces/yd<sup>2</sup>, Mullen burst strength exceeding 300 lb/in<sup>2</sup> in conformance with the requirements in ASTM designation D3786, and ultraviolet stability exceeding 70% in conformance with the requirements in ASTM designation D4355. Bag Size: Each gravel-filled bag should have a length of 18 in., width of 12 in., thickness of 3 in., and mass of approximately 33 lbs. Bag dimensions are nominal, and may vary based on locally available materials.

### **2.6.2 Fill Material**

Fill material should be 0.5 to 1 in. crushed rock, clean and free from clay, organic matter, and other deleterious material, or other suitable open graded, non-cohesive, porous gravel.



### **3.0 CONSTRUCTION METHODS**

#### **3.1 Erosion and Storm Water Control**

It is the intent of these Specifications that the erosion and storm water control elements conform to the final configuration of erosion control components as indicated on the drawings and as specified herein. It is also the intent of these specifications that at the conclusion of the contract, the site will be protected with newly installed erosion control improvements. However, interim erosion control features installed during the latter phases of the project maybe considered and compensated as final, at the discretion of the CM, if the components are deemed to be in suitable and undamaged condition.

#### **3.2 Hydro Seeding - Preparation**

All areas designated to receive seed are to be track walked prior to hydroseeding, leaving track divots parallel to the slope contours and shall be pre-dampened to a 2-inch depth. Hydroseeding on dry slopes or dry level areas shall not be permitted.

Hydroseeding of all completed deck areas shall be completed no earlier than September 15, nor later than January 15.

##### **3.2.1 Hydroseed Application Sequence**

Application of erosion control hydroseed mixes on the receiving area shall consist of the following two-step procedure:

- Hydroseed with 800 lbs/acre of fiber, seed mix and endomycorrhizal inoculum to give 3,600,000 live propagules per acre.
- Hydroseed with 2,500 lbs/acre of fiber and 140 lbs/acre organic tackifier.

Mixing of hydroseeding materials shall be performed in a thoroughly clean tank with a built-in, continuous agitation system of sufficient operating capacity to produce a homogeneous slurry and a discharge system which shall apply the slurry to the area at a continuous and uniform rate.

A dispersing agent may be added provided the Contractor furnishes evidence that the additive is not harmful to the mixture. Any materials considered harmful, as determined by the County's Consulting Biological Firm, shall not be used. The seed shall be the last item added to the slurry. Slurry shall be applied within 30 minutes after the seed has been added.

#### **3.3 Fiber Rolls**

Fiber rolls shall be installed in accordance with the manufacturer's recommendations, at the locations indicated on the drawings. Minor adjustments may be made, with the approval of the CM, to accommodate field conditions.

#### **3.4 Gravel-bag Chevrons**

Gravel-bag Chevrons shall be placed to the limits indicated, and in accordance with the details on the drawings.

#### **4.0 MEASUREMENT AND PAYMENT**

##### **4.1 Hydroseeding– Item No. 30**

The Contract Unit Price for hydroseeding shall include full compensation for all labor, material, and equipment required to complete the hydroseeding as indicated on the Drawing and in accordance with these Specifications, and supplier's recommendations.

Final pay quantities will be determined by field verification of the actual surface area of hydroseed. No additional payment will be made for material placed beyond the limits indicated on the Drawings unless authorized by the Engineer.

##### **4.2 Fiber Rolls (Per Details 2/D4 and 3/D4) – Item No. 31**

The Contract Unit Price to furnish and install fiber rolls shall include full compensation for all labor, material, and equipment required to complete the installations as indicated on the Drawing and in accordance with these Specifications.

Final pay quantities will be determined by field verification of the actual lineal footage of fiber rolls installed in accordance with the drawing. No additional payment will be made for material placed beyond the limits indicated on the Drawings unless authorized by the Engineer.

##### **4.3 Gravel-bag Chevrons (Per Detail 1/D4) – Item No. 32**

The Contract Unit Price to furnish and install gravel-bag chevrons shall include full compensation for all labor, material, and equipment required to complete the installations as indicated on the Drawing and in accordance with these Specifications.

Final pay quantities will be determined by field verification of the length of gravel-bag chevrons installed in accordance with the drawing. No additional payment will be made for material placed beyond the limits indicated on the Drawings unless authorized by the Engineer.

#### **END OF SECTION 21**

## **SECTION 2J**

### **LANDFILL GAS IMPROVEMENTS**

#### **1.0 GENERAL**

This section sets forth the requirements for Landfill Gas improvements indicated on the Drawings.

##### **1.1 Work Included**

In general, Landfill Gas improvements shall include:

- Protection/adjustment of LFG Probes in place or to new grade.
- Installation of Pipe Bollards.
- Installation of LFG trench collection gallery/vent, fittings, and caps.
- Anchor trench/LFG collection trench.
- Installation of LLDPE Skirt and Sleeve
- Installation of LFG Passive Vertical Well.

##### **1.2 Submittals Required**

The Contractor shall thoroughly review the Specifications and identify all required project submittals. The submittals listed below are intended as a general summary of the submittal items contained in this section. This submittal list does not release the Contractor from the responsibility of identifying and providing all information requested.

##### **LFG Improvement Submittals:**

- HDPE Pipe and Fittings Certificates of Compliance.
- LFG Gravel material gradation certification.
- Well Drilling Logs

#### **2.0 MATERIALS**

##### **2.1 Solid and Slotted HDPE Pipe and Fittings**

###### **2.1.1 LFG Pipe and Fittings**

LFG piping and fittings shall consist of high-density polyethylene (HDPE), smooth walled (non-corrugated), solid pipe conforming to requirements of Section 207-19 of the SSPWC, SDR and diameter per plan. HDPE Pipe for the LFG Header shall be 4-inches in diameter and SDR-17. Slotted piping shall conform to the slot detail pursuant to detail on construction drawings.

###### **2.1.2 Physical Properties**

HDPE pipe shall meet the following minimum specifications:

TEST	TEST METHOD	UNIT	REQUIREMENTS
Density*	ASTM D-1505	g/cc	0.955
Melt Flow Index (1)	ASTM D-1238 Condition E	g/10 min	13
Tensile Properties	ASTM D-638	psi psi %	3,300 @ yield 4,500 @ break ≥800 elongation @ break
Flexural Modulus (2)	ASTM D-790	psi	120,000
Environmental Stress Crack Resistance	ASTM D 1693	hrs	≥10,000 (3) ≥5,000 (4)
(1) 190° C/21600g (2) 2% Secant-Method 1 (3) Condition B, 10% (4) Condition C			

The Contractor shall submit two samples of each type of piping proposed for use. The submittal shall also include manufacturer's catalog cut sheets, manufacturer's quality control test results, recommended methods of jointing, and a Certificate of Compliance for each class of pipe. The submittal shall be provided to the Engineer at least 15 working days prior to intended use.

## 2.2 LFG Collection Gravel

LFG Collection Gravel shall be washed rock of the size listed below:

Gravel Type	Size
Vertical LFG Well	3/8-inch
Horizontal Trench/Well Vent	3/4-inch

## 2.3 Bentonite Seal

Bentonite seal shall consist of 3/8-inch bentonite chips, poured in place dry and then hydrated.

## 3.0 CONSTRUCTION METHODS

### 3.11 Solid and Slotted HDPE Pipe and Fittings

Installation of the 4-Inch SDR-17 HDPE LFG piping, shall conform to the lines, grades, details, and notes shown on the Plans and as referenced in these Technical Specifications.

HDPE pipe and fittings shall be joined by the butt fusion method unless otherwise specified on the Plans. Butt fusion welding of HDPE pipe shall be performed by qualified personnel. All personnel used by the Contractor for pipe installation shall have a current HDPE welding certificate for the type of welding in which they are engaged. The Contractor shall submit copies of these certificates for verification by the Engineer. No pipe shall be installed prior to submittal of this verification. The pipe shall not be concealed until a final record survey has been completed and the Engineer has approved the pipe installation.

Pipe and fittings shall be held firmly in position and protected from damage while backfill is being placed. All pipe and fittings shall be cleaned upon installation and kept so during the progress of the work.

Any pipe that becomes either partially or fully clogged and/or damaged before final acceptance shall be cleaned/repaired to the satisfaction of the Engineer and/or replaced at the Contractor's expense.

#### **4.0 MEASUREMENT AND PAYMENT**

The contract unit price for each of the following Landfill Gas Improvements shall include full compensation for all labor, material and equipment required to construct the improvements in accordance with the Construction Drawings, Specifications, and manufacturer's recommendations. Quantities installed beyond the limits indicated on the drawings will not be compensated unless previously authorized by the Engineer.

##### **4.1 Protection/Adjustment of LFG Monitoring Probe During Final Cover System Installation (Per Details 4/6 and 8/6) – Item No. 26**

The contract lump sum price paid for Protection Adjustment of LFG Monitoring Probes During Final Cover System Installation shall include all work associated with the Protection/Adjustment.

Final pay quantities shall be determined by field verification that the operation was completed in accordance with these specifications

##### **4.2 Construct LFG Passive Vertical Well (Per Detail 3/6) – Item No. 27**

All layout, drilling, 4-inch solid and slotted HDPE SDR 17 pipe, fittings, drilling tip, fusion welding, gravel, backfill and compaction, per these specifications and/or all other operations, equipment, or materials incidental to completing the work as represented by the Drawings and Specifications shall be included in the Contractor's unit price.

Final pay quantities shall be determined by the actual vertical foot of LFG Passive Vertical Well installed. Quantities exceeding beyond the limits indicated on the Drawings will not be compensated, unless the additional work was authorized by the Engineer prior to the work being performed.

##### **4.3 LFG Passive Trench/Collection Gallery/Well/Vent (Per Detail 1/6) – Item No. 28A**

The contract price paid per linear foot for LFG Passive Trench/Well/Vent shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in LFG Passive Trench/Well Vent complete in place, including all trenching, geotextile, trench gravel, 4-Inch Slotted and Solid HDPE SDR 17 pipe, fittings, caps, concrete collars and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual linear footage of LFG Passive Trench/Well/Vent installed – All cost for vents shall be included in the unit price per linear foot of LFG Passive Trench/Collection Gallery.

#### **4.4 Anchor Trench/LFG Collection Trench (Per Detail 8/D1) – Item No. 28B**

The contract price paid per linear foot for Anchor Trench/LFG Collection Trench shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in Anchor Trench/LFG Collection Trench complete in place, including all trenching, geotextile, trench gravel, 4-Inch Slotted and Solid HDPE SDR 17 pipe, fittings, caps, and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual linear footage of Anchor Trench/LFG Collection Trench installed.

#### **4.5 LFG/Seep Collector (Per Detail 10/D1) – Item No. 28C**

The contract price paid per linear foot for LFG/Seep Collector shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in LFG/Seep Collector complete in place, including all LLDPE Super Grip Net, geotextile, Heat Leistering and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual linear footage of LFG/Seep Collector installed.

#### **4.6 LLDPE Skirt and Sleeve (Per Detail 7/6) – Item No. 29**

The contract price paid per each LLDPE Skirt and Sleeve, shall include full compensation for furnishing all labor, tools, equipment, and incidentals and for doing all the work involved in LLDPE Skirt and Sleeve, complete in place, including all LLDPE Geomembrane, grinding of drainage stud, Extrusion welding to Final Cover Geomembrane, neoprene gasket, stainless steel straps and other appurtenances as shown on the plans, as specified in the Standard Specifications and these Special Provisions, and as directed by the engineer.

Final pay quantities shall be determined from the approved Record Drawings indicating the actual number of LLDPE Skirt and Sleeves installed.

### **END OF SECTION 2J**

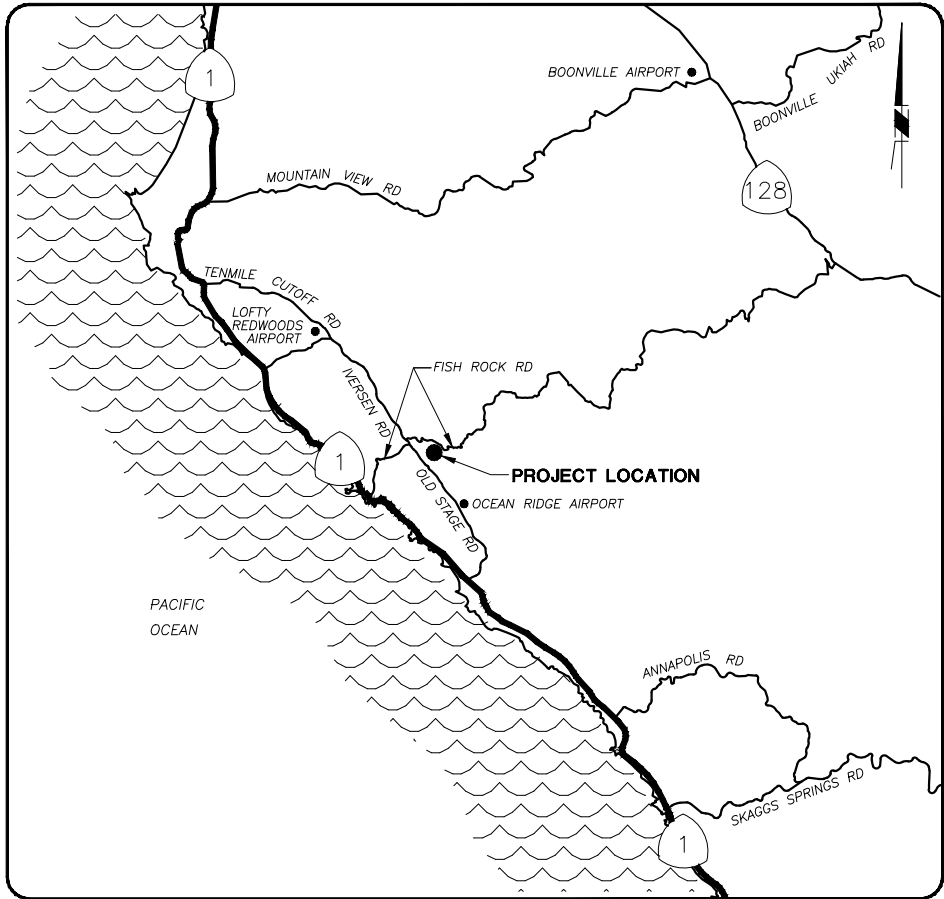


**APPENDIX A**  
**CONSTRUCTION DRAWINGS FOR FINAL CLOSURE**  
**CONSTRUCTION PROJECT – SOUTH COAST LANDFILL –**  
**MENDOCINO COUNTY, CA**

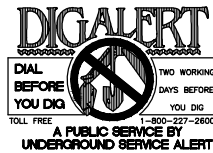




**SOUTH COAST LANDFILL  
FINAL CLOSURE CONSTRUCTION PROJECT  
GUALALA, CALIFORNIA  
COUNTY OF MENDOCINO  
DEPARTMENT OF TRANSPORTATION**

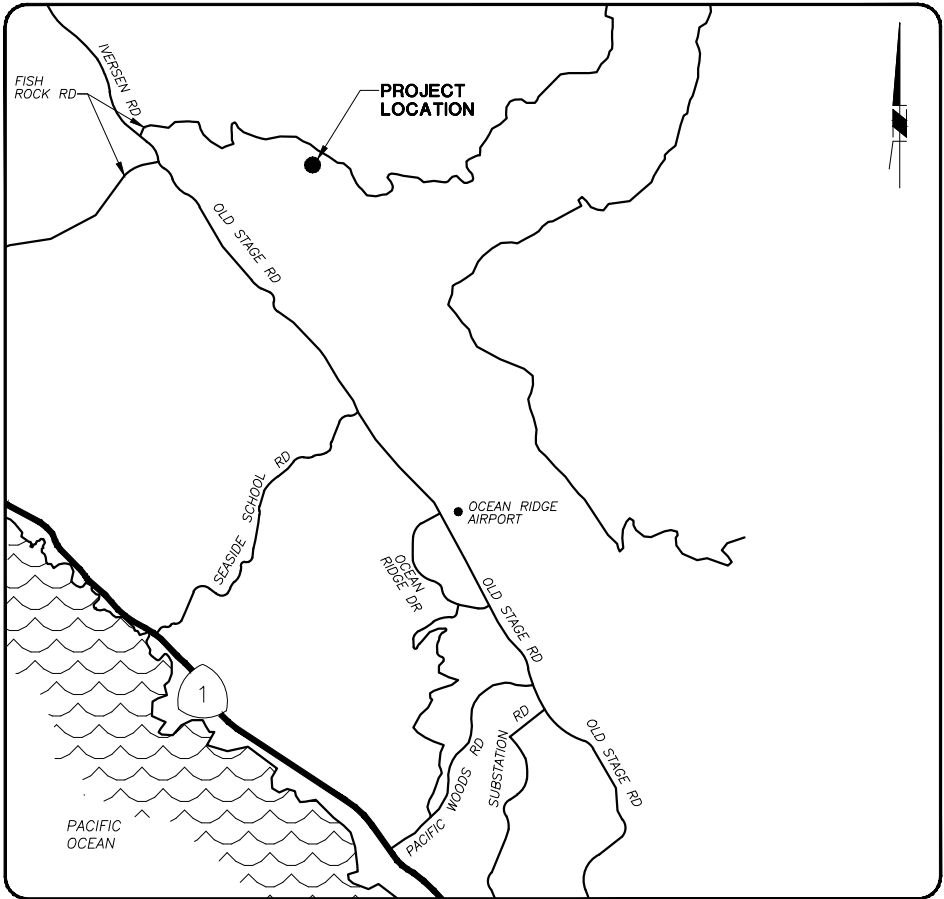


**VICINITY MAP**  
SCALE: 1"=3 MI



**LIST OF DRAWINGS**

DRAWING NUMBER	TITLE AND DESCRIPTION
1	TITLE SHEET
2	SITE PLAN
3	REFUSE LIMIT VERIFICATION/ TRENCHING/SOIL BORROW PLAN
4	REFUSE RECONSOLIDATION PLAN
5	FINAL GRADING PLAN
6	LFG PLAN
7	SECTIONS
8	PAVING/EROSION CONTROL PLAN
D1	DETAIL SHEET
D2	DETAIL SHEET
D3	DETAIL SHEET
D4	EROSION CONTROL DETAIL SHEET



**LOCATION MAP**  
SCALE: 1"=0.5 MI

PREPARED BY:

**SWT Engineering** Civil & Environmental  
800-C SOUTH ROCHESTER AVENUE  
ONTARIO, CALIFORNIA 91761



PREPARED UNDER THE SUPERVISION OF

DATE

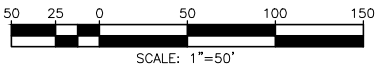
MENDOCINO COUNTY  
SOUTH COAST LANDFILL  
**FINAL CLOSURE CONSTRUCTION PROJECT 2019  
TITLE SHEET**

DESIGNED BY : RMG	SCALE : AS SHOWN	PROJECT NO: --
DRAWN BY : CTD/DMW	DATE : 01-2019	
CHECKED BY :	DATE :	
APPROVED BY :	DATE :	SHEET <b>1</b> OF <b>12</b>

Z:\PROJECTS\MENDOCINO COUNTY\SOUTH COAST\FINAL CLOSURE CONSTRUCTION 2016\ACAD\SHEET SET\01-SOC TITLE SHEET



- ④1 INSTALL GRAVEL BAG CHEVRON PER ① D4  
④2 CONSTRUCT INLET TO CONCRETE DOWNDRAIN PER ⑦ D3  
④3 INSTALL CABLE GATE PER ⑤ D2  
④4 JOIN 4" HDPE PIPE TO HDPE EDGE DRAIN WITH EDGE DRAIN TO PIPE TRANSITION FITTING  
④5 INSTALL ARMOR FILL EMULSION OVER SAND INFILL PER PLAN  
④6 INSTALL HYDRO BINDER INFILL IN LIEU OF SAND INFILL AT ALL DRAINAGE SWALES PER PLAN (1-FOOT DEPTH)



LEGEND

- APPROXIMATE PROPERTY BOUNDARY  
- - - PERMITTED LIMIT OF REFUSE  
X X EXISTING FENCE  
500 EXISTING GRADE CONTOUR  
500 FINISHED GRADE CONTOUR  
--- TOE OF SLOPE  
--- DAYLIGHT LINE  
--- RIDGE LINE  
C F CUT/FILL TRANSITION  
FINISHED BENCH  
--- HDPE EDGE DRAIN  
--- DRAINAGE COLLECTOR  
--- LFG/SEEP COLLECTOR  
3:1 DIRECTION AND RATE OF SLOPE  
① D1 DETAIL NUMBER  
① D1 SHEET SHOWN ON  
7 Δ 513.6 HORIZONTAL/VERTICAL CONTROL (HVC)  
◆ FINAL COVER SETTLEMENT MONUMENT  
⊗ P-3 LFG PROBE  
--- VERTICAL PASSIVE VENT GAS WELL  
--- LANDFILL GAS PASSIVE VENT RISER LOCATION  
--- LANDFILL GAS PASSIVE TRENCH BELOW 60 MIL LLDPE  
■ LFGW-1 GAS MONITORING PROBE

NOTICE TO CONTRACTOR

1. THE EXISTENCE AND LOCATION OF UNDERGROUND UTILITY PIPES OR STRUCTURES SHOWN ON THESE PLANS WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THESE LOCATIONS ARE APPROXIMATE AND SHALL BE CONFIRMED IN THE FIELD BY THE CONTRACTOR SO THAT ANY NECESSARY ADJUSTMENT CAN BE MADE IN ALIGNMENT AND/OR GRADE OF THE PROPOSED IMPROVEMENT. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT ANY UTILITY LINES SHOWN AND ANY OTHER LINES NOT OF RECORD OR NOT SHOWN ON THESE PLANS.
2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MAKE EXACT DETERMINATION AS THE LOCATION OF ALL EXISTING UTILITIES. FORTY-EIGHT (48) HOURS PRIOR TO ANY EXCAVATION, THE CONTRACTOR SHALL NOTIFY UNDERGROUND SERVICE ALERT AT 1-800-422-4133 AND SHALL PROVIDE THE CONSTRUCTION MANAGER WITH VERIFICATION NUMBERS ISSUED.
3. THE FACT THAT ANY UTILITY FACILITY IS SHOWN OR NOT SHOWN UPON THE PLANS SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY UNDER SECTION 8-1.10 "UTILITY AND NON-HIGHWAY FACILITIES," OF THE STATE STANDARD SPECIFICATIONS. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY, PURSUANT THERETO, TO ASCERTAIN THE LOCATION OF ANY UTILITY FACILITY WHICH MAY BE SUBJECT TO DAMAGE BY REASON OF THE CONTRACTOR'S OPERATIONS.

4. REGARDING SIGNED DRAWING VERSUS ELECTRONIC COPY: SHOULD THE CONTRACTOR OR CONTRACTOR'S SURVEYOR FIND A CONTOUR LABEL OR ELEVATION DISCREPANCY BETWEEN THE SIGNED DRAWING AND THE ELECTRONIC VERSION (WHICH HAVE BEEN PROVIDED AS A COURTESY FOR EASE OF CONSTRUCTION STAKING), THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF THE DISCREPANCY SO THAT THE DISCREPANCY MAY BE RESOLVED, PRIOR TO CONSTRUCTION. THE SIGNED DRAWING SUPERSEDES THE ELECTRONIC VERSION.

COORDINATE CONTROL POINTS

PT NO	NORTHING	EASTING	ELEVATION
3	9443.63	10064.07	498.9
6	9618.41	10287.41	496.2
7	10128.71	9963.78	513.6
8	10049.25	9525.71	490.2
9	9959.54	9483.59	494.5

NOTES

1. TOPOGRAPHIC DATA COMPILED FROM 15 FEBRUARY 2012 AERIAL PHOTOGRAPHY BY DELTA GEOMATICS CORPORATION.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL, NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29).
3. GRID COORDINATES CORRESPOND TO THE CALIFORNIA STATE PLANE COORDINATE SYSTEM, ZONE 3, NAD83.
4. LOCATIONS OF STOCKPILES ARE APPROXIMATE.
5. EQUIPMENT AND MATERIAL STAGING AREA(S) TO BE DETERMINED BY OWNER.
6. ALL EXISTING STRUCTURES SUCH AS BUILDINGS, POLES, FENCES, PIPES, DITCHES, PONDS, ETC. WITHIN LIMIT OF EARTHWORK SHALL BE REMOVED AS REQUIRED BY THE OWNER.

ABBREVIATIONS

AC	ASPHALT CONCRETE	LFG	LANDFILL GAS
CHDPE	CORRUGATED HIGH DENSITY POLYETHYLENE	LP	LOW POINT
		OC	ON CENTER
FL	FLOWLINE	PP	POWER POLE
FP	FINISHED PAVEMENT	TC	TOP OF CURB
GB	GRADE BREAK	TS	TOP OF SLOPE
HP	HIGH POINT	TYP	TYPICAL
INV	INVERT OF PIPE	UD	UNDERDRAIN

CONSTRUCTION NOTES

- ① CLEAR AND GRUB  
② PROTECT IN PLACE  
③ REMOVE EXISTING STRUCTURES  
④ ADJUST TO FINAL GRADE  
⑤ PERFORM REFUSE EXCAVATION AND PLACE IN DESIGNATED RECONSOLIDATION AREA SHOWN PER PLAN  
⑥ PERFORM UNCLASSIFIED EXCAVATION AT STOCKPILE AREAS AND BORROW AREA FOR FINAL COVER  
⑦ CONSTRUCT FINAL COVER SECTION - SLOPE PER ① D1  
⑧ CONSTRUCT FINAL COVER SECTION - DECK PER ② D1  
⑨ CONSTRUCT HDPE EDGE DRAIN COLLECTOR (BELOW FINAL COVER LLDPE) PER ③ D1  
⑩ CONSTRUCT DRAINAGE COLLECTOR PER ④ D1  
⑪ CONSTRUCT FINAL COVER SLOPE TERMINATION PER ⑤ D1 (WITH SWALE), OR PER ⑪ D1 (NO SWALE)  
⑫ PERFORM 2-FOOT (PLUS INTERIM SOIL COVER) REFUSE EXCAVATION PRIOR TO PLACEMENT OF INTERIM COVER AND 2-FOOT FOUNDATION SOIL LAYER; PERFORM 10-FOOT TRANSITION FROM 2-FOOT VERTICAL CUT TO DAYLIGHT WITH EXISTING GRADE (REFUSE EXCAVATION PLUS INTERIM COVER) PER ④ D2  
⑬ CONSTRUCT BENCH LINER TERMINATION PER ⑥ D3  
⑭ CONSTRUCT FINAL COVER TERMINATION - NORTHEAST PERIMETER ROAD PER ⑥ D1  
⑮ CONSTRUCT CONCRETE ACCESS RAMP TO BASIN WITH INTEGRAL CONCRETE CURB PER ④ D3  
⑯ CONSTRUCT TOP DECK TRANSITION PER ⑧ D1  
⑰ CONSTRUCT FINAL COVER TERMINATION - SOUTH AND WEST PERIMETER ROAD PER ④ D2  
⑱ CONSTRUCT DECK ACCESS ROAD PER ⑨ D1  
⑲ INSTALL PIPE BOLLARD PER ⑧ 6  
⑳ CONSTRUCT CONCRETE DOWNDRAIN/CHANNEL PER ① D2  
㉑ CONSTRUCT RIP RAP PAD PER ① D2  
㉒ CONSTRUCT BASIN BERM AND DOWNDRAIN INLET AT STORMWATER BASIN PER ③ D3  
㉓ RELOCATE/ADJUST SURVEY MONUMENT TO GRADE PER PROJECT SPECIFICATIONS AND PER ② D3  
㉔ INSTALL SAND IN-FILL PER MANUFACTURERS RECOMMENDATIONS PER ① D1 ② D1  
㉕ CONSTRUCT BENTONITE PLUG/EDGE DRAIN OUTLET PER ⑦ D1  
㉖ CONSTRUCT 4" SOLID HDPE PIPE (SDR 17)  
㉗ EXTEND PIPE AND JOIN TO EXISTING LEACHATE OUTFALL PIPING/TANK  
㉘ CONSTRUCT ANCHOR TRENCH WITH LFG COLLECTION TRENCH PER ⑧ D1  
㉙ CONSTRUCT TYPE A AC DIKE PER CALTRANS STD PLAN A87B  
㉚ CONSTRUCT 12"x12" DEEP LIFT AC/CONCRETE TERMINATION  
㉛ CONSTRUCT 3" AC OVER NATIVE SOIL COMPACTED TO 95% OF ASTM D1557 PER ⑥ D1 OR ⑨ D1 OR ④ D2  
㉜ CONSTRUCT SPLASHWALL PER ⑤ D3  
㉝ PROTECT/ADJUST LFG GAS PROBE TO FINAL GRADE; INSTALL 3 EACH PIPE BOLLARDS AT EACH PROBE PER ④ 6 ⑧ 6  
㉞ CONSTRUCT VERTICAL LANDFILL GAS WELL PER ③ 6  
㉟ CONSTRUCT LANDFILL GAS VENT PER ① 6  
㊱ INSTALL LANDFILL GAS TRENCH COLLECTION GALLERY WITH 2 CF/LF TRENCH GRAVEL, 4" SLOTTED HDPE PIPE AND 8 OZ/SY GEOTEXTILE WRAP PER ② 6  
㊲ CONSTRUCT LLDPE SKIRT AND SLEEVE PER ⑦ 6  
㊳ INSTALL LFG/SEEP COLLECTOR PER ⑩ D1  
㊴ HYDROSEED ON SITE AREA  
㊵ INSTALL FIBER ROLL PER ② D4 ③ D4

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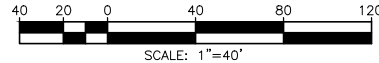


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MENDOCINO COUNTY  
SOUTH COAST LANDFILL  
**FINAL CLOSURE CONSTRUCTION PROJECT 2019  
SITE PLAN**

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DRAWN BY : CTD/DMW	DATE : 01-2019	
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APPROVED BY :	DATE :	SHEET <b>2</b> OF <b>12</b>





- ① CLEAR AND GRUB
- ② PROTECT IN PLACE
- ③ REMOVE EXISTING STRUCTURES
- ⑥ PERFORM UNCLASSIFIED EXCAVATION AT STOCKPILE AREAS AND BORROW AREA FOR FINAL COVER
- ②③ RELOCATE/ADJUST SURVEY MONUMENT TO GRADE PER PROJECT SPECIFICATIONS AND PER 2  
D3

- B  TRENCH FOR REFUSE BOTTOM  
EXCAVATION DETERMINATION
- A  LIMIT OF REFUSE LOCATION  
TRENCH

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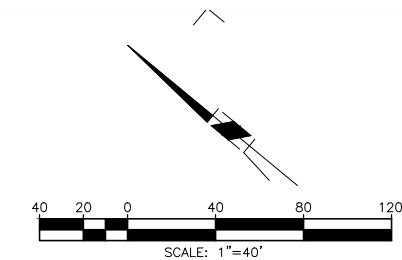
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<b>FINAL CLOSURE CONSTRUCTION PROJECT 2019 REFUSE LIMIT VERIFICATION/TRENCHING/SOIL BORROW PLAN</b>		
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Z:\PROJECTS\MENDOCINO COUNTY\SOUTH COAST\FINAL CLOSURE CONSTRUCTION 2016\ACAD\SHEET SET\03-SOC STOCKPILE REMOVAL AND BORROW PLAN







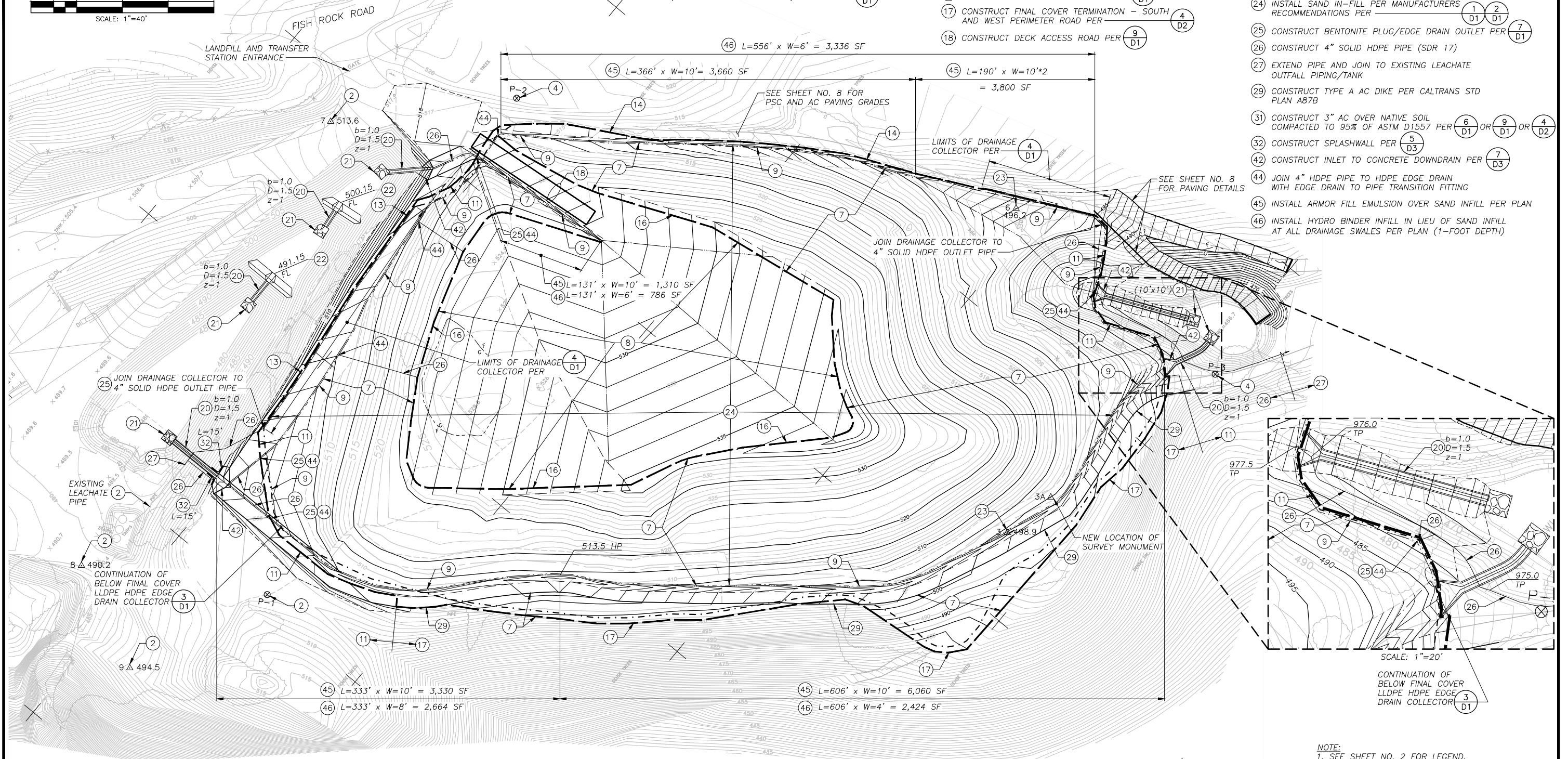


- (2) PROTECT IN PLACE  
(4) ADJUST TO FINAL GRADE  
(7) CONSTRUCT FINAL COVER SECTION - SLOPE PER (1 D1)  
(8) CONSTRUCT FINAL COVER SECTION - DECK PER (2 D1)  
(9) CONSTRUCT HDPE EDGE DRAIN COLLECTOR (BELOW FINAL COVER LLDPE) PER (3 D1)

CONSTRUCTION NOTES

- (11) CONSTRUCT FINAL COVER SLOPE TERMINATION PER (5 D1) (WITH SWALE), OR (11 D1) (NO SWALE)  
(13) CONSTRUCT BENCH LINER TERMINATION PER (6 D3)  
(14) CONSTRUCT FINAL COVER TERMINATION - NORTHEAST PERIMETER ROAD PER (6 D1)  
(16) CONSTRUCT TOP DECK TRANSITION PER (8 D1)  
(17) CONSTRUCT FINAL COVER TERMINATION - SOUTH AND WEST PERIMETER ROAD PER (4 D2)  
(18) CONSTRUCT DECK ACCESS ROAD PER (9 D1)

- (20) CONSTRUCT CONCRETE DOWNDRAIN/CHANNEL PER (1 D3)  
(21) CONSTRUCT RIP RAP PAD PER (1 D2)  
(22) CONSTRUCT BASIN BERM AND DOWNDRAIN INLET AT STORMWATER BASIN PER (3 D3)  
(23) RELOCATE/ADJUST SURVEY MONUMENT TO GRADE PER PROJECT SPECIFICATIONS AND PER (2 D3)  
(24) INSTALL SAND IN-FILL PER MANUFACTURERS RECOMMENDATIONS PER (1 D1) (2 D1)  
(25) CONSTRUCT BENTONITE PLUG/EDGE DRAIN OUTLET PER (7 D1)  
(26) CONSTRUCT 4" SOLID HDPE PIPE (SDR 17)  
(27) EXTEND PIPE AND JOIN TO EXISTING LEACHATE OUTFALL PIPING/TANK  
(29) CONSTRUCT TYPE A AC DIKE PER CALTRANS STD PLAN A87B  
(31) CONSTRUCT 3" AC OVER NATIVE SOIL COMPACTED TO 95% OF ASTM D1557 PER (6 D1) OR (9 D1) OR (4 D2)  
(32) CONSTRUCT SPLASHWALL PER (5 D3)  
(42) CONSTRUCT INLET TO CONCRETE DOWNDRAIN PER (7 D3)  
(44) JOIN 4" HDPE PIPE TO HDPE EDGE DRAIN WITH EDGE DRAIN TO PIPE TRANSITION FITTING  
(45) INSTALL ARMOR FILL EMULSION OVER SAND INFILL PER PLAN  
(46) INSTALL HYDRO BINDER INFILL IN LIEU OF SAND INFILL AT ALL DRAINAGE SWALES PER PLAN (1-FOOT DEPTH)



NOTE:  
1. SEE SHEET NO. 2 FOR LEGEND.

DATE OF TOPOGRAPHY: FEBRUARY 15, 2012

PREPARED BY:

**SWT** Civil & Environmental Engineering  
800-C SOUTH ROCHESTER AVENUE  
ONTARIO, CALIFORNIA 91761



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MENDOCINO COUNTY  
SOUTH COAST LANDFILL  
**FINAL CLOSURE CONSTRUCTION PROJECT 2019**  
**FINAL GRADING PLAN**

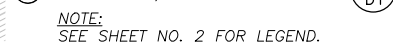
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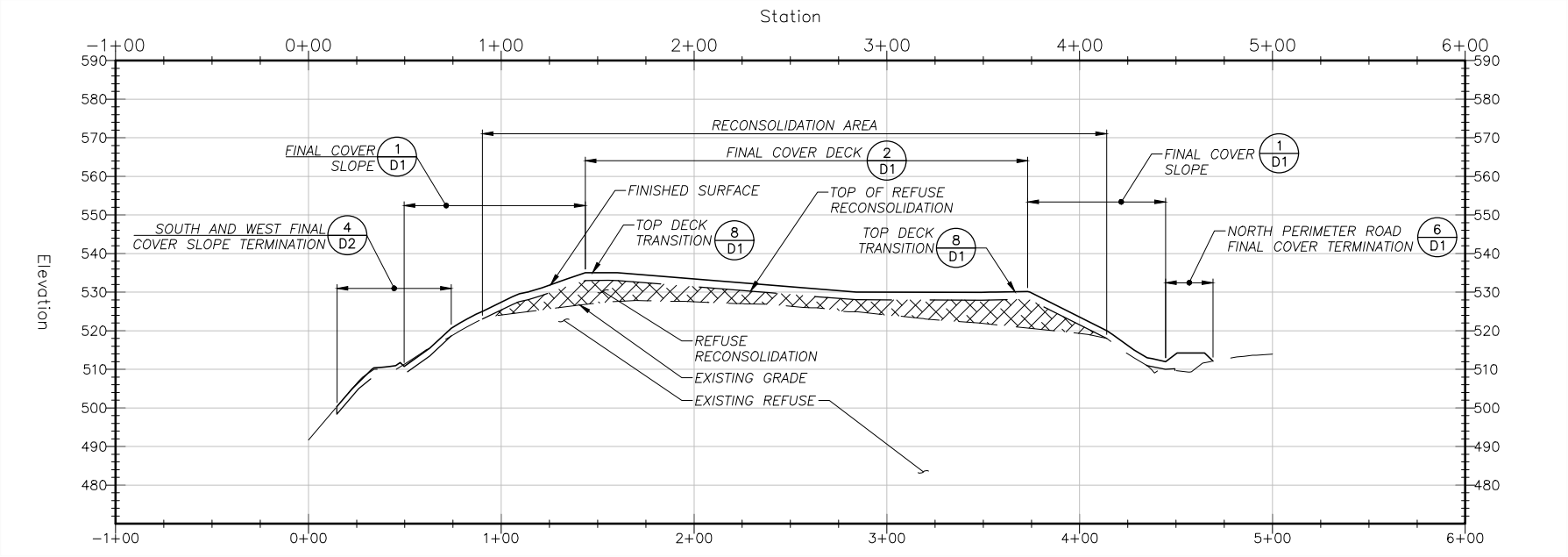
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-IF THE BOTTOM OF THE LANDFILL IS ENCOUNTERED DURING DRILLING, THE CONTRACTOR SHALL INSTALL A 5' THICK BENTONITE SEAL, AT BOTTOM OF BORE HOLE



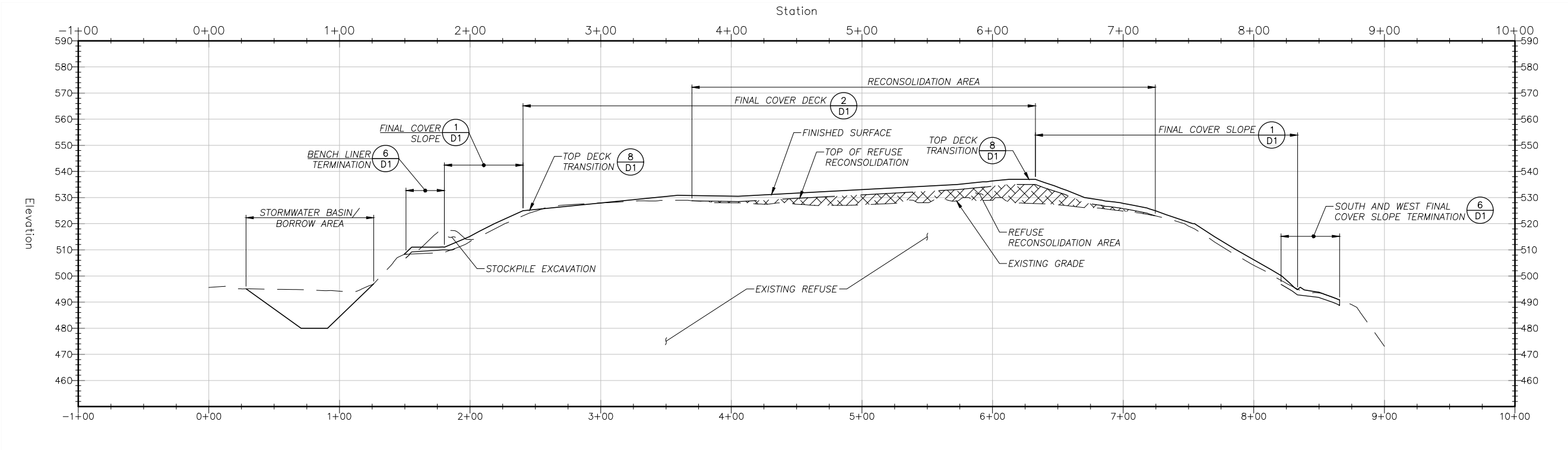


SECTION A

SCALE: HORIZ. 1"=40'  
VERT. 1"=20'

A

7



SECTION B

SCALE: HORIZ. 1"=40'  
VERT. 1"=20'

B

7

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MENDOCINO COUNTY  
SOUTH COAST LANDFILL  
**FINAL CLOSURE CONSTRUCTION PROJECT 2019  
SECTIONS**

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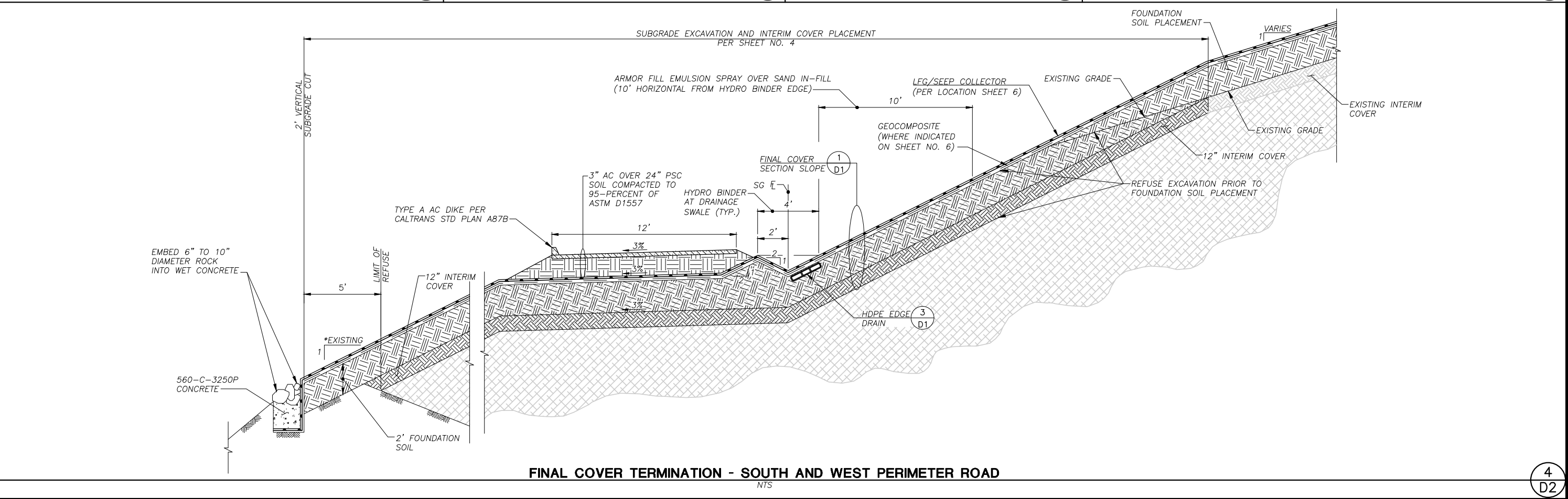
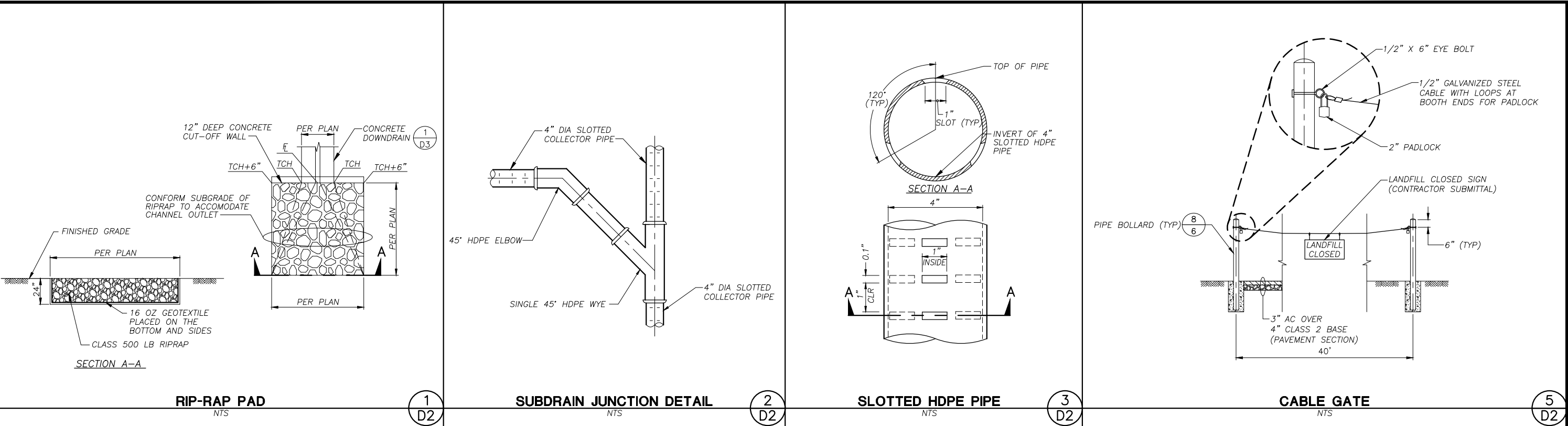
SHEET 7 OF 12





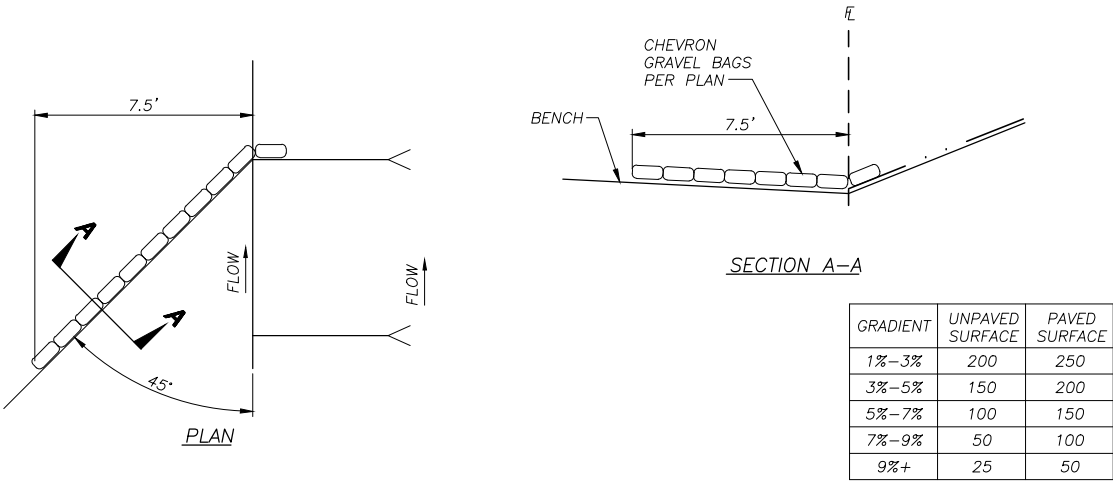


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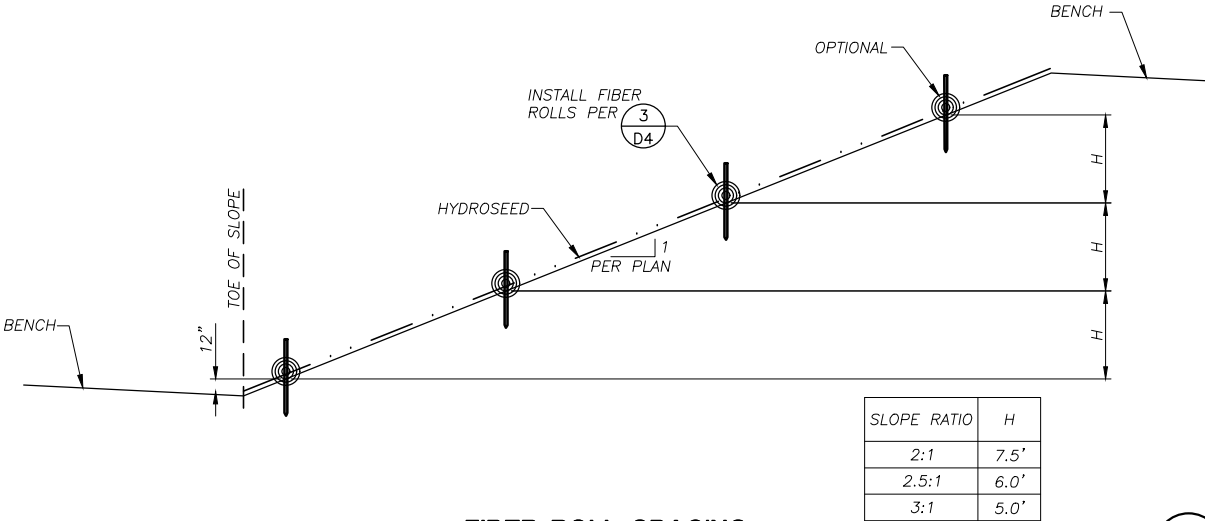
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GRAVEL BAG CHEVRON DETAIL

NTS

1  
D4

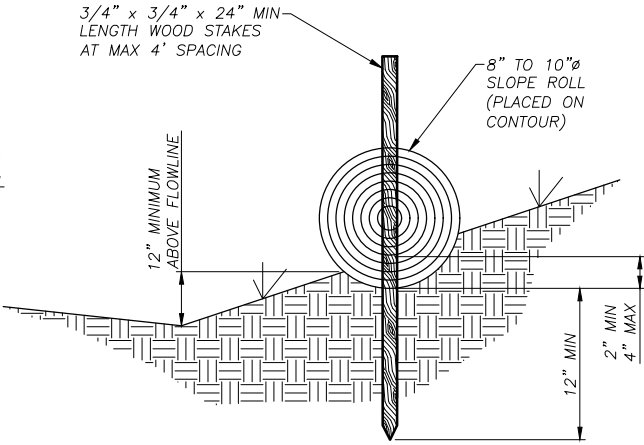


FIBER ROLL SPACING

NTS

2  
D4

- NOTES:
- 1) FIBER ROLL INSTALLATION AT BENCH SHALL BE A MINIMUM OF 12" ABOVE BENCH FLOWLINE, UNLESS SILT FENCE IS SPECIFIED AT THAT LOCATION.
  - 2) A 3" DEEP TRENCH, THE WIDTH OF THE ROLL, DUG PER PLAN LOCATION SHALL "NEST" THE STRAW ROLL SO AS NOT TO ALLOW RUNOFF TO FLOW UNDER OR AROUND ROLL.
  - 3) FIBER ROLLS SHALL BE PLACED ON SLOPES AT H- FEET VERTICAL INTERVALS STARTING FROM THE TOE OF RESPECTIVE SLOPE. DECK ROLLS SHALL BE PLACED AT 10- FEET VERTICAL INTERVALS AS SHOWN ON THE PLAN.
  - 4) INSTALL FIBER ROLLS ALONG A LEVEL CONTOUR.
  - 5) INSTALL FIBER ROLLS UP GRADIENT AND NEAR TRANSITION OF SLOPES.
  - 6) INSTALL NUMEROUS ROLLS IN A ROW BY OVERLAPPING, NOT ABUTTING.
  - 7) TURN ENDS OF ROLLS UP SLOPE TO PREVENT RUNOFF FROM GOING AROUND THE ROLL.
  - 8) SEDIMENT IS TO BE REMOVED WHEN ACCUMULATION REACHES ONE HALF THE DISTANCE BETWEEN THE TOP OF THE ROLL AND ADJACENT GROUND SURFACE.



FIBER ROLLS

NTS

3  
D4

NO.	REVISION	DESCRIPTION	DATE

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ONTARIO, CALIFORNIA 91761

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MENDOCINO COUNTY SOUTH COAST LANDFILL FINAL CLOSURE CONSTRUCTION PROJECT 2019 EROSION CONTROL DETAIL SHEET		
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## **APPENDIX B**

### **HEALTH AND SAFETY PROVISIONS**





## **HEALTH AND SAFETY PROVISIONS**

Within seven days of the award of the Contract, the Contractor shall submit for the review of the OWNER, a copy of its Injury and Illness Prevention Program (IIPP). The IIPP shall be in sufficient detail to include all aspects of health and safety that may be anticipated by the scope of work.

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, is combustible, and contains no oxygen. Landfill gas can also migrate through soil near the landfill. The Contractor is, therefore, advised of the need for precautions against fire, explosion, and asphyxiation when working in or near construction areas which are in or near refuse areas. The Contractor's IIPP shall address this issue.

The Contractor shall at all times be responsible for the safe prosecution of the Work and protection of its employees and the public. Review of the Contractor's IIPP by OWNER shall not relieve the Contractor of responsibility for any aspect of the work, or for compliance with all Federal, State, and local laws pertaining to health and safety. Strict Adherence to the Contractor's Health and Safety Plan will be required for all Contractor and subcontractor personnel.

The contents of the Health and Safety Plan must meet all regulatory requirements for the specific work that is proposed. The following is a list of some of the elements for a Health and Safety Plan. Those plan elements which will not apply to the specific contract should be noted (such as "this construction does not involve any confined space work,").

One or more of the following may be required to be included in an employer's (Contractor's) Health and Safety Plan (HSAP).

### **Mandatory**

1. Site Background and Scope of Work: Site specific with an emphasis on the type(s) of service(s) performed, the hazards associated with such work, and the programs in effect to protect the employee against those recognized hazards.
2. Injury and Illness Prevention Program (Title 8, California Code of Regulations, Section 3203): Required of all employers of 10 or more employees.
3. Code of Safe Practices (Cal. Code Regs., Title 8, §1509): All employers are required to have a Code of Safe Practices in writing and posted at the work place.
4. Emergency Medical Services (Cal. Code Regs., Title 8, §1512): All employers are required to have this program in writing.
5. Fire Protection Program (Cal. Code Regs., Title 8, §1920): All employers are required to have this program in writing.

### **Required by Scope of Work**

6. Hazard Communication Program (Cal. Code Regs., Title 8, §5194): All employers are required to have this program in writing if there is a potential for their employees to come in contact with any products that may be hazardous.
7. Requirements for Excavation and Shoring (Cal. Code Regs., Title 8 §1541.1): All employers are required to have this program in writing.



8. Confined Space Procedures (Cal. Code Regs., Title 8, §5156): All employers are required to have this program in writing if confined spaces will be entered.
9. Hearing Conservation Program (Cal. Code Regs., Title 8 §5097): This program shall be written into the HASP if employee noise exposures meet or exceed the levels outlined in Cal. Code Regs., Title 8, §5097.
10. Personal Protective Equipment (Cal. Code Regs., Title 8, §§3380-3400): Requirements must be included in the HASP if personal protective equipment is required for the contracted work.
11. Storage, Handling, and Dispensing of Flammable/Combustible Liquids (Uniform Fire Code Article 79): Requirements must be included in the HASP if flammable/combustible liquids will be stored, handled, or dispensed.
12. Welding, Brazing, and Cutting (Cal. Code Regs., Title 8, §§1536, 1537): Requirements must be included in the HASP if performing these actions.
13. Compressed Gas Cylinders (Cal. Code Regs., Title 8, §§1740-1743): Requirements must be included in the HASP if storing or using compressed gas cylinders.

In addition to submittal of the IIPP, the Contractor shall provide safety checklists for each piece of operated equipment to be used on the site. The checklists shall reflect that the equipment has been properly maintained, that all protection features are in good repair, and that the equipment is safe to operate.

**APPENDIX C**  
**EARTHWORK AND GEOSYNTHETIC QUALITY ASSURANCE PLAN**  
**FOR THE CONSTRUCTION OF THE FINAL COVER SYSTEM AT**  
**THE SOUTH COAST LANDFILL**



**EARTHWORK AND GEOSYNTHETIC  
QUALITY ASSURANCE PLAN  
FOR THE CONSTRUCTION OF THE  
FINAL COVER SYSTEM  
AT THE SOUTH COAST LANDFILL**

**Prepared for:**

**MENDOCINO COUNTY  
SOLID WASTE DIVISION  
340 LAKE MENDOCINO DRIVE  
UKIAH, CALIFORNIA**

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**In Association with:**

**SWT Engineering  
800-C South Rochester Avenue  
Ontario, California 91761**

**November 2012  
Job No. 2012-0007**

  
\_\_\_\_\_  
**Signature/Certification No./GE No. 2189**

\_\_\_\_\_  
**Supervising Geotechnical Engineer**  
**Title**

**11-13-2012**  
\_\_\_\_\_  
**Date**



**EARTHWORK AND GEOSYNTHETIC  
QUALITY ASSURANCE PLAN  
FOR THE CONSTRUCTION OF THE FINAL COVER SYSTEM**

**SOUTH COAST LANDFILL  
MENDOCINO COUNTY, CALIFORNIA**

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**EARTHWORK AND GEOSYNTHETIC  
QUALITY ASSURANCE PLAN  
FOR THE CONSTRUCTION OF THE FINAL COVER SYSTEM  
SOUTH COAST LANDFILL  
MENDOCINO COUNTY, CALIFORNIA**

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FOR THE CONSTRUCTION OF THE FINAL COVER SYSTEM  
SOUTH COAST LANDFILL  
MENDOCINO COUNTY, CALIFORNIA**

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## **1.0 INTRODUCTION**

A Quality Assurance (QA) program consists of selected testing and inspection of a final product completed in order to provide the Owner/Agencies an evaluation of whether the end product is of the specified quality of materials and workmanship. Because of possible conflicts of interest, the Contractor should not undertake the QA function directly. Rather, QA inspection and testing should be left under the objective authority of a single team of design and inspection professionals.

A Quality Control (QC) program consists of selected tests and inspections during production which assist the Contractor in producing the quality product required. While the QC function is the sole responsibility of the Contractor, the Project Manager may, at his discretion, provide information regarding the on-going QA monitoring for the Contractor's use in implementing his QC function. Release of the QA data to the Contractor would be for convenience only and would, in no way, relieve the Contractor from sole responsibility for fulfilling the project requirements.

The final cover system proposed for the South Coast Landfill consists of individual discrete layers of earth and synthetic materials which will function as a unit to form the final cover system for closure of the waste management area. As proposed, the final cover system will consist of individual discrete members including, from bottom to top: a foundation layer composed on on-site soils; a 60-mil thick geomembrane liner; a separator non-woven geotextile; and a 2-foot thick final cover layer composed of select soil materials. Each of these components functions as an integral part of the final cover system and consequently must become a finished product during the course of construction. As a result, it is important that each element of the final cover be completed to the design specifications prior to construction of successive or overlying members. For this reason, it is both inefficient and impractical to withhold QA observation or testing until completion of the cover and it is necessary to conduct an on-going QA program during construction to verify a quality end product.

This document presents the QA criteria for construction of the earthworks and geosynthetic components of the final cover.

This QA Document will be used in conjunction with the Project Drawings and Specifications.

### **1.1 PROJECT REQUIREMENTS**

As detailed in the Construction Documents, the final cover system was designed to satisfy requirements established by the governing regulatory agencies. As such the following final cover system has been selected.

- A two (2) foot thick foundation layer consisting of existing interim cover soils and soils derived from the on-site borrow source compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557.



- A 60-mil thick Super Gripnet linear low-density polyethylene (LLDPE) geomembrane liner overlying the foundation layer and serving as the low-permeability barrier layer for the final cover system.
- A 12-ounce per square yard non-woven geotextile placed as a separator between the geomembrane and overlying cover soils.
- A two (2) foot thick protective soil cover layer placed on deck and slope areas. The protective soil cover will be composed of select materials derived from the on-site borrow source.

All materials used to construct the final cover system must meet or exceed the criteria established for each particular component of the system as indicated on the Project Plans and Specifications. Any deviation from the Specifications must be pre-approved by the Engineer under procedures set forth in the changes clause of the General Conditions.

## **2.0 RESPONSIBLE PARTIES AND DEFINITIONS**

### **2.1 RESPONSIBLE PARTIES**

The responsible parties for all South Coast Landfill final cover construction activities, as set forth herein, are as follows:

Landfill Owner/Operator:

County of Mendocino  
Department of Transportation Solid Waste Division  
340 Lake Mendocino Drive  
Ukiah, California 95482  
Phone: (707) 463-4363  
Contact: Mr. Paul Cayler, Director of Solid Waste

Landfill Engineer:

SWT Engineering  
800-C South Rochester Avenue  
Ontario, California 91761  
Phone: (909) 390-1328  
Contact: Mr. Michael Cullinane

Construction Quality Assurance (CQA) Consultant:

To be Determined

## 2.2 DEFINITIONS

"Construction Manager" - Person(s) or firm(s) authorized by the Owner/Operator to manage and oversee the administration of the Construction Contract.

"Contractor" - The firm responsible for closure construction and preparation of supporting surfaces. The Contractor is further responsible for his/her Subcontractors.

"County" - County of Mendocino, Department of Transportation Solid Waste Division.

"CQA Manager" - The individual or company responsible for construction quality assurance (CQA).

"CQA Monitors" - The individuals working under the direction of the CQA Manager. Such personnel include "Technicians", "Field Engineers" and "Field Geologists" representing the Landfill Engineer and CQA Consultant. CQA Monitors responsible for the earthwork, shall be experienced in landfill construction monitoring, geosynthetic material construction and testing, and compaction testing during grading operations.

"Construction Quality Assurance (CQA) Consultant" - Professional Engineer (P.E.) or Certified Engineering Geologist (C.E.G.) registered in the state of California and responsible for earthwork and geosynthetic Construction Quality Assurance observation, inspection and testing. The CQA Consultant shall be independent of the County, Landfill Engineer, Contractor and Material Suppliers.

"Geotextile" - Any permeable textile used with foundation, soil, rock, earth, or any other geotechnically related material as an integral part of a human-made project, structure, or system.

"Independent Testing Laboratory" - The firm responsible for conducting tests on geosynthetic samples, such as conformance and destructive seam testing. The laboratory shall be independent of the Owner, Manufacturer, Geosynthetics Subcontractor and any party involved with the manufacture and/or installation of any of the geosynthetics.

"Landfill Engineer" - The firm responsible for the design and preparation of the Project Drawings and Specifications. All completed work or modification to said work are subject to approval by the Landfill Engineer.

"Minimum Average Roll Value (MARV)" - The minimum average value of a particular physical property of a material, for 95 percent of all the material in the lot.

"Overlap" - Where two adjacent geosynthetic material panels contact, the distance measured perpendicular from the overlying edge of one panel to the underlying edge of the other.

"Owner" - The owner of the landfill, in this case, the Mendocino County, Department of Transportation Solid Waste Division.

"Project Documents" - All Contractor submittals, Contract Drawings, Record Drawings, Contract Specifications and duly issued addenda, CQA Plan, Health and Safety Plan and Project Schedule.

"Project Manager" - The County's designated representative responsible for the project.

"Project Drawings and Specifications" - All project related Drawings and Specifications including design modifications and Record Drawings.

"Work" - All tools, equipment, supervision, labor, and materials or supplies necessary to complete the project as specified herein and the Contract Documents.

### **3.0 CQA ORGANIZATION**

The CQA Team will consist of design and field personnel with specific experience in the inspection and CQA monitoring of earthwork and geosynthetic material installation related to landfill final cover construction. The CQA Consultant will also be independent of the County, Landfill Engineer, and Contractor. The principal functions of the CQA Team are presented below:

#### **3.1 CQA MANAGER/OFFICER**

The CQA Manager/Officer shall have overall authority and supervision for all CQA activities. The CQA Manager/Officer shall be a registered civil engineer or a Certified Engineering Geologist.

#### **3.2 CONSTRUCTION MANAGER**

The Construction Manager will serve as the Owner/Operator's on-site representative. All CQA functions will be under his direct authority. All coordination, reporting and issues related to non-compliance will be directed through the Construction Manager. In addition, he will participate with the Landfill Engineer and CQA Consultant in all decisions related to design issues which arise during the course of construction.

#### **3.3 LANDFILL DESIGN ENGINEER**

The Landfill Design Engineer will be responsible for reviewing all design issues which may arise during construction. The approval of the Landfill Design Engineer will be required prior to any design changes.

### **3.4 CQA CONSULTANT**

The CQA Consultant will be responsible for reviewing all earth material or geosynthetic issues which may arise during construction. CQA Consultant approval will be required for any earth or geosynthetic material modifications or for any design modifications which may impact the performance of the earth or geosynthetic materials.

### **3.5 CQA MANAGER**

The CQA Manager will be a representative of the CQA Consultant and shall be responsible for overall review of observation, sampling and testing activities for construction. Specific duties of the CQA Manager include:

- Review of all designs, Project Drawings and Specifications;
- Implementation of the CQA Plan including: assignment and management of all CQA personnel; review of all field reports; and engineering review of all CQA related issues;
- Review of all design changes;
- Familiarization of all CQA Monitors with the site and the CQA requirements;
- Attendance at all CQA related meetings, (i.e. preconstruction, progress and special meetings as required);
- Participation in the preparation of the Record Drawings;
- Coordination of all field testing, sampling and laboratory testing;
- Review all field and laboratory test results and provision of recommendations for appropriate responses;
- Review all CQA Monitor's daily reports and logs;
- Notation of any on-site activities or conditions that could jeopardize the quality or function of the final cover system and reporting of these to the Construction Manager;
- Preparation of a monthly summary of CQA activities;
- Designation of a Senior CQA Monitor to act on his behalf at the site while operations are ongoing;

- Reporting of any unresolved deviations from the CQA Plan to the Construction Manager;
- Preparation of the final "As-Built" report for all completed earthwork and geosynthetic material construction activities, including final CQA Report.

### **3.6 CQA MONITORS**

#### **3.6.1 FIELD ENGINEER/FIELD GEOLOGIST**

The Field Engineer/Field Geologist will be a representative of the CQA Consultant and will be responsible for evaluation of whether all earth materials conform to the requirements of the Project Drawings and Specifications. Duties of the Field Engineer/Field Geologist will include the following:

- Subgrade inspection;
- Review of the adequacy of all clearing, grubbing, stripping and preparation of areas to receive fill;
- Monitoring and evaluation of all soil mixing, processing and compaction operations;
- Evaluation of the engineering characteristics of the processed and constructed earth materials;
- Observation and evaluation of all cuts which may be impacted by geologic conditions.

#### **3.6.2 CQA TECHNICIANS**

CQA Technicians will be representatives of the CQA Consultant and will continuously observe all grading operations and geosynthetic installation to provide a basis for concluding that construction is carried out in conformance with the Project Drawings and Specifications. Duties will include:

- Observation of the preparation of subgrade surface;
- Verification that cover soils are derived from appropriate sources;
- Visual evaluation of the physical soil properties for consistency with the Project Drawings and Specifications;
- Verification that the geosynthetic materials are delivered and stored in conformance with the project specifications;
- Evaluation of all soil mixing and blending operations;

- Monitoring of soil mixing and blending operations for uniformity of the finished product;
- Evaluation of all moisture conditioning and processing operations to evaluate uniformity of material and moisture content;
- Evaluation of the constructed flexible membrane liner material for conformance with the Project Drawings and Specifications;
- Identification of deleterious materials or other deficiencies in soil quality to minimize the possibility that these materials are incorporated into the final cover system;
- Monitoring of activities for the removal and/or disaggregation of all oversize material;
- Observation of uniformity of coverage of compaction equipment, especially at fill edges, turnaround areas and on slope faces;
- Monitoring of lift thickness;
- Observation of the active fill pad at the beginning of each grading day and establishment of requirements for wetting/drying and/or processing of exposed surfaces prior to placement of additional fill;
- Undertaking field tests including but not limited to field density/moisture content at the minimum frequencies noted herein or at any time that a deficiency is suspected;
- Recovery of samples for laboratory testing;
- Laboratory testing of in-place moisture content and density of soil materials in accordance with the requirements of the Specifications (including retests if necessary);
- Confirmation that the test results are in accordance with the Project Specifications (including retests of any previously failed areas).

In addition, the duties of the CQA Monitors include monitoring, logging and documenting all geosynthetic installation operations.

The operations to be monitored for all geosynthetics include:

- Material delivery, unloading, and on-site storage and handling;
- Placement, joining and seaming operations;
- Repair operations.

Specifically, the seaming operations to be monitored include:

- Seam overlap and positioning;
- Evaluate panel adjustment to minimize wrinkles, creases or “fish mouths”;
- Verify panel/seam “shingling” on slope areas.

In addition to these specific duties, the CQA Monitors shall be responsible for:

- Observing the condition of panels as placed;
- Selecting samples for conformance testing by the Independent Testing Laboratory ;
- Marking samples for conformance testing;
- Notation of any on-site activities that could result in damage to the geomembrane.

All observations shall be reported as soon as possible to the Construction Manager.

### **3.7 INDEPENDENT TESTING LABORATORY**

The Independent Testing Laboratory shall perform all conformance testing of geosynthetics.

## **4.0 MEETINGS**

In order to facilitate construction of the final cover system, close coordination between the Project Director, Construction Manager, Landfill Engineer, CQA Consultant, Contractor (including appropriate Sub-contractors) and CQA personnel is essential. To this end, the following meetings may be scheduled:

### **4.1 PRE-CONSTRUCTION MEETING**

A Pre-construction Meeting will be held prior to initiation of construction activities. At a minimum, the meeting shall be attended by the Mendocino County Department of Transportation Solid Waste Division (or designated representative), the Construction Manager, the Landfill Engineer, The CQA Consultant , the Contractor and appropriate CQA staff.

Specific items to be considered at this meeting will include:

- Any appropriate modifications to the CQA requirements;
- Development of a format for site specific addenda;
- Review of the responsibilities of each party;
- Review of the lines of authority and communication;

- Review of work area security and safety protocol;
- Review of the procedures for project documentation and reporting, and distribution of documents and reports;
- Review of procedures for submittals, change orders and extra work efforts;
- Review of the Contractor's proposed methods of shipping and storing the geomembrane;
- Review of the Contractor's proposed methods of construction, (including equipment), with specific emphasis on methods of select grading, soil mixing, stockpiling, processing, moisture conditioning and compaction;
- Review of the procedures for field and laboratory Geotechnical CQA testing;
- Establishment of procedures for correcting and documenting construction deficiencies;
- Conducting a site inspection to discuss work areas, stockpile areas, mixing tables, laydown areas, access roads, haul roads, and related items;
- Review of the project schedule.

The meeting shall be documented by the Construction Manager and minutes shall be distributed to all parties.

## **4.2 WEEKLY PROGRESS MEETINGS**

Progress Meetings shall be held weekly. At a minimum, these meetings shall be attended by the County (or designated representative), the Construction Manager, the CQA Manager and/or the CQA Monitors, and the Contractor. The purpose of these meetings is to:

- Discuss any health and safety related issues;
- Review scheduled work activities;
- Discuss project related problems;
- Review laboratory and field test data;
- Discuss the Contractor's personnel and equipment assignments;
- Review the previous week's activities and accomplishments;



- Weekly progress meetings shall be documented by the Construction Manager or his representative and minutes shall be distributed to all parties.

#### **4.3 SPECIAL MEETINGS**

Special meetings will be conducted as required to discuss problems or deficiencies. At a minimum, these meetings will be attended by the Construction Manager, the CQA staff and the Contractor. If correction of a problem requires a design modification, the Landfill Engineer will also be present. The purpose of these meetings is to:

- Define and discuss any problems or deficiencies in the project;
- Review possible corrective actions or solutions;
- Implement an action plan to resolve the problems or deficiencies.

Special meetings shall be documented by the Construction Manager or his representative and minutes shall be distributed to all parties.

### **5.0 EARTHWORK REQUIREMENTS**

The following earthwork specifications present the generally accepted standards and minimum requirements for earthwork grading operations to be used in development of the project. These specifications shall be the project requirements for earthwork except where specifically superseded by prevailing guidance documents of the controlling agency.

#### **5.1 GENERAL**

- A. The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with this document and the Project Drawings and Specifications.
- B. Equipment used in the excavation, stockpiling, processing, installation and compaction of all soil materials used in construction of the final cover shall be standard of practice grading machinery, of known specifications, capable of performing the required work in a timely and efficient manner.
- C. All clearing, grubbing, stripping and site preparation for the project shall be accomplished by the Contractor to the satisfaction of the Construction Manager. The ground surface to receive any fills shall be prepared to the satisfaction of the Construction Manager. The fill shall be placed, spread, mixed, watered and compacted in accordance with the Project Specifications and as recommended by the CQA Manager.
- D. The ground surface prepared to receive the initial foundation layer fill shall be scarified, disced or bladed to a depth of six (6) inches until it is uniform and free from

uneven features which may prevent uniform compaction. The scarified ground surface shall then be brought to approximately optimum moisture content, mixed as required, and compacted as specified in the contract documents. If the scarified zone is greater than 12 inches in depth, the excess material shall be removed and placed in lifts of 6-to 8-inches in thickness. Prior to placing fill, the ground surface to receive fill shall be inspected and approved by the CQA Manager.

- E. Prior to construction in any given zone, the Contractor shall (if necessary) selectively excavate on-site native and/or stockpiled soils identified by the Construction Manager or CQA Manager (or his representative) and transport these soils to a separate processing and/or stockpile area approved by the Construction Manager.
- F. In the designated processing area, select soils shall be screened and dried and/or moisture conditioned (if necessary) to facilitate fill placement operations.
- G. All material considered by the Construction Manager or CQA Manager to be unsuitable for use in the construction of the cover shall be removed. All materials incorporated as part of the compacted fill must be inspected and tested and placement must be observed by the CQA Consultant (or his representative).
- H. Suitable and sufficient processing and compaction equipment shall be on the job site to handle the amount of fill being stockpiled, processed, mixed and/or placed. If necessary, excavation, import, or compaction equipment will be shut down temporarily in order to allow time for proper preparation and/or compaction of fills. Sufficient watering apparatus will be provided with due consideration given to the type of fill material, curing characteristics, rate of placement, and time of year.
- I. Material deemed unlikely to meet the performance specifications and not disposed of during clearing and grubbing or demolition shall be removed from the work area and/or fill as directed by the CQA Manager and/or the Construction Manager.
- J. Irreducible rock or rock fragments in excess of one (1) inch in maximum dimension shall not be utilized in the foundation layer or the protective soil cover layer within 6-inches of the geosynthetics. With the exception of the protective soil cover, fill material shall be placed in thin lifts with a maximum uncompacted thickness of 6 to 8 inches. Each layer shall be spread evenly and be thoroughly mixed to obtain a near uniform condition in each layer. In areas of excess lift thickness, regrading of the surface to the maximum lift thickness will be completed prior to construction of additional lifts. Protective soil cover layer materials and gravel materials shall be placed with Low Ground Pressure (LGP) equipment with a maximum ground pressure of 5.0 psi. The minimum lift thickness over the geomembrane liner for gravel or soil cover shall be one (1) foot.

- K. The minimum compaction for the foundation layer and engineered fill materials is specified as 90 percent of the maximum dry density as determined by ASTM D1557 and the specified moisture content is plus or minus 2 percent of optimum moisture content as determined by ASTM D1557. Given the yielding nature of the underlying refuse, a compaction of slightly less than 90 percent may be acceptable based on the field conditions encountered and the discretion of the CQA Manager. The minimum compaction criteria for the protective soil cover is 85 percent of the maximum dry density as determined by ASTM D1557.
- L. Where tests indicate the moisture content, or density of any layer of fill or portion thereof is below the project requirements, the particular layer or portion thereof shall be retested and if necessary reworked until the required moisture/density has been attained. No additional fill shall be placed over an area until the last fill has been tested horizontally and vertically and found to meet the requirements of this document and to the satisfaction of the CQA Manager.
- M. Where work is interrupted by rains, fill operations shall not be resumed until observations and field tests by the CQA Monitor indicate the moisture content and density of the in-place fills are within the limits previously specified.
- N. At the beginning of each grading day, the active fill pad will be inspected. Any previously placed soils which have a moisture content below the specified minimum shall be thoroughly watered and processed in preparation for receiving additional fill. Additional moisture shall be added until the moisture content is within the limits required so as to assure an adequate bonding and compaction of all fill materials. As stated above, in the event of rain, if the moisture content of previously placed fill material is above the maximum allowable moisture content as determined by ASTM D1557, the fill material shall be aerated by blading or other satisfactory methods until the moisture content is within the specified moisture content range. Any previously compacted materials which are disturbed (aerated, bladed etc.) to reduce or increase the moisture content must be recompacted to the project specifications and to the satisfaction of the CQA Monitor once specified moisture contents are attained.
- O. Drainage provisions shall be constructed in compliance with the recommendations of the Landfill Engineer and as shown on the project drawings.
- P. Fill over cut slopes shall be properly keyed through top soils, colluvium or creep material into rock or firm material as approved by the Landfill Engineer and/or CQA Manager. All transitions shall be stripped of all loose soils prior to placing fill.
- Q. If earth conditions of an adverse or potentially adverse nature are encountered during grading, the CQA Manager and Landfill Engineer shall investigate, analyze and make recommendations to mitigate these conditions.

- R. Unless otherwise specified by the CQA Manager and Landfill Engineer, no permanent cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agencies.
- S. All excavated surfaces and stockpile areas shall be graded to provide good drainage and prevent ponding of water. Surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site.

## **6.0 CQA MONITORING FOR EARTH MATERIALS**

### **6.1 GENERAL**

Construction of the final cover system shall be performed in accordance with the Project Drawings and Specifications and shall be continuously observed, and routinely sampled and tested by the CQA Monitors for the physical parameters described in this section.

The testing frequency presented herein is a minimum. Additional tests will be conducted by the CQA Monitor for retests and at any time that in the opinion of the CQA Monitor, additional testing is required and/or a deficiency is suspected. Retests of previously failed areas will be performed at the discretion of the CQA Monitor when, in his opinion, sufficient reworking of the area has been performed to warrant a retest.

Following a thorough reworking for a failed area, retesting will be performed by the CQA Monitor to evaluate whether the re-worked area meets the project requirements.

### **6.2 FOUNDATION LAYER BORROW MATERIAL EVALUATION**

Field and laboratory testing will be conducted during excavation and screening of borrow soils for construction of the foundation layer. Testing of borrow soils will be performed according to the following minimum schedule.

**Foundation Layer Borrow Material Evaluation**

<b>Test Description</b>	<b>Test Designation</b>	<b>Test Frequency</b>	<b>Criteria</b>
Moisture-Density Relationship	ASTM D1557	One per 5,000 cubic yards or change of material.	N/A
Grain Size Distribution	ASTM D422	One per 5,000 cubic yards or change of material.	Max 1-inch particle size
Soil Classification	ASTM D2487	One per 5,000 cubic yards or change of material.	Well graded, amendable to compaction.

### **6.3 FOUNDATION LAYER FILL PLACEMENT**

Field and laboratory testing will be conducted during construction of the Foundation layer for moisture content and in-place dry density. This testing will be completed according to the following minimum schedule.

### **Foundation Layer Compaction Testing Type and Frequency**

<b>Test Description</b>	<b>Test Designation</b>	<b>Minimum Test Frequency</b>	<b>Criteria</b>
Moisture-Density Relationship	ASTM D1557	One per 10,000 cubic yards or per change in material type.	N/A
In-Place Moisture-Density (Nuclear and/or Drive Ring)	ASTM D6938 ASTM D2922	One per 250 cubic yards placed.	90%
In-Place Density and Moisture Content (Sand-Cone)	ASTM D1556	Once per 5,000 cubic yards placed.	90%
Visual Inspection	ASTM D2488	One per 5,000 cubic yards	Well-graded max. particle size 1-inch.

## **6.4 ACCEPTANCE CRITERIA**

### **6.4.1 GENERAL**

Where test results indicate that the lift thickness, maximum particle size, or homogeneity of material, moisture content or density, of any portion of the liner is below the project requirements, that particular portion shall be retested and/or re-worked or replaced until the required condition has been attained and the resulting product meets or exceeds the Project Specifications. No additional fill shall be placed over an area until the existing fill has been tested horizontally and vertically and determined by the CQA Monitor to meet the Earthwork Requirements (Section 5.0) of this document. The area to be reworked will be verified by survey if in the opinion of the CQA Monitor conditions warrant.

### **6.4.2 MOISTURE CONTENT AND DENSITY**

If in the opinion of the CQA Manager, fill materials which have been placed and/or are ready to be placed, do not visually have a uniform and homogeneous moisture content throughout the material in question, these materials will be removed, without testing, and will be reprocessed and/or reworked until, in the opinion of the CQA Manager or his designated representative, they meet the Project Specifications.

Unless otherwise specified, if test results indicate a relative dry density of less than that specified for the materials placed or a moisture content outside the limits specified, the area will be considered inadequate and will be reworked. Any reworked areas will be retested by the CQA Monitor to assure the reworked area meets the density and moisture content requirements.

### **6.4.3 LIFT THICKNESS AND PROCESSING**

With the exception of the protective soil cover layer, if at any time the CQA Monitor observes an uncompacted lift thickness in excess of six-to eight-inches or observes material being placed without meeting the required processing, moisture content and/or particle size criteria, the Contractor shall immediately discontinue placing additional fills

in that area. For an over thick lift, the Contractor shall immediately blade the surface to reduce the lift thickness to the project specifications. If inadequately mixed materials are placed, the Contractor shall immediately remove these materials and return them to the stockpile area where they will be reprocessed.

#### **6.4.4 FOUNDATION LAYER THICKNESS**

Following placement and compaction of the foundation layer, the thickness of the foundation layer will be verified to be a minimum of 2-feet. Thickness verification will be based on contractors survey data (50-foot centers), and direct measurement of potholes excavated in the completed foundation layer.

### **7.0 CQA MONITORING FOR GEOSYNTHETICS**

#### **7.1 GEOMEMBRANE**

Delivery of geomembrane to the site will not be allowed until all required documentation and/or certifications are approved by the Construction Manager and CQA Manager. It is the responsibility of the Contractor/Subcontractor to ensure that all required documentation and/or certifications are approved prior to shipment. Pursuant to Section 2E of the Project Specifications, the geomembrane supplier is required to submit for approval an executed copy of Attachment E-1 (Geomembrane Manufacturer Certification).

##### **7.1.1 GEOMEMBRANE MANUFACTURING**

During manufacture, the geomembrane supplier will perform Quality Control testing for the properties shown in Section 2E-2.2.2 of the Project Specifications at a minimum frequency of every 50,000 square feet.

Prior to the delivery of any geosynthetic material, the Liner Manufacturer shall provide the Construction Manager with the following:

- A properties sheet for the rolls to be delivered including all specified properties measured using test methods indicated in the specifications.
- The sampling procedure and results of testing.
- A certification for each roll stating that property values given in the properties sheet are guaranteed by the Liner Manufacturer.

The CQA Manager shall verify that:

- The property values certified by the Liner Manufacturer meet the project specifications.

- The measurements of properties by the Liner Manufacturer are properly documented and that the test methods used are acceptable.

Prior to shipment, the Liner Manufacturer shall provide the Construction Manager with a quality control certificate for each roll of geomembrane. The quality control certificate(s) shall be signed by a responsible person employed by the Liner Manufacturer and shall include:

- Lot and roll numbers and identification.
- Sampling procedures and results of quality control tests. At a minimum, results shall be given for those properties identified in the Project Specifications.

The CQA Manager shall:

- Verify that the quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it.
- Review the quality control certificates and verify that the certified roll properties meet the specifications.

#### **7.1.2 GEOMEMBRANE DELIVERY**

Prior to delivery, all individual roll manufacturer certifications required by this document and/or the Project Specifications must be received and approved by the Construction Manager and/or CQA Manager. Delivery of any unapproved roll will not be allowed and unapproved rolls will be transported off-site at the Contractors expense.

##### **7.1.2.1 Transportation and Handling**

All transportation and on-site handling of the geomembrane is the responsibility of the Contractor and Liner Subcontractor.

The CQA Manager shall observe the handling equipment used on the site and provide comment on whether it poses any risk of damage to the geomembrane. The CQA Manager will also observe the Contractor and Liner Subcontractor personnel's handling of the geomembrane and provide comment on whether appropriate care is being taken. Finally, the CQA CQA Monitor shall verify that all documentation required upon delivery has been received.

Upon delivery at the site, the Contractor, Liner Subcontractor and the CQA Monitor shall complete a surface observation of all rolls for defects and damage. This inspection shall be conducted without unrolling rolls unless defects or damage are found or suspected. The CQA Manager shall report the following to the Construction Manager:

- Rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws. All damaged rolls will be documented and logged by the CQA Monitor.
- Rolls which visually include minor repairable flaws.

Any damaged rolls shall be rejected and removed from the site or be stored at a location separate from accepted rolls as designated by the Construction Manager. All rolls which do not have proper Liner Manufacturer's documentation shall be removed from the site at the Contractors expense until all required documentation has been received and approved.

A log of all geomembrane received shall be maintained by the CQA Monitors.

### 7.1.2.2 Geomembrane Storage

The Contractor and Liner Subcontractor shall be responsible for storage of the geomembrane on-site and shall ensure the storage is consistent with the Manufacturer's recommendations. The Contractor shall coordinate with the County to ensure that storage space is provided in a location (or several locations) such that on-site transportation and handling are minimized. Storage space shall be protected by the Contractor and Liner Subcontractor from theft, vandalism, and damage from actions of man, weather, animals and other sources. The CQA Monitor shall observe that the materials are not stored directly on the ground and storage of the geomembrane is completed in a fashion that protects against damage.

### 7.1.3 GEOMEMBRANE CONFORMANCE TESTING

#### 7.1.3.1 Tests

Upon delivery of the geomembrane, the Contractor or Liner Subcontractor shall ensure that conformance samples are obtained and forwarded to the Independent Testing Laboratory at the frequency required for testing to ensure conformance with the Project Specifications. All conformance samples will be obtained in the presence of the CQA Monitor or his/her designated representative.

Conformance tests will include the tests specified in Section E- 3.6.1 of the Project Specifications and will include the following type and frequency of tests:

**Geomembrane Conformance Tests**

Test Method	Frequency	Criteria
Density (ASTM D1505/D792).	50,000 ft <sup>2</sup> /1 per lot	0.939 g/cc
Thickness (ASTM D5994).	Each Roll	60-mils ± 10%
Tear Resistance (ASTM D1004).	50,000 ft <sup>2</sup> /1 per lot	≥ 40 lbs.
Carbon Black Content (ASTM D1603).	50,000 ft <sup>2</sup> /1 per lot	2 – 3 %
Carbon Black Dispersion (ASTM D5596).	50,000 ft <sup>2</sup> /1 per lot	9 of 10 in category 1 or 2
Tensile strength at break (ASTM D6693).	50,000 ft <sup>2</sup> /1 per lot	126 ppi
Puncture resistance (ASTM D4833).	50,000 ft <sup>2</sup> /1 per lot	≥ 70
Asperity (Spike) Height	Every Second Roll	175



Where optional procedures are noted in the test method, the requirements of the Project Specifications shall prevail.

#### **7.1.3.2 Sampling and Testing Frequency**

Unless otherwise specified, conformance samples shall be taken and tested at a rate of one per lot or one per 50,000 square feet, whichever results in the greater number of tests.

#### **7.1.3.3 Sampling Procedures**

Samples shall be taken across the entire width of the roll and shall not include the first three feet. Unless otherwise specified, samples shall be 3 ft. long by the roll width. The CQA Monitor shall mark the machine direction on the samples with an arrow, and the Liner Manufacturer's roll identification number.

#### **7.1.3.4 Test Results**

The Geotechnical CQA Manager shall examine all conformance testing results and shall report any non-conformance to the Construction Manager, the Contractor and the Lining Subcontractor.

The CQA Manager shall examine all results from the laboratory conformance testing. All specimens tested shall pass. If any specimen fails, the entire sample shall be considered as a failure and rejected. In this event, the material represented by the sample shall be considered nonconformant with the Specifications, and corrective measures shall be implemented. Corrective measures shall include a rerun of the conformance testing using a portion of the same sample. If the second test passes, the CQA Manager may assume an error was made in the first test and the geomembrane material can be accepted. If the second test fails, the Liner Subcontractor shall remove all material represented by the sample from the work area.

All conformance test results must be approved by the Construction Manager prior to the geomembrane represented by the test being approved for deployment/installation. The decision of the Construction Manager shall be final.

### **7.1.4 GEOMEMBRANE INSTALLATION**

#### **7.1.4.1 Earthwork**

##### **Surface Preparation**

The Contractor shall be responsible for preparing the supporting soil according to the Project Specifications.

Prior to liner installation, the Contractor and Liner Subcontractor shall verify and the Construction Manager and CQA Monitor shall observe that:

- All lines and grades have been checked by survey and approved by the Construction Manager.
- The subgrade has been prepared in accordance with the Project Specifications.
- The surface has been rolled and compacted to be free of surface irregularities, loose soil, and protrusions.
- The supporting soil surfaces do not contain stones or other sharp protrusions which could damage the geomembrane.
- There are no excessively soft areas which could result in geomembrane damage.
- All construction stakes, hubs or other items used for grade control and/or verification have been removed.
- The Liner Subcontractor has certified in writing that the surface on which the geomembrane will be installed is acceptable.

The certificate of acceptance shall be given by the Liner Subcontractor to the Contractor and the Construction Manager prior to commencement of geomembrane installation in the area under consideration. The CQA Monitor shall have a copy of this certificate before installation of geomembrane commences in any given area.

After the supporting surface has been accepted by the Contractor and Liner Subcontractor, it shall be the Contractor and Liner Subcontractor's responsibility to indicate to the Construction Manager any change in the supporting soil condition that may require repair work. If the Construction Manager concurs with the Contractor and Liner Subcontractor, then the Construction Manager shall coordinate the repair of the supporting surface. The subject area will also be observed by the CQA Monitors who shall have the authority to reject an area even after it has been accepted by the Contractor and Liner Subcontractor.

#### Anchor Trench

Anchor trenches shall be excavated to the lines and widths shown on the Project Drawings, prior to geomembrane placement. The CQA Monitors shall observe that the anchor trenches have been constructed according to the project documents.

Slightly rounded corners shall be provided where the geomembrane adjoins the trench so as to avoid sharp bends in the geomembrane. No loose soil shall be allowed to underlie the geomembrane in the anchor trench.

Anchor trench backfill shall be compacted to at least 90 percent relative compaction (ASTM D1557) as outlined in the Specifications.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics. The CQA Monitors shall observe the backfilling operation and advise the Construction Manager of any problems.

#### **7.1.4.2 Geomembrane Placement**

##### Field Panel Identification

A field panel (sheet) is a discrete and integral area of geomembrane which is to be seamed in the field along the edges to other field panels (i.e., a field panel is a roll or a single portion of a single roll). The Contractor or Liner Subcontractor shall assign each panel over 25 sq. feet an identification code which shall be agreed to and used by the CQA Monitors, Construction Manager, Contractor and the Liner Subcontractor. The Contractor or Liner Subcontractor shall locate the code with identifying roll number near the middle of panels less than 50 feet in length and at both ends of any panel over 50 feet in length. The CQA Monitors shall establish a chart showing correspondence between roll numbers, certification reports, and the panel identification code. The field panel identification code shall be used for all CQA records. A geomembrane panel placement log will be maintained by the CQA Monitors.

##### Field Panel Placement

The CQA Monitors shall record the identification code, location and date of installation of each field panel.

During panel placement, the CQA Monitors shall:

- Verify that field panels are installed in general accordance with the panel layout plan, as approved or modified by the Construction Manager/Landfill Engineer.
- Observe the panel surface as it is deployed and record all panel defects and disposition of the defects. All repairs are to be made in accordance with the Specifications.
- Observe that the equipment used does not damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Observe that the surface beneath the geomembrane has not deteriorated since previous acceptance.

- Observe that there are no stones, construction debris, or other items beneath the geomembrane which could cause damage.
- Observe that the geomembrane is not dragged across an unprepared surface. If the geomembrane is dragged across an unprepared surface, it shall be inspected for scratches and repaired or rejected, if necessary.
- Observe that the method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil surface.
- Record weather conditions including temperature, wind, and humidity. The geomembrane shall not be deployed in the presence of excess moisture (fog, dew, mist, etc.), high winds and extreme temperatures as determined by the CQA Manager.
- Observe that people working during the installation of geomembrane do not smoke, wear shoes which could damage the geomembrane, or engage in activities which could damage the geomembrane.
- Observe that the method used to deploy the panel minimizes wrinkles and that the panels are anchored to prevent movement by the wind.
- Observe that direct contact with the geomembrane is minimized; (i.e., the geomembrane is protected by geotextiles, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected).

The CQA Monitors shall inform the Contractor, the Liner Subcontractor and the Construction Manager if the above conditions are not met.

After placement and prior to seaming, the CQA Monitors shall inspect each panel for damage. The CQA Monitors shall advise the Construction Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Monitors.

#### **7.1.4.3 Field Seaming**

The Contractor shall provide the Construction Manager and CQA Manager with a seam and panel layout plan and shall update this plan daily as the job proceeds. No panels shall be seamed until the panel layout plan has been approved by the Construction Manager. A seam numbering system shall be agreed to by the CQA Monitors, Construction Manager, Contractor and Liner Subcontractor prior to the start of seaming operations.

Prior to seaming, each seaming apparatus (welder) shall be tested in accordance with the Specifications to determine if the equipment is functioning properly. The CQA Monitors shall observe all trial weld operations and record the results. It is important that the trial

welds be completed under conditions similar to those under which the panels will be seamed. If at any time the CQA Monitor believes that an operator or seaming apparatus is not functioning properly, a test shall be performed on a trial weld. If there are large changes in temperature, humidity, or wind speed, the trial weld test shall be repeated. Laboratory tests may be carried out at the discretion of the CQA Monitors to verify field test results.

During seaming operations the CQA Monitors shall observe that:

- The Liner Subcontractor has the number of welders and spare parts agreed to in the pre-construction meeting.
- Equipment used for seaming will not damage the geomembrane.
- The extruder is purged prior to beginning a seam until all the heat-degraded extrudate is removed (extrusion welding only).
- Seam grinding has been completed less than 1 hour before seam welding (extrusion welding only).
- The ambient temperature measured 6 inches above the geomembrane surface is between 40 and 105 degrees Fahrenheit and relative humidity is less than 80 percent.
- The end of welds more than 5 minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The weld is free of dust and other debris.
- For cross seams, the seam is ground to a smooth incline prior to welding.
- The seams are overlapped in a downgradient direction with a minimum overlap of 4 inches.
- No solvents or adhesives are present in the seam area.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being seamed in accordance with the Project Plans and Specifications using approved equipment with gauges giving applicable temperatures.
- There is no free moisture in the weld area.
- The electric generator is placed on a smooth base such that no damage occurs to the geomembrane.

- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after use.
- The geomembrane is protected from damage in heavily trafficked areas.

The CQA Monitors shall log all appropriate temperatures and conditions, and shall log and report to the CQA Manager any non-compliance.

### Trial Seams

Trial seam samples are not removed from installed seams, but are made along side the seaming work area by the Liner Subcontractor using a fragment of the same geomembrane sheet and the same installation procedures as for the geomembrane installation itself. As such, they are considered nondestructive samples. Such trial seams shall be made at the beginning of each seaming period (start of day, mid-day, and anytime the equipment is shut down or the seaming operation is suspended for more than 1/2 hour) for each piece of seaming equipment used that day. In addition, each welder shall make at least one trial seam each day. Trial seams shall be made under the same conditions as those anticipated for actual seams.

The trial seam sample shall be at least 3 ft. long by 1 ft. plus the seam width wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as per the Specifications.

Two opposite specimens, each 1 inch wide, shall be cut from the trial seam sample by the Contractor and/or Liner Subcontractor. Under the observation of a CQA Monitor, the specimens shall be tested by the Liner Subcontractor in shear and peel using a field tensiometer to verify that seams satisfy peel and tensile strength requirements. If a specimen fails, the seaming equipment and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful full trial welds are achieved. After completing a successful trial/nondestructive sample, the Contractor and/or Liner Subcontractor shall cut a 2' x 2' remnant from the sample and mark the welder number, date, time, ambient temperature, welder temperature, and speed and submit it to the CQA Monitor who will assign an identification number and enter the information on the non-destructive sample form.

The results of field tests carried out on trial seams shall be documented by the CQA Monitors.

### General Seaming Procedure

Unless otherwise specified, the general seaming procedure to be used by the Contractor and/or Liner Subcontractor shall be as follows:

- All geomembrane seams shall be overlapped a minimum of four (4) inches.
- "Fishmouths" or wrinkles at the seam overlaps shall be cut 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 6 inches beyond the cut in all directions. All corners of the patch shall be rounded with a 1-inch minimum radius.
- Adjacent to anchor trenches, seaming shall extend up the panels a minimum of 12 inches past the crest of the anchor trench.
- All cross seams shall be offset at least two feet from the cross seam of the adjacent panel and be extrusion or wedge welded where they intersect.

The CQA Monitors shall observe that the above seaming procedures are followed, and shall inform the Construction Manager if they are not.

#### 7.1.5 CONSTRUCTION TESTING

##### **7.1.5.1 Nondestructive Seam Testing**

The Contractor and/or Liner Subcontractor shall non-destructively test all field seams over their full length using a vacuum test unit, spark detector, or an air pressure test (for double wedge fusion seams only), as described below. The purpose of nondestructive tests is to check the continuity of seams. It does not provide any information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of field seaming.

##### Visual Inspection

All seams shall be visually evaluated by the Contractor and/or Liner Subcontractor as the installation progresses and again at completion of the installation. Defective and questionable sections shall be clearly marked and repaired as necessary.

##### Vacuum Box Testing

If the fillet weld, extrusion lap weld or single hot-wedge fusion lap weld technique is used to weld seams, the Contractor and/or Liner Subcontractor shall further test all seams and repairs in the geomembrane by vacuum box. The vacuum box shall be an American Vacuum Seam Tester, Series A100 as manufactured by American Parts and Service Company, Alhambra, California, or an approved equal. All vacuum box testing shall be done in the presence of the Geotechnical CQA Monitor. The area to be tested shall be cleaned of all dust, debris, dirt and other foreign matter. A soap solution shall be applied to the test area with a brush, paint roller or spray bottle and a minimum vacuum of 10

inches of mercury (Hg) (5 psi) shall be induced and held as long as necessary to visually inspect and mark for repair any suspicious areas as evidenced by bubbles in the soap solution.

### Spark Testing

If the fillet weld is used to weld seams, the Contractor and/or Liner Subcontractor may, in lieu of vacuum box testing, test all seams and repairs in the geomembrane liner by using a high voltage spark detector, similar to Tinker and Rasor Holiday Detector (Model AP-W). The setting of the detector shall be 20,000 volts. In order to conduct this test, all seams to be tested shall be provided with 24-30 gauge copper wires properly embedded in the seams and grounded. All spark testing shall be done in the presence of the Geotechnical CQA Monitor. All defective areas shall be marked for repair.

### Air Pressure Test

If the double hot-wedge welding technique is used, the Contractor and/or Liner Subcontractor shall further test all seams in the geomembrane lining by using the air pressure test which consists of inserting a needle with gauge in the air space between welds. Air shall be pumped to 40 psi within the weld void and held for at least 5 minutes. If the pressure loss exceeds 2 psi within the weld void during air pressure testing, the outside weld edge (not free edge) shall be sprayed with a soap solution and visually examined for bubbles. If no bubbles appear, the problem is with the inside weld and the seam is acceptable. If any bubbles appear, the defect shall be repaired by extrusion welding and tested by vacuum box and spark detector.

If pressure loss is not more than 2 psi, the opposite end of the seam will be punctured to release the air. If a blockage is present, it will be located and tests on both sides of the blockage will be completed. All penetration holes created during testing shall be sealed by patching and extrusion welding.

### Responsibilities of the CQA Monitors

The CQA Monitor/Manager shall:

- Observe and record the continuity of all testing.
- Record the location seam/panel number, date, time, equipment number, CQA Monitor name, test number, welding technician's name, weld, sheet and ambient temperatures and results of all testing.
- Mark the failed areas with a waterproof marker compatible with the lining material and inform the Contractor and/or Liner Subcontractor and the Construction Manager of any required repairs.



- Observe that all testing is completed in accordance with the Project Specifications.
- Observe that all repairs are completed and tested in accordance with the Project Specifications.

#### **7.1.5.2 Destructive Seam Testing**

Destructive seam tests shall be performed at selected locations according to ASTM D6392. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

Destructive sampling involves samples which have been removed from the installed field seams by the Contractor/Liner Subcontractor. Test locations shall be determined at the discretion of the CQA Monitors and the Contractor/Liner Subcontractor shall not be informed in advance of the locations where the seam samples will be made or will be removed.

Destructive samples shall be delivered to the CQA Manager/Monitor by the Contractor/Liner Subcontractor and shipped to the Independent Testing Laboratory. All costs associated with the collection, repair, shipping and testing of destructive samples will be borne by the Contractor/Liner Subcontractor.

A minimum of one destructive sample per 500 feet of field seam shall be obtained. This average frequency will be used for the entire installation with the actual frequency of samples based on performance as determined by the CQA Manager.

Additional samples may be removed if the Geotechnical CQA Monitor observes a suspect seam.

#### **7.1.5.3 Sampling Procedures**

Samples shall be made or removed by the Contractor/Liner Subcontractor at locations selected by the CQA Monitors as the seaming operation progresses. The CQA Monitor shall:

- Observe making and/or removal of samples.
- Mark each sample with an identifying number which contains the seam number. (For nondestructive samples the seam number welded just prior to making a sample will be marked on the sample).
- Record sample location on the panel layout drawing and enter the information on a Destructive Sample Log Form.

- Record the sample location, date and time taken, weather conditions, and reason the sample was made and/or taken (e.g., random sample, visual appearance, result of a previous failure, etc.).
- Mark sample identifying number on geomembrane adjacent to the location where the sample was taken.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described herein. The continuity of the new seams in the repaired area shall be tested according to procedures described herein.

#### **7.1.5.4 Size of Samples**

Two types of samples shall be made or removed at each location. First, two samples shall be removed for field testing. Each of these samples shall be 1 inch wide with a length of 12 inches plus the seam width. For destructive sampling, the sample shall be taken perpendicular to the seam and the distance between these two samples shall be 38 inches. Samples designated for laboratory testing shall be that portion of seam located between the two samples taken for field testing. The samples for laboratory testing shall be 36 inches long with a width of 12 inches plus the seam width. The seam shall be centered lengthwise. The samples for laboratory testing shall be cut into three equal parts and distributed as follows:

- One part for the Independent Testing Laboratory for testing.
- One part to the Contractor/Liner Subcontractor.
- One part to the Construction Manager for archive storage.

#### **7.1.5.5 Field Testing**

The two 1 inch wide samples shall be tested in the field for peel adhesion and bonded seam strength (shear) by the Contractor/Liner Subcontractor, and shall not fail in the seam, and shall meet the minimum requirements of the Specifications. If one or both of the samples fails in either peel or shear, the Contractor/Liner Subcontractor can, at his/her discretion, (1) reconstruct or cap strip the seam between passed test locations, or (2) take two additional test samples 10 feet on either side of the point of the failed test and repeat this procedure. If the second test passes, the Contractor/Liner Subcontractor shall reconstruct or cap strip the same between the two passed test locations. If subsequent tests fail, the procedure is repeated until the length of the poor quality seam is established. Repeated failures indicate that either the seaming equipment and/or operator is not performing properly, and appropriate action shall be taken.

### 7.1.5.6 Laboratory Testing

Once the field tests have passed, a sample shall be recovered from between passing field sample locations for testing by the Independent Testing Laboratory. Destructive test samples shall be packaged and shipped to the laboratory by the CQA Monitors and will be handled in a manner which will not damage the test sample. The Construction Manager will be responsible for storing the archive samples.

All specimens of a field weld sample tested by the Independent Testing Laboratory shall pass. If any specimen fails, the entire sample shall be considered as a failure, and the field weld shall be rejected. In this event, the field seam(s) shall be rejected as being nonconformant with the Specifications, and corrective measures shall be implemented.

For destructive samples which have failed, corrective measures shall include a rerun of the weld test using the same sample. If the second test passes, the CQA Monitor may assume an error was made in the first test and the field seam may be accepted. If the second test fails, the Contractor/Liner Subcontractor shall reconstruct or cap strip the field seam between any two previous passed seam locations which include the failed seam or shall go on both sides of the failed seam location (10-feet minimum), take another sample each side and test both in the independent laboratory.

If both samples pass, the Contractor/Liner Subcontractor shall reconstruct or cap strip the field seam between the two passing locations. If either fails, the Contractor/Liner Subcontractor shall repeat the process of taking samples for testing by the Independent Testing Laboratory. In all cases, acceptable field seams must be bounded by two passed test locations. In cases involving more than 50 feet of reconstructed or cap stripped seam, the reconstructed or cap stripped seam shall also be tested. The results of the Independent Testing Laboratory govern seam acceptance. In no case shall field testing of installed seams be used for final acceptance.

Testing shall include peel adhesion and bonded seam strength (shear; ASTM D6392). At least five specimens each shall be tested for peel and shear. Minimum test values are presented in the Specifications and the Table below.

<b>Test</b>	<b>Frequency</b>	<b>Criteria<sup>(1)</sup></b>
Fusion Shear Strength	1 per 500 lineal feet	90 ppi
Fusion Shear Elongation	1 per 500 lineal feet	50 %
Fusion Peel Strength	1 per 500 lineal feet	75 ppi
Fusion Peel Separation	1 per 500 lineal feet	25 %
Extrusion Shear Strength	N/A	90 ppi
Extrusion Shear Elongation	N/A	50 %
Extrusion Peel Strength	N/A	66 ppi
Extrusion Peel Separation	N/A	25 %

(1) Acceptance criteria for both fusion and extrusion welds.

The Independent Testing Laboratory shall provide test results within 24 hours after receipt of samples for testing. Certified test results shall be provided within 5 days. The CQA Monitor shall document all test results and shall immediately notify the CQA Manager, Construction Manager and/or Contractor/Liner Subcontractor in the event of a failed test.

The Contractor/Liner Subcontractor's laboratory test results shall be presented to the CQA Manager for comments.

## **7.1.6 DEFECTS AND REPAIRS**

### **7.1.6.1 Identification**

All seams and non-seam areas of the geomembrane shall be examined by the CQA Monitors for identification of 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 examination. The geomembrane surface shall be cleaned by the Contractor/Liner Subcontractor if the amount of dust or mud inhibits examination.

Each suspect location as identified by the CQA Monitors, both in seam and non-seam areas, shall be non-destructively tested using the methods described herein, as appropriate. Each location which fails the nondestructive testing shall be marked by the CQA Monitor and then repaired and re-tested by the Contractor/Liner Subcontractor. Work shall not proceed with any materials which will cover locations which have been repaired until laboratory test results with passing values have been obtained.

### **7.1.6.2 Repair Procedures**

Any portion of the geomembrane with a flaw or which fails a nondestructive or destructive test shall be repaired in accordance with the Specifications. The CQA Monitor shall locate and describe all repairs on the appropriate forms. Repair procedures include:

- Patching - used to repair large holes, tears, large panel defects, and destructive sample locations which are less than 25 sq. feet in total area.
- Extrusion - used to repair relatively small defects in panels and seams.
- Capping - used to repair failed welds or liner seams where welds cannot be non-destructively tested.

- Removal - used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles) from the installed geomembrane.

### **7.1.6.3 Seam Test Summary**

Documentation of all nondestructive and destructive seam testing results, including repairs, shall be summarized by the CQA Manager.

### **7.1.7 WRINKLES**

When placing soil or drain materials over the geomembrane, temperature changes or creep may cause wrinkles to develop in the geomembrane. Any wrinkles which can fold over shall be repaired either by cutting out excess material or, if possible, allowing the geomembrane to contract due to temperature reduction. In no case shall material be placed over the geomembrane which could result in the geomembrane folding. All folded geomembrane shall be removed. No material shall be placed in areas where liner is not in contact with the supporting subgrade.

### **7.1.8 ANCHOR TRENCH**

The anchor trench shall be adequately drained to prevent ponding or softening of the adjacent soils while the trench is open. The anchor trench shall be backfilled and compacted as outlined in the Specifications. Fill soils shall consist of on-site granular soil essentially free of organic and deleterious material and approved by the CQA Monitor and Construction Manager. The material shall have a maximum particle size of 1 inch.

Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics. The CQA Monitor shall observe the bottom of the trenches prior to fill placement to ensure they are free of loose and disturbed materials. The CQA Monitor shall also observe the backfilling and compaction operation, and shall notify the CQA Manager and the Construction Manager of work performed not in accordance with the Project Specifications.

### **7.1.9 GEOMEMBRANE ACCEPTANCE**

The Contractor/Liner Subcontractor shall retain all ownership and responsibility for the geomembrane until acceptance by the County. The geomembrane shall be accepted by the County when:

- The installation is finished and approved.
- All seams have been inspected and approved.

- All required laboratory tests have been completed and approved.
- All required Contractor/Liner Subcontractor supplied documentation has been received and approved.
- All record drawings have been completed and approved.

#### 7.1.10 LINER MATERIALS

The CQA procedures indicated in this section are intended to allow the installation of materials in contact with the geosynthetics without causing damage to the geomembrane.

Important points for Quality Assurance of materials in contact with geomembrane include:

- A geotextile or drainage medium approved by the Construction Manager shall be installed above the geomembrane.
- Equipment used for placing soil shall not be driven directly on the geomembrane.
- In heavily trafficked areas, such as access ramps, soil thickness should be at least two (2) feet over the geosynthetics.
- Placement of soils, gravels, sand or other types of earth materials on top of the geomembrane shall not be performed until all destructive and nondestructive testing has been performed and accepted.
- Placement of overlying earth materials shall be performed in a manner to minimize wrinkles. Equipment operators shall be briefed on methods of placement relative to thermal expansion and contraction of the geomembrane.
- Soil material(s) placed on top of the geomembrane shall be stockpiled and displaced off the stockpile to create a cascading effect of the material on top of the geomembrane.

The CQA Monitors shall inform the Construction Manager and CQA Manager if the above conditions are not fulfilled.

## 7.2 **GEOTEXTILE AND GEOCOMPOSITE**

Delivery of geotextile and geocomposite will not be allowed to the site until all required documentation and/or certifications are approved by the Construction Manager and CQA Manager. It is the responsibility of the Contractor/Subcontractor to ensure that all required documentation and/or certifications are approved prior to shipment. Pursuant to Sections 2D and 2F of the Project Specifications, the geosynthetic material supplier is

required to submit for approval an executed copy of Attachment D-1 (Manufacturers Certification for Drainage Geocomposite).

During manufacture, the geotextile and geocomposite supplier will perform Quality Control Testing of the geonet and geotextile properties shown in Section 2D and 2F of the Project Specifications at a minimum frequency of every 50,000 square feet.

Prior to delivery, the Contractor/Geosynthetic Manufacturer shall provide the Construction Manager with the following documentation:

- A properties sheet which includes all specified properties measured using test methods indicated in the specifications.
- A description of the sampling procedure and appropriate test results.
- A certification that values given in the properties sheet are guaranteed by the Geosynthetic Manufacturer.

The CQA Manager shall verify that:

- The property values certified by the Geosynthetic Manufacturer meet or exceed the project specifications.
- The measurement of properties by the Geosynthetic Manufacturer are properly documented and the test methods used are acceptable.

Prior to shipment, the Contractor/Geosynthetic Manufacturer shall provide the Construction Manager with a quality control certificate for each roll of geocomposite and geotextile. The quality control certificate shall be signed by a responsible person employed by the Geosynthetic Manufacturer, and shall include roll number and identification.

The CQA Manager shall:

- Verify that the quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls to be delivered.
- Review the quality control certificates and verify that the certified roll properties meet the project specifications.

#### 7.2.1 GEOTEXTILE/GEOCOMPOSITE DELIVERY

The Contractor/Geosynthetic Installation Subcontractor shall submit for approval by the Construction Manager, method(s) for handling and storage of geotextile/geocomposite material(s) prior to installation. The CQA Monitor shall observe that:

- Equipment used to unload the rolls will not damage the geotextile/geocomposite.
- Care is used to unload the rolls.
- All documentation required by the Project Specifications has been received.

Upon delivery at the site, the CQA Monitors shall conduct a surface inspection of all rolls for defects and damage. This inspection shall be conducted without unrolling rolls unless defects or damage are found or suspected. The CQA Monitors shall indicate to the CQA Manager any rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws.

Any damaged rolls shall be marked as rejected and removed from the site or stored at a location, designated by the Construction Manager separate from accepted rolls. All rolls which do not have proper documentation from the manufacturer shall also be stored at a separate location until all documentation has been received and approved. A log of the geotextile/geocomposite material(s) received shall be maintained by the CQA Monitors.

The Construction Manager shall designate storage space in a location (or several locations) on-site. Storage space shall be protected by the Contractor from theft, vandalism, damage from the actions of man, weather, animals and other sources. The CQA Monitors shall observe that the material is not stored directly on the ground and that storage of the geotextile/geocomposite provides protection against damage pursuant to ASTM D4873.

## **7.2.2 GEOTEXTILE/GEOCOMPOSITE INSTALLATION**

### **7.2.2.1 Surface Preparation**

Prior to installation, the Construction Manager and CQA Monitors shall observe that:

- All lines and grades have been verified.
- The subgrade has been prepared in accordance with the Project Specifications and the supporting surface does not contain rocks or irregular surfaces which could damage the geotextile/geocomposite.
- There are no excessively soft areas which could result in damage to the geotextile/geocomposite.
- All construction stakes and hubs have been removed.
- The Contractor/Liner Subcontractor has certified in writing that the surface on which the geotextile/geocomposite will be installed is acceptable.

## **7.2.3 GEOCOMPOSITE/GEOTEXTILE CONFORMANCE TESTING**

### **7.2.3.1 Tests**

Upon delivery of the geocomposite and geotextile, the Contractor or Liner Subcontractor shall ensure that conformance samples are obtained and forwarded to the Independent Testing Laboratory at the frequency required for testing to ensure conformance with the Project Specifications. All conformance samples will be obtained in the presence of the CQA Monitor or his/her designated representative.



Conformance tests will include the tests specified in Sections 2D- 3.6 and 2F- 3.5 of the Project Specifications and will include the following tests:

**Drainage Geocomposite:**

- Ply Adhesion (GRI – GC-7)
- Apparent Opening Size (ASTM D4751)
- Transmissivity (ASTM D4716)
- Permittivity (ASTM D4491)

**Geotextiles:**

- Mass per Unit Area (ASTM D5261)
- Grab Tensile Strength (ASTM D4632)
- Trapezoidal Tear Strength (ASTM D4533)
- Puncture Resistance (ASTM D4833)
- Apparent Opening Size (ASTM D4751)

Where optional procedures are noted in the test method, the requirements of the Project Specifications shall prevail.

### **7.2.3.2 Sampling and Testing Frequency**

Unless otherwise specified, conformance samples shall be taken and tested at a rate of one per lot or one per 50,000 square feet, whichever results in the greater number of tests.

### **7.2.3.3 Sampling Procedures**

Samples shall be taken across the entire width of the roll and shall not include the first three feet. Unless otherwise specified, samples shall be 3 ft. long by the roll width. The CQA Monitor shall mark the machine direction on the samples with an arrow, and the Liner Manufacturer's roll identification number.

### **7.2.3.4 Test Results**

The Geotechnical CQA Manager shall examine all conformance testing results and shall report any non-conformance to the Construction Manager, the Contractor and the Lining Subcontractor.

The CQA Manager shall examine all results from the laboratory conformance testing. All specimens tested shall pass. If any specimen fails, the entire sample shall be considered as a failure and rejected. In this event, the material represented by the sample shall be considered nonconformant with the Specifications, and corrective measures shall be implemented. Corrective measures shall include a rerun of the conformance testing using

a portion of the same sample. If the second test passes, the CQA Manager may assume an error was made in the first test and the geomembrane material can be accepted. If the second test fails, the Liner Subcontractor shall remove all material represented by the sample from the work area.

All conformance test results must be approved by the Construction Manager prior to the geomembrane represented by the test being approved for deployment/installation. The decision of the Construction Manager shall be final.

#### **7.2.3.5 Placement**

The Contractor/Subcontractor shall give each geotextile and geocomposite panel an identification number which shall be agreed to and used by the CQA Monitors and the Contractor/Liner Subcontractor. The CQA Monitor shall establish a chart showing correspondence between roll numbers, certification reports, and panel numbers.

During panel placement, the CQA Monitor shall:

- Observe the geotextile/geocomposite as it is placed and record all defects and disposition of the defects (panel rejected, patch installed, etc.). All repairs are to be made in accordance with the Specifications.
- Observe that equipment used does not damage the geotextile/geocomposite by handling, traffic, leakage of hydrocarbons, or other means.
- Observe that people working during installation of geocomposite do not smoke, wear shoes that could damage the geocomposite, or engage in other activities that could damage the geotextile/geocomposite.
- Observe that the geotextile/geocomposite is anchored to prevent movement by the wind.
- Observe that adjacent panels of geotextile/geocomposite are overlapped a minimum of 18 inches where the fabric is not seamed (welded or sewn). When seamed, a three inch minimum overlap will be required.

The CQA Monitors shall inform both the Contractor/Liner Subcontractor and the CQA Manager if the above minimum conditions are not met.

The Contractor/Liner Subcontractor shall provide the Construction Manager with a panel layout plan, and shall update this plan daily as the job proceeds. No geotextile/geocomposite shall be placed until the panel layout plan has been approved by the Construction Manager. During geotextile/geocomposite placement, the CQA Monitors shall observe that:

- The geotextile/geocomposite is cut only with an approved cutter, and is not torn or ripped.
- Geotextile/geocomposite seaming equipment meet the Project requirements.

- The panels are being overlapped or joined in accordance with the Project Plans and Specifications.
- Any damaged roll of geotextile/geocomposite is removed and replaced.

#### 7.2.4 REPAIRS

Any necessary repairs to the geotextile/geocomposite shall be made with the geotextile/geocomposite material itself, using approved overlaps or seaming systems, equipment, and techniques. The patch size shall be 18 inches or larger in all directions than the area to be patched and all corners shall be rounded.

### 8.0 DOCUMENTATION

To provide evidence of satisfactory work performance, all stages of final cover construction shall be documented. The information shall be recorded on a standardized form or in a bound field logbook.

#### 8.1 DAILY RECORD KEEPING

The purpose of daily record keeping is to record construction activities, including: results of continuous visual observations; laboratory/field test data; sampling; review of test results; repairs; problems; solutions; and general field activity. The daily record keeping will include a daily field inspection report and a daily test summary report, as discussed below.

##### 8.1.1 DAILY FIELD INSPECTION REPORT

The CQA Monitor(s) shall keep a daily field inspection report of project activities. At a minimum, this report shall include the following:

- Date and project identification
- Field activity and work locations
- Summaries of field communications
- Summary of Equipment and personnel used
- Work activity monitored, its general location on-site and any related test results
- Record of material sampling and testing activities
- Any variance from specified methods and standards
- Estimated quantities of material placed and compacted

- Unusual events
- Actions regarding acceptance/rejection of work
- Weather conditions
- Signature of person preparing the report

#### **8.1.2 DAILY TEST SUMMARY REPORT**

A daily summary report of the field and laboratory tests conducted for the CQA of the earth materials portion of the cover will be prepared under the direction of the CQA Manager. The daily test summary report will include:

- Locations and results of all field and laboratory tests with pass/fail comment.
- Results of all re-tests for failed areas with remarks showing the corrective action taken before the re-tests. If re-test(s) also show a rejection, final corrective action shall be noted.

Both the daily field inspection report and the daily test summary report shall be reviewed by the CQA Manager and shall be submitted to the Construction Manager. One complete set of both daily reports shall be kept on site by the CQA personnel at all times.

### **8.2 MONTHLY PROGRESS REPORT**

A Monthly Progress Report shall be prepared by the CQA Manager and submitted to the Construction Manager. This monthly progress report shall summarize the work activities, deficiencies, and corrective actions implemented. It shall also summarize the CQA test results.

### **8.3 PHOTO DOCUMENTATION**

A photographic record shall be prepared by the Construction Manager as part of the construction control activities. Photographs shall be in color and shall include photographs of construction activities, problem areas, corrective actions, and final constructed features. Photographs shall be identified with the landfill site designation, the date taken, the location, and a description of the activity covered by the photograph.

### **8.4 AS-BUILT DOCUMENTATION**

As the work is completed, final Record Drawings (As-Built Drawings) will be prepared by the Contractor and reviewed by the Construction Manager and Landfill Engineer. Upon completion of the construction project, the Landfill Engineer and Construction

Manager will prepare a final construction report utilizing the Record Drawings prepared by the Contractor during construction. These drawings and the report shall be retained as a permanent record of final cover construction. The report shall include a laboratory test results summary and photographs showing typical construction conditions and procedures. The Record Drawings and report will be submitted to the Owner.

**APPENDIX D**  
**SITE INDUSTRIAL STORM WATER POLLUTION PREVENTION PLAN**  
**(SWPPP)**

# Stormwater Pollution Prevention Plan Amendment 2

South Coast Landfill  
Mendocino County, California



Prepared for:

**Mendocino County Department of Transportation**



**February 2018**

**418018.300**

Reference: 418018.300

# **Stormwater Pollution Prevention Plan Amendment 2**

## **South Coast Landfill Mendocino County, California**

**Waste Discharge Identification: 1 23I005730**

Exceedence Response Action (ERA) Status: Baseline

Legally Responsible Person (LRP):  
Mendocino County Department of Transportation  
40 Lake Mendocino Dr., Ukiah, CA 95482  
Howard Dashiell  
707-463-4363

Duly Authorized Representatives:  
Geoffrey Brunet–707-234-2816  
Amber Muñoz–707-234-2838

Prepared by:



Engineers & Geologists  
335 S. Main St.  
Willits, CA 95490-3977  
707-459-4518

February 2018

QA/QC: GJE\_\_\_\_



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## Legally Responsible Person

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### Approval and Certification of the Stormwater Pollution Prevention Plan

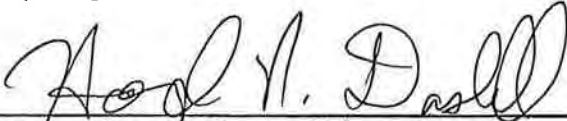
Facility Name: South Coast SWDS

Waste Discharge Identification (WDID): 1 23I005730

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Howard Dashiell

Legally Responsible Person



Signature of Legally Responsible Person or  
Approved Signatory

(707) 463-4363

Telephone Number

6-25-15

Date



Signature of Duly Authorized Representative,  
Geoffrey Brunet, PE

(707) 463-4566

Telephone Number

## Amendment Log

Facility Name:  
Waste Discharge Identification (WDID):

South Coast Landfill

1 23I005730

Amendment No.	Date	Section No.	Brief Description of Amendment; include reason for change, site location, and BMP modifications.	Prepared and Approved By
1	2/11/16	Letter doc.	Remove SIC code 4953: Not a primary activity occurring at site.	G. Erickson and LRP
2	2/28/18	Sect. 1.1, 1.13, 2.1.2.2 - 2.1.2.4, 2.1.3, 5.5, 5.5.1; Tables 1.1, 1.2, 3.3	Update facility and contact information; include sample frequency reduction; update site map	G. Erickson and LRP

## Section 1 SWPPP Requirements

### 1.1 Introduction

The South Coast landfill (SCL) is an inactive Class III solid waste disposal site (SWDS) with a transfer station facility located in southwest Mendocino County. The SCL facility is owned by the County of Mendocino Transportation Department Solid Waste Division and the transfer station is operated by Solid Waste of Willits.

The interim closed landfill is covered by North Coast Regional Water Quality Control Board (RWQCB) Order 77-23 Waste Discharge Requirements (WDRs) for County of Mendocino South Coast Solid Waste Disposal Site (RWQCB, 1977) requiring water quality monitoring of groundwater, surface water, and leachate. No primary industrial landfill operation is occurring at the site. The primary industrial activity at the site consists of local collecting and transferring of garbage, scrap, and recycling without disposal. The associated standard industrial classification (SIC) codes are 4212 and 5093.

This stormwater pollution prevention plan (SWPPP) is designed to comply with California's General Permit for Stormwater Discharges Associated with Industrial Activities (General Permit or IGP) Order No. 2014-0057-DWQ (NPDES No. CAS000001), issued by the State Water Resources Control Board (State Water Board). This SWPPP has been prepared following the SWPPP Template provided on the California Stormwater Quality Association Stormwater *Best Management Practice Handbook: Industrial and Commercial* (CASQA, 2014). In accordance with the General Permit, Section X.A, this SWPPP contains the following required elements:

- Facility Name and Contact Information
- Site Map
- List of Significant Industrial Materials
- Description of Potential Pollution Sources
- Assessment of Potential Pollutant Sources
- Minimum Best Management Practices (BMPs)
- Advanced BMPs, if applicable
- Monitoring Implementation Plan (MIP)
- Annual Comprehensive Facility Compliance Evaluation (ACFCE)
- Date that SWPPP was initially prepared, and the date of each SWPPP Amendment, if applicable

### 1.2 Permit Registration Documents

Permit Registration Documents (PRDs) were submitted to the State Water Board using the Stormwater Multi Application and Report Tracking System (SMARTS), by the Legally Responsible Person (LRP), or authorized personnel (i.e., Approved Signatory) under the direction of the LRP. The project-specific PRDs include:

- Notice of Intent (NOI)
- Signed Certification Statement (LRP Certification is provided electronically with SMARTS PRD submittal)
- Site Maps
- SWPPP
- Annual Fee

The site maps can be found in Appendix 1. A copy of the submitted PRDs is included in Appendix 2, along with the Waste Discharge Identification (WDID) confirmation.

The SWPPP uploaded into SMARTS **does not** include a copy of the General Permit.

In the event of future significant changes to the facility layout, the Discharger will certify and submit new PRDs using SMARTS.

### 1.3 SWPPP Availability and Implementation

The SWPPP is available onsite to employees during hours of operation (see Section 2.4 for the Operations Schedule), and will be made available upon request by a State or municipal inspector. The SWPPP will begin to be implemented by July 1, 2015.

### 1.4 Pollution Prevention Team

Facility staff members that have been designated as Pollution Prevention Team members are listed below in Table 1.1., along with their responsibilities and duties. This table will be updated as needed when there are changes to staff and staff responsibilities. Team members will be trained to perform the duties assigned to them. Employee training logs are provided in Appendix 3.

**Table 1.1 Pollution Prevention Team**

Name	Title	24-hour Phone Number	Responsibilities and Duties
Howard Dashiell	Director of Transportation	707-463-4363	Legally Responsible Person
Geoff Brunet	Civil Engineer Transportation (Landfill manager)	707-234-2816	Duly Authorized Representative, SWPPP implementation, certification of reporting
Amber Muñoz	Deputy Director, Transportation	707-234-2838	Duly Authorized Representative, SWPPP implementation, certification of reporting
Rocky Seaton	Transfer Stations Manager	707-459-4845 ext. 222	SWPPP implementation
David Coontz	Facility operator	707-684-0683	SWPPP implementation
James Linderman	Environmental Compliance Specialist	707-234-2819	SWPPP implementation
Justin Brandt	Engineer II	707-234-2824	SWPPP implementation
Gwen Erickson	Stormwater Compliance Manager; QISP	707-441-8855	Training of staff; water quality evaluations; reporting

### 1.5 Duly Authorized Representatives

Duly authorized representatives who are responsible for SWPPP implementation and have authority to sign PRDs are listed below in Table 1.2.

**Table 1.2 Duly Authorized Representatives**

Name	Title	Phone Number
Geoff Brunet	Civil Engineer Transportation	707-234-2816
Amber Muñoz	Deputy Director, Transportation	707-234-2838

## 1.6 Permits and Governing Documents

In addition to the General Permit, the following documents have been taken into account while preparing this SWPPP:

- Regional Water Board requirements
- Basin Plan requirements (RWQCB, 2011)
- North Coast Regional Water Quality Control Board Order 77-23 WDRs for County of Mendocino South Coast Solid Waste Disposal Site (RWQCB,1977)
- South Coast Landfill Final Closure/Post Closure Maintenance Plan December 2016 (SWT Engineering, 2016)

## 1.7 SWPPP Amendments

This SWPPP will be amended or revised as needed. A list of amendments (Amendment Log) is included in the front of this SWPPP, and amendment certifications are included in Appendix 5. The Amendment Log will include the date of initial preparation and the date of each amendment.

The SWPPP should be revised when:

- There is a General Permit violation.
- There is a reduction or increase in the total industrial area exposed to stormwater.
- BMPs do not meet the objectives of reducing or eliminating pollutants in stormwater discharges.
- There is a change in industrial operations that may affect the discharge of pollutants to surface waters, groundwater(s), or a municipal separate storm sewer system (MS4).
- There is a change to the parties responsible for implementing the SWPPP.
- Otherwise deemed necessary by the QISP.



The following items will be included in each amendment:

- Identification of the party who requested the amendment
- The location of proposed change
- The reason for change
- The original BMP(s) proposed, if any
- The new BMP(s) proposed

Amendments will be logged at the front of the SWPPP and certification kept in Appendix 5. The SWPPP text will be revised replaced, and/or hand annotated as necessary to convey the amendment properly. SWPPP amendments must be certified and submitted by the LRP or their designated Duly Authorized Representative using SMARTS within 30 days whenever the SWPPP contains significant revisions. With the exception of significant revisions, SWPPP changes will be certified and uploaded to SMARTS once every three (3) months in the reporting year.

## **1.8 Retention of Records**

Paper or electronic records of documents required by this SWPPP will be retained for a minimum of five (5) years from the date generated or date submitted, whichever is later, for the following items:

- Employee Training Records
- BMP Implementation Records
- Spill and Clean-up Related Records
- Records of Sampling and Analysis Information
  - The date, exact location, and time of sampling or measurement
  - The date(s) analyses were performed
  - The name(s) of the individual(s) that performed the analyses
  - The analytical techniques or methods used
  - The results of such analyses
- Records of visual observations
  - The date of visual observations
  - The industrial areas/drainage areas of the facility observed during the inspection (Location)
  - The approximate time of the observation
  - Presence and probable source of observed pollutants
  - Name of the individual(s) that conducted the observations
- Response to the observations including identification of SWPPP revisions if needed
- Level 1 Exceedence Response Action (ERA) Reports
- Level 2 ERA Action Plan
- Level 2 ERA Technical Report
- Annual Reports from SMARTS (checklist and any explanations)

Copies of these records will be available for review by the Water Board's staff at the facility during scheduled facility operating hours. Upon written request by U.S. EPA or the local MS4, Dischargers will provide paper or electronic copies of requested records to the Water Boards, U.S. EPA, or local MS4 within 10 working days from receipt of the request.

## 1.9 Exceedence Response Actions (ERAs)

If a General Permit numeric action level (NAL) exceedence occurs in a given reporting year, a Level 1 ERA evaluation and a Level 1 ERA report will be required in the following year, or, if in a subsequent year, a Level 2 ERA action plan and a Level 2 ERA report will be required in accordance with the General Permit. The results of either of the ERA reports may require that the SWPPP be amended.

## 1.10 Annual Comprehensive Facility Compliance Evaluation

The General Permit (Section XV) requires the Discharger to conduct one Annual Comprehensive Facility Compliance Evaluation (Annual Evaluation) for each reporting year (July 1 to June 30). Annual evaluations will be conducted at least eight (8) months and not more than sixteen (16) months after the previous annual evaluation. The planned window for conducting the annual evaluation is between April and June of each year.

The SWPPP will be revised, as appropriate based on the results of the annual evaluation, and the revisions will be implemented within 90 days of the annual evaluation.

At a minimum, annual evaluations will consist of:

- A review of sampling, visual observation, and inspection and monitoring records and sampling and analysis results conducted during the previous reporting year
- A visual inspection of areas of industrial activity and associated potential pollutant sources for evidence of, or the potential for, pollutants entering the stormwater conveyance system
- A visual inspection of drainage areas previously identified as having no exposure to industrial activities and materials in accordance with the definitions in Section XVII
- A visual inspection of equipment needed to implement the BMPs
- A visual inspection of BMPs
- A review and effectiveness assessment of BMPs for each area of industrial activity and associated potential pollutant sources to determine if the BMPs are properly designed, implemented, and are effective in reducing and preventing pollutants in industrial stormwater discharges and authorized Non-Stormwater Discharges (NSWDs)
- An assessment of any other factors needed to comply with the annual reporting requirements in General Permit Section XVI.B

## 1.11 Annual Report

The annual report will be prepared, certified, and electronically submitted no later than July 15<sup>th</sup> following each reporting year using the standardized format and checklists in SMARTS based on the reporting requirements identified in Section XVI of the General Permit. Annual reports will be submitted in SMARTS and in accordance with information required by the on-line forms.

## **1.12 Termination and Changes to general Permit Coverage**

When any of the following conditions occurs, termination of coverage under the General Permit will be requested by certifying and submitting a Notice of Termination (NOT) using SMARTS:

- Operation of the facility has been transferred to another entity.
- The facility has ceased operations, completed closure activities, and removed industrial related pollutant generating sources.
- The facility's operations have changed and are no longer subject to the General Permit.
- The SWPPP and provisions of the General Permit will be complied with until a valid NOT is received and accepted by the Board.
- If ownership changes, the new owner of the facility will be notified of the General Permit and regulatory requirements for permit coverage.

## **1.13 Compliance Group Participation**

This facility is a participant of the stormwater compliance group, North Coast Transfer Stations that has been established in accordance with General Permit Section XIV. The compliance group consists of dischargers that operate facilities with similar types of industrial activities, pollutant sources, pollutant characteristics, and standard industrial classification codes.

The compliance group has a designated compliance group leader who has completed a State Water Board-approved training program, and is certified as a QISP Trainer of Record (as required for compliance group leaders). The compliance group leader assists facility personnel with compliance activities required by the General Permit, prepares and revises ERA reports (if needed), and conducts at least one facility inspection per year. The compliance group leader is Gwendolyn Erickson, IGP ToR/QISP #00141.

## Section 2 Facility Information

### 2.1 Facility Description

#### 2.1.1 Facility Location

The SCL facility is located in Mendocino County, east of Highway 1 on Fish Rock Road in the southeast of the south 1/2 of Section 4, Township 11 north, Range 15 west, Mount Diablo Base and Meridian. The address of the SCL facility is 40855 Fish Rock Road, Gualala, California 95445, Assessor's parcel number 141-080-26. The facility is located at approximately latitude 38.83072°, longitude -123.54276° and is identified on Figure 1 in Appendix 1.

#### 2.1.2 Facility Operational Areas

Active operations at the SCL consist of local collecting and transfer of garbage without disposal. This facility is no longer used for disposing garbage. The SWDS is currently inactive and has an interim soil cover but no geomembrane layer. A closure plan and post-closure maintenance plan (SWT, 2013) has been submitted for the facility.

A list of current facility operations and activities is provided below. Each operational area is described in further detail in the following sections.

- Facility Entrance and Access Roads
- Interim Closed SWDS
- Leachate Collection Storage Tanks
- Transfer Station

##### 2.1.2.1 Facility Entrance and Access Roads

The entrance to the facility is located along the eastern side of the site and is paved with asphalt into the transfer station area. Public and private waste haulers, as well as employees, access the landfill facility through the main entrance. Access to the site is restricted along the perimeter by a 6-foot high steel cyclone fence in some areas, steel field fence or steep heavily vegetated topography in other areas. Site access is also restricted by a locking gate at the entrance.

Unpaved access roads exist on the east and west perimeters of the facility and are primarily used to access the sedimentation basins and leachate storage tanks.

##### 2.1.2.2 Interim Closed SWDS

The interim closed SWDS comprises approximately 6 acres of the facility. Refuse disposal and storage operations began at the SWDS in 1977 and ceased in 2000. The SWDS was constructed in a shallow ravine, using the area fill method to place, compact, and cover refuse on a daily basis (SWT, 2013). Historically the site accepted mixed municipal refuse, classified nonhazardous solid waste, and inert waste as defined in the 27 California Code of Regulations (CCR), Sections 20220 and 20230. No liquid or hazardous waste was knowingly accepted at the site. Wastes at the landfill generally consisted of municipal refuse including residential refuse (90 percent), commercial refuse (5 percent), and demolition refuse (5 percent) (SWT, 2013).

The County of Mendocino has submitted a final closure plan for the facility. The plan includes provisions for bringing the final cover, drainage system, and environmental monitoring systems into compliance with relevant regulations. Currently, the interim cover consists of relatively uniform soil, from 6 to greater than 96 inches in depth, with no geomembrane layer.

Stormwater runoff at the SWDS is managed by a surface water conveyance system. Surface runoff from the deck of the landfill is conveyed by both open drainage ditches and buried and overland 12-inch high-density polyethylene (HDPE) pipe to one of two sedimentation basins at the facility. Figure 2 in Appendix 1 shows facility drainage controls and sedimentation basin locations.

As indicated previously, the SWDS is monitored in accordance with RWQCB Order 77-23 WDRs for County of Mendocino South Coast Solid Waste Disposal Site.

### **2.1.2.3 Leachate Collection Storage Tanks**

For the most part, rainwater that infiltrates into the landfill is recovered by the leachate collection and recovery system (LCRS). The two LCRSs at the SWDS are used to transport leachate that is collected from small surface seeps on the SWDS to one of the two containment facilities located at the site: the northern leachate containment facility and the southeastern leachate containment facility.

The northern LCRS collects leachate from approximately the northern third of the SWDS to three storage tanks located northwest of the SWDS. This system is comprised of polyvinyl chloride (PVC) pipes plumbed into the three 2,300-gallon plastic storage tanks located within the northern leachate containment area which is surrounded by an earthen berm.

The southern LCRS collects leachate from the majority of the SWDS and stores the leachate in the southeastern leachate containment facility. Leachate from the western slope of the SWDS is collected into an infiltration gallery where it then flows to the southeastern leachate containment facility. The leachate containment facility consists of nine 2,300-gallon plastic tanks, which have the capacity to store 20,700 gallons of leachate. The southeastern containment facility is also surrounded by an earthen berm.

The tanks are periodically pumped by tanker truck and leachate is disposed of at the Gualala Community Service District (GCSD) Sewage Treatment Plant in Gualala, California (SWT, 2013).

The system is inspected quarterly in accordance with the WDR, and minor problems and maintenance issues are corrected when noted.

### **2.1.2.4 Transfer Station**

The north portion of the facility comprises the South Coast transfer station, which is operated by Solid Waste of Willits. The transfer station is paved from the facility entrance road to the concrete stalls area located on the northwest side of the transfer station. The transfer station area is approximately 2.5 acres and includes an approximately 5,800-square foot covered transfer station building; a 200-square foot office; an open ramp, which allows patrons to drop their recycling directly into 40- to 50-yard bins; a yard waste pile; scrap metal and white waste piles; and a 500-gallon used oil aboveground storage tank (AST).

The transfer station accepts:

- Household Hazardous Waste
- Mixed Metal
- Mixed or Other Electronics
- Mixed Recyclables
- Mixed Solid Waste
- Tires
- Used Oil
- Green waste

The transfer station building is covered, has open sides, and houses the tipping area and transport truck loading activities. The building is two stories with a drive-in truck ramp on the lower level that allows the facility loader to dump directly into transfer trailers. The building is constructed of steel over a concrete slab foundation. Tipping vehicles access the building from a concrete pad on the north side of the building. Hauling truck access is from a truck ramp on the east side of the building. Household waste is hauled daily to the Solid Waste of Willits, Willits Transfer Station, where it is dumped and reloaded for transfer to the Potrero Hills Landfill in Suisun, California.

Most of materials for single stream recycling are deposited in 40- to 50-cubic yard open-topped steel bins. Removal of bins containing recyclables occurs daily.

Used oil is placed in an aboveground 500-gallon double-walled storage tank. The tank is located approximately 65 feet northwest of the office building and is surrounded by bollards. A spill kit is located adjacent to the used oil tank.

White goods are checked onsite; however, white goods and steel are not flattened or disposed of onsite. White goods and other residential and commercial steel products are checked for the presence of fluids (such as, refrigerants) before recycling. A transfer station employee is responsible for removing liquids. Tri-county Metal of Ukiah removes metals approximately once per month.

Liquids are stored in covered containers in a hazardous materials cabinet located in the southernmost concrete stall on the northwest side of the site. The cabinets are supplied by Mendocino County and the Mendocino Solid Waste Authority removes the hazardous waste approximately twice per month.

Green waste is collected and temporarily stored in the northernmost concrete stall on the northwest side of the site. Green waste is transported approximately weekly to Ukiah Waste Solutions, in Ukiah, California.

### **2.1.3 Description of Existing Drainage**

The site map shows the area layout, including the general site topography, storm drainage system, drainage inlets, their respective drainage areas, and discharge locations.

The facility is located east of the Little North Fork Gualala River (LNFR). The existing SWDS drainage system has been in place for several years, and has been sized through trial and error (SWT, 2013). Stormwater is routed to 12-inch corrugated plastic pipes placed on top of the landfill cover, and then to a perimeter ditch

that directs runoff to one of two basins. A rock-lined swale provides runoff control along the north and east sides of the landfill, directing stormwater off site to a ravine leading to the LNFR. The adjacent land south and west of the landfill slope downward to the LNFR.

Two sedimentation basins collect stormwater at the SCL: 1) the southeastern sedimentation basin and 2) the northwestern sedimentation basin. The southeastern basin is located at the southeast side of the SWDS and collects runoff from the south and east slopes of the SWDS and facility. This basin has an approximate volume of 18,000 cubic feet (ft<sup>3</sup>). An 18-inch discharge pipe is located approximately 2 feet below the top of the basin. The discharge pipe conveys stormwater under the road to a drainage leading off site. The discharge is designated as SW-1. From SW-1 there is a poorly defined geomorphologic channel for storm/surface water flow. The presence of a "channel" is delineated by moss growing on rocks. Water is presumed to infiltrate primarily into the ground surface, but may ultimately flow to the LNFR.

The northwestern basin collects runoff from the transfer station and northernmost slopes of the SWDS and has an approximate volume of 45,000 ft<sup>3</sup>. The basin discharges by way of an underground pipe to a second smaller basin from which it is conveyed by way of a downslope drain to LNFR (Figure 2 in Appendix 1). The discharge location is designated as SW-2.

#### **2.1.4 Stormwater Runon from Offsite Areas**

The SCL facility receives runoff from the northern, northwestern and eastern slopes topographically above the site. The General Permit requires that BMPs be implemented to direct offsite and non-industrial runoff away from industrial areas and erodible surfaces. Within the control of the facility, the following BMPs are being implemented to meet this requirement:

- Perimeter vegetated buffers
- Paved surfaces
- Perimeter rock-lined swales which direct runoff away from the transfer station and SWDS

The offsite drainage areas and facility drainage control devices are shown on Figure 3 in Appendix 1.

## **2.2 Pollutant Source Assessment**

Operational activities conducted at the South Coast transfer station facility have the potential to be the source of a variety of stormwater pollutants. These pollutants can become entrained in stormwater as the result of solid waste and recycling operations, heavy equipment operations, and maintenance activities.

## 2.2.1 Description of Potential Pollutant Sources

Table 2.1 lists industrial activities and associated materials that are anticipated to be used in each operational area. These activities and associated materials will or could potentially contribute pollutants to stormwater runoff. The anticipated activities and associated pollutants provided in Table 2.1 are the basis for selecting the BMPs for the facility as described in Section 3.

**Table 2.1 Summary of Potential Pollutant Sources and Corresponding BMPs<sup>1</sup>**

Operational Area	Pollutant Source	Pollutant	BMPs
Facility Entrance and Access Roads	<ul style="list-style-type: none"> <li>Trucks and vehicles</li> <li>Leaks and spills</li> <li>Windblown debris, and particulates</li> <li>Erosion from unpaved access roads</li> </ul>	<ul style="list-style-type: none"> <li>Lubricants</li> <li>Gasoline and diesel</li> <li>Hydraulic oil</li> <li>Grease and motor oil</li> <li>Soil, tire, and vehicle exhaust particulates</li> </ul>	<ul style="list-style-type: none"> <li>Paved entrance road</li> <li>Gravel access road</li> <li>Upgradient sediment controls for unpaved access road surfaces</li> <li>Good housekeeping</li> <li>Routine inspections</li> <li>Employee training</li> </ul>
Interim Closed SWDS <sup>2</sup>	<ul style="list-style-type: none"> <li>Heavy equipment and trucks</li> </ul>	<ul style="list-style-type: none"> <li>Lubricants</li> <li>Gasoline and diesel</li> <li>Hydraulic oil</li> <li>Grease and motor oil</li> <li>Soil, tire, and vehicle exhaust particulates</li> </ul>	<ul style="list-style-type: none"> <li>Recover leachate by a collection and removal system</li> <li>Route stormwater to sedimentation basins</li> <li>Route stormwater runoff away from breaks in slopes</li> <li>Waste management</li> <li>Good housekeeping</li> <li>Routine inspections</li> <li>Employee training</li> </ul>
Transfer Station	<ul style="list-style-type: none"> <li>Trucks, vehicles and heavy equipment</li> <li>Leaks and spills</li> <li>Windblown debris, and particulates</li> <li>Appliances</li> <li>Waste materials</li> <li>Waste bins</li> <li>Inert debris</li> </ul>	<ul style="list-style-type: none"> <li>Lubricants</li> <li>Gasoline and diesel</li> <li>Paint</li> <li>Hydraulic oil</li> <li>Grease and motor oil</li> <li>Soil, tire, and vehicle exhaust particulates</li> <li>Hazardous materials</li> </ul>	<ul style="list-style-type: none"> <li>Load-checking program</li> <li>Oil absorbent booms as determined necessary</li> <li>Covered loading building</li> <li>Covered used tire trailer</li> <li>Storage of potentially hazardous and toxic materials inside covered storage containers</li> <li>Preservation of adjacent existing vegetation</li> <li>Good housekeeping</li> <li>Routine inspections</li> <li>Employee training</li> <li>Spill cleanup materials stored near ASTs<sup>3</sup></li> <li>Regular removal of hazardous and toxic materials inside covered and contained building</li> </ul>



**Table 2.1 Summary of Potential Pollutant Sources and Corresponding BMPs<sup>1</sup>**

Operational Area	Pollutant Source	Pollutant	BMPs
Leachate Collection Storage Tanks	<ul style="list-style-type: none"> <li>Leachate Storage Tanks</li> </ul>	<ul style="list-style-type: none"> <li>Leachate</li> </ul>	<ul style="list-style-type: none"> <li>Berm around perimeters</li> <li>Preservation of adjacent existing vegetation</li> <li>Good housekeeping</li> <li>Routine inspections</li> <li>Employee training</li> </ul>
1. BMPs: best management practices 2. SWDS: solid waste disposal site 3. AST: aboveground storage tank			

## 2.2.2 Significant Spills and Leaks

Table 2.2 includes a list of industrial materials where spills and leaks have potential to occur, and includes material characteristics, quantities, locations, and containers. Spills and leaks will be prevented by implementing the BMPs described in Section 3.

**Table 2.2 Summary of Chemical Storage**

Location	Contents	Capacity and Container Type
Used Oil AST	Used oil	500 gallon double wall
Hazmat Storage Container	Miscellaneous materials (Paint, refrigerants, switch boards)	Sorted by material, stored in covered 5-gallon buckets
1. AST: aboveground storage tank		

## 2.3 Identification of Non-Stormwater Discharges (NSWDs)

Non-stormwater discharges (NSWDs) consist of discharges that do not originate from precipitation events. The General Permit provides allowances for specified NSWDs provided they:

- do not cause erosion;
- do not carry other pollutants;
- are not prohibited by the local MS4; and
- do not require a separate National Pollutant Discharge Elimination System (NPDES) Permit from the Regional Water Board.

NSWDs into storm drainage systems or waterways, which are not authorized under the General Permit and listed in the SWPPP, or authorized under a separate NPDES permit, are prohibited.

Monthly visual observations will be conducted according to the General Permit (Section XI.A.1) to ensure adequate BMP implementation and effectiveness. Monthly visual observations include observations for

evidence of unauthorized NSWDS. Steps will be taken, including the implementation of appropriate BMPs as defined in Section 3, to ensure that unauthorized NSWDS are eliminated, controlled, disposed offsite, or treated onsite.

## 2.4 Operations Schedule

The South Coast transfer station facility is open Monday through Wednesday 12 p.m. to 4 p.m. and Saturday and Sunday 9 a.m. to 4 p.m. (except County holidays). Variations in actual operating hours may occur as necessary. The facility may shut down for indeterminate durations throughout the year. If industrial activities are temporarily suspended for ten (10) or more consecutive calendar days during a reporting year, BMPs that are necessary to achieve compliance with the General Permit during the temporary suspension of the industrial activity will be identified and incorporated into this SWPPP.

This SWPPP will remain onsite, and a copy will be made available to facility staff. A copy will be made available to regulatory agency personnel upon request.

## 2.5 Required Site Maps Information

The facility site maps in Appendix 1 include the information required by the General Permit. Table 2.3 summarizes information provided in the site maps.

**Table 2.3 Required Site Map Information Checklist**

Included on Site Maps? Yes/No/ NA <sup>1</sup>	Required Element
Yes	The facility boundary
Yes	Stormwater drainage areas within the facility boundary
Yes	Portions of any drainage area impacted by discharges from surrounding areas
Yes	Flow direction of each drainage area
Yes	On-facility surface water bodies
Yes	Areas of soil erosion
Yes	Location of nearby water bodies (such as rivers, lakes, wetlands, etc.)
NA	Location of municipal storm drain inlets that may receive the facility's industrial stormwater discharges and authorized NSWDS <sup>1</sup>
Yes	Locations of stormwater collection and conveyance systems and associated points of discharge, and direction of flow
Yes	Any structural control measures (that affect industrial stormwater discharges, authorized NSWDS, and runoff)
Yes	Impervious areas of the facility, including paved areas, buildings, covered storage areas, or other roofed structures
Yes	Locations where materials are directly exposed to precipitation
NA	Locations where significant spills or leaks (Section X.G.1.d of the General Permit) have occurred
Yes	Areas of industrial activity subject to the General Permit
Yes	Storage areas and storage tanks
Yes	Shipping and receiving areas
NA	Fueling areas

**Table 2.3 Required Site Map Information Checklist**

Included on Site Maps? Yes/No/ NA <sup>1</sup>	Required Element
Yes	Vehicle and equipment storage/maintenance areas
Yes	Material handling and processing areas
Yes	Waste treatment and disposal areas
Yes	Dust or particulate generating areas
NA	Cleaning and material reuse areas
Yes	Any other areas of industrial activity which may have potential pollutant sources
1. NA: not applicale 2. NSWDS: non-stormwater discharges	

## Section 3 Best Management Practices

### 3.1 Minimum BMPs

Minimum BMPs that are required by the General Permit and are necessary to meet the facility conditions will be implemented. Guidance for BMP implementation is provided in the CASQA *Stormwater BMP Handbook: Industrial Commercial* (CASQA, 2014) fact sheets; the relevant fact sheets are included in Appendix 6.

Table 3.1 (on the following page) lists the five minimum General Permit BMP elements that are included in the relevant BMP fact sheets and indicates which BMPs are implemented at the facility. Sections 3.1.1 through 3.1.5 list the requirements for each of these minimum BMPs. Minimum BMPs will be implemented for additional targeted industrial activities, equipment, and materials as necessary. If required minimum BMPs are applicable but cannot be implemented, an explanation and alternative approach will be provided in the following sections. Employee Training, described in Section 3.1.6, and quality assurance and record keeping, described in Section 3.1.7, are additional minimum BMPs that will be implemented.

The schedule for BMP implementation and the requirements for inspection and maintenance are contained in Section 4.

#### 3.1.1 Good Housekeeping

The following good housekeeping measures will be implemented in accordance with the General Permit (Section X.H.1.a):

- Outdoor areas associated with industrial activity including stormwater discharge locations, drainage areas, conveyance systems, waste handling/disposal areas, and perimeter areas impacted by off-facility materials or stormwater runoff will be observed and identified; debris, waste, spills, tracked materials, or leaked materials will be cleaned and disposed of properly.
- Minimize or prevent material tracking.
- Minimize dust generated from industrial materials or activities.
- Ensure that facility areas impacted by rinse/wash waters are cleaned as soon as possible.
- Cover stored industrial materials that can be readily mobilized by contact with stormwater.
- Contain stored non-solid industrial materials or wastes (e.g., particulates, powders, shredded paper, etc.) that can be transported or dispersed by the wind or contact with stormwater.
- Prevent disposal of rinse/wash waters or industrial materials into the stormwater conveyance system.
- Minimize stormwater discharges from non-industrial areas (e.g., stormwater flows from employee parking area) that contact industrial areas of the facility.
- Minimize authorized NSWDs from non-industrial areas (e.g., potable water, fire hydrant testing, etc.) that contact industrial areas of the facility.

**Table 3.1 Minimum BMPs<sup>1</sup>**

CASQA <sup>2</sup> Fact Sheet Number	CASQA BMP Fact Sheet Name	Addresses Minimum General Permit BMP Requirements					BMP to be Implemented?	
		Good Housekeeping	Preventative Maintenance	Spill and Leak Prevention and Response	Material Handling and Waste Management	Erosion and Sediment Control	Yes	No
SC-10	Non-Stormwater Discharges	✓		✓	✓			✓
SC-11	Spill Prevention, Control, and Cleanup	✓	✓	✓	✓		✓	
SC-20	Vehicle and Equipment Fueling	✓	✓	✓	✓			✓
SC-21	Vehicle and Equipment Cleaning	✓	✓	✓	✓			✓
SC-22	Vehicle and Equipment Maintenance and Repair	✓	✓	✓	✓		✓	
SC-30	Outdoor Loading and Unloading	✓		✓	✓		✓	
SC-31	Outdoor Liquid Container Storage	✓	✓	✓	✓		✓	
SC-32	Outdoor Equipment Operations	✓	✓	✓	✓		✓	
SC-33	Outdoor Storage of Raw Materials	✓	✓	✓	✓	✓	✓	
SC-34	Waste Handling and Disposal	✓	✓	✓	✓		✓	
SC-35	Safer Alternative Products				✓			✓
SC-40	Contaminated or Erodible Surfaces		✓		✓	✓		✓
SC-41	Building and Grounds Maintenance	✓		✓	✓	✓	✓	
SC-42	Building Repair, Remodeling, and Construction	✓				✓		✓
SC-43	Parking Area Maintenance	✓	✓	✓				✓
SC-44	Drainage System Maintenance	✓	✓	✓		✓	✓	
1. BMP: best management practice 2. CASQA: California Stormwater Quality Association								

### 3.1.2 Preventative Maintenance

The following preventative maintenance measures will be implemented in accordance with the General Permit (Section X.H.1.b):

- Equipment and systems that may spill or leak pollutants are identified in Table 2.2.
- Observe the identified equipment and systems to detect leaks, or identify conditions that may result in the development of leaks.
- Establish an appropriate schedule for maintenance of identified equipment and systems.
- Establish procedures for prompt maintenance and repair of equipment, and maintenance of systems when conditions exist that may result in the development of spills or leaks.

Specific preventative maintenance BMPs to be implemented at the facility are provided in Table 3.1; BMP fact sheets are included in Appendix 6.

### 3.1.3 Spill and Leak Prevention and Response

The following spill and leak prevention and response measures will be implemented in accordance with the General Permit (Section X.H.1.c):

- Establish procedures and/or controls to minimize spills and leaks;
- Develop and implement spill and leak response procedures to prevent industrial materials from discharging through the stormwater conveyance system. Spilled or leaked industrial materials will be cleaned promptly and disposed of properly;
- Identify and describe necessary and appropriate spill and leak response equipment, locations of spill and leak response equipment, and spill or leak response equipment maintenance procedures; and
- Identify and train appropriate spill and leak response personnel.

Specific spill and leak prevention and response BMPs to be implemented at the facility are provided in Table 3.1; the BMP fact sheets are included in Appendix 6.

### 3.1.4 Material Handling and Waste Management

The following material handling and waste management measures will be implemented in accordance with the General Permit (Section X.H.1.d):

- Prevent or minimize handling of industrial materials or wastes that can be readily mobilized by contact with stormwater during a storm event.
- Contain stored non-solid industrial materials or wastes (e.g., particulates, powders, shredded paper, etc.) that can be transported or dispersed by the wind or contact with stormwater during handling.
- Cover industrial waste disposal containers and industrial material storage containers that contain industrial materials when not in use.
- Divert runoff and stormwater generated from within the facility away from stockpiled materials.

- Clean spills of industrial materials or wastes that occur during handling in accordance with the spill response procedures (Section X.H.1.c).
- Observe and clean as appropriate, outdoor material or waste handling equipment or containers that can be contaminated by contact with industrial materials or wastes.

Specific material handling and waste management BMPs to be implemented at the facility are provided in Table 3.1; BMP fact sheets are included in Appendix 6.

### **3.1.5 Erosion and Sediment Controls**

The following erosion and sediment control measures will be implemented in accordance with the General Permit (Section X.H.1.e):

- Implement effective wind erosion controls.
- Provide effective stabilization for disturbed soils and other erodible areas prior to a forecasted storm event.
- Maintain effective perimeter controls and stabilize site entrances and exits to allow sufficient control of discharges of erodible materials from discharging or being tracked off the site.
- Divert runoff and stormwater generated from within the facility away from erodible materials.

Specific erosion and sediment control BMPs to be implemented at the facility are provided in Table 3.1; BMP fact sheets are included in Appendix 6.

### **3.1.6 Employee Training Program**

An employee training program will be implemented in accordance with the following requirements in the General Permit (Section X.H.1.f):

- Ensure that team members implementing the various compliance activities of this SWPPP are properly trained in topics including but not limited to: BMP implementation, BMP effectiveness evaluations, visual observations, and monitoring activities.
- Prepare or acquire appropriate training manuals or training materials.
- Identify which personnel need to be trained, their responsibilities, and the type of training they will receive.
- Provide a training schedule.
- Maintain documentation of completed training classes and the personnel that received training in the SWPPP.

Task-specific training for employees engaged in activities that have the potential to cause stormwater pollution will be conducted when new employees are hired and refresher training will be provided annually. Each team member will be trained in the specific role for which he or she is responsible. Training will be performed by the personnel identified in “Table 1.1: Pollution Prevention Team,” or as needed by the QISP.

The trainer will be responsible for providing information during training sessions and subsequently completing the training logs shown in Appendix 3, which identifies the site-specific stormwater topics covered, as well as the names of site personnel who attended the meeting.

### **3.1.7 Quality Assurance and Record Keeping**

The following quality assurance and record keeping activities will be performed in accordance with the requirements in the General Permit (Section X.H.1.g):

- Develop and implement management procedures to ensure that appropriate staff implements elements of the SWPPP, including the Monitoring Implementation Plan (SWPPP Section 5).
- Develop a method of tracking and recording the implementation of BMPs identified in the SWPPP.
- Maintain the BMP implementation records, training records, and records related to any spills and clean-up related response activities for a minimum of five (5) years as required in the General Permit (Section XXI.J.4).

BMPs will be implemented according to the frequency presented in SWPPP Section 4. BMPs will be implemented by properly trained team members as documented in Appendix 3.

Visual observations will be performed as described in SWPPP Section 5.5. Potential pollutant sources and BMPs will be inspected during visual observations, and new BMPs will be implemented as needed. Records of visual observations of BMP implementation will be retained in Appendix 7.

Paper or electronic records of documents required by this SWPPP will be retained for a minimum of five (5) years from the date generated or date submitted, whichever is later, for the following items:

- Employee Training Records
- BMP Implementation Records
- Spill and Clean-up Related Records
- Records of Monitoring Information
  - The date, exact location, and time of sampling or measurement
  - The date analyses were performed
  - The name of the individual that performed the analyses
  - The analytical techniques or methods used
  - The results of such analyses
- Level 1 ERA Reports
- Level 2 ERA Action Plan
- Level 2 ERA Technical Report
- Annual Reports

## **3.2 Advanced BMPs**

Storm resistant shelters are installed onsite to prevent the contact of stormwater with industrial activities and material. The locations of these shelters and associated industrial activities and materials are presented in Table 3.2.



**Table 3.2 Exposure Minimization BMPs<sup>1</sup>**

Shelter Location/Description	Associated Industrial Activity/Material
Tipping Area and Transfer Station Building	Household waste loading/unloading
Hazmat storage containers	Storage of regulated material, waste materials
LCRS <sup>2</sup> storage tanks	SWDS <sup>3</sup> wastewater/leachate
1. BMPs: best management practices 2. LCRS: leachate collection and removal system 3. SWDS: solid waste disposal site	

Stormwater containment and discharge reduction BMPs include BMPs that divert, reuse, contain, or reduce the volume of stormwater runoff. Specific stormwater containment and discharge structural control measures used at the SCL facility include:

- dedicated secondary containment areas for the storage of chemicals,
- vegetated and rocked swales along the perimeter of the waste management unit slowing surface runoff and allowing sediment to settle prior to stormwater runoff discharging off site,
- gravel roads, and
- sedimentation basins.

**Table 3.3 Advanced BMPs<sup>1</sup>**

CASQA2 Fact Sheet Number	CASQA BMP Factsheet Name	Meets Advanced BMP Requirement	BMP Used		BMP Location, Runoff Sources, and Potential Pollutants
			Yes	No	
TC-10	Infiltration Trench	✓	✓		Vegetated and rock lined trenches around perimeter of SWDS provide drainage from SWDS <sup>3</sup> and perimeter roadways
TC-11	Infiltration Basin	✓		✓	
TC-12	Harvest and Reuse			✓	
TC-20	Wet Pond			✓	
TC-21	Constructed Wetland			✓	
TC-22	Extended Detention Basin		✓		Sediment basins northwest and southeast of SWDS provides basin for northern SWDS
TC-30	Vegetated Swale	✓	✓		Vegetated and rock lined trenches around perimeter of SWDS provide drainage from SWDS and perimeter roadways. Vegetated swales also provide runoff control from adjacent slopes.
TC-31	Vegetated Buffer Strip	✓	✓		In and around entire facility
TC-32	Bioretention			✓	
TC-40	Media Filter			✓	
TC-50	Water Quality Inlet		✓		Catch basin in covered building
TC-60	Multiple Systems	✓	✓		Rocked/vegetated trenches, into sediment basins
MP-20	Biotreatment			✓	
MP-40	Stormwater Filter			✓	
MP-50	Wet Vault			✓	
MP-51	Gravity Separator			✓	
MP-52	Drain Inlet Insert	✓	✓		Absorbent booms and straw bales throughout the transfer station
1. BMPs: best management practices 2. CASQA: California Stormwater Quality Association 3. SWDS: solid waste disposal site					

## Section 4 BMP Implementation

### 4.1 BMP Implementation Schedule

The schedule for implementing minimum and advanced BMPs is presented in Table 4.1 (on the following page). BMPs will be implemented as necessary to reduce or prevent transport of industrial pollutants in stormwater runoff. Slight modifications to this schedule may be necessary to achieve this goal. Records of BMP implementation will be included in Appendix 7.

### 4.2 BMP Inspection and Maintenance

The General Permit requires, at a minimum, monthly observations of BMPs, as well as inspections during sampling events. Monthly observations will be conducted during daylight hours of scheduled facility operating hours and on days without precipitation.

A BMP observation checklist must be completed for each inspection and shall be maintained onsite with the SWPPP. The observation checklist includes the necessary information as discussed in Section 5.5. A blank observation checklist can be found in Appendix 8, and completed checklists will be kept in Appendix 7 or in an accompanying file/binder that is referenced in the SWPPP and readily accessible onsite.

BMPs will be maintained regularly to ensure proper and effective functionality. If necessary, corrective actions will be implemented within 72 hours of identified deficiencies and associated amendments to the SWPPP will be prepared and documented.

Specific guidance for maintenance, observation, and repair of advanced BMPs can be found in the BMP Factsheets in Appendix 6.

**Table 4.1 BMP<sup>1</sup> Implementation Schedule**

Location	BMPs	Person Responsible for Implementing BMP	Frequency of Implementation
Facility Entrance and Access Roads	Observation monitoring and upgrade sediment controls for unpaved roads	Transfer Station Manager	Weekly
	Good housekeeping	Transfer Station Manager	Daily
	Routine inspections	Transfer Station Manager	Daily
Interim Closed SWDS <sup>2</sup>	Inspect route of stormwater runoff from SWDS to vegetated and rock lined trenches and sediment basin	Landfill Manager	Semiannually
	Good housekeeping	Landfill Manager	Monthly
	Routine inspections	Landfill Manager	Monthly
Transfer Station	Absorbent booms and wattles as determined necessary	Transfer Station Manager	Semiannually
	Waste management	Transfer Station Manager	Daily
	Preservation of adjacent existing vegetation	Transfer Station Manager	As Necessary
	Good housekeeping	Transfer Station Manager	Weekly
	Routine inspections	Transfer Station Manager	Weekly
Leachate Collection Storage Tanks	Preservation of adjacent existing vegetation	Landfill Manager	As Necessary
	Observation monitoring of berm along outer perimeter	Landfill Manager	Monthly
	Good housekeeping	Landfill Manager	Monthly
	Routine inspections	Landfill Manager	Monthly
1. BMP: best management practice 2. SWDS: solid waste disposal site			

## Section 5 Monitoring Implementation Plan

### 5.1 Purpose

This Monitoring Implementation Plan was developed to address the following objectives:  
Identify the monitoring team.

- Describe weather and rain event tracking procedures.
- Describe discharge locations, visual observations procedures.
- Describe visual observation response procedures.
- Describe sample collection and handling procedures.
- Describe field instrumentation calibration instructions and intervals.
- Provide justification for alternative discharge locations, representative sample reduction (RSR), and qualified combined samples (QCS), as applicable.
- Provide an example Chain-of-Custody form to be used when handling and shipping water quality samples to the laboratory.

### 5.2 Weather and Rain Event Tracking

Stormwater sampling and visual observations will be conducted during Qualified Storm Events (QSEs). A QSE is defined as any precipitation event that produces a discharge for at least one drainage area and is preceded by 48 hours with no discharge from any drainage area. Weather and precipitation forecasts will be tracked to identify potential QSEs.

When targeting a QSE for stormwater sampling, the appropriate team member will consult weekly National Oceanographic and Atmospheric Administration (NOAA) weather forecasts. These forecasts can be obtained at <http://www.srh.noaa.gov/>. If weekly forecasts indicate potential for significant precipitation, the weather forecast will be closely monitored during the 48 hours preceding the event. Weather reports with precipitation data should be printed and maintained with the SWPPP in “MIP Attachment 1: Weather Reports” to document precipitation totals and antecedent conditions.

### 5.3 Sample Collection and Visual Observation Exceptions

The collection of samples or conducting visual observations is not required under the following conditions:

- During dangerous weather conditions, such as, flooding and electrical storms
- Outside of scheduled site business hours

Scheduled site business hours are presented in Section 2.4.

If monitoring (visual observations or sample collection) of the site is unsafe because of the dangerous conditions noted above, then the appropriate team member will document the conditions under which an exception to performing the monitoring was necessary. The exception documentation will be filed in “MIP Attachment 2: Monitoring Records.”

## 5.4 Visual Observation Procedures

Visual monitoring includes observations of drainage areas, BMPs, and discharge locations.

- Observations of BMPs are required to identify and record BMPs that need maintenance to operate effectively, that have failed, or that could fail to operate as intended.
- Observations of the drainage areas are required to identify any spills, leaks, uncontrolled pollutant sources, and non-stormwater discharges.
- Observations of discharge locations are required to identify the presence of visible pollutants in stormwater discharged from the facility.

Visual observations will be performed at least once every calendar month during dry conditions. Visual observations will also be performed during stormwater sampling events when discharge is occurring.

### 5.4.1 Monthly Visual Observations

Monthly visual observations are necessary to document the presence and source of pollutants and non-stormwater flows. These should consist of observations of the outdoor facility operations, BMPs, and NSWD observations. In the event that monthly visual observations are not performed, an explanation must be provided in the annual report.

#### 5.4.1.1 Outdoor Facility Operations Observations

Observe potential sources of industrial pollutants including industrial equipment and storage areas, and outdoor industrial activities. Record observations of:

- spills or leaks, and
- uncontrolled pollutant sources.

#### 5.4.1.2 BMP Observations

Observe BMPs to identify and record BMPs that:

- are properly implemented,
- need maintenance to operate effectively,
- have failed, or
- could fail to operate as intended.

#### 5.4.1.3 Non-Stormwater Discharge Observations

Observe each industrial activity area for the presence of or indications of prior unauthorized and authorized non-stormwater discharges. Record:

- presence or evidence of any non-stormwater discharge (authorized or unauthorized),
- pollutant characteristics (floating and suspended material, sheen, discoloration, turbidity, odor, etc.), and
- source of discharge.

For authorized non-stormwater discharges, also document whether BMPs are in place and are functioning to prevent contact with materials or equipment that could introduce pollutants.

### 5.4.2 Sampling Event Visual Observations

Sampling event visual observations evaluate the general appearance of the stormwater as an indicator of potential pollutants. These observations will be conducted at the same time sampling occurs at the discharge locations identified in Section 5.5.

At each discharge location where a sample is obtained, record observations of:

- floating and suspended materials,
- oil and grease,
- discoloration,
- turbidity,
- odors, and
- trash.

When pollutants are observed in the discharged stormwater, follow-up observations of the drainage area will be conducted to identify the probable source of the pollutants. In the event that a discharge location is not visually observed during the sampling event, the location of the discharge and reasoning for not obtaining observations must be recorded.

### 5.4.3 Visual Monitoring Procedures

Visual monitoring will be conducted by trained team members. The names and contact numbers of the site visual monitoring personnel are listed below and their training qualifications are provided in Appendix 3.

David Coontz	707-684-0683
James Linderman	707-234-2819
Geoff Brunet	707-234-2826
Justin Brandt	707-234-2824

Visual observations will be documented on the “Visual Observation Log.” Visual observations will be supplemented with a site-specific BMP inspection checklist. Photographs used to document observations will be referenced on the “Visual Observation Log” and maintained in Appendix 8.

### 5.4.4 Visual Monitoring Follow-Up and Reporting

Correction of deficiencies identified by the observations, including required repairs or maintenance of BMPs, will be initiated and completed as soon as possible. Response actions will include the following:

- Report observations to the Pollution Prevention Team Leader or designated individual.
- Identify and implement appropriate response actions.
- Determine if SWPPP update is needed.
- Verify completion of response actions.
- Document response actions.

If identified deficiencies require design changes, including additional BMPs, the implementation of changes will be completed as soon as possible, and the SWPPP will be amended to reflect the changes.

BMP deficiencies identified in site observation reports and correction of deficiencies will be tracked on the “BMP Observation Checklist” and will be retained in Appendix 8.

Results of visual monitoring must be summarized and reported in the Annual Report.

### **5.4.5 Visual Monitoring Locations**

The observations identified as described in Sections 5.4.1 and 5.4.2 will be conducted at the locations identified in this section. Visual monitoring locations and stormwater discharge locations are shown on Figure 2 in Appendix 1.

**SW-1:** This observation point is located at the discharge outlet for the southeastern sedimentation basin and is the primary discharge point for a majority of the SWDS facility’s surface/stormwater.

**SW-2:** This observation point is located at the discharge outlet for the northwestern sedimentation basin. The discharge location collects surface and stormwater runoff from the transfer station and the northernmost portion of the SWDS.

## **5.5 Sampling and Analysis Procedures**

This section describes the methods and procedures that will be followed for stormwater sampling and analysis. It contains information for sampling schedule, sampling locations, monitoring preparation, analytical constituents, sample collection, sample analysis, and data evaluation and reporting. The South Coast transfer station facility is a participant in a compliance group in accordance with General Permit Section XIV.

### **5.5.1 Sampling Schedule**

Based on historical analytical results, the facility qualifies for a sample frequency reduction in accordance with Section XI.C.7 of the General Permit. The facility has certified by way of SMARTS that it meets sample frequency reduction conditions of XI.C.7.a. Stormwater samples at each discharge location will be collected and analyzed in accordance with General Permit Section XI.C.7.e for compliance group participants from one (1) QSE within the each reporting year (July 1 to June 30). A QSE is a precipitation event that:

- produces a discharge for at least one drainage area; and
- is preceded by 48 hours with no discharge from any drainage area.

### **5.5.2 Sampling Locations**

Sampling locations include locations where stormwater is discharged from the site. Discharge locations are shown on Figure 2 in Appendix 1 and are included in Table 5.1, below.



**Table 5.1 Sample Locations**

Stormwater Discharge Location Number	Sample Location Latitude, Longitude (Decimal Degrees)
SW-1	38.828735°, -123.541561°
SW-2	38.830577°, -123.544099°

Whenever changes in facility operations might affect the appropriateness of sampling locations, the sampling locations will be revised accordingly. Revisions will be implemented as soon as feasible and the SWPPP amended.

### 5.5.3 Monitoring Preparation

Samples on the project site may be collected by the following sampling personnel:

David Coontz	707-684-0683
James Linderman	707-234-2819
Geoff Brunet	707-234-2826
Justin Brandt	707-234-2824

Sampling personnel will be available to collect samples in accordance with the sampling schedule.

An adequate stock of monitoring supplies and equipment for sampling will be available onsite prior to a sampling event. Monitoring supplies and equipment will be stored in a cool environment that will prevent them from coming into contact with rain or direct sunlight. Supplies maintained at the facility will include, but are not limited to:

- clean powder-free latex or nitrile gloves; sample collection equipment;
- coolers;
- appropriate number and volume of sample containers;
- identification labels;
- re-sealable storage bags;
- paper towels;
- personal rain gear;
- ice; and
- “Sampling Field Log Sheets” and Chain-of-Custody (CoC) forms, which are provided in “MIP Attachment 3: Example Forms.”

### 5.5.4 Analytical Constituents

Table 5.2 identifies the constituents identified for sampling and analysis. The SIC code 5093 (scrap and waste materials) requires additional parameters in accordance with the General Permit.

**Table 5.2 Analytical Constituents**

Constituent	Reason	Sample Location
pH	Basic required constituent	SW-1 and SW-2
Oil and grease (O&G)		
Total Suspended Solids (TSS)		
Iron	5093 SIC <sup>1</sup> code constituent	SW-2
Lead		
Aluminum		
Zinc		
Chemical Oxygen Demand (COD)		
1. SIC: standard industrial classification		

### 5.5.5 Sample Collection

Samples of discharge will be collected at the designated sampling locations summarized in Table 5.1 and shown on Figure 2 in Appendix 1. Samples from each discharge location will be collected within four (4) hours of:

- the start of the discharge; or
- the start of facility operations if the QSE occurs within the previous 12-hour period.

Sample collection is required during scheduled facility operating hours, when sampling conditions are safe.

Grab samples will be collected and preserved in accordance with the methods identified in Table 5.3. Sample collection and handling requirements are described in Section 5.7. Only team members properly trained in water quality sampling will collect samples.

Grab samples will be collected and analyzed for pH using either a wide range litmus paper or other equivalent pH test kits. If a portable pH meter is used the meter will be utilized following the instrument calibration requirements and manufacturer information that will be stored in "MIP Attachment 4: Field Meter Instructions." The pH analysis will be performed as soon as practicable, but no later than 15 minutes after sample collection.

### 5.5.6 Sample Analysis

Samples will be analyzed using the analytical methods identified in the Table 5.3. Samples will be analyzed by:

Laboratory Name:	Alpha Analytical Laboratories, Inc.
Street Address:	208 Mason Street
City, State Zip:	Ukiah, CA 95482
Telephone Number:	707-468-0401
Point of Contact:	Sheri Speaks
ELAP Certification Number:	#1551

### **5.5.7 Data Evaluation and Reporting**

The designated member of the Pollution Prevention Team will complete an evaluation of the water quality sample analytical results.

Sampling and analytical results for individual samples will be submitted using SMARTS within 30 days of obtaining results for each sampling event. The method detection limit will be provided when an analytical result from samples taken is reported by the laboratory as a "non-detect" or less than the method detection limit. A value of zero will not be reported. Analytical results that are reported by the laboratory as below the minimum level (often referred to as the reporting limit) but above the method detection limit will be provided.

Reported analytical results will be averaged automatically by SMARTS at the end of the reporting year. For any calculations required by the General Permit a value of zero shall be used for effluent sampling analytical results that are reported by the laboratory as "non-detect" or less than the method detection limit (MDL).

**Table 5.3 Sample Collection, Preservation and Analysis for Water Quality Samples**

Constituent	Analytical Method	Minimum Sample Volume	Sample Containers	Sample Preservation	Reporting Limit	Maximum Holding Time
pH	pH Units (see Section X1.C.2 of the IGP <sup>1</sup> )	Field or Container	½ gallon plastic (with TSS)	None	pH 1 to 12	15 minutes
Total Suspended Solids (TSS)	SM 2540-D	½ gallon	½ gallon plastic (with pH)	None	1.0 mg/L <sup>2</sup>	14 days
Oil and Grease (O&G)	EPA 1664-A	2 liters	Two 1-liter brown glass	HCl <sup>(3)</sup>	5 mg/L	14 days
Iron	EPA 200.7 Total Recoverable	500 ml <sup>(4)</sup>	500 ml plastic	HNO <sub>3</sub> <sup>5</sup>	50 µg/L <sup>6</sup>	6 months
Zinc						
Aluminum						
Lead						
Chemical Oxygen Demand (COD)	SM5220D	500 ml	500 ml plastic	H <sub>2</sub> SO <sub>4</sub> <sup>7</sup>	50 mg/L	28 days
1. IGP: industrial general permit 2. mg/L: milligrams per liter 3. HCl: hydrochloric acid 4. ml: milliliters 5. HNO <sub>3</sub> : nitric acid 6. µg/L: micrograms per liter 7. H <sub>2</sub> SO <sub>4</sub> : sulfuric acid						

## 5.6 Training Of Sampling Personnel

Sampling personnel will be trained to collect, maintain, and ship samples in accordance with the General Permit and this SWPPP. Training records of designated sampling personnel are provided in Appendix 3.

## 5.7 Sample Collection and Handling

### 5.7.1 Sample Collection

Samples will be collected at the designated sampling locations shown on Figures 2 and 3 in Appendix 1 and listed in the preceding sections. Samples will be collected, maintained, and shipped in accordance with the requirements in the following sections.

Grab samples will be collected and preserved in accordance with the methods identified in preceding sections.

To maintain sample integrity and prevent cross-contamination, sample collection personnel will follow the protocols below.

- Collect samples (for laboratory analysis) only in analytical laboratory-provided sample containers.
- Wear clean, powder-free latex or nitrile gloves when collecting samples.
- Change gloves whenever something not known to be clean has been touched.
- Change gloves between sites.
- Decontaminate equipment (e.g., bucket, tubing) prior to sample collection using a trisodium phosphate water wash, distilled water rinse, and final rinse with distilled water. (Dispose of wash and rinse water appropriately; do not discharge to storm drain or receiving water). Do not decontaminate laboratory-provided sample containers.
- Do not smoke during sampling events.
- Never sample near a running vehicle.
- Do not park vehicles in the immediate sample collection area (even when they are not running).
- Do not eat or drink during sample collection.
- Do not breathe, sneeze, or cough in the direction of an open sample container.

The most important aspect of grab sampling is to collect a sample that represents the entire runoff stream. Typically, samples are collected by dipping the collection container in the runoff flow paths and streams as noted below.

- For small streams and flow paths, simply dip the bottle facing upstream until full.
- For larger stream that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle, once again making sure that the opening of the bottle is facing upstream as to avoid any contamination by the sampler.

- For larger streams that cannot be safely waded, pole-samplers may be needed to access the representative flow safely.
- Avoid collecting samples from ponded, sluggish, or stagnant water.
- Avoid collecting samples directly downstream from a bridge—the samples can be affected by the bridge structure or runoff from the road surface.
- Do not stand upstream of the sampling point within the flow path.

Note, that depending upon the specific analytical test, some containers may contain preservatives. These containers should **never** be dipped into the stream, but filled indirectly from the collection container.

### 5.7.2 Sample Handling

Field pH measurements must be conducted immediately. Do not store pH samples for later measurement.

Samples for laboratory analysis must be handled as follows. Immediately following sample collection:

- Cap sample containers.
- Complete sample container labels.
- Seal containers in a re-sealable storage bag.
- Place sample containers into an ice-chilled cooler.
- Document sample information on the “Sampling Field Log Sheet.”
- Complete the CoC.

Samples for laboratory analysis must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Place samples to be shipped inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless required sooner by the analytical laboratory).

### 5.7.3 Sample Documentation Procedures

Data documented on sample bottle identification labels, “Sampling Log,” and CoCs will be recorded using waterproof ink. If an error is made on a document, sampling personnel will make corrections by lining through the error once and entering the correct information. The erroneous information will not be obliterated. Corrections will be initialed and dated.

Duplicate samples will be identified consistent with the numbering system for other samples to prevent the laboratory from identifying duplicate samples. Duplicate samples will be identified in the Sampling Log.

Sample documentation procedures include the following:

- **Sample Bottle Identification Labels:** Sampling personnel will attach an identification label to each sample bottle. Sample identification will uniquely identify each sample location.
- **Field Log Sheets:** Sampling personnel will complete the “Effluent Sampling Field Log Sheet” for each sampling event, as appropriate.
- **Chain-of-Custody:** Sampling personnel will complete the CoC for each sampling event for which samples are collected for laboratory analysis. The sampler will sign the CoC when the samples are turned over to the testing laboratory or courier.

## 5.8 Quality Assurance and Quality Control

An effective quality assurance and quality control (QA/QC) plan will be implemented as part of the MIP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs
- Clean sampling techniques
- CoCs
- QA/QC samples
- Data verification

Each of these procedures is discussed in more detail in the following sections.

### 5.8.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. Sampling information to be included in the field log include the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and types of samples that were collected. Field observations should be noted in the field log for any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity should also be recorded in the field log. An Effluent Sampling Field Log Sheet is included in “MIP Attachment 3: Example Forms.”

### 5.8.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free latex or nitrile gloves during sample collection and handling. As discussed in Section 5.8, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

### 5.8.3 Chain-of-Custody

The sample CoC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample CoC procedures include the following:

- Proper labeling of samples
- Use of CoC forms for samples
- Prompt sample delivery to the analytical laboratory

Analytical laboratories usually provide CoC forms to be filled out for sample containers. An example CoC is included in “MIP Attachment 3: Example Forms.”

### 5.8.4 QA/QC Samples

QA/QC samples provide an indication of the accuracy and precision of the sample collection; sample handling; field measurements; and analytical laboratory methods. Field duplicate sample QA/QC samples will be collected at a frequency of one per sampling event.

Field duplicates provide verification of laboratory or field analysis and sample collection. Duplicate samples will be collected, handled, and analyzed using the same protocols as primary samples. The sample location where field duplicates are collected will be randomly selected from the discharge locations. Duplicate samples will be collected immediately after the primary sample has been collected. Duplicate samples must be collected in the same manner and as close in time as possible to the original sample. Duplicate samples will not influence any evaluations or conclusion.

### 5.8.5 Data Verification

After results are received from the analytical laboratory, the discharger will verify the data to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data must be verified as soon as the data reports are received. Data verification will include:

- Check the CoC and laboratory reports.  
*Make sure requested analyses were performed and samples are accounted for in the reports.*
- Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.
- Check data for outlier values and follow up with the laboratory.  
*Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. Especially note data that is an order of magnitude or more different from similar locations, or is inconsistent with previous data from the same location.*
- Check laboratory QA/QC results.  
*EPA establishes QA/QC checks and acceptable criteria for laboratory analyses. This data is typically reported along with the sample results. Evaluate the reported QA/QC data to check for contamination (method, field, and equipment blanks), precision (laboratory matrix spike duplicates),*



*and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.*

- Check the data set for outlier values and accordingly, confirm results and reanalyze samples where appropriate.  
*Sample reanalysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the accepted range. Sample results may not be discounted unless the analytical laboratory determines that the required QA/QC criteria were not met, and confirms this finding in writing.*

Field data, including pH measurements and visual observations, must be verified as soon as the Visual Observation and Sampling Logs are received, typically at the end of the monitoring event. Field data verification will include:

- Check logs to make sure required measurements were completed and appropriately documented.
- Check reported values that appear out of the typical range or that are inconsistent. Follow-up immediately to identify potential reporting or equipment problems, if appropriate, recalibrate equipment after sampling.
- Verify equipment calibrations.
- Review observations noted on the logs.
- Review notations of any errors and actions taken to correct the equipment or recording errors.

## 5.9 Records Retention

Records of stormwater monitoring information and copies of reports (including Annual Reports) must be retained for a period of at least five (5) years from date of submittal or longer if required by the Regional Water Board.

Results of visual observations, field measurements, and laboratory analyses must be kept in the SWPPP along with CoCs, and other documentation related to the monitoring.

Records to be retained include:

- The date, place, and time of inspections, sampling, visual observations, and/or measurements, including precipitation
- The name(s) of the individual(s) who performed the inspections, sampling, visual observation, and/or field measurements
- The date and approximate time of field measurements and laboratory analyses
- The name(s) of the individual(s) who performed the laboratory analyses
- A summary of analytical results, the method detection limits and reporting limits, and the analytical techniques or methods used

- Weather reports
- QA/QC records and results
- Calibration records
- Visual observation and sample collection exception records
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations, or inspections

## Section 6 References

- California Stormwater Quality Association. (August 2014). *Stormwater BMP Handbook: Industrial Commercial*. Accessed at: [www.casqa.org](http://www.casqa.org)
- National Oceanographic and Atmospheric Administration. (NR). "Weather Forecasts." Accessed at <http://www.srh.noaa.gov/>.
- North Coast Regional Water Quality Control Board. (May 2011). *The Water Quality Control Plan for the North Coast Region*. Santa Rosa, CA:RWQCB.
- . (1977). "Order 77-23 Waste Discharge Requirements for County of Mendocino South Coast Solid Waste Disposal Site." Santa Rosa, CA: RWQCB.
- State Water Resources Control Board. (2014). "Order 2014-0057-DWQ, NPDES General Permit No. CAS000001: National Pollutant Discharges Elimination System (NPDES) California General Permit for Stormwater Discharge Associated with Industrial Activities." Accessed at: [http://www.waterboards.ca.gov/water\\_issues/programs/stormwater/industrial.shtml](http://www.waterboards.ca.gov/water_issues/programs/stormwater/industrial.shtml).
- SWT Engineering. (2016). "South Coast Landfill Final Closure/Post-Closure Maintenance Plan." NR:SWT.







Visual Observation Log – Sampling Events			
Date and Time of Inspection:			Report Date:
Facility Name: <b>South Coast Landfill</b>			
Weather			
Antecedent Conditions (last 48 hours):		Weather:	
Precipitation Total:		Predicted % chance of rain:	
Estimate storm beginning:	Estimate storm duration: _____	Estimate time since last storm: _____	Rain gauge reading: _____
(date and time)	(hours)	(days or hours)	(inches)
Sampling Event Observations			
Observations: If yes identify location and observe drainage area to identify probable cause			
Odors	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Floating material	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Suspended Material	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Sheen	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Discolorations	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Turbidity	<input type="checkbox"/> Yes	<input type="checkbox"/> No	
NSWD Observations			
Was any authorized non-stormwater discharge observed?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Was any <b>unauthorized</b> non-stormwater discharge observed?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
If yes to either, identify source			
Drainage Area Observations			
Drainage Area		Deficiencies Noted	
Exception Documentation (explanation required if inspection could not be conducted).			
Inspector Information			
Inspector Name:		Inspector Title:	
Signature:		Date:	

Sampling Log		
Facility Name: South Coast Landfill		
Sampler Name:	Date:	Time Start:
Field Meter Calibration		
pH Meter ID No./Description:		
Calibration Date/Time:		
Field pH Measurements		
Discharge Location Identifier	pH	Time
Samples Collected		
Discharge Location Identifier	Constituent	Time
	Oil and Grease, TSS, COD, Fe, Al, Pb, Zn	
Additional Sampling Notes:		
Time End:		



CHAIN-OF-CUSTODY					Date:			Lab ID:			
Destination Lab:							Requested Analysis			Notes:	
	Attn:										
Address:											
Office Phone:											
Cell Phone:											
Sampled By:											
Contact:											
Facility Name: South Coast Landfill											
Client Sample ID	Sample Date	Sample Time	Sample Matrix	Container							
				#	Type	Pres.					
Sender Comments:							Relinquished By				
							Signature:				
							Print:				
							Company:				
							Date:		Time:		
Laboratory Comments:							Received By				
							Signature:				
							Print:				
							Company:				
							Date:		Time:		





## Appendix 2:

## Permit Registration Documents

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Permit Registration Documents included in this appendix

Y/N	Permit Registration Document
	Notice of Intent
	Certification
	Copy of Annual Fee Receipt
	Site Maps, see Appendix 1



**Trained Team Member Log**  
**Stormwater Management Training Log and Documentation**

**Facility Name:** South Coast Landfill  
**WDID #:** 1 231005730

Stormwater Management Topic: (check as appropriate)

- |   |   |
|---|---|
| <input type="checkbox"/> Good Housekeeping                      | <input type="checkbox"/> Preventative Maintenance               |
| <input type="checkbox"/> Spill and Leak Prevention and Response | <input type="checkbox"/> Material Handling and Waste Management |
| <input type="checkbox"/> Erosion and Sediment Controls          | <input type="checkbox"/> Quality Assurance and Record Keeping   |
| <input type="checkbox"/> Advanced BMPs                          | <input type="checkbox"/> Visual Monitoring                      |
| <input type="checkbox"/> Stormwater Sampling and Analysis       |   |

Specific Training Objective: \_\_\_\_\_

Location: \_\_\_\_\_

Date: \_\_\_\_\_

Instructor: \_\_\_\_\_

Telephone: \_\_\_\_\_

Course Length (hours): \_\_\_\_\_

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

As needed, add proof of external training (e.g., course completion certificates, credentials for QISP).



**Identification of QISP**

Facility Name:

**South Coast Landfill**

Waste Discharge Identification (WDID):

**1 23I005730**

The following are QISPs associated with this project:

Name of Personnel <sup>(1)</sup>	Company	Date
1. If additional QISPs are required, add additional lines and include information here		





SWPPP Amendment No.

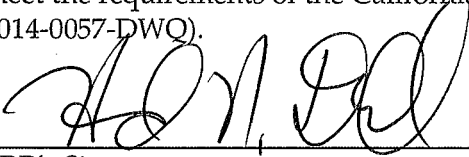
1

Project Name: South Coast Landfill and Transfer Station

WDID Number: 1 23I005730

Legally Responsible Person's Certification of the Stormwater Pollution Prevention Plan Amendment

This Stormwater Pollution Prevention Plan and attachments were prepared under my direction to meet the requirements of the California Industrial General Permit (SWRCB Order No. 2014-0057-DWQ).



LRP's Signature

Howard N. Dashiell

LRP Name

County of Mendocino

Title and Affiliation

340 Lake Mendocino Drive

Address

Ukiah, CA 95482

2/16/16

Date

Director of Transportation

LRP Title

(707) 463-4363

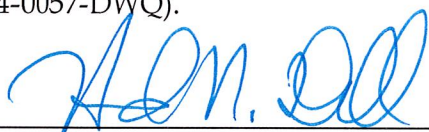
Telephone

dashiellh@co.mendocino.ca.us

Email

Project Name: South Coast Transfer StationProject Number: WDID# 1 23I005730Legally Responsible Person's Certification of the  
Stormwater Pollution Prevention Plan Amendment

This Stormwater Pollution Prevention Plan and attachments were prepared under my direction to meet the requirements of the California Industrial General Permit (SWRCB Order No. 2014-0057-DWQ).



LRP's Signature

Howard N. Dashiell

LRP Name

Mendocino Co. Transportation

Title and Affiliation

340 Lake Mendocino Dr.

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Date

Director of Transportation

LRP Title

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dashiellh@mendocinocounty.org

Email

SWPPP Amendment No. \_\_\_\_\_

Project Name: \_\_\_\_\_

Project Number: \_\_\_\_\_

Legally Responsible Person's Certification of the  
Stormwater Pollution Prevention Plan Amendment

This Stormwater Pollution Prevention Plan and attachments were prepared under my direction to meet the requirements of the California Industrial General Permit (SWRCB Order No. 2014-0057-DWQ).

\_\_\_\_\_  
LRP's Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
LRP Name

\_\_\_\_\_  
LRP Title

\_\_\_\_\_  
Title and Affiliation

\_\_\_\_\_  
Telephone

\_\_\_\_\_  
Address

\_\_\_\_\_  
Email

**Appendix 6:**

**CASQA Stormwater BMP Handbook:  
Industrial and Commercial Fact Sheets**

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## General Description

Drain inlet inserts, also known as catch basin, drop inlet or curb inlet inserts, are used to remove pollutants at the point of entry to the storm drain system. There are a multitude of inserts of various shapes and configurations including baffles, baskets, boxes, fabrics, sorbent media, screens, and skimmers. The effectiveness of drain inlet inserts depends on their design, application, loading, and frequency of maintenance to remove accumulated sediment, trash, and debris.

## Inspection/Maintenance Considerations

Routine inspection and maintenance is necessary to maintain functionality of drain inlet inserts and to prevent re-suspension and discharge of accumulated pollutants. Maintenance activities vary depending on the type of drain inlet insert being implemented; refer to the manufacturer's recommendations for more information.

## Advanced BMPs Covered



## Maintenance Concerns

- *Sediment, Trash, and Debris Accumulations*
- *Pollutant Re-suspension and Discharge*

## Targeted Constituents\*

<i>Sediment</i>	✓
<i>Nutrients</i>	✓
<i>Trash</i>	✓
<i>Metals</i>	✓
<i>Bacteria</i>	
<i>Oil and Grease</i>	✓
<i>Organics</i>	✓

\*Removal Effectiveness varies for different manufacturer designs. See New Development and Redevelopment Handbook-Section 5 for more information.



Inspection Activities	Suggested Frequency
<input type="checkbox"/> Verify that stormwater enters the unit and does not leak around the perimeter.	After construction.
<input type="checkbox"/> Inspect for sediment, trash, and debris buildup and proper functioning.	At the beginning of the wet season and after significant storms
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Remove accumulated sediment, trash, and debris. <input type="checkbox"/> Replace sorbent media.	At the beginning of the wet season and as necessary

## References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, April, 2010. <http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf>.

California Stormwater Quality Association. *Stormwater Best Management Practice Handbook, New Development and Redevelopment*, 2003. <https://www.casqa.org/resources/bmp-handbooks/new-development-redevelopment-bmp-handbook>.

Orange County Stormwater Program. Technical Guidance Document BMP Fact Sheets. [http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical\\_guidance\\_document\\_bmp\\_fact\\_sheets.asp](http://media.ocgov.com/gov/pw/watersheds/documents/wqmp/tgd/technical_guidance_document_bmp_fact_sheets.asp).

San Francisco Public Utilities Commission, et al. San Francisco Stormwater Design Guidelines. Appendix A, Stormwater BMP Fact Sheets, June, 2010. <http://www.sfwater.org/modules/showdocument.aspx?documentid=2778>.

Tahoe Regional Planning Agency. Best Management Practices Handbook, 2012. <http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf>.

U.S. Environmental Protection Agency, Post-Construction Stormwater Management in New Development and Redevelopment. BMP Fact Sheets. Available at: [http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min\\_measure&min\\_measure\\_id=5](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=min_measure&min_measure_id=5).

Ventura Countywide Stormwater Quality Management Program. *Technical Guidance Manual for Stormwater Quality Control Measures*, May, 2010. [http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document\\_5-6-10.pdf](http://www.vcstormwater.org/documents/workproducts/technicalguidancemanual/2010revisions/Ventura%20Technical%20Guidance%20Document_5-6-10.pdf).

# Spill Prevention, Control & Cleanup SC-11

## Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental spills. Preparation for accidental spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify hazardous material storage areas, specify material handling procedures, describe spill response procedures, and provide locations of spill clean-up equipment and materials. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills. An adequate supply of spill clean-up materials must be maintained onsite.

## Approach

### General Pollution Prevention Protocols

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems.
- ☐ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ Establish procedures and/or controls to minimize spills and leaks. The procedures should address:
  - ✓ Description of the facility, owner and address, activities, chemicals, and quantities present;

### Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

### Targeted Constituents

Sediment

Nutrients

Trash

Metals ✓

Bacteria

Oil and Grease ✓

Organics ✓

### Minimum BMPs Covered

-  Good Housekeeping
-  Preventative Maintenance
-  Spill and Leak Prevention and Response ✓
-  Material Handling & Waste Management
-  Erosion and Sediment Controls
-  Employee Training Program ✓
-  Quality Assurance Record Keeping ✓





# Spill Prevention, Control & Cleanup SC-11

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- ✓ Facility map of the locations of industrial materials;
  - ✓ Notification and evacuation procedures;
  - ✓ Cleanup instructions;
  - ✓ Identification of responsible departments; and
  - ✓ Identify key spill response personnel.
- ☐ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.



## ***Spill and Leak Prevention and Response***

### ***Spill Prevention***

- ☐ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ☐ If illegal dumping is observed at the facility:
- ✓ Post “No Dumping” signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
  - ✓ Landscaping and beautification efforts may also discourage illegal dumping.
  - ✓ Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.
- ☐ Store and contain liquid materials in such a manner that if the container is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.
- ☐ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collect runoff from the storage tank area.



### ***Preventative Maintenance***

- ☐ Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

# **Spill Prevention, Control & Cleanup SC-11**

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- ❑ Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain*.
- ❑ Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.
- ❑ Label all containers according to their contents (e.g., solvent, gasoline).
- ❑ Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- ❑ Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- ❑ Identify key spill response personnel.

## *Spill Response*

- ❑ Clean up leaks and spills immediately.
- ❑ Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- ❑ On paved surfaces, clean up spills with as little water as possible.
  - ✓ Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills.
  - ✓ If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.
  - ✓ If possible use physical methods for the cleanup of dry chemicals (e.g., brooms, shovels, sweepers, or vacuums).
- ❑ Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- ❑ Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- ❑ For larger spills, a private spill cleanup company or Hazmat team may be necessary.

# **Spill Prevention, Control & Cleanup SC-11**

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## *Reporting*

- ❑ Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board or local authority as location regulations dictate.
- ❑ Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- ❑ Report spills to 911 for dispatch and clean-up assistance when needed. Do not contact fire agencies directly.
- ❑ Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills);
  - ✓ Clean-up procedures; and
  - ✓ Responsible parties.



## ***Employee Training Program***

- ❑ Educate employees about spill prevention and cleanup.
- ❑ Well-trained employees can reduce human errors that lead to accidental releases or spills:
  - ✓ The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur; and
  - ✓ Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.
- ❑ Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.
- ❑ Train employees to recognize and report illegal dumping incidents.

# Spill Prevention, Control & Cleanup SC-11

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## ***Other Considerations (Limitations and Regulations)***

- ❑ State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).
- ❑ State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.
- ❑ Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

## **Requirements**

### ***Costs (including capital and operation & maintenance)***

- ❑ Will vary depending on the size of the facility and the necessary controls.
- ❑ Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

### ***Maintenance (including administrative and staffing)***

- ❑ Develop spill prevention and control plan, provide and document training, conduct inspections of material storage areas, and supply spill kits.
- ❑ Extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

## **Supplemental Information**

### ***Further Detail of the BMP***

#### ***Reporting***

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- ❑ Date and time of the incident;
- ❑ Weather conditions;
- ❑ Duration of the spill/leak/discharge;

## **Spill Prevention, Control & Cleanup SC-11**

- ☐ Cause of the spill/leak/discharge;
- ☐ Response procedures implemented;
- ☐ Persons notified; and
- ☐ Environmental problems associated with the spill/leak/discharge.

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- ☐ Date and time the inspection was performed;
- ☐ Name of the inspector;
- ☐ Items inspected;
- ☐ Problems noted;
- ☐ Corrective action required; and
- ☐ Date corrective action was taken.

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

### *Aboveground Tank Leak and Spill Control*

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- ☐ Installation problems;
- ☐ Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- ☐ External corrosion and structural failure;
- ☐ Spills and overfills due to operator error; and
- ☐ Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

# **Spill Prevention, Control & Cleanup SC-11**

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Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- ❑ Tanks should be placed in a designated area.
- ❑ Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- ❑ Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- ❑ Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- ❑ For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- ❑ All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- ❑ Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- ❑ Check for external corrosion and structural failure.
- ❑ Check for spills and overfills due to operator error.
- ❑ Check for failure of piping system (pipes, pumps, flanges, coupling, hoses, and valves).
- ❑ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- ❑ Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
- ❑ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- ❑ Frequently relocate accumulated stormwater during the wet season.

# Spill Prevention, Control & Cleanup SC-11

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- Periodically conduct integrity testing by a qualified professional.

## *Vehicle Leak and Spill Control*

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

## *Vehicle and Equipment Maintenance*

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.
- Regularly inspect vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Immediately drain all fluids from wrecked vehicles.
- Store wrecked vehicles or damaged equipment under cover.
- Place drip pans or absorbent materials under heavy equipment when not in use.
- Use absorbent materials on small spills rather than hosing down the spill.
- Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

# **Spill Prevention, Control & Cleanup SC-11**

## *Vehicle and Equipment Fueling*

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:

Cover fueling area if possible.

Use a perimeter drain or slope pavement inward with drainage to a sump.

Pave fueling area with concrete rather than asphalt.

- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage “topping-off” of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use absorbent materials on small spills and general cleaning rather than hosing down the area. Remove the absorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

## ***Industrial Spill Prevention Response***

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities.

The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department).
- Develop procedures to prevent/mitigate spills to storm drain systems.
- Identify responsible departments.



# **Spill Prevention, Control & Cleanup SC-11**

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- ❑ Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.
- ❑ Address spills at municipal facilities, as well as public areas.
- ❑ Provide training concerning spill prevention, response and cleanup to all appropriate personnel.

## **References and Resources**

California's Nonpoint Source Program Plan. <http://www.swrcb.ca.gov/nps/index.html>.

Clark County Storm Water Pollution Control Manual. Available online at:  
<http://www.co.clark.wa.us/pubworks/bmpman.pdf>.

King County Storm Water Pollution Control Manual. Available online at:  
<http://dnr.metrokc.gov/wlr/dss/spcm.htm>.

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at:  
<http://ocwatersheds.com/documents/bmp/industrialcommercialbusinessesactivities>

Santa Clara Valley Urban Runoff Pollution Prevention Program.  
<http://www.scvurppp.org>.

The Stormwater Managers Resource Center. <http://www.stormwatercenter.net/>.

# Vehicle and Equipment Fueling SC-20

## Description

Spills and leaks that occur during vehicle and equipment fueling can contribute hydrocarbons, oil and grease, as well as heavy metals, to stormwater runoff. Implementing the following management practices can help prevent fuel spills and leaks.

## Approach

- Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## General Pollution Prevention Protocols

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.



## Good Housekeeping

- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.
- Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- Post signs at sinks to remind employees not to pour wastes down drains.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

## Minimum BMPs Covered

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	✓
 Erosion and Sediment Controls	
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



# Vehicle and Equipment Fueling SC-20

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- ❑ Clean yard storm drain inlets(s) regularly and especially after large storms.
- ❑ Do not pour materials down storm drains.
- ❑ Build a shed or temporary roof over fueling area to limit exposure to rain.
- ❑ Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.
- ❑ Report leaking vehicles to fleet maintenance.
- ❑ Ensure the following safeguards are in place:
  - ✓ Overflow protection devices on tank systems to warn the operator or automatically shut down transfer pumps when the tank reaches full capacity.
  - ✓ Protective guards around tanks and piping to prevent vehicle or forklift damage.
  - ✓ Clear tagging or labeling of all valves to reduce human error.
  - ✓ Emergency shut-off and emergency phone number.



## ***Preventative Maintenance***

### ***Fuel Dispensing Areas***

- ❑ Inspect vehicles and equipment for leaks regularly and repair immediately.
- ❑ Sweep the fueling area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.
- ❑ Fit underground storage tanks with spill containment and overfill prevention systems meeting the requirements of Section 2635(b) of Title 23 of the California Code of Regulations.
- ❑ Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- ❑ Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- ❑ Design fueling area to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump; regularly remove materials accumulated in sump.
- ❑ Pave area with concrete rather than asphalt.

# Vehicle and Equipment Fueling SC-20

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- ❑ Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area. Where covering is not feasible and the fuel island is surrounded by pavement, apply a suitable sealant that protects the asphalt from spilled fuels.
- ❑ Install vapor recovery nozzles to help control drips as well as air pollution.
- ❑ Use secondary containment when transferring fuel from the tank truck to the fuel tank. Cover storm drains in the vicinity during transfer.

## *Air/Water Supply Area*

- ❑ Minimize the possibility of stormwater pollution from air/water supply areas by doing at least one of the following:
  - ✓ Spot clean leaks and drips routinely to prevent runoff of spillage.
  - ✓ Grade and pave the air/water supply area to prevent run-on of stormwater.
  - ✓ Install a roof over the air/water supply area.
  - ✓ Install a low containment berm around the air/water supply area.

## *Inspection*

- ❑ Aboveground Tank Leak and Spill Control:
  - ✓ Check for external corrosion and structural failure.
  - ✓ Check for spills and overfills due to operator error.
  - ✓ Check for failure of piping system.
  - ✓ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
  - ✓ Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.
  - ✓ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
  - ✓ Conduct integrity testing periodically by a qualified professional.
- ❑ Inspect and clean, if necessary, storm drain inlets and catch basins within the facility boundary before October 1 each year.

# Vehicle and Equipment Fueling SC-20

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## ***Spill Response and Prevention Procedures***

- ❑ Keep your spill prevention and control plan up-to-date.
- ❑ Maintain an adequate stockpile of spill cleanup materials at locations where it will be readily accessible.
- ❑ Clean leaks, drips, and other spills with as little water as possible.
  - ✓ Use rags for small spills,
  - ✓ Use a damp mop for general cleanup,
  - ✓ Use dry absorbent material for larger spills.
- ❑ Use the following three-step method for cleaning floors:
  - ✓ Clean spills with rags or other absorbent materials
  - ✓ Sweep floor using dry absorbent material
  - ✓ Mop the floor. Mop water may be discharged to the sanitary sewer via a toilet or sink.
- ❑ Remove the adsorbent materials promptly and dispose of properly when using absorbent materials on small spills.
- ❑ Store portable absorbent booms (long flexible shafts or barriers made of absorbent material) in unbermed fueling areas.
- ❑ Report spills promptly.
- ❑ If a dead-end sump is not used to collect spills, install an oil/water separator.



## ***Material Handling and Waste Management***

- ❑ Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ❑ Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the sanitary sewer.
- ❑ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ❑ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.

# Vehicle and Equipment Fueling SC-20

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- ❑ Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- ❑ Post “no littering” signs.



## ***Employee Training Program***

- ❑ Educate employees about facility-wide pollution prevention measures and goals.
- ❑ Train designated employees (e.g., those involved with the handling or management of fuels) on proper fueling and cleanup procedures.
- ❑ Train designated employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Make sure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- ❑ Ensure that employees are familiar with the site’s spill control plan and/or proper spill cleanup procedures.
- ❑ Use a training log or similar method to document training. The training log should include entries for:
  - ✓ Training topic,
  - ✓ Trainer,
  - ✓ Attendees,
  - ✓ Frequency,
  - ✓ Comments,
  - ✓ Target date for completion of training, and
  - ✓ Date completed.

# Vehicle and Equipment Fueling SC-20

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## **Quality Assurance and Record Keeping**

- ❑ Keep accurate maintenance logs that document minimum BMP activities performed for vehicle and equipment fueling, quantities of materials removed, and improvement actions.
- ❑ Keep accurate logs of spill response actions that document what types of liquids were spilled, how it was cleaned up, and how the waste was disposed.
- ❑ Establish procedures to complete logs and file them in the central office.

## **Potential Capital Facility Costs and Operation & Maintenance Requirements**

### ***Facilities***

- ❑ The retrofitting of existing fueling areas to minimize stormwater exposure or spill runoff can be expensive. Good design must occur during the initial installation. Extruded curb along the “upstream” side of the fueling area to prevent stormwater run-on is of modest cost.
- ❑ Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### ***Maintenance***

- ❑ Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- ❑ For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- ❑ Routine cleanout of sumps and oil/water separators is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the system. Sediment removal is also required on a regular basis to keep the device working efficiently.

## **Supplemental Information**

### ***Designing New Installations***

The elements listed below should be included in the design and construction of new or substantially remodeled facilities.

### ***Fuel Dispensing Areas***

- ❑ Fuel dispensing areas must be paved with Portland cement concrete (or, equivalent smooth impervious surface), with a 2 to 4% slope to prevent ponding, and must be

# Vehicle and Equipment Fueling SC-20

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separated from the rest of the site by a grade break that prevents run-on of stormwater to the extent practicable. The fuel dispensing area is defined as extending 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 foot, whichever is less. The paving around the fuel dispensing area may exceed the minimum dimensions of the "fuel dispensing area" stated above.

- ❑ The fuel dispensing area must be covered, and the cover's minimum dimensions must be equal to or greater than the area within the grade break or the fuel dispensing area, as defined above. The cover must not drain onto the fuel dispensing area.
- ❑ If necessary, install and maintain an oil control device in the appropriate catch basin(s) to treat runoff from the fueling area.

## *Outdoor Waste Receptacle Area*

- ❑ Grade and pave the outdoor waste receptacle area to prevent run-on of stormwater to the extent practicable.

## *Air/Water Supply Area*

- ❑ Grade and pave the air/water supply area to prevent run-on of stormwater to the extent practicable.

## *Designated Fueling Area*

- ❑ If your facility has large numbers of mobile equipment working throughout the site and you currently fuel them with a mobile fuel truck, consider establishing a designated fueling area. With the exception of tracked equipment such as bulldozers and perhaps small forklifts, most vehicles should be able to travel to a designated area with little lost time. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs it is prevented from entering the storm drain.

## **Examples**

The Spill Prevention Control and Countermeasure (SPCC) Plan, which is required by law for some facilities, is an effective program to reduce the number of accidental spills and minimize contamination of stormwater runoff.

The City of Palo Alto has an effective program for commercial vehicle service facilities. Many of the program's elements, including specific BMP guidance and lists of equipment suppliers, are also applicable to industrial facilities.

## **References and Resources**

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at:

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# Vehicle and Equipment Repair SC-22

## Description

Vehicle or equipment maintenance and repair are potentially significant sources of stormwater pollution, due to use of harmful materials and wastes during maintenance and repair processes. Engine repair and service (e.g., parts cleaning), replacement of fluids (e.g., oil change), and outdoor equipment storage and parking (leaking vehicles) can impact water quality if stormwater runoff from areas with these activities becomes polluted by a variety of contaminants. Implementation of the following activities must be done where applicable to prevent or reduce the discharge of pollutants to stormwater from vehicle and equipment maintenance and repair activities.

## Approach

The BMP approach is to reduce the potential for pollutant discharges through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives. General pollution prevention protocols are presented followed by applicable minimum BMPs as required by the Industrial General Permit.

### General Pollution Prevention Protocols

- ☐ Designate a vehicle maintenance area designed to prevent stormwater pollution.
- ☐ Minimize contact of stormwater with outside operations through berming and appropriate drainage routing.
- ☐ Keep accurate maintenance logs to evaluate materials removed and improvements made.
- ☐ Switch to non-toxic chemicals for maintenance when possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Use drop cloths and drip pans.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment

Nutrients

Trash

Metals ✓

Bacteria

Oil and Grease ✓

Organics ✓

## Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	✓
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	✓
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



# Vehicle and Equipment Repair SC-22

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- ☐ Minimize use of solvents. Clean parts without using solvents whenever possible, or use water-based solvents for cleaning.
- ☐ Recycle used motor oil, diesel oil, and other vehicle fluids and parts whenever possible.

## ***Operational Protocols***

### *General*

- ☐ Move maintenance and repair activities indoors whenever feasible.
- ☐ Place curbs around the immediate boundaries of process equipment.



### ***Good Housekeeping***

- ☐ Store idle equipment under cover
- ☐ Use a vehicle maintenance area designed to prevent stormwater pollution - minimize contact of stormwater with outside operations through berming and appropriate drainage routing.
- ☐ Avoid hosing down your work areas. If work areas are washed, collect and direct wash water to sanitary sewer. Use dry sweeping if possible.
- ☐ Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- ☐ Post signs at sinks to remind employees not to pour wastes down drains.
- ☐ Clean yard storm drain inlets(s) regularly and especially after large storms.
- ☐ Do not pour materials down storm drains.
- ☐ Cover the work area to limit exposure to rain.
- ☐ Place curbs around the immediate boundaries of process equipment.
- ☐ Build a shed or temporary roof over areas where parked cars await repair or salvage, especially wrecked vehicles. Build a roof over vehicles kept for parts.



### ***Preventive Maintenance and Repair Activities***

- ☐ Provide a designated area for vehicle maintenance.
- ☐ Inspect vehicles and equipment for leaks regularly and repair immediately.
- ☐ Make sure incoming vehicles are checked for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site without correcting the source of the leak and cleaning up any spill.
- ☐ Keep equipment clean; don't allow excessive build-up of oil and grease.

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- ❑ Perform all vehicle fluid removal or changing inside or under cover if possible to prevent the run-on of stormwater and the runoff of spills.
- ❑ Use a tarp, ground cloth, or drip pans beneath the vehicle or equipment to capture all spills and drips if temporary work is being conducted outside. Collected drips and spills must be disposed, reused, or recycled properly.
- ❑ It is important to sweep the maintenance area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.
- ❑ Establish standard procedures to prevent spillage/leakage of fluids including:
  - ✓ Keep a drip pan under the vehicle while you unclip hoses, unscrew filters, or remove other parts. Use a drip pan under any vehicle that might leak while working on it to keep splatters or drips off the shop floor.
  - ✓ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
  - ✓ Keep drip pans or containers under vehicles or equipment that may drip during repairs.
  - ✓ Do not change motor oil or perform equipment maintenance in non-appropriate areas.
- ❑ Drain oil and other fluids first if the vehicle or equipment is to be stored outdoors. Elevate and tarp stored vehicles and equipment.
- ❑ Monitor parked vehicles closely for leaks. Pans should be placed under any leaks to collect the fluids for proper disposal or recycling.
- ❑ Mechanics should clean vehicle parts without using liquid cleaners wherever possible to reduce waste.
- ❑ Steam cleaning and pressure washing may be used instead of solvent parts cleaning. The wastewater generated from steam cleaning must be discharged to an on-site oil water separator that is connected to a sanitary sewer or blind sump. Non-caustic detergents should be used instead of caustic cleaning agents, detergent-based or water-based cleaning systems in place of organic solvent degreasers, and non-chlorinated solvent in place of chlorinated organic solvents for parts cleaning. Refer to SC21 for more information on steam cleaning.
- ❑ Fifth-wheel bearings on trucks require routine lubrication. Typically chassis grease is applied to the fifth-wheel bearing at rates that result in grease dripping off of the bearing into the environment. To address this concern the following options are available:
  - ✓ Use specialized lubricants with good adhesion (e.g., stay in place) properties. Carefully follow manufacturer's label regarding the use of adhesive lubricant for

# Vehicle and Equipment Repair SC-22

truck fifth-wheels. Typically this means applying no more than 8 oz. of grease. No visible extrusion of lubricant from the fifth-wheel bearing when truck and trailer are connected should be present.

- ✓ Use on-board truck or on-board trailer automatic lubrication systems. If these systems apply lube thinner than National Grease Lubrication Institute #2, equipment for collection of used lubricant is needed to prevent excess lubricant from dripping off the truck.
- ✓ Use plastic or Teflon plates instead of grease or other lubricants. Carefully follow manufacturer's instructions for installation and operation.
- Use one of the following for lubricating vehicle-trailer coupling:
  - ✓ Specialized adhesive lubricants;
  - ✓ Grease-free fifth wheel slip plates (e.g., plastic or Teflon coatings); and
  - ✓ On-Board automatic lubricating systems.



## ***Spill and Leak Prevention and Response Procedures***

- Keep your spill prevention and control plan up-to-date.
- Place an adequate stockpile of spill cleanup materials where it will be readily accessible.
- Clean leaks, drips, and other spills with as little water as possible. Use rags for small spills, a damp mop for general cleanup, and dry absorbent material for larger spills. Use the following three-step method for cleaning floors:
  - ✓ Clean spills with rags or other absorbent materials;
  - ✓ Sweep floor using dry absorbent material; and
  - ✓ Mop the floor.

Mop water may be discharged to the sanitary sewer via a toilet or sink.

- Remove the adsorbent materials promptly and dispose of properly when using adsorbent materials on small spills.



## ***Material Handling and Waste Management***

- Designate a special area to drain and replace motor oil, coolant, and other fluids, where there are no connections to the storm drain or the sanitary sewer, and drips and spills can be easily cleaned up.
- Drain all fluids immediately from wrecked vehicles. Ensure that the drain pan or drip pan is large enough to contain drained fluids (e.g., larger pans are needed to contain antifreeze, which may gush from some vehicles).

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- ❑ Do not pour liquid waste to floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ❑ Do not put used or leftover cleaning solutions, solvents, and automotive fluids and in the sanitary sewer.
- ❑ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ❑ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- ❑ Place oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal since municipalities prohibit or discourage disposal of these items in solid waste facilities.
- ❑ Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters. Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater.
- ❑ Store cracked batteries in a non-leaking secondary container and dispose of properly at recycling or household hazardous waste facilities.



## ***Employee Training Program***

- ❑ Train employees and contractors in the proper handling and disposal of engine fluids and waste materials.
- ❑ Employees should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- ❑ Conduct annual training to ensure that employees are familiar with the facility's spill control plan and/or proper spill cleanup procedures (You can use reusable cloth rags to clean up small drips and spills instead of disposables; these can be washed by a permitted industrial laundry. Do not clean them at home or at a coin-operated laundry business).
- ❑ Use a training log or similar method to document training.



## ***Quality Assurance and Recordkeeping***

- ❑ Keep accurate maintenance logs to evaluate materials removed and improvements made.
- ❑ Establish procedures to collect and file maintenance logs in the central office.

# Vehicle and Equipment Repair SC-22

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## ***Other Facility-Specific Considerations***

### ***Parts Cleaning***

Vehicle and equipment maintenance facilities often must clean parts as a part of day-to-day operations. The following activities should be considered:

- ❑ Clean vehicle parts without using liquid cleaners wherever possible to reduce waste.
- ❑ Steam cleaning and pressure washing may be used instead of solvent parts cleaning.
- ❑ Wastewater generated from steam cleaning must be discharged to an on-site oil water separator that is connected to a sanitary sewer or blind sump.
- ❑ Use non-caustic detergents instead of caustic cleaning agents, detergent-based or water-based cleaning systems in place of organic solvent degreasers, and non-chlorinated solvent in place of chlorinated organic solvents for parts cleaning. Refer to SC21 for more information on steam cleaning.

### ***Potential Limitations and Work-Arounds***

- ❑ Some facilities may have space constraints and time limitations that may preclude all work from being conducted indoors.
  - ✓ Designate specific areas for outdoor activities.
  - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
- ❑ It may not be possible to contain and clean up spills from vehicles/equipment brought on-site after working hours.
  - ✓ Provide a designated area for afterhours deliveries.
  - ✓ Install spill kits.
- ❑ Drain pans (usually 1 ft. x 1 ft.) are generally too small to contain antifreeze
  - ✓ Purchase or fabricate large drip pans (3 ft. x 3 ft.) with sufficient volume to contain expected quantities of liquids based on equipment/vehicle specifications.
- ❑ Dry floor cleaning methods may not be sufficient for some spills.
  - ✓ Use three-step method instead.
- ❑ Identification of engine leaks may require some use of solvents.
  - ✓ Minimize the use of solvents and use drip pans to collect spills and leaks.
- ❑ Prices for recycled materials and fluids may be higher than those of non-recycled materials.



# Vehicle and Equipment Repair SC-22

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- ❑ Some facilities may be limited by a lack of providers of recycled materials, and by the absence of businesses to provide services such as hazardous waste removal, structural treatment practice maintenance, or solvent equipment and solvent recycling.

## Potential Facilities and Maintenance Requirements

### *Facilities Requirements*

- ❑ For facilities that already have covered areas where maintenance takes place, have berms or other means to retain spills and leaks, and/ have other appropriate constructed systems for containment, there may not need to be any significant new capital investment. Capital costs will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.



### *Maintenance Requirements*

- ❑ Most of the operations and maintenance activity associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore, significant additional operations and maintenance efforts are not likely to be required.
- ❑ For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration. Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.
- ❑ It is important to sweep the maintenance area weekly, if it is paved, to collect loose particles, and wipe up spills with rags and other absorbent material immediately. Do not hose down the area to a storm drain.

## Supplemental Information

### *Waste Reduction*

Parts are often cleaned using solvents such as trichloroethylene, 1,1,1-trichloroethane or methylene chloride. Many of these cleaners are harmful and must be disposed of as a hazardous waste. Cleaning without using liquid cleaners (e.g., wire brush) whenever possible reduces waste. Prevent spills and drips of solvents and cleansers to the shop floor. Do all liquid cleaning at a centralized station so the solvents and residues stay in one area. Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents.

- ❑ Clean parts without using liquid cleaners whenever possible to reduce waste.
- ❑ Prevent spills and drips of solvents and cleansers to the shop floor.



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- ☐ Do all liquid cleaning at a centralized station so the solvents and residues stay in one area.
- ☐ Locate drip pans, drain boards, and drying racks to direct drips back into a solvent sink or fluid holding tank for reuse.

## ***Recycling***

Separating wastes allows for easier recycling and may reduce treatment costs. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents (e.g., 1,1,1-trichloroethane) separate from non-chlorinated solvents (e.g., kerosene and mineral spirits).

Many products made of recycled (i.e., refined or purified) materials are available. Engine oil, transmission fluid, antifreeze, and hydraulic fluid are available in recycled form. Buying recycled products supports the market for recycled materials.

- ☐ Recycling is always preferable to disposal of unwanted materials.
- ☐ Separate wastes for easier recycling. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents separate from non-chlorinated solvents.
- ☐ Label and track the recycling of waste material (e.g., used oil, spent solvents, batteries).
- ☐ Purchase recycled products to support the market for recycled materials.

## ***Safer Alternatives***

If possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous material:

- ☐ Use non-caustic detergents instead of caustic cleaning for parts cleaning.
- ☐ Use detergent-based or water-based cleaning systems in place of organic solvent degreasers. Wash water may require treatment before it can be discharged to the sewer.
- ☐ Replace chlorinated organic solvents with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents.
- ☐ Choose cleaning agents that can be recycled.

## **References and Resources**

Orange County Stormwater Program, Best Management Practices for Industrial/Commercial Business Activities. Available online at:  
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## Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by wind, stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## General Pollution Prevention Protocols

- ☐ Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- ☐ Limit exposure of material to rainfall whenever possible.
- ☐ Prevent stormwater run-on.
- ☐ Check equipment regularly for leaks.



## Good Housekeeping

- ☐ Develop an operations plan that describes procedures for loading and/or unloading.
- ☐ Conduct loading and unloading in dry weather if possible.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

<i>Sediment</i>	✓
<i>Nutrients</i>	✓
<i>Trash</i>	
<i>Metals</i>	✓
<i>Bacteria</i>	
<i>Oil and Grease</i>	✓
<i>Organics</i>	✓

## Minimum BMPs Covered

	<i>Good Housekeeping</i>	✓
	<i>Preventative Maintenance</i>	
	<i>Spill and Leak Prevention and Response</i>	✓
	<i>Material Handling &amp; Waste Management</i>	✓
	<i>Erosion and Sediment Controls</i>	
	<i>Employee Training Program</i>	✓
	<i>Quality Assurance Record Keeping</i>	✓



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- ❑ Cover designated loading/unloading areas to reduce exposure of materials to rain.
- ❑ Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- ❑ Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- ❑ Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- ❑ Load/unload only at designated loading areas.
- ❑ Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- ❑ Pave loading areas with concrete instead of asphalt.
- ❑ Avoid placing storm drains inlets in the area.
- ❑ Grade and/or berm the loading/unloading area with drainage to sump; regularly remove materials accumulated in sump.



## ***Spill Response and Prevention Procedures***

- ❑ Keep your spill prevention and control plan up-to-date or have an emergency spill cleanup plan readily available, as applicable.
- ❑ Contain leaks during transfer.
- ❑ Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all employees.
- ❑ Ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- ❑ Use drip pans or comparable devices when transferring oils, solvents, and paints.



## ***Material Handling and Waste Management***

- ❑ Spot clean leaks and drips routinely to prevent runoff of spillage.
- ❑ Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.

- ☐ Do not put used or leftover cleaning solutions, solvents, and automotive fluids in the storm drain or sanitary sewer.
- ☐ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ☐ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- ☐ Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.
  - ✓ Install a low containment berm around the waste receptacle area.
  - ✓ Use and maintain drip pans under waste receptacles.
- ☐ Post “no littering” signs.
- ☐ Perform work area clean-up and dry sweep after daily operations.



## ***Employee Training Program***

- ☐ Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- ☐ Have employees trained in spill containment and cleanup present during loading/unloading.
- ☐ Train employees in proper handling techniques during liquid transfers to avoid spills.
- ☐ Make sure forklift operators are properly trained on loading and unloading procedures.



## ***Quality Assurance and Record Keeping***

- ☐ Keep accurate maintenance logs that document activities performed, quantities of materials removed, and improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.
- ☐ Keep accurate logs of daily clean-up operations.

## Potential Limitations and Work-Arounds

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds.”

- ❑ Space and time limitations may preclude all transfers from being performed indoors or under cover.
  - ✓ Designate specific areas for outdoor loading and unloading.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.
- ❑ It may not be possible to conduct transfers only during dry weather.
  - ✓ Limit materials and equipment rainfall exposure to all extents practicable.
  - ✓ Require employees to understand and follow spill and leak prevention BMPs.

## Potential Capital Facility Costs and Operation & Maintenance Requirements

### *Facilities*

Many facilities will already have indoor or covered areas where loading/unloading takes place and will require no additional capital expenditures.

If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.

Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### *Maintenance*

Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.

- ❑ Conduct regular inspections and make repairs and improvements as necessary.
- ❑ Check loading and unloading equipment regularly for leaks.
- ❑ Conduct regular broom dry-sweeping of area. Do not wash with water.

## Supplemental Information

### *Loading and Unloading of Liquids*

- ❑ Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer,

treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - ✓ The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - ✓ The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.
  - ✓ The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.
- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:
  - ✓ Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.
  - ✓ Drip pan systems should be installed between the rails to collect spillage from tank cars.

## References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook BMP 26 Fueling and Liquid Loading/Unloading Operations*. Available online at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=10557>.

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<http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm>.

# Outdoor Liquid Container Storage SC-31

## Description

Accidental releases of materials from above ground liquid storage tanks, drums, and dumpsters present the potential for contaminating stormwater with many different pollutants. Tanks may store many potential stormwater runoff pollutants, such as gasoline, aviation gas, diesel fuel, kerosene, oils, greases, lubricants and other distilled, blended and refined products derived from crude petroleum. Materials spilled, leaked, or lost from storage tanks may accumulate in soils or on other surfaces and be carried away by rainfall runoff. These source controls apply to containers located outside of a building used to temporarily store liquid materials and include installing safeguards against accidental releases, installing secondary containment, conducting regular inspections, and training employees in standard operating procedures and spill cleanup techniques.

## Approach

### General Pollution Prevention Protocols

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.
- ☐ Try to keep chemicals in their original containers, and keep them well labeled.
- ☐ Develop an operations plan that describes procedures for loading and/or unloading. Refer to SC-30 Outdoor Loading/Unloading of Materials for more detailed BMP information pertaining to loading and unloading of liquids.
- ☐ Protect materials from rainfall, run-on, runoff, and wind dispersal:
  - ✓ Cover the storage area with a roof.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

## Minimum BMPs Covered

	Good Housekeeping	
	Preventative Maintenance	✓
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	✓
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



# Outdoor Liquid Container Storage SC-31

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- ✓ Minimize stormwater run-on by enclosing the area or building a berm around it.
- ✓ Use a walled structure for storage of liquid containers.
- ✓ Use only watertight containers and keep the lids closed.
- Employ safeguards against accidental releases:
  - ✓ Provide overflow protection devices to warn operator or automatic shutdown transfer pumps.
  - ✓ Provide protection guards (bollards) around tanks and piping to prevent damage from a vehicle or forklift.
  - ✓ Provide clear tagging or labeling, and restrict access to valves to reduce human error.
  - ✓ Berm or surround tank or container with secondary containment system, including dikes, liners, vaults, or double walled tanks.
  - ✓ Be aware and ready to address the fact that some municipalities require secondary containment areas to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
  - ✓ Contact the appropriate regulatory agency regarding environmental compliance for facilities with “spill ponds” designed to intercept, treat, and/or divert spills.
  - ✓ Have registered and specifically trained professional engineers identify and correct potential problems such as loose fittings, poor welding, and improper or poorly fitted gaskets for newly installed tank systems.
- Use MSDSs to ID hazardous components and keep incompatible products apart and to list/have available appropriate PPE and clean-up products.



## **Good Housekeeping**

- Provide storage tank piping located below product level with a shut-off valve at the tank; ideally this valve should be an automatic shear valve with the shut-off located inside the tank.
- Provide barriers such as posts or guardrails, where tanks are exposed, to prevent collision damage with vehicles.
- Provide secure storage to prevent vandalism-caused contamination.
- Place tight-fitting lids on containers.

# Outdoor Liquid Container Storage SC-31

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- ❑ Enclose or cover the containers where they are stored.
- ❑ Raise the containers off the ground by use of pallet or similar method, with provisions for spill control.
- ❑ Do not store liquid containers near the storm drainage system or surface waters.
- ❑ Sweep and clean the storage area regularly if it is paved, do not hose down the area to a storm drain.



## ***Preventative Maintenance***

- ❑ Inspect storage areas regularly for leaks or spills.
- ❑ Conduct routine inspections and check for external corrosion of material containers. Also check for structural failure, spills and overfills due to operator error, failure of piping system.
- ❑ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- ❑ Visually inspect new tank or container installations for loose fittings, poor welding, and improper or poorly fitted gaskets.
- ❑ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- ❑ Replace containers that are leaking, corroded, or otherwise deteriorating with ones in good condition. If the liquid chemicals are corrosive, containers made of compatible materials must be used instead of metal drums.
- ❑ New or secondary containers must be labeled with the product name and hazards.



## ***Spill Response and Prevention Procedures***

- ❑ Keep your spill prevention and control plan up-to-date.
- ❑ Maintain an adequate stockpile of spill cleanup materials at locations where it will be readily accessible.
- ❑ Have an emergency plan, equipment, and trained personnel ready at all times to deal immediately with major spills.
- ❑ Collect spilled liquids and properly dispose of them.
- ❑ Remove the adsorbent materials promptly and dispose of properly when using adsorbent materials on small spills.
- ❑ Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.

# Outdoor Liquid Container Storage **SC-31**

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- ❑ Prevent operator errors by using engineering safeguards and thus reducing accidental releases of pollutants.



## ***Material Handling and Waste Management***

- ❑ Contain the material in such a manner that if the container leaks or spills, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters or groundwater.
- ❑ Place drip pans or absorbent materials beneath mounted container taps, and at potential drip and spill locations during filling and unloading of containers. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- ❑ Ensure that any underground or aboveground storage tanks are designed and managed in accordance with applicable regulations, identified as a potential pollution source, and have secondary containment such as a berm or dike with an impervious surface.
- ❑ Do not pour liquids into floor drains, sinks, outdoor storm drain inlets, or other storm drains or sewer connections.
- ❑ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ❑ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.



## ***Employee Training Program***

- ❑ Train employee (e.g., fork lift operators) and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.
- ❑ Train employees in proper spill response and prevention, materials handling, and waste management.
- ❑ Use a training log or similar method to document training.



## ***Quality Assurance and Record Keeping***

- ❑ Keep accurate maintenance/inspection logs that document minimum BMP activities performed for liquid container storage and improvement actions.
- ❑ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ❑ Establish procedures to complete logs and file them in the central office.

## **Other Facility-Specific Considerations**

- ❑ Storage sheds often must meet building and fire code requirements.

# Outdoor Liquid Container Storage SC-31

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- ❑ The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.
- ❑ All specific standards set by Federal and State laws concerning the storage of oil and hazardous materials must be met.
- ❑ Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code.
- ❑ Storage of oil and hazardous materials must meet specific Federal and State standards including:
  - ✓ Spill Prevention Control and Countermeasure Plan (SPCC) Plan;
  - ✓ Secondary containment;
  - ✓ Integrity and leak detection monitoring; and
  - ✓ Emergency preparedness plans.

## Potential Capital Facility Costs and Operation & Maintenance Requirements

### *Facilities*

- ❑ Capital investments such as sheds, covers, dikes, and curbs will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### *Maintenance*

- ❑ Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- ❑ Conduct regular inspections and make repairs and improvements as necessary.
- ❑ Conduct regular broom dry-sweeping of area. Do not wash with water.

## Supplemental Information

The most common causes of unintentional releases are:

- ❑ Installation problems;
- ❑ Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves);
- ❑ External corrosion and structural failure;
- ❑ Spills and overfills due to operator error; and
- ❑ Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa.

# Outdoor Liquid Container Storage SC-31

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## ***Aboveground Tank Leak and Spill Control***

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- ❑ Tanks should be placed in a designated area.
- ❑ Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- ❑ Designated areas should be paved with Portland cement concrete, free of cracks and gaps, and impervious in order to contain leaks and spills.
- ❑ Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10% of the volume of the containers or 110% of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- ❑ For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- ❑ Other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- ❑ Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine weekly inspections and:

- ❑ Check for external corrosion and structural failure.
- ❑ Check for spills and overfills due to operator error.
- ❑ Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- ❑ Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.
- ❑ Inspect new tank or container installation visually for loose fittings, poor welding, and improper or poorly fitted gaskets.
- ❑ Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.
- ❑ Frequently release accumulated stormwater during the wet season.
- ❑ Have periodic integrity testing conducted by a qualified professional.



# Outdoor Liquid Container Storage SC-31

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## ***Dikes***

One of the best protective measures against contamination of stormwater is the use of dikes. Containment dikes are berms or retaining walls that are designed to hold spills. Use of dikes is an effective pollution prevention measure for above ground storage tanks and railcar or tank truck loading and unloading areas. The dike surrounds the area of concern and holds the spill, keeping spill materials separated from the stormwater side of the dike area. Diking can be used in any industrial or municipal facility, but it is most commonly used for controlling large spills or releases from liquid storage areas and liquid transfer areas.

- ❑ For single-wall tanks, containment dikes should be large enough to hold the contents of the storage tank for the facility plus rain water.
- ❑ For trucks, diked areas should be capable of holding an amount equal to the volume of the tank truck compartment. Diked construction material should be strong enough to safely hold spilled materials.
- ❑ Dike materials can consist of earth, concrete, synthetic materials, metal, or other impervious materials.
- ❑ Strong acids or bases may react with metal containers, concrete, and some plastics.
- ❑ Where strong acids or bases are stored, alternative dike materials should be considered. More active organic chemicals may need certain special liners for dikes.
- ❑ Dikes may also be designed with impermeable materials to increase containment capabilities.
- ❑ Dikes should be inspected during or after significant storms or spills to check for washouts or overflows.
- ❑ Regular checks of containment dikes to insure the dikes are capable of holding spills should be conducted.
- ❑ Inability of a structure to retain stormwater, dike erosion, soggy areas, or changes in vegetation indicate problems with dike structures. Damaged areas should be patched and stabilized immediately.
- ❑ Earthen dikes may require special maintenance of vegetation such as mulching and irrigation.
- ❑ Remove accumulated stormwater after precipitation events and dispose of according to local regulations.

## ***Curbing***

Curbing is a barrier that surrounds an area of concern. Curbing is similar to containment diking in the way that it prevents spills and leaks from being released into the environment. Curbing is usually small scaled and does not contain large spills to the degree that dikes can. Curbing is common at many facilities in small areas where



# Outdoor Liquid Container Storage SC-31

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handling and transfer of liquid materials occur. Curbing can redirect contaminated stormwater away from the storage area. It is useful in areas where liquid materials are transferred from one container to another. Asphalt is a common material used for curbing; however, curbing materials can include earth, concrete, synthetic materials, metal, or other impenetrable materials.

- ❑ Spilled materials should be removed immediately from curbed areas to allow space for future spills.
- ❑ Curbs should have manually-controlled pump systems rather than common drainage systems for collection of spilled materials.
- ❑ The curbed area should be inspected regularly to clear clogging debris.
- ❑ Maintenance should also be conducted frequently to prevent overflow of any spilled materials as curbed areas are designed only for smaller spills.
- ❑ Remove accumulated stormwater after precipitation events and dispose of according to local regulations.
- ❑ Curbing has the following advantages:
  - ✓ Excellent run-on control;
  - ✓ Inexpensive;
  - ✓ Ease of installment;
  - ✓ Provides option to recycle materials spilled in curb areas; and
  - ✓ Common industry practice.

## References and Resources

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# Outdoor Equipment Operations SC-32

## Description

Outside process equipment operations and maintenance can contaminate stormwater runoff. Activities, such as grinding, painting, coating, sanding, degreasing or parts cleaning, landfills and waste piles, and solid waste treatment and disposal are examples of process operations that can lead to contamination of stormwater runoff. The targeted constituents will vary for each site depending on the operation being performed.

## Approach

Implement source control BMPs to limit exposure of outdoor equipment to direct precipitation and stormwater run-on. Refer to SC-22 Vehicle and Equipment Repair for additional information.

### General Pollution Prevention Protocols

- ☐ Perform the activity during dry periods whenever possible.
- ☐ Install secondary containment measures where leaks and spills may occur.
- ☐ Use non-toxic chemicals for maintenance and minimize or eliminate the use of solvents.
- ☐ Connect process equipment area to public sanitary sewer or facility wastewater treatment system when possible. Some jurisdictions require that secondary containment areas be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.



### Good Housekeeping

- ☐ Manage materials and waste properly (see Material Handling and Waste Management) to reduce adverse impacts on stormwater quality.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

## Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	✓
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	✓
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



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# Outdoor Equipment Operations SC-32

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- ❑ Cover the work area with a permanent roof if possible.
- ❑ Use drop cloths for sanding and painting operations.
- ❑ Use a vacuum for fine particle clean-up in pavement cracks and crevices.
- ❑ Minimize contact of stormwater with outside process equipment operations through berming and drainage routing (run-on prevention).
- ❑ "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- ❑ Paint signs on storm drain inlets to indicate that they are not to receive liquid or solid wastes.
- ❑ Use roll down or permanent walls when windy/breezy to prevent wind transport of particulates/pollutants.



## ***Preventative Maintenance***

- ❑ Design outdoor equipment areas to prevent stormwater runoff and spills. Use a perimeter drain or slope pavement inward with drainage to sump.
- ❑ Dry clean the work area regularly. Do not wash outdoor equipment with water if there is a direct connection to the storm drain.
- ❑ Pave area with concrete rather than asphalt.
- ❑ Inspect outdoor equipment regularly for leaks or spills. Also check for structural failure, spills and overfills due to operator error, and/or failure of piping system.
- ❑ Inspect and clean, if necessary, storm drain inlets and catch basins within the outdoor equipment area before October 1 each year.



## ***Spill Response and Prevention Procedures***

- ❑ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- ❑ Have employees trained in emergency spill cleanup procedures present when dangerous waste, liquid chemicals, or other wastes are delivered.
- ❑ Place a stockpile of spill cleanup materials where it will be readily accessible.
- ❑ Prevent operator errors by using engineering safe guards and thus reducing accidental releases of pollutant.



## ***Material Handling and Waste Management***

# Outdoor Equipment Operations SC-32

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- ☐ Do not pour liquid wastes into floor drains, sinks, outdoor storm drain inlets, or other storm drain or sewer connections.
- ☐ Collect leaking or dripping fluids in drip pans or containers. Fluids are easier to recycle if kept separate.
- ☐ Promptly transfer used fluids to the proper waste or recycling drums. Do not leave drip pans or other open containers lying around.
- ☐ Minimize the possibility of stormwater pollution from outside waste receptacles by doing at least one of the following:
  - ✓ Use only watertight waste receptacle(s) and keep the lid(s) closed.
  - ✓ Grade and pave the waste receptacle area to prevent run-on of stormwater.
  - ✓ Install a roof over the waste receptacle area.



## ***Employee Training Program***

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees on proper equipment operation and maintenance procedures.
- ☐ Train all employees upon hiring and annually thereafter on proper methods for handling and disposing of waste. Ensure that all employees understand stormwater discharge prohibitions, wastewater discharge requirements, and these best management practices.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



## ***Quality Assurance and Record Keeping***

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for outdoor equipment, types and quantities of materials removed and disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

## **Potential Limitations and Work-Arounds**

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended "work-arounds."

# **Outdoor Equipment Operations SC-32**

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- ❑ Providing cover over outdoor equipment may be impractical or cost-prohibitive.
  - ✓ Operate outdoor equipment only during periods of dry weather.
- ❑ Regular operations and time limitations may require outdoor activities during wet weather.
  - ✓ Designate specific areas for outdoor activities.
  - ✓ Allow time for work area clean-up after each shift.
  - ✓ Require employees to understand and follow preventive maintenance and spill and leak prevention BMPs.
  - ✓ Design and install secondary containment and good housekeeping BMPs for outdoor equipment area.
- ❑ Storage sheds often must meet building and fire code requirements.

## **Potential Capital Facility Costs and Operation & Maintenance Requirements**

### ***Facilities***

- ❑ Many facilities will already have indoor covered areas where vehicle and equipment repairs take place and will require no additional capital expenditures.
- ❑ If outdoor activities are required, construction of berms or other means to retain spills and leaks may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- ❑ Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### ***Maintenance***

- ❑ Most of the operations and maintenance activities associated with implementing this BMP are integrally linked to routine operations as previously described. Therefore additional O&M is not required.
- ❑ For facilities responsible for pre-treating their wastewater prior to discharging, the proper functioning of structural treatment system is an important maintenance consideration.
- ❑ Routine cleanout of oil and grease is required for the devices to maintain their effectiveness, usually at least once a month. During periods of heavy rainfall, cleanout is required more often to ensure pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the device working efficiently.

# Outdoor Equipment Operations SC-32

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# Outdoor Storage of Raw Materials SC-33

## Description

Stockpiles of raw materials, by-products, and finished products exposed to rain and/or runoff can pollute stormwater. Stormwater can become contaminated when materials wash off or dissolve into water due to improper storage and containment. To prevent or reduce the discharge of pollutants to stormwater from raw material delivery and storage, pollution prevention and source control measures must be implemented, such as minimizing the storage of hazardous materials on-site, enclosing or covering materials, storing materials in a designated area, installing secondary containment, conducting regular inspections, preventing stormwater run-on and runoff, and training employees and subcontractors. This fact sheet focuses on source control BMPs for stockpiles of solid materials; if the raw material, by-product, or product is a liquid, more information for outside storage of liquids can be found under SC-31 Outdoor Liquid Container Storage.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## General Pollution Prevention Protocols

- ☐ Emphasize employee education for successful BMP implementation.
- ☐ Store materials that could contaminate stormwater inside or under permanent cover. If this is not feasible, then all outside storage areas should be covered with a roof and bermed or enclosed to prevent stormwater contact.
- ☐ Elevate and tarp solid materials such as beams, metal, etc.
- ☐ Minimize the inventory of raw materials kept outside.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

## Minimum BMPs Covered

 Good Housekeeping	✓
 Preventative Maintenance	✓
 Spill and Leak Prevention and Response	✓
 Material Handling & Waste Management	
 Erosion and Sediment Controls	✓
 Employee Training Program	✓
 Quality Assurance Record Keeping	✓



# Outdoor Storage of Raw Materials SC-33

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- ❑ Keep an accurate, up-to-date inventory of the materials delivered and stored on-site.
- ❑ Stormwater runoff that could potentially be contaminated by materials stored outdoors should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.



## ***Good Housekeeping***

- ❑ If raw materials cannot all be stored inside or under permanent cover, prevent exposure to direct precipitation and stormwater run-on by installing a storm-resistant waterproof covering made of polyethylene, polypropylene or hypalon over all materials stored outside. The covers must be in place at all times when work with the stockpiles is not occurring (Applicable to small stockpiles only).
- ❑ Implement erosion control practices at the perimeter of the facility site and at any catch basins to prevent erosion of the stockpiled material off-site, if the stockpiles are so large that they cannot feasibly be covered and contained.
- ❑ Minimize stormwater run-on by enclosing the area or building a berm around it.
- ❑ Keep storage areas clean and dry.
- ❑ Slope paved areas in a manner that minimizes pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5% is recommended.
- ❑ Secure drums stored in an area where unauthorized persons may not gain access to prevent accidental spillage, pilferage, or any unauthorized use.
- ❑ Install curbing or berms along the perimeter of the area to prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from the stockpile areas.
- ❑ Slope the area inside the curb or berm to a drain with sump. The sump should be equipped with an oil and water separator if applicable for materials stored onsite.
- ❑ Do not store materials on top of or directly adjacent to storm drain inlets.
- ❑ Cover wood products treated with chromated copper arsenate, ammoniacal copper zinc arsenate, creosote, or pentachlorophenol with properly secured tarps or store indoors.



## ***Preventative Maintenance***

- ❑ Maintain outdoor storage containers in good condition. Replace leaky or otherwise inadequate containers as necessary.
- ❑ Maintain outdoor waterproof covers (e.g., tarps) in good condition and properly secure them to be storm resistant. Replace tarps damaged by UV exposure or wear and tear on a regular basis.

# Outdoor Storage of Raw Materials SC-33

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- ☐ Perform routine inspection of storm drains and sumps and regularly remove accumulated materials.
- ☐ Dry clean the work area regularly. Do not wash outdoor material storage areas with water if there is a direct connection to the storm drain.
- ☐ Pave outdoor storage areas for liquids such as solvents with concrete rather than asphalt.
- ☐ Conduct regular inspections of storage areas so that leaks and spills are detected as soon as possible.
- ☐ Routinely inspect berms, curbing, containment, and sediment controls for proper function and repair as necessary.



## ***Spill and Leak Prevention and Response***

- ☐ Keep the facility spill prevention and control plan up-to-date.
- ☐ Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- ☐ Have employees trained in spill containment and cleanup present during the loading/unloading of hazardous or otherwise dangerous materials.



## ***Erosion and Sediment Controls***

- ☐ Keep materials covered to prevent erosion of stockpiles. This may not be feasible for large stockpiles.
- ☐ Install sediment controls such as fiber rolls around the perimeter of stockpiles to prevent transport of raw materials to the storm drain.
- ☐ Install drain inlet protection around all inlets to prevent raw materials from entering storm drain.
- ☐ Install sediment controls such as silt fence around the perimeter of the site to prevent transport of raw materials to the storm drain or offsite surface waters.



## ***Employee Training Program***

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly store outdoor raw materials using the source control BMPs described above.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.

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## **Quality Assurance and Record Keeping**

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for outdoor storage of raw materials, types and quantities of materials removed and disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

## **Other Facility-Specific Considerations**

- ☐ Storage sheds often must meet building and fire code requirements. Storage of reactive, ignitable, or flammable liquids must comply with the Uniform Fire Code and the National Electric Code.
- ☐ Some municipalities require that secondary containment areas (regardless of size) be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.
- ☐ The local fire district must be consulted for limitations on clearance of roof covers over containers used to store flammable materials.

## **Potential Limitations and Work-Arounds**

Some facilities may have space constraints, limited staffing and time limitations that may preclude implementation of BMPs. Provided below are typical limitations and recommended “work-arounds”

- ☐ Space limitations may preclude storing all materials indoors.
  - ✓ Implement good housekeeping, preventative maintenance, and erosion and sediment controls as described above.

## **Potential Capital Facility Costs and Operation & Maintenance Requirements**

### ***Facilities***

- ☐ Many facilities will already have indoor covered areas where raw materials will be stored and will require no additional capital expenditures.
- ☐ If outdoor storage of materials is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment. These containment areas may require significant new capital investment.
- ☐ Purchase and installation of erosion and sediment controls will require additional capital investments, and this amount will vary depending on site characteristics.
- ☐ Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

# Outdoor Storage of Raw Materials SC-33

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## ***Maintenance***

- ❑ Accurate and up-to-date inventories should be kept of all stored materials.
- ❑ Berms and curbs may require periodic repair and patching.
- ❑ Parking lots or other surfaces near bulk materials storage areas should be swept periodically to remove debris blown or washed from storage areas.
- ❑ Sweep paved storage areas regularly for collection and disposal of loose solid materials, do not hose down the area to a storm drain or conveyance ditch.
- ❑ Erosion and sediment controls require regular inspection and periodic replacement or reinstallation.

## **Supplemental Information**

### ***Raw Material Containment***

Paved areas should be sloped in a manner that minimizes pooling of water on the site, particularly with materials that may leach pollutants into stormwater and/or groundwater, such as compost, logs, and wood chips. A minimum slope of 1.5% is recommended.

- ❑ Curbing or berms should be placed along the perimeter of the area to prevent the run-on of uncontaminated stormwater from adjacent areas as well as runoff of stormwater from stockpile areas.
- ❑ The storm drainage system should be designed to minimize use of catch basins in the interior of the area as they tend to rapidly fill with manufacturing material.

The area should be sloped to drain stormwater to the perimeter where it can be collected or to internal drainage alleyways where material is not stockpiled.

The “doghouse” design has been used to store small liquid containers. The roof and flooring design prevent contact with direct rain or runoff. The doghouse has two solid structural walls and two canvas covered walls. The flooring is wire mesh about secondary containment.

## **References and Resources**

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=10557>.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*. Available online at: [http://www.nj.gov/dep/dwg/pdf/5G2\\_guidance\\_color.pdf](http://www.nj.gov/dep/dwg/pdf/5G2_guidance_color.pdf).

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# **Outdoor Storage of Raw Materials SC-33**

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Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>.

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA’s Multi Sector General Permit. Available online at:  
<http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm>.

## Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## General Pollution Prevention Protocols

- ❑ Accomplish reduction in the amount of waste generated using the following source controls:
  - ✓ Production planning and sequencing;
  - ✓ Process or equipment modification;
  - ✓ Raw material substitution or elimination;
  - ✓ Loss prevention and housekeeping;
  - ✓ Waste segregation and separation; and
  - ✓ Close loop recycling.
- ❑ Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- ❑ Recycle materials whenever possible.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment

Nutrients

Trash

Metals

✓

Bacteria

✓

Oil and Grease

✓

Organics

✓

## Minimum BMPs Covered



Good Housekeeping

✓



Preventative Maintenance

✓



Spill and Leak Prevention and Response

✓



Material Handling & Waste Management

✓



Erosion and Sediment Controls

✓



Employee Training Program

✓



Quality Assurance Record Keeping

✓



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- ☐ Use the entire product before disposing of the container.
- ☐ To the extent possible, store wastes under cover or indoors after ensuring all safety concerns such as fire hazard and ventilation are addressed.
- ☐ Provide containers for each waste stream at each work station. Allow time after shift to clean area.



## ***Good Housekeeping***

- ☐ Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.
- ☐ Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.
- ☐ Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain. Clean in a designated wash area that drains to a clarifier.
- ☐ Transfer waste from damaged containers into safe containers.
- ☐ Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.
- ☐ Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- ☐ Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- ☐ Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.
- ☐ Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- ☐ If possible, move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.



## ***Preventative Maintenance***

- ☐ Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- ☐ Prevent waste materials from directly contacting rain.

- ☐ Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropylene or hypalon.
- ☐ Cover the area with a permanent roof if feasible.
- ☐ Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- ☐ Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- ☐ Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, vacuuming, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- ☐ Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- ☐ Repair leaking equipment including valves, lines, seals, or pumps promptly.



## ***Spill Response and Prevention Procedures***

- ☐ Keep your spill prevention and plan up-to-date.
- ☐ Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills.
- ☐ Collect all spilled liquids and properly dispose of them.
- ☐ Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- ☐ Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - ✓ Vehicles equipped with baffles for liquid waste; and
  - ✓ Trucks with sealed gates and spill guards for solid waste.



## ***Material Handling and Waste Management***

### ***Litter Control***

- ☐ Post “No Littering” signs and enforce anti-litter laws.
- ☐ Provide a sufficient number of litter receptacles for the facility.
- ☐ Clean out and cover litter receptacles frequently to prevent spillage.

### ***Waste Collection***

- ☐ Keep waste collection areas clean.

- ☐ Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.
- ☐ Secure solid waste containers; containers must be closed tightly when not in use.
- ☐ Do not fill waste containers with washout water or any other liquid.
- ☐ Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).
- ☐ Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal. Affix labels to all waste containers.

## *Chemical/Hazardous Wastes*

- ☐ Select designated hazardous waste collection areas on-site.
- ☐ Store hazardous materials and wastes in covered containers and protect them from vandalism.
- ☐ Place hazardous waste containers in secondary containment.
- ☐ Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- ☐ Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.



## **Employee Training Program**

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- ☐ Train employees and subcontractors in proper hazardous waste management.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.



## **Quality Assurance and Record Keeping**

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for waste handling and disposal, types and quantities of waste disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.

- ❑ Establish procedures to complete logs and file them in the central office.

## Potential Capital Facility Costs and Operation & Maintenance Requirements

### Facilities

- ❑ Capital costs will vary substantially depending on the size of the facility and the types of waste handled. Significant capital costs may be associated with reducing wastes by modifying processes or implementing closed-loop recycling.
- ❑ Many facilities will already have indoor covered areas where waste materials will be stored and will require no additional capital expenditures for providing cover.
- ❑ If outdoor storage of wastes is required, construction of berms or other means to prevent stormwater run-on and runoff may require appropriate constructed systems for containment.
- ❑ Capital investments will likely be required at some sites if adequate cover and containment facilities do not exist and can vary significantly depending upon site conditions.

### Maintenance

- ❑ Check waste containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.
- ❑ Sweep and clean the waste management area regularly. Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.
- ❑ Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- ❑ Repair leaking equipment including valves, lines, seals, or pumps promptly.

## References and Resources

Minnesota Pollution Control Agency, *Industrial Stormwater Best Management Practices Guidebook*. Available online at: <http://www.pca.state.mn.us/index.php/view-document.html?gid=10557>.

New Jersey Department of Environmental Protection, 2013. *Basic Industrial Stormwater General Permit Guidance Document NJPDES General Permit No NJ0088315*, Revised. Available online at: [http://www.nj.gov/dep/dwq/pdf/5G2\\_guidance\\_color.pdf](http://www.nj.gov/dep/dwq/pdf/5G2_guidance_color.pdf).

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Santa Clara Valley Urban Runoff Pollution Prevention Program. <http://www.scvurppp-w2k.com/>

US EPA. National Pollutant Discharge Elimination System – Industrial Fact Sheet Series for Activities Covered by EPA’s Multi Sector General Permit. Available online at:  
<http://cfpub.epa.gov/npdes/stormwater/swsectors.cfm>

# Building & Grounds Maintenance SC-41

## Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

## Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

## General Pollution Prevention Protocols

- ☐ Switch to non-toxic chemicals for maintenance to the maximum extent possible.
- ☐ Choose cleaning agents that can be recycled.
- ☐ Encourage proper lawn management and landscaping, including use of native vegetation.
- ☐ Encourage use of Integrated Pest Management techniques for pest control.
- ☐ Encourage proper onsite recycling of yard trimmings.
- ☐ Recycle residual paints, solvents, lumber, and other material as much as possible.

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

## Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

## Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	✓
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓





# Building & Grounds Maintenance SC-41

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- Clean work areas at the end of each work shift using dry cleaning methods such as sweeping and vacuuming.



## **Good Housekeeping**

### *Pressure Washing of Buildings, Rooftops, and Other Large Objects*

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

### *Landscaping Activities*

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils. See also SC-40, Contaminated and Erodible Areas, for more information.

### *Building Repair, Remodeling, and Construction*

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and

# Building & Grounds Maintenance SC-41

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solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- ❑ If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- ❑ Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

## *Mowing, Trimming, and Planting*

- ❑ Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- ❑ Use mulch or other erosion control measures when soils are exposed.
- ❑ Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- ❑ Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- ❑ Use hand weeding where practical.

## *Fertilizer and Pesticide Management*

- ❑ Do not use pesticides if rain is expected.
- ❑ Do not mix or prepare pesticides for application near storm drains.
- ❑ Use the minimum amount needed for the job.
- ❑ Calibrate fertilizer distributors to avoid excessive application.
- ❑ Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- ❑ Apply pesticides only when wind speeds are low.
- ❑ Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- ❑ Irrigate slowly to prevent runoff and then only as much as is needed.
- ❑ Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.

## *Inspection*

- ❑ Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.



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## ***Spill Response and Prevention Procedures***

- ☐ Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- ☐ Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- ☐ Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- ☐ Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- ☐ Clean up spills immediately.



## ***Material Handling and Waste Management***

- ☐ Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- ☐ Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- ☐ Dispose of empty pesticide containers according to the instructions on the container label.
- ☐ Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- ☐ Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.



## ***Employee Training Program***

- ☐ Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- ☐ Train employees and contractors in proper techniques for spill containment and cleanup.
- ☐ Be sure the frequency of training takes into account the complexity of the operations and the needs of individual staff.



## ***Quality Assurance and Record Keeping***

- ☐ Keep accurate logs that document maintenance activities performed and minimum BMP measures implemented.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

# Building & Grounds Maintenance SC-41

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## Potential Capital Facility Costs and Operation & Maintenance Requirements

### *Facilities*

- Additional capital costs are not anticipated for building and grounds maintenance. Implementation of the minimum BMPs described above should be conducted as part of regular site operations.

### *Maintenance*

- Maintenance activities for the BMPs described above will be minimal, and no additional cost is anticipated.

## Supplemental Information

### *Fire Sprinkler Line Flushing*

Site fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

## References and Resources

City of Seattle, Seattle Public Utilities Department of Planning and Development, 2009. *Stormwater Manual Vol. 1 Source Control Technical Requirements Manual*.

Kennedy/Jenks Consultants, 2007. *The Truckee Meadows Industrial and Commercial Storm Water Best Management Practices Handbook*. Available online at: [http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C\\_BMP\\_Handbook\\_2-07-final.pdf](http://www.cityofsparks.us/sites/default/files/assets/documents/env-control/construction/TM-I-C_BMP_Handbook_2-07-final.pdf).

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# **Building & Grounds Maintenance SC-41**

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US EPA, 1997. *Best Management Practices Handbook for Hazardous Waste Containers*. Available online at: <http://www.epa.gov/region6/6en/h/handbk4.pdf>.

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# Drainage System Maintenance SC-44

## Description

As a consequence of its function, the stormwater drainage facilities on site convey stormwater that may contain certain pollutants either to the offsite conveyance system that collects and transports urban runoff and stormwater, or directly to receiving waters. The protocols in this fact sheet are intended to reduce pollutants leaving the site to the offsite drainage infrastructure or to receiving waters through proper on-site conveyance system operation and maintenance. The targeted constituents will vary depending on site characteristics and operations.

## Approach

Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

### General Pollution Prevention Protocols

- ❑ Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.
- ❑ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.



### Good Housekeeping

#### Illicit Connections and Discharges

- ❑ Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

## Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

## Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	✓
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

## Minimum BMPs Covered

	Good Housekeeping	✓
	Preventative Maintenance	✓
	Spill and Leak Prevention and Response	✓
	Material Handling & Waste Management	
	Erosion and Sediment Controls	
	Employee Training Program	✓
	Quality Assurance Record Keeping	✓



# Drainage System Maintenance SC-44

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- ✓ Identify evidence of spills such as paints, discoloring, odors, etc.
- ✓ Record locations of apparent illegal discharges/illicit connections.
- ✓ Track flows back to potential discharges and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
- ✓ Eliminate the discharge once the origin of flow is established.
- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” or similar stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.

## *Illegal Dumping*

- Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - ✓ Illegal dumping hot spots;
  - ✓ Types and quantities (in some cases) of wastes;
  - ✓ Patterns in time of occurrence (time of day/night, month, or year);
  - ✓ Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills); and
  - ✓ Responsible parties.
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges for additional information.



## **Preventative Maintenance**

### *Catch Basins/Inlet Structures*

- Staff should regularly inspect facilities to ensure compliance with the following:
  - ✓ Immediate repair of any deterioration threatening structural integrity.
  - ✓ Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.

# Drainage System Maintenance SC-44

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- ❑ Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.
- ❑ Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Prioritize storm drain inlets; clean and repair as needed.
- ❑ Keep accurate logs of the number of catch basins cleaned.
- ❑ Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- ❑ Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

## *Storm Drain Conveyance System*

- ❑ Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- ❑ Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

## *Pump Stations*

- ❑ Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- ❑ Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.
- ❑ Conduct routine maintenance at each pump station.
- ❑ Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

## *Open Channel*

- ❑ Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.
- ❑ Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural state of any river, stream, or lake in California, must enter into a Stream or Lake Alteration Agreement with the Department of Fish and Wildlife. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Army Corps of Engineers and USFWS.



## **Spill Response and Prevention Procedures**

- ❑ Keep your spill prevention control plan up-to-date.



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- ☐ Investigate all reports of spills, leaks, and/or illegal dumping promptly.
- ☐ Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- ☐ Clean up all spills and leaks using “dry” methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.



## ***Employee Training Program***

- ☐ Educate employees about pollution prevention measures and goals.
- ☐ Train employees how to properly handle and dispose of waste using the source control BMPs described above.
- ☐ Train employees and subcontractors in proper hazardous waste management.
- ☐ Use a training log or similar method to document training.
- ☐ Ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- ☐ Have staff involved in detection and removal of illicit connections trained in the following:
  - ✓ OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).
  - ✓ OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).
  - ✓ Procedural training (field screening, sampling, smoke/dye testing, TV inspection).



## ***Quality Assurance and Record Keeping***

- ☐ Keep accurate maintenance logs that document minimum BMP activities performed for drainage system maintenance, types and quantities of waste disposed of, and any improvement actions.
- ☐ Keep accurate logs of spill response actions that document what was spilled, how it was cleaned up, and how the waste was disposed.
- ☐ Keep accurate logs of illicit connections, illicit discharges, and illegal dumping into the storm drain system including how wastes were cleaned up and disposed.
- ☐ Establish procedures to complete logs and file them in the central office.

## **Potential Limitations and Work-Arounds**

Provided below are typical limitations and recommended “work-arounds” for drainage system maintenance:

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- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.
  - ✓ Perform all maintenance onsite and do not flush accumulated material downstream to private property or riparian habitats.
- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, and liquid/sediment disposal.
  - ✓ Develop and follow a site specific drainage system maintenance plan that describes maintenance locations, methods, required equipment, water sources, sediment collection areas, disposal requirements, and any other pertinent information.
- Regulations may include adoption of substantial penalties for illegal dumping and disposal.
  - ✓ Do not dump illegal materials anywhere onsite.
  - ✓ Identify illicit connections, illicit discharge, and illegal dumping.
  - ✓ Cleanup spills immediately and properly dispose of wastes.
- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the sanitary sewer system.
  - ✓ Collect all materials and pollutants accumulated in drainage system and dispose of according to local regulations.
  - ✓ Install debris excluders in areas with a trash TMDL.

## **Potential Capital Facility Costs and Operation & Maintenance Requirements**

### ***Facilities***

- Capital costs will vary substantially depending on the size of the facility and characteristics of the drainage system. Significant capital costs may be associated with purchasing water trucks, vacuum trucks, and any other necessary cleaning equipment or improving the drainage infrastructure to reduce the potential .
- Developing and implementing a site specific drainage system maintenance plan will require additional capital if a similar program is not already in place.



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## *Maintenance*

- Two-person teams may be required to clean catch basins with vacuor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.
- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

## **Supplemental Information**

### *Storm Drain Flushing*

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents “plug flow” discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used if allowed or that fire hydrant line flushing coincide with storm sewer flushing.

# **Drainage System Maintenance SC-44**

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## General Description

An infiltration trench is a gravel-filled trench that receives stormwater runoff. Runoff is stored in the void space between the stones and infiltrates through the bottom and sides of the trench into the soil matrix. Infiltration trenches promote stormwater infiltration, reduce discharge of stormwater to receiving waters and provide pollutant removal. Pretreatment using buffer strips, swales, or detention basins is important for limiting amounts of sediment, oil & grease, and trash and debris entering the trench which can clog and render the trench ineffective.

## Inspection/Maintenance Considerations

Frequency of clogging is dependent on effectiveness of pretreatment, such as vegetated buffer strips (see TC-31), vegetated swales (see TC-30), and detention basins (see TC-22) at removing sediments. Generally, clogging is occurring if the trench shows signs of long surface ponding. Clogging often occurs within the surface layer and removing and replacing the top 2-3 inches of the surface media may improve performance. If the clogging is subsurface, as determined by observing an inspection well, then completely removing the media and rehabbing the trench is needed. Clogged infiltration trenches with surface standing water can become a nuisance due to mosquito breeding. Maintenance efforts associated with infiltration trenches should include frequent inspections to ensure that water infiltrates into the subsurface completely at a recommended infiltration rate of 96 hours or less to prevent creating mosquito and other vector habitats.

## Advanced BMPs Covered



## Maintenance Concerns

- Accumulation of metals
- Clogged soil or outlet structures
- Vegetation/landscape maintenance

## Targeted Constituents

Sediment	■*
Nutrients	■
Trash	■*
Metals	■
Bacteria	■
Oil and Grease	■*
Organics	■

## Legend (Removal Effectiveness)

- Low ■ High ▲ Medium
- \* Requires Pretreatment

*Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.*



# Infiltration Trench

# TC-10

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>□ Inspect after major storms for the first few months to ensure proper functioning. Drain times should be observed to confirm that the designed drain time has been achieved.</li> <li>□ Inspect for upslope or adjacent contributing sediment sources and ensure that pretreatment systems are in place.</li> </ul>	After construction and semi-annually (beginning and end of rainy season)
<ul style="list-style-type: none"> <li>□ Inspect facility for signs of wetness or damage to structures, signs of petroleum hydrocarbon contamination, standing water, trash and debris, sediment accumulation, slope stability, standing water, and material buildup.</li> <li>□ Check for standing water or, if available, check observation wells following 3 days of dry weather to ensure proper drain time.</li> <li>□ Inspect pretreatment devices and diversion structures for damage, sediment buildup, and structural damage.</li> </ul>	Semi-annual and after major storm events
<ul style="list-style-type: none"> <li>□ Trenches with filter fabric should be inspected for sediment deposits by removing a small section of the top layer. If inspection indicates that the trench is partially or completely clogged, it should be restored to its design condition.</li> </ul>	Annual
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>□ Repair undercut and eroded areas at inflow and outflow structures.</li> <li>□ Remove sediment, debris, and oil/grease from pretreatment devices, forebays, inlet/outlet structures, overflow spillway, and trenches as necessary.</li> </ul>	Standard maintenance (as needed)
<ul style="list-style-type: none"> <li>□ Remove trash, debris, grass clippings, trees, and other large vegetation from the trench perimeter and dispose of properly.</li> <li>□ Mow and trim vegetation to prevent establishment of woody vegetation, and for aesthetic and vector reasons.</li> </ul>	Semi-annual, more often as needed
<ul style="list-style-type: none"> <li>□ Remove accumulated sediment from the surface of the trench. Replace first layer of aggregate and filter fabric if clogging appears only to be at the surface.</li> <li>□ Clean trench when loss of infiltrative capacity is observed. If drawdown time is observed to have increased significantly over the design drawdown time, removal of sediment may be necessary. This is an expensive maintenance activity and the need for it can be minimized through prevention of upstream erosion.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>□ Monitor ongoing effectiveness and determine if another BMP type or additional pretreatment could improve long-term performance. A qualified designer with knowledge of local soils and BMP design should be consulted in order to make this determination.</li> </ul>	Every 5 years

<ul style="list-style-type: none"> <li>❑ Total rehabilitation of the trench should be conducted to maintain storage capacity within 2/3 of the design treatment volume and 96-hour exfiltration rate limit.</li> <li>❑ Rehabilitation of the trench should be performed under the direction of a qualified designer with knowledge of local soils and BMP design. General steps for trench rehabilitation include:               <ul style="list-style-type: none"> <li>✓ Trench walls should be excavated to expose clean soil.</li> <li>✓ All of the stone aggregate must be removed. Filter fabric may need to be removed from the sides and bottom</li> <li>✓ Accumulated sediment should be stripped from the trench bottom. At this point the bottom may be scarified or tilled to help induce infiltration. New fabric and clean stone aggregate should be refilled.</li> </ul> </li> </ul>	<p>Upon reaching target thresholds</p>
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Most of the maintenance should be concentrated on the pretreatment practices, such as buffer strips and swales upstream of the trench to limit the amount of sediment that reaches the infiltration trench. Regular inspection should determine if the sediment removal structures require routine maintenance. Infiltration trenches should not be put into operation until the upstream tributary area is stabilized.

## Additional Information

Infiltration practices have historically had a high rate of failure compared to other stormwater management practices. One study conducted in Prince George's County, Maryland (Galli, 1992), revealed that less than half of the infiltration trenches investigated (of about 50) were still functioning properly, and less than one-third still functioned properly after 5 years. Many of these practices, however, did not incorporate advanced pretreatment. By carefully selecting the location and improving the design features of infiltration practices, their performance should improve.

It is absolutely critical that settleable particles and floatable materials be removed from runoff water before it enters the infiltration trench. The trench will clog and become nonfunctional if excessive particulate matter is allowed to enter the trench.

Special considerations are required for infiltration trenches to be effective in cold climates – refer to the Stormwater Managers Resource Center for more information.

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## General Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to draw down the stormwater runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage. Considerable stormwater volume reduction can also occur, depending on the infiltration capacity of the subsoil.

## Inspection/Maintenance Considerations

Inspections should be conducted semi-annually and after significant storm events to identify potential problems early. Most maintenance efforts will need to be directed toward vegetation management and vector control, which may focus on basic housekeeping practices such as removal of debris accumulations and vegetation management to ensure that the basin dewateres completely (recommended 48 hour residence time or less) to prevent creating mosquito and other vector habitats.

If infiltration is desired for stormwater reduction, the following additional maintenance may be required to maintain infiltrative capacity:

- ❑ Mechanically de-thatching and/or aerating the top soils along the sides and bottom of the basin;
- ❑ Tilling or dicing to scarify the bottom of the basin; and
- ❑ Maintaining adequate vegetative cover.

## Advanced BMPs Covered



## Maintenance Concerns

- *Accumulation of Metals and Toxics*
- *Clogged Soil Outlet Structures*
- *Vegetation/Landscape Maintenance*
- *Erosion*
- *Vector Control*

## Targeted Constituents

<i>Sediment</i>	▲
<i>Nutrients</i>	●
<i>Trash</i>	■
<i>Metals</i>	▲
<i>Bacteria</i>	▲
<i>Oil and Grease</i>	▲
<i>Organics</i>	▲

## Legend (Removal Effectiveness)

- Low ■ High ▲ Medium
- \* Requires Pretreatment

*Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.*





Refer to TC-11 Infiltration Basin for further information.

Inspection Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>□ Inspect after several storm events for bank stability, vegetation growth, and to determine if the desired residence time has been achieved.</li> <li>□ Inspect outlet structure for evidence of clogging or outflow release velocities that are greater than design flow.</li> </ul>	Post construction
<ul style="list-style-type: none"> <li>□ Inspect for the following issues: differential settlement, cracking, erosion of pond banks or bottom, leakage, tree growth on the embankment, the condition of the riprap in the inlet, clogging of outlet and pilot channels, standing water, slope stability, presence of burrows, sediment accumulation in the basin, forebay, and outlet structures, trash and debris, and the vigor and density of vegetation on the basin side slopes and floor.</li> </ul>	Semi-annual, after significant storms, or more frequent
<ul style="list-style-type: none"> <li>□ Inspect for the following issues: subsidence, damage to the emergency spillway, inadequacy of the inlet/outlet channel erosion control measures, changes in the condition of the pilot channel, accumulated sediment volume, and semi-annual inspection items.</li> </ul>	Annual
<ul style="list-style-type: none"> <li>□ During inspections, changes to the extended storage pond or the contributing watershed should be noted, as these may affect basin performance.</li> </ul>	Annual inspection
Maintenance Activities	Suggested Frequency
<ul style="list-style-type: none"> <li>□ If necessary, modify the outlet orifice to achieve design values if inspection indicates modifications are necessary.</li> <li>□ Repair undercut or eroded areas.</li> <li>□ Mow side slopes for aesthetics and to remove woody debris that reduces storage volume.</li> <li>□ Maintain vegetation in and around basin to prevent any erosion and minimize aesthetic concerns. Minimize use of fertilizers and pesticides. Reseed if necessary.</li> <li>□ Remove litter and debris.</li> <li>□ Make structural changes or repairs as needed to eliminate pools of water that stand longer than 96 hrs to prevent mosquito production, particularly during the warmer months of the year. Identify and eliminate sources of non-stormwater runoff that feed standing water pools. Coordinate with the local mosquito and vector control agency to control mosquitoes, if necessary.</li> </ul>	Standard Maintenance (As needed)
<ul style="list-style-type: none"> <li>□ Remove accumulated trash and debris from the basin, around the riser pipe, side slopes, embankment, emergency spillway, and outflow trash racks. The frequency of this activity may be altered to meet specific site conditions.</li> <li>□ Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.</li> </ul>	Semi-annual, or more frequent, as needed
<ul style="list-style-type: none"> <li>□ Seed or sod to restore dead or damaged ground cover.</li> <li>□ Repair erosion to banks and bottom as required.</li> </ul>	Annual maintenance (as needed)
<ul style="list-style-type: none"> <li>□ Supplement vegetation if a significant portion have not been established (at least 50% of the surface area).</li> <li>□ Remove nuisance plant species.</li> </ul>	Annual maintenance (if needed)
<ul style="list-style-type: none"> <li>□ Remove sediment from the forebay to reduce frequency of main basin cleaning.</li> </ul>	3- to 5-year

<input type="checkbox"/> Remove sediment from the basin bottom and thatch, aerate, or scarify soils to maintain infiltrative capacity.	maintenance
<input type="checkbox"/> Monitor sediment accumulation and remove accumulated sediment and regrade about every 10 years or when the accumulated sediment volume exceeds 10-20% of the basin volume, or when accumulation reaches 6 inches or if resuspension is observed. Clean in early spring so vegetation damaged during cleaning has time to re-establish.	Every 10-25 years

## Additional Information

In most cases, surface sediment removed from an extended detention basin during periodic maintenance to restore capacity does not contain toxic materials (e/g metals, oil and grease, or organics) at levels posing a hazardous concern. Studies to date indicate that pond sediments are generally below toxicity limits and can be safely landfilled or disposed onsite. Onsite sediment disposal is always preferable (if local authorities permit) as long as the sediments are deposited away from the perimeter to prevent their reentry into the basin. Sediments should be tested for toxic materials in compliance with current landfill requirements and disposed of properly.

Special considerations are required for extended detention basins to be effective in cold climates. Refer to the Stormwater Managers Resource Center for more information.

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## General Description

Vegetated swales (also referred to as bioswales, biofiltration swales, or landscaped swales) are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, reduce flow velocity, and increase time of concentration of stormwater runoff. Vegetated swales can be implemented to provide effective pretreatment for detention and infiltration stormwater BMPs.

Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, swales are best suited for small landscaped portions of industrial or commercial facilities with low peak flow rates. They are not well suited to treat stormwater runoff from industrial areas that have insufficient source control BMPs.

## Inspection/Maintenance Considerations

A thick vegetative cover is needed for vegetated swales to function properly. Usually, swales require little more than normal landscape maintenance activities such as irrigation and mowing to maintain pollutant removal efficiency. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g., debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained. The application of fertilizers and pesticides should be minimized.

## Advanced BMPs Covered



## Maintenance Concerns

- Channelization
- Vegetation/Landscape Maintenance
- Vector Control
- Aesthetics
- Flow Obstructions

## Targeted Constituents

Sediment	▲
Nutrients	●
Trash	●
Metals	▲
Bacteria	●
Oil and Grease	▲
Organics	▲

## Legend (Removal Effectiveness)

● Low ■ High ▲ Medium

\* Requires Pretreatment

*Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.*



# Vegetated Swale

TC-30

Inspection Activities	Suggested Frequency
<input type="checkbox"/> Inspect after seeding and after first major storms for any damages.	Post construction
<input type="checkbox"/> Inspect for signs of erosion, damage to vegetation, channelization of flow, debris and litter, and areas of sediment accumulation. Perform inspections at the beginning and end of the wet season. Additional inspections after periods of heavy runoff are desirable.	Semi-annual
<input type="checkbox"/> Inspect level spreader for clogging, grass alongside slopes for erosion and formation of rills or gullies, and sand/soil bed for erosion problems.	Annual
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Mow grass to maintain a height of 3–4 inches, for safety, aesthetic, or other purposes. Litter should always be removed prior to mowing. Clippings should be composted. <input type="checkbox"/> Irrigate swale during dry season (April through October) or when necessary to maintain the vegetation. <input type="checkbox"/> Provide weed control, if necessary to control invasive species.	As needed (frequent, seasonally)
<input type="checkbox"/> Remove litter, branches, rocks blockages, and other debris and dispose of properly. <input type="checkbox"/> Maintain inlet flow spreader (if applicable). <input type="checkbox"/> Repair any damaged areas within a channel identified during inspections. Erosion rills or gullies should be corrected as needed. Bare areas should be replanted as necessary.	Semi-annual
<input type="checkbox"/> Declog the pea gravel diaphragm, if necessary. <input type="checkbox"/> Correct erosion problems in the sand/soil bed of dry swales. <input type="checkbox"/> Plant an alternative grass species if the original grass cover has not been successfully established. Reseed and apply mulch to damaged areas.	Annual (as needed)
<input type="checkbox"/> Remove all accumulated sediment that may obstruct flow through the swale. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation, or once it has accumulated to 10% of the original design volume. Replace the grass areas damaged in the process. <input type="checkbox"/> Rototill or cultivate the surface of the sand/soil bed of dry swales if the swale does not draw down within 48 hours.	As needed (infrequent)

## Additional Information

Research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

The swale bottom and side slopes should be covered with dense vegetative cover to filter pollutants out of runoff and helps reduce flow velocities and protect the swale from erosion. Fine, close-growing grasses are ideal because increasing the surface area of the vegetation exposed to runoff improves the effectiveness of the swale. Drought tolerant vegetation than can tolerate sediment and debris accumulations are best-suited for swales.

## References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, 2010. Available online at:

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## General Description

Vegetated buffer strips (vegetated filter strips, biostrips, filter strips, and grassed filters) are vegetated surfaces that are designed to treat sheet flow from adjacent surfaces. They are an effective, easy to implement BMP that often go unrecognized at industrial and commercial facilities.

Vegetated buffer strips function by slowing runoff velocities and allowing sediment and other pollutants to settle and by providing some infiltration into underlying soils. They are well-suited to treating runoff from roads, roof downspouts, small parking lots, and pervious surfaces. They can be implemented to provide effective pretreatment for detention and infiltration stormwater BMPs.

Vegetated buffer strips can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems. Therefore, they are best suited for small landscaped portions of industrial or commercial facilities with low peak flow rates. They are not well suited to treat stormwater runoff from industrial areas that have insufficient source control BMPs.

## Inspection/Maintenance Considerations

Vegetated buffer strips require frequent landscape maintenance. In many cases, vegetated buffer strips initially require intense maintenance, but less maintenance is needed over time. Maintenance tasks may be conducted by a landscaping contractor. Maintenance requirements typically include grass or shrub-growing activities such as irrigation, mowing, trimming, removal of invasive species, and replanting when necessary. Buffer strips require more attention as the volume of sediment increases. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless

## Advanced BMPs Covered



## Maintenance Concerns

- *Vector Control*
- *Invasive Species Management*
- *Vegetation/Landscape Maintenance*
- *Erosion*
- *Channelization of Flow*
- *Aesthetics*

## Targeted Constituents

<i>Sediment</i>	■
<i>Nutrients</i>	●
<i>Trash</i>	▲
<i>Metals</i>	■
<i>Bacteria</i>	●
<i>Oil and Grease</i>	■
<i>Organics</i>	▲

## Legend (Removal Effectiveness)

● Low ■ High ▲ Medium

\* Requires Pretreatment

*Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.*





designed to dewater completely in 96 hours or less) and/or if proper drainage slopes are not maintained.

Inspection Activities	Suggested Frequency
<input type="checkbox"/> Once the vegetated buffer strip is established, inspect at least three times per year. Repair all damage immediately. <input type="checkbox"/> Inspect buffer strips after seeding and repair as needed.	Post construction
<input type="checkbox"/> Inspect buffer strip and repair all damage immediately. <input type="checkbox"/> Inspect soil and repair eroded areas.	After major storms
<input type="checkbox"/> Inspect for erosion or damage to vegetation, preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the strips are ready for winter. However, additional inspection after periods of heavy runoff is desirable. <input type="checkbox"/> Inspect pea-gravel diaphragm/level spreader for clogging and effectiveness and remove built-up sediment. <input type="checkbox"/> Inspect for rolls and gullies. Immediately fill with topsoil, install erosion control blanket and seed or sod. <input type="checkbox"/> Inspect to ensure vegetation is well established. If not, either prepare soil and reseed or replace with alternative species. Install erosion control blanket. <input type="checkbox"/> Check for debris and litter, and areas of sediment accumulation.	Semi-annual
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Water plants daily for 2 weeks after construction.	Post construction
<input type="checkbox"/> Mow regularly to maintain vegetation height between 2 - 4 inches, and to promote thick, dense vegetative growth. Cut only when soil is dry to prevent tracking damage to vegetation, soil compaction and flow concentrations. Clippings are to be removed immediately after mowing. <input type="checkbox"/> Remove all litter, branches, rocks, or other debris. Damaged areas of the filter strip should be repaired immediately by reseeding and applying mulch. <input type="checkbox"/> Regularly maintain inlet flow spreader. <input type="checkbox"/> Irrigate during dry season (April through October) when necessary to maintain the vegetation.	Frequently, as needed
<input type="checkbox"/> Remulch void areas. <input type="checkbox"/> Treat diseased trees and shrubs, remove dead vegetation.	Semi-annual
<input type="checkbox"/> Remove sediment and replant in areas of buildup. Sediment accumulating near culverts and in channels should be removed when it builds up to 3 in. at any spot, or covers vegetation. <input type="checkbox"/> Limit fertilizer applications based on plant vigor and soil test results. <input type="checkbox"/> Rework or replant buffer strip if concentrated flow erodes a channel through the strip.	Annual

## Additional Information

Research (Colwell et al., 2000) indicates that grass height and mowing frequency have little impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

The buffer strip should be covered with dense vegetative cover to filter pollutants out of runoff and helps reduce flow velocities and protect the strip from erosion. Fine, close-growing grasses are ideal because increasing the surface area of the vegetation exposed to runoff improves the effectiveness of the swale. Drought tolerant vegetation that can tolerate sediment and debris accumulations is best-suited for vegetated buffer strips.

## References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*. April, 2010. Available online at:  
<http://www.dot.ca.gov/hq/env/stormwater/pdf/CTSW-RT-09-239-06.pdf>.

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Watershed Management Institute, Inc. *Operation, Maintenance, and Management of Stormwater Management Systems*. August, 1997. Available online at: <http://www.stormwater.ucf.edu/research/stormwaterOMM/stormwateromm.pdf>.

## General Description

Water quality inlets (WQIs), also typically called trapping catch basins, oil/grit separators or oil/water separators, consist of one or more chambers that promote sedimentation of coarse materials and separation of free oil (as opposed to emulsified or dissolved oil) from stormwater. Some WQIs also contain screens to help retain larger or floating debris, and many of the newer designs also include a coalescing unit that helps promote oil/water separation.

These devices are appropriate for capturing hydrocarbon spills, but provide very marginal sediment removal and are not very effective for treatment of stormwater runoff. WQIs typically capture only the first portion of runoff for treatment and are generally used for pretreatment before discharging to other best management practices (BMPs).

## Inspection/Maintenance Considerations

High sediment loads can interfere with the ability of the WQI to effectively separate oil and grease from the runoff. During periods of high flow, sediment can be re-suspended and released from the WQI into surface waters if this is the only BMP on site prior to discharge. Maintenance of WQIs can be easily neglected because they are underground. Establishment of a maintenance schedule is helpful for ensuring proper maintenance occurs. The required maintenance effort will be site-specific due to variations in sediment and hydrocarbon loading. Since WQI residuals contain hydrocarbon by-products, they may require disposal as hazardous waste. Many WQI owners coordinate with waste haulers to collect and dispose of these residuals.

## Advanced BMPs Covered



## Maintenance Concerns

- *High Sediment Loads*
- *Hazardous Waste*
- *Vector Control*
- *Pollutant Release*

## Targeted Constituents

<i>Sediment</i>	●
<i>Nutrients</i>	●
<i>Trash</i>	▲
<i>Metals</i>	●
<i>Bacteria</i>	●
<i>Oil and Grease</i>	▲
<i>Organics</i>	●

## Legend (Removal Effectiveness)

● Low ▲ Medium ■ High

\* Requires Pretreatment

*Note: The removal effectiveness ratings shown in the table are for properly designed, sited, and maintained BMPs; some configurations will have variations in pollutant effectiveness.*



Inspection Activities	Suggested Frequency
<input type="checkbox"/> Inspect regularly to determine if maintenance is required.	Monthly during the wet season, or after significant rain events
<input type="checkbox"/> Contact the local mosquito and vector control agency if mosquito breeding is observed or suspected.	As needed
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Clean out and dispose of accumulated oil, grease, and sediments. Remove accumulated trash and debris. The clean out and disposal techniques should be environmentally acceptable and in accordance with local regulations.	Annual, before the wet season, or more frequent as needed

## Additional Information

Water quality inlets are most effective for drainage areas of 1 acre or less. They are often used in industrial applications such as airport runways, equipment washdown areas, and gas station parking lots. WQIs can be situated at the ground surface or underground, and they are available as pre-manufactured or cast-in-place units, typically constructed with reinforced concrete. They should be water-tight to prevent possible groundwater contamination, and should be sited such that vector trucks can easily access and remove sediment and pollutants.

Since WQIs can be relatively deep, they may be designated as confined spaces. Caution should be exercised to comply with confined space entry safety regulations if it is required.

## References

California Department of Transportation. *Treatment BMP Technology Report (CTSW-RT-09-239.06)*, 2010. Available online at:  
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Tahoe Regional Planning Agency. *Best Management Practices Handbook*, 2012. Available online at:  
<http://www.tahoebmp.org/Documents/2012%20BMP%20Handbook.pdf>.

## General Description

A multiple treatment system uses two or more treatment control BMPs in series to enhance pollutant removal and minimize maintenance efforts. There are many different combinations of treatment control BMPs to consider, and selection should be based on site-specific conditions and needs. Examples of multiple systems include:

- ☐ Water quality inlet combined with a media filter, infiltration basin, or infiltration trench;
- ☐ Vegetated swale or bioretention unit combined with a media filter, infiltration basin, or infiltration trench;
- ☐ Vegetated buffer strip combined with a vegetated swale;
- ☐ Extended detention zone on a wet pond; and
- ☐ Extended detention basin or media filter combined with a harvest and reuse system.

## Inspection/Maintenance Considerations

Each of the separate treatment processes will require maintenance as described in the previous fact sheets. For example, a multiple system comprised of a biofilter combined with an infiltration basin would require the inspection and maintenance considerations outlined on the fact sheet for each process.

Inspection Activities	Suggested Frequency
<input type="checkbox"/> Refer to individual treatment control fact sheets	As needed
Maintenance Activities	Suggested Frequency
<input type="checkbox"/> Refer to individual treatment control fact sheets	As needed

### Advanced BMPs Covered

- *Refer to Individual Treatment Control (TC) Fact Sheets*

### Maintenance Concerns

- *Refer to Individual Treatment Control (TC) Fact Sheets*

### Targeted Constituents

- *Refer to Individual Treatment Control (TC) Fact Sheets*





[illegible]





Visual Observation Log - Monthly	
Date and Time of Inspection:	Report Date:
Facility Name: <b>South Coast Landfill</b>	
Weather	
Antecedent Conditions (last 48 hours):	Current Weather:
NSWD Observations	
Was any authorized non-stormwater discharge observed?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Was any <b>unauthorized</b> non-stormwater discharge observed?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes to either, identify source:	
Outdoor Industrial Equipment and Storage Area Observations	
Complete Monthly BMP Inspection Report	<input type="checkbox"/> Yes <input type="checkbox"/> No
Observation/Drainage Area	Were any deficiencies or any other potential source of industrial pollutants observed?
Facility Entrance and Access Roads	<input type="checkbox"/> Yes <input type="checkbox"/> No
Interim Closed SWDS	<input type="checkbox"/> Yes <input type="checkbox"/> No
Transfer Station	<input type="checkbox"/> Yes <input type="checkbox"/> No
Leachate Collection Storage Tanks	<input type="checkbox"/> Yes <input type="checkbox"/> No
If yes to any, describe:	
Exception Documentation (explanation required if inspection could not be conducted).	
Inspector Information	
Inspector Name:	Inspector Title:
Signature:	Date:

### MONTHLY BMP INSPECTION REPORT

Date and Time of Inspection:		Date Report Written:	
<b>Part I. General Information</b>			
<b>Site Information</b>			
Facility Name: Facility Name: <b>South Coast Landfill</b>			
Facility Address: <b>40855 Fish Rock Road, Gualala, California 95445</b>			
Photos Taken:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Photo Reference IDs:	
<b>Weather</b>			
Estimate storm beginning: (date and time)		Estimate storm duration: (hours)	
Estimate time since last runoff from any drainage area: (days or hours)		Rain gauge reading and location: (in)	
Is a "Qualifying Storm Event" predicted or did one occur (i.e., discharge from site preceded by 48-hrs without discharge)? <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, summarize forecast:			
<b>Exception Documentation (explanation required if inspection could not be conducted).</b>			
<b>Inspector Information</b>			
Inspector Name:		Inspector Title:	
Signature:		Date:	

**Part II. BMP Observations. Describe deficiencies in Part III.**

Minimum BMPs (List and Inspect all BMPs Implemented)	Adequately designed, implemented and effective (Yes, No, NA)	Action Required (Yes/No)	Action Implemented (Date)
Good Housekeeping			
Preventative Maintenance			
Spill and Leak Prevention and Response			
Materials Handling and Waste Management			
Erosion and Sediment Controls			

Part II. BMP Observations Continued. Describe deficiencies in Part III.			
Advanced BMPs (List and Inspect all BMPs Implemented)	Adequately designed, implemented and effective (Yes, No, NA)	Action Required (Yes/No)	Action Implemented (Date)
Exposure Minimization BMPs			
Stormwater Containment and Discharge Reduction BMPs			
Treatment Control BMPs			
Other Advanced BMPs			

Part III. Descriptions of BMP Deficiencies		
Deficiency	Repairs Implemented:	
	Note - Repairs must be completed as soon as possible.	
	Repaired (Y/N)	Corrective Action Implemented
1.		
2.		
3.		
4.		

Part IV. Additional Corrective Actions Required. Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Identify BMPs that need more frequent inspection. Note if SWPPP change is required.	
Required Actions	Implementation Date

**Appendix 9:**

**Industrial General Permit (Hard Copy Only)**

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Eureka, CA | Arcata, CA | Redding, CA | Willits, CA | Coos Bay, OR | Klamath Falls, OR

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**APPENDIX E**  
**REFUSE REMOVAL/RECONSOLIDATION CLEAN CLOSURE WORK**  
**PLAN**



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# REFUSE REMOVAL AND RECONSOLIDATION WORK PLAN FOR THE SOUTH COAST LANDFILL



Prepared for:  
County of Mendocino  
Department of Transportation  
Solid Waste Division  
340 Lake Mendocino Drive  
Ukiah, California 95482

Prepared by:



800-C South Rochester Avenue  
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February 2013

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**REFUSE REMOVAL AND RECONSOLIDATION WORK PLAN  
SOUTH COAST LANDFILL, MENDOCINO COUNTY, CA**

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## **SECTION 1.0 INTRODUCTION**

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## 1.0 INTRODUCTION

This Refuse Removal and Reconsolidation Work Plan (Work Plan) has been prepared to present activities associated with work to remove and reconsolidate refuse from a portion of South Coast Landfill (SCL) to the existing top deck area of the SCL. Refuse removed from specific landfill areas will be removed in accordance with Title 27 of the California Code of Regulations (27 CCR), Section 20950(a)(2)(B). It is estimated that approximately 25,000 cubic yards (cy) of refuse would need to be removed and reconsolidated. The capacity of the reconsolidation area is approximately 30,000 cy (refuse and soil).

The SCL is located in Mendocino County, east of Highway 1 on Fish Rock Road (see Figure 1) in the southeast  $\frac{1}{4}$  of the south  $\frac{1}{2}$  of Section 4, Township 11 north, Range 15 west, Mount Diablo Base and Meridian. The address of the SCL is 40855 Fish Rock Road, Gualala, California 95445, Assessor's Parcel No. 141-080-26.

### 1.1 Site Location and Site Description

The SCL is an inactive Class III landfill that is located in a remote portion of southwestern Mendocino County and encompasses approximately 48 acres. Approximately six acres were utilized for waste disposal. There are no structures within 1,000 feet of the site property boundary. The land surrounding the SCL is zoned Timber Preserve Zone (TPZ), with a minimum parcel size of 160 acres.

The SCL was permitted and approved to operate as a Class III municipal solid waste disposal site. The SCL exhausted waste capacity in 2000. A municipal solid waste transfer station was then constructed and currently operates at the site. The current waste types received at the transfer station consist of mixed municipal refuse, classified non-hazardous solid waste and inert waste as defined in accordance with 27 CCR, Sections 20220 and 20230 defining Class III wastes. The current maximum daily refuse inflow rate for the South Coast Recycling and Transfer Station is 550 tons per day (tpd) as allowed under Solid Waste Facility Permit (SWFP) No. 42-AA-0014.

### 1.2 Facility History and Project Background

The SCL is a Class III solid waste disposal facility. The County began landfill operations in 1970 and ceased operations in 2000. The SCL is owned and was operated by the County of Mendocino Department of Transportation (County) Solid Waste Division (SWD). The SCL served the residents of Mendocino County South Coast Area, which is the State Route 1 corridor from the Sonoma County Line to the Navarro River. This area includes the towns of Elk, Irish Beach, Manchester, Point Arena and Gualala. The landfill was constructed in a shallow ravine utilizing the area fill method to place, compact, and cover refuse on a daily basis.

The site operated in accordance with State Minimum Standards for a Class III disposal facility as established by the State Water Resources Control Board (SWRCB) and CalRecycle. The site accepted mixed municipal refuse, classified nonhazardous solid waste and inert

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waste as defined in the 27 CCR, Sections 20220 and 20230. No liquid or hazardous waste was knowingly accepted at the site. Wastes at the landfill generally consisted of municipal refuse including residential refuse, commercial refuse, and demolition refuse.

### **1.3      Work Plan Purpose**

This Work Plan addresses removal and reconsolidation of waste materials and associated verification sampling procedures to certify the designated areas as free of waste constituents. A completion report will be prepared at the conclusion of this closure project. This Work Plan was prepared to comply with 27 CCR, Section 21810(c) and (d). Confirmatory sampling and the verification (completion report) will be prepared to comply with 27 CCR, Section 21810(e).

Figure 2 shows the areas of waste removal and where waste reconsolidation will occur. This Work Plan was prepared for submittal to the regulatory agencies having jurisdiction over the SCL, in conjunction with the Final Closure Construction Drawings and Final Closure Plan (FCP). This Work Plan has been developed to provide more specific detail of the waste removal and reconsolidation activities to be implemented at SCL and will be included as part of the FCP. All work described in this Work Plan was coordinated through the County of Mendocino Public Health Department, Division of Environmental Health (acting as the Local Enforcement Agency [LEA]), the California Department of Resources Recycling & Recovery (CalRecycle), the Regional Water Quality Control Board (RWQCB) North Coast Region, and the Mendocino County Air Quality Management District (MCAQMD).

Health and safety procedures must also be followed during any waste material removal. A Health & Safety Plan (HSP), which establishes the policies and procedures to be followed for the protection of the site construction personnel and the public from potential hazards posed by excavation and associated work at this site, will be provided by the selected Contractor. Section 4.4 also discusses the HSP. Dust control procedures followed during waste removal and reconsolidation will be outlined in the Contractor's Dust Control Plan (DCP).

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**SECTION 2.0**  
**REFUSE REMOVAL AND RECONSOLIDATION**  
**MANAGEMENT PLAN**



## 2.0 REFUSE REMOVAL AND RECONSOLIDATION MANAGEMENT PLAN

This section describes procedures to be implemented during removal and reconsolidation of the waste materials. Areas currently designated for waste removal within SCL and reconsolidation into the existing top deck area is shown on Figure 2.

### 2.1 Schedule and Sequence of Operations

This Work Plan provides an approximate schedule and sequence of anticipated waste removal and reconsolidation activities (see Table 1 below). No activity described in this Work Plan will continue in the event that the LEA, MCAQMD, or RWQCB requires cessation of the operation.

A detailed construction schedule will be provided by the contractor after the construction contract is awarded, which is anticipated in 2014.

**TABLE 1**  
**REFUSE REMOVAL AND RECONSOLIDATION SCHEDULE**

Activities	Months				
	1	2	3	4	5
Work Plan Preparation	■				
Work Plan Approval*		■			
SCL Waste Removal/Reconsolidation		■	■	■	
Confirmation Sampling					■
Verification Report					■

\*Concurrent with review and approval of the FCP.

Refuse removal will be conducted from the known extent of the waste relocation area shown on Figure 2 and will continue until all wastes have been removed. Removed waste will be immediately placed into trucks, delivered to and deposited at the reconsolidation area of the site, and compacted and covered with clean soil as shown on Figure 2. Refuse removal and reconsolidation activities for the designated portion of the SCL are anticipated to be completed at the start of and concurrent with final closure construction up to a two and a half month period.

Work days and hours will be consistent with closure construction operating days and hours identified in the Final Closure/Post-Closure Maintenance Plan (FCPCMP) for the SCL.

### 2.2 Removal and Reconsolidation Activities

Prior to waste removal and reconsolidation of the refuse, existing cover materials, estimated to vary in thickness from one foot to as much as several feet, will be scrapped off and stockpiled near the removal or reconsolidation area to be used for cover soils. Following

removal of the existing cover, to a point where approximately six inches remain, refuse and inter-mixed soil will be excavated using conventional excavation equipment. Upon removal, the refuse will be placed into end-dump trucks, or equivalent equipment, and transported to the re-consolidation area at the top deck of the landfill. Removed materials (refuse and inter-mixed soil) will be moved to the reconsolidation area and will be covered promptly throughout the day depending on the nature of the removed waste (e.g., highly odorous).

The project duration will depend on a daily removal rate (as low as 500 cubic yards per day and as high as 2,000 cubic yards per day) that can vary depending on actual site conditions, and/or based on regulatory agency requirement. The anticipated duration of waste removal and reconsolidation is up to two and a half months (see Table 1).

## **2.3      Management of Excavated Waste**

Activities described in this Work Plan (i.e., removal and reconsolidation phases of work) will comply with the provisions of the Contractor's HSP. In addition to health and safety requirements, the following site controls will be implemented:

- ◆ All exposed refuse will be covered daily with clean soil or tarps.
- ◆ Removed refuse materials will not be stockpiled upon removal and will be covered promptly throughout the day depending on the nature of the removed waste (i.e., highly odorous).
- ◆ Removal and loading of waste will not be conducted when wind speed is consistently greater than 15 mph or when wind gusts exceed 25 mph, unless allowed by the LEA, the MCAQMD, or other regulatory agencies.
- ◆ To avoid potential run-on of surface water during wet weather, dirt berms, ditches or sand bags will be placed around the waste removal area in such a manner as to divert surface water flow and prevent potential infiltration. No waste removal will take place during significant storm events that are capable of generating surface accumulation or flow.
- ◆ All transport trucks will be loaded in such a manner so as to minimize the potential for spillage during transport. If it is determined that a load has to leave the site, it will be covered with a tarp or other equivalent means.
- ◆ At the end of the workday, the waste removal workface will be covered (e.g., tarps) and watered in such a manner as to prevent dust nuisance but not to create run-off.

### **2.3.1      Waste Characterization**

A record of waste reconsolidation activities will be maintained on a daily basis. Daily relocation records will include the approximate volume of material removed and reconsolidated, and the area of relocation.

The SCL is an inactive Class III landfill. Waste removal/observation will be performed and recorded as part of the final closure Construction Quality Assurance (CQA).

Once all refuse materials are removed, the underlying soils will be visually assessed for any potential impacts. If any discoloration, odor or stains are observed, these soils will be excavated until visually non-impacted native materials are encountered. Confirmatory sampling will be conducted as outlined in Section 3.0.

### **2.3.2 Contingency Plan for Burn Ash and Hazardous Waste**

Based on the available information, burn ash and/or hazardous wastes are not anticipated to be encountered during waste removal and reconsolidation (re-disposal) activities for the designated areas.

Refuse excavation will be performed under the observation of CQA personnel for the purpose of detection of hazardous waste. Disposal operations personnel will be trained in detection of potential hazardous waste and will also observe the reconsolidation efforts at the working face during reconsolidation. This “second chance” at hazardous waste material detection will be performed under the more stringent waste screening process than in effect during the time of original disposal.

If burn ash or suspected hazardous materials are encountered during excavation, these wastes will be isolated and carefully separated without being blended or diluted with underlying and surrounding soils or other wastes. Burn ash or suspected hazardous materials will be stockpiled on plastic and covered with plastic.

Random samples of burn ash and/or suspected hazardous materials will be collected and sent to a state-certified laboratory for characterization. Following receipt of analytical results, arrangements for proper removal and disposal according to state and federal hazardous waste laws will be made. The sampling plan for burn ash and/or hazardous waste (which includes analysis of collected samples for soluble concentrations of heavy metals) is presented in Appendix B.

Prohibitions in SCL’s WDR Order No. 77-23 requires that the discharge of “Group 1” or hazardous waste is prohibited. For the purposes of the WDR, the term “hazardous waste” is as defined in Title 23 of the California Code of Regulations, Section 2510 et seq. and “designated waste” is as defined in 27 CCR. Designated waste constituents are those waste constituents that could be released from a Unit at concentrations exceeding background groundwater or surface water concentrations or affect the beneficial uses of waters of the state as contained in the *Water Quality Control Plan Report for the North Coast Region* (Basin Plan). Based on analytical results, the burn ash/or suspected hazardous materials may not be appropriate for reconsolidation to another area at the landfill based on the current WDR. Waste that falls under this category will be removed from the site and transported to an approved waste disposal facility.

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### 2.3.3 Contingency Plan and Best Management Practices (BMP's) for Rain Events

To avoid potential run-on of surface water during the rainy season, dirt berms or ditches will be placed around the waste removal area in such a manner as to divert surface water flow and prevent potential infiltration. If surface flow areas are temporarily blocked, a membrane-lined pumping pond will be constructed to prevent potential infiltration. No waste removal will take place during significant storm events that are capable of generating surface accumulation or flow.

Should a rainfall event as defined by the Construction General Permit (CGP), be predicted, the working face of the removal area will be covered with either tarps or soil, and the waste removal and re-disposal activities will be curtailed until the event has passed.

All work relative to waste removal and re-disposal at the SCL is subject to the requirements of the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Industrial Activities Order No. 97-03-DWQ, NPDES No. CAS000001 (hereinafter referred to as the "IAO"). The Contractor will be required to provide BMP's for interim erosion control as required per Order No. 2009-0009-DWQ, NPDES No. CAS000002, (Construction General Permit) as modified January 8, 2009 (hereinafter referred to as the "Order"). A Construction General Storm Water Permit may not specifically be required for this project; however, the overall construction project requires a Construction General Storm Water Permit, therefore all requirements of the CGP will apply.

### STORM WATER POLLUTION PREVENTION PLAN

The Contractor shall develop a Storm Water Pollution Prevention Plan (SWPPP) as required by the Construction General Permit (CGP) described within Section D, "Permits." The SWPPP shall be developed, amended, and certified by a Qualified SWPPP Developer (QSD). A QSD shall have one of the registrations or certifications listed in Section VII.B.1 of the CGP, and effective September 2, 2011, must have attended a State Water Board-sponsored or approved Qualified SWPPP Developer Training Course.

The SWPPP shall be developed and updated using Section 2 and Appendix G of the California Stormwater Quality Association (CASQA) Stormwater Best Management Practice (BMP) Handbook Web Portal for Construction. The web portal requires a subscription to be purchased from CASQA and can be accessed at the following link:

<http://www.casqa.org/LeftNavigation/BMPHandbooksPortal/tabid/200/Default.aspx>

The Contractor shall submit the first version of the complete SWPPP in electronic format with at least two hard copies in three-ring binders with separators and tabs to the Engineer for review and comments.

Upon acceptance of the SWPPP, the Contractor shall submit a final electronic plan and six hard copies, each placed in a three-ring binder with separators and tabs.

The Engineer's review/acceptance is for administrative purposes only and shall not relieve the Contractor from his responsibility to provide adequate stormwater management per the requirements of the CGP.

The Contractor shall implement, maintain, and amend the SWPPP as needed during the course of work to reflect actual construction progress and construction practices. The Contractor shall designate a Qualified SWPPP Practitioner (QSP), as defined by the CGP, who will be responsible for compliance with CGP requirements for the project at all times.

The Contractor shall be responsible for and shall submit to the Engineer copies of all Contractor-generated SWPPP documents, including all sampling test results, inspection reports, Rain Event Action Plans (REAP), annual reports, and other time sensitive documents involving monitoring data. Such documentation shall be provided as soon as the information is made available and shall be provided within twenty-four hours when requested by the Engineer. The Contractor shall be required to produce such data and documentation at the project site on demand if so requested by the RWQCB staff during a site inspection.

The Contractor shall comply with all the requirements identified in the CGP. Non-adherence with the requirements identified in the CGP may constitute a violation of the Clean Water Act and the Porter-Cologne Water Quality Control Act and may be grounds for enforcement action by the RWQCB. Any fines incurred by SWD due to the Contractor's lack of compliance with the requirements of the CGP, shall be back charged by SWD to the Contractor and deducted from any monies that may become due to the Contractor.

The requirements of the SWPPP shall include, but not be limited to, the following:

1. Submit Permit Registration Documents (PRDs) per Section XV of the Municipal Permit and Appendix B of the CGP to the Engineer;
2. Develop a SWPPP to conform to the correct risk level and the Contractor's actual construction practices;
3. Administer, implement, maintain, and ensure adequate functioning of the various water quality control measures identified within the SWPPP during construction including all Numeric Action Level (NAL) and Numeric Effluent Limitation (NEL) sampling, monitoring and reporting requirements statutorily required for the determined Risk Level of the site. These tasks must be performed by QSP. Effective on September 2, 2011, a QSP shall meet the requirements listed in the General Permit;
4. Pay all permit fees;
5. Contractor will be responsible for paying all fines imposed by the SWRCB for violation to the CGP caused by the Contractor's operations which fail to comply with the CGP;
6. Provide and maintain all documentation (at the site) and administration for the entire contract period;

7. Perform all work required for compliance with the requirements of the CGP including preparation of all REAPs, construction of effective treatment control BMPs (i.e., contingency basins, chemical treatments, etc.), if applicable; and
8. Provide all labor, tools, equipment, materials and incidentals for any additional BMPs not shown or identified in the SWPPP which may be required to comply with the requirements of the CGP or when requested by the Engineer.

#### **2.3.4 Dust Control**

Dust will be controlled in accordance with the MCAQMD Rule 1-403. It is anticipated that water will be the primary means of controlling fugitive dust emissions resulting from waste removal, waste reconsolidation, and on-site transportation of the material. The contractor is required to have a water truck with a spray hose at the refuse removal face at all times during the soil/refuse excavation operation. The water applied will be limited to what is required to control dust without allowing run-off of water or saturation of waste. Water or other dust suppressants will be provided for all operations to prevent dust nuisance at the site and along the access roads. Both potable and non-potable water is used for dust control.

The waste will be removed from the area in a manner to minimize or eliminate dust emissions during transport. During waste removal, all working areas, excavated material, and unpaved roads shall be watered down until the surface is moist, and then maintained in a moist condition to eliminate dust emissions. Watering of the material removed will be conducted in such a manner as to not generate any run-off.

In addition, as discussed in Section 1.3, a DCP will be followed for these activities. The Contractor will be required to implement their own dust control program.

#### **2.3.5 Waste Stabilization**

All material generated from the waste removal portion of the operation shall be transported to the designated waste reconsolidation area on the top deck. All material shall be spread in lifts within the reconsolidation area not to exceed 24-inches and compacted with a landfill compactor or equivalent piece of heavy equipment.

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## **SECTION 3.0 VERIFICATION SAMPLING**

### 3.0 VERIFICATION SAMPLING

As discussed in Section 2.0 of the Work Plan, once visual confirmation verifies that all refuse and stained/discolored soil has been removed from the designated waste removal/reconsolidation area, verification sampling of the underlying exposed soil will begin. Soil sample locations within the designated portion of the SCL area were selected by SWT Engineering using a linear method from the center of refuse excavation area. Each sampling location is approximately 100 feet from each other, with at least two sampling points per area. To assure accurate background comparison of the confirmation samples, three samples will be taken outside of the refuse excavation area in an undisturbed location.

In accordance with 27 CCR, Section 21810(e), the final Verification Report will confirm that all waste and residual contaminated soil has been removed. The Verification Report will be prepared by a registered civil engineer or a certified engineering geologist and submitted to the LEA, CalRecycle, and the RWQCB.

#### 3.1 Field Observation

The waste removal and reconsolidation area will be visually inspected upon completion of activities in the designated area. Field personnel will look for discolored soil and/or waste residue/layer along the bottom of the excavation area, as well as along the refuse limits. Previous field investigation, as well as historic records, defined the waste limits. However, in the event additional waste is observed, additional refuse removal will be conducted as outlined in Section 2.0. In order to document the adequacy of the waste removal and reconsolidation work, in addition to the visual inspection, soil samples to evaluate the presence of residual, non-visible contamination will be collected and analyzed in accordance with procedures outlined in Section 3.2.

#### 3.2 Soil Sampling Analysis

Soil samples will be collected using disposable sampling equipment and placed in laboratory-supplied containers. The samples will be labeled, sealed, and placed in a cooler for transportation to the laboratory with appropriate chain-of-custody documentation. Sample locations will be marked and surveyed. Field personnel will collect four soil samples representative of background conditions at the SCL from areas outside of the existing refuse limits. Additional samples will be collected from the waste removal area, as discussed herein.

It should be noted that the base of the refuse removal area may vary, which may have occurred prior to historical waste discharges. It is within the deep basal areas (i.e., the areas with deepest waste discharge) of the waste removal area where leachate would most likely have accumulated, much like a “sump”, and migrated into underlying soils. The deeper basal areas will be identified during the excavation phase of waste removal and one additional confirmation soil sample will be collected from beneath such areas along with the other proposed random soil samples.



All of the soil samples will be analyzed for 22 CCR metals by EPA Method 6010B, and total petroleum hydrocarbons (TPH) by EPA Method 8015M. If burn ash or suspected hazardous materials are encountered during refuse removal activities and such wastes are determined to contain PCBs, dioxins, furans, PAHs, semi-volatile organic compounds, pesticides or other waste constituents, then further analysis for these waste constituents will also be included in the verification soil sampling investigation. The samples analysis will be used as a screening-level assessment for residual contamination by comparing the highest background soil chemistry results against the waste removal area confirmation samples. Table 2 presents a sample constituent concentration table, which will be utilized in the Verification Report. If the analytical results are above the highest background soil chemistry results, the impacted sampling area will be further characterized to define the lateral extent of the impact. Once the area of impact is defined, an additional foot of soil will be excavated from the area of impact. After additional soil removal, an additional confirmation soil sample will be collected (as described above) from the impacted area(s) from which additional soil was removed. Further excavation will be warranted if the analytical results are above the highest background soil chemistry results. This process will be repeated until analytical results are below the highest background soil chemistry results.

TABLE 2 - SAMPLE CONSTITUENT CONCENTRATIONS

Background Samples		Analyte																			
		Grid Location	Total Petroleum Hydrocarbons	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc	VOC Analysis
CleanUp Configuration Samples	BS-1																				
	BS-2																				
	CCS-1																				
	CCS-2																				
	CCS-3																				
	CCS-4																				
	CCS-5																				
	CCS-6																				
	CCS-7																				
	CCS-8																				
	CCS-9																				
	CCS-10																				
	CCS-11																				
	CCS-12																				
	CCS-13																				
	CCS-14																				
	CCS-15																				
	CCS-16																				
	CCS-17																				
	CCS-18																				
	CCS-19																				
	CCS-20																				
	CCS-21																				
	CCS-22																				
	CCS-23																				
	CCS-24																				
CCS-25																					
CCS-26																					
CCS-27																					

**Notes:** NA – Not Analyzed                      ND – Not Detected above the laboratory reporting Limit.  
Mg/kg – milligrams per kilogram

The soil sampling and analysis procedures outlined in the section are consistent with standard methods and practices exercised in the State of California for similar types of work. The procedures outlined in the Work Plan are specific to site conditions at the SCL and may not be sufficient for other seemingly similar purposes.

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## **SECTION 4.0 HEALTH AND SAFETY PLAN**

## 4.0 HEALTH AND SAFETY PLAN

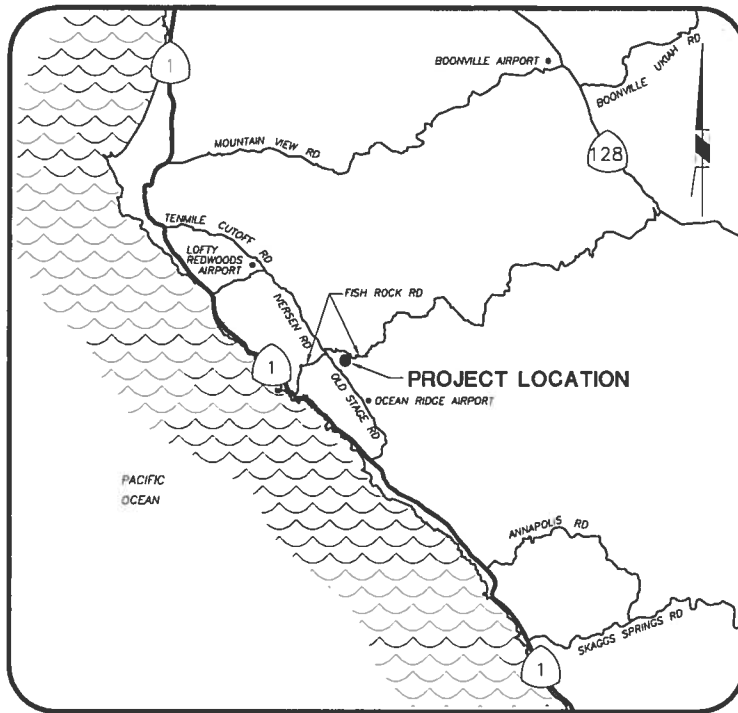
A HSP will be provided by the selected Contractor to complement this Work Plan. The Contractor's HSP will establish policies and procedures which protect site personnel and the public from potential hazards posed by work at the SCL during refuse removal and relocation. The HSP will discuss key personnel and management, hazards associated with the SCL site during refuse removal, requirements for personal protective equipment, decontamination procedures, emergency response protocols, and training requirements. It will also provide necessary health awareness information and forms for meetings, records, and reports.

Project activities shall be conducted in a manner that minimizes the probability of injury, accident or incident occurrence. All of the Contractor's site personnel will be required to read and sign the HSP prior to working at the site.

Based on the field-encountered conditions, the HSP may be modified to accommodate revised requirements for the protection of and the health and safety of on-site personnel.

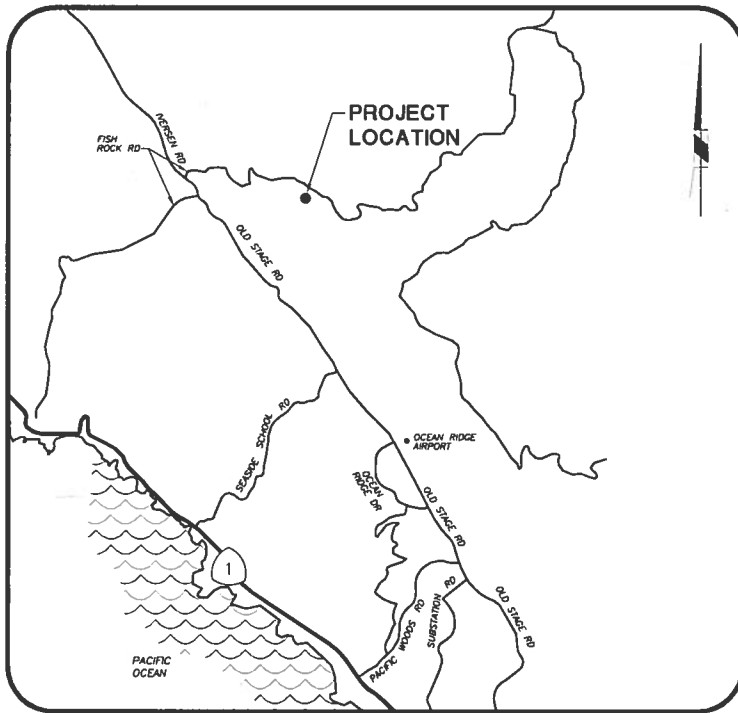
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## FIGURES



### VICINITY MAP

SCALE: 1"=8 MI



### LOCATION MAP

SCALE: 1"=1.5 MI

SITE ADDRESS:  
40855 FISH ROCK ROAD  
GUALALA, CA 95445  
ASSESSOR'S PARCEL NO.  
141-080-26

FIGURE 1

PREPARED BY:



800-C SOUTH ROCHESTER AVENUE  
ONTARIO, CALIFORNIA 91761

SOUTH COAST LANDFILL

SITE VICINITY AND LOCATION MAP



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**APPENDIX A  
BURN ASH/HAZARDOUS MATERIALS  
SAMPLING PLAN**

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## **SAMPLING PLAN**

This sampling plan is intended to document the procedural and analytical requirements for collection and analysis of burn ash and/or suspected hazardous material samples.

### **1. BURN ASH AND/OR HAZARDOUS MATERIALS SAMPLING**

Based on past experience with burn ash sites, elevated levels of heavy metals, especially lead, and low to non-detectable levels of Total Petroleum Hydrocarbons (TPH), Semi-Volatile Organic Compounds (Semi-VOCs), Polychlorinated Biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAHs), dioxins and furans, may be expected to be found in the samples. The pH is expected to range from 6.0 to 9.0. Burn ash is not anticipated to be reactive or ignitable.

However remote, a possibility of encountering hazardous waste at the site also exists. As such, a myriad of potential compounds may be present. In addition, hazardous wastes can be reactive, ignitable and/or corrosive.

#### **1.1 Sampling Methodology**

Burn ash will be stockpiled outside the area of planned excavation and to a height of approximately six feet. To select sampling locations, the surface area of the stockpile will be divided in 100 cubic yard sectors. Each sector will be divided into six subsectors. One subsector from each sector will then be randomly selected. The depth of the sample will also be randomly selected.

Suspected hazardous material will be stockpiled outside the area of planned excavation. Each discovery of suspected hazardous material will be placed into a separate stockpile. Discrete sampling will be used to assess the suspected hazardous materials. The sampling will be conducted by using the authoritative sampling method. This method is based on the subjective judgment of the investigator regarding the location of potential contamination and serves as a valuable investigative tool in ascertaining if a hazardous substance is or is not present. As with most waste sites, the waste material is expected to be highly heterogeneous, and therefore, development of a uniform sampling protocol is not practical.

#### **1.2 Sampling Equipment**

The following equipment will be necessary to perform the sampling:

- Disposable or stainless steel (SS) trowels
- Sealable plastic bags
- Packing and duct tape
- Cooler and ice or blue ice
- Wide mouth glass jars
- 2-inch diameter stainless steel sampling tubes
- Five gallons of de-ionized/distilled water
- 500 mL of 0.1 N nitric acid in a spray bottle



- 
- Chain of custody forms and custody seals
  - Decontamination equipment (2-1/2 gallon sprayer, non-phosphate detergent, disposable brush, paper towels, cotton towels)
  - Level C health and safety equipment (Tyvex, tape, respirator with HEPA filter)
  - Field log book
  - Survey lath
  - First aid kit and eye wash
  - Mailing labels and markers

### **1.3 Waste Sampling Procedures and Handling**

Burn ash and/or suspected hazardous material samples will be collected using stainless steel or disposable hand trowels and/or a stainless steel split-tube core sampler, or equivalent sampling device. At locations where the use of a hand trowel is practical, samples will be collected into wide-mouth, ½ liter plastic or glass containers or plastic bags. Samples collected from greater than one-foot beneath the surface of the waste will be collected in a stainless steel tube sampler which will be driven into the underlying waste material using a hand driven slide sampler. Samples will be collected into 6-inch long by 2-inch diameter stainless steel tubes installed within the tube sampler. As the samples are retrieved, the ends of the tubes will be covered with Teflon sheets and secured with plastic caps. Sample containers will be filled to the top, taking care to prevent material from remaining in the lid threads prior to being closed to prevent potential contamination. Both the tubes and/or the sample containers will be properly labeled, placed inside a sealable plastic bag, and stored in an ice chest and cooled to 4°C.

At the completion of sampling activities, samples will be delivered to a state-certified hazardous waste laboratory for analyses using standard chain-of-custody protocols.

### **1.4 Decontamination Procedures**

All equipment that comes into contact with burn ash and/or suspected hazardous materials will be decontaminated in a pre-designated area. Disposable equipment intended for one-time use will not be decontaminated, but will be packaged for appropriate disposal. Decontamination will occur prior to and after each use of a piece of equipment.

The following decontamination procedures will be followed:

- Non-phosphate detergent and tap-water (bottled water) wash, using a brush if necessary
- Tap-water rinse
  - N nitric acid rinse
- De-ionized /distilled water rinse, repeated twice

---

## 1.5 Disposal of Residual Materials

In the process of collecting burn ash and/or suspected hazardous material samples at the ARL, the sampling efforts will generate different types of potentially contaminated investigation-derived waste (IDW) that will include:

- Used personal protective equipment (PPE)
- Disposable sampling equipment
- Decontamination fluids

The US EPA's National Contingency Plan requires management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements to the extent practicable. The IDW will contain minor residual amount of the burn ash and/or suspected hazardous materials. These residual wastes are not considered hazardous and will be disposed of at the site (within the active refuse fill area). Used PPE and disposable equipment will be double-bagged and also disposed of at the site. Any PPE and disposable equipment that is to be disposed of, which can still be used, will be rendered inoperable before disposal. Decontamination fluids that will be generated during sampling will consist of nitric acid, de-ionized water, residual contaminants, and water with non-phosphate detergent. The volumes and concentrations of the decontamination fluids will be sufficiently low to allow disposal. The water with detergent will be poured onto the ground. The nitric acid will be diluted and tested with pH paper before pouring onto the ground.

## 1.6 Analytical Procedures

Collected burn ash samples will be tested for the following:

- pH, EPA Method 9040
- CAM 17 Metals, EPA Method 6010B/ 7000 series.
- TPH, carbon chain, EPA Method 8015M
- Semi-VOCs, EPA Method 8270
- PCBs, EPA Method 8082
- PAHs, EPA Method 8310
- Dioxins and furans, EPA Method 8280

Collected suspected hazardous material samples will be tested for the following:

- pH, EPA Method 9040
- CAM 17 Metals, EPA Method 6010B/ 7000 series.

- 
- Total Petroleum Hydrocarbons (TPH, carbon chain), EPA Method 8015M
  - Semi-Volatile Organic Compounds, EPA Method 8270
  - Volatile Organic Compounds, EPA Method 8260
  - Pesticides, EPA Method 8080
  - Asbestos, EPA 600/M4-82-020 (if suspected)

In the event that results of the CAM 17 Metals analysis for total metal concentrations indicate exceedance of the 10-times the California Soluble Threshold Limit Concentration (STLC) or 20-times the Federal Toxicity Characteristic Leaching Potential (TCLP) levels, additional testing (using a Waste Extraction Test with a citrate buffer [Title 22, California Code of Regulations] and a TCLP test [USEPA Test Method 1311]) for soluble content and/or leaching potential will be performed and compared with respective state and federal standards.

In addition, other analyses may be necessary based on field observations and/or results of above proposed testing. Suspected hazardous materials may require analysis for reactivity (EPA Method 9030A), corrosivity (EPA Method 9045) and ignitability (EPA Method 1010).

### **1.7      Laboratory Quality Assurance and Quality Control**

Aside from following standard operating procedures and regular industry practices, no project-specific field quality control will be performed.

The analytical laboratory will perform Quality Control (QC) in accordance with their in-house QC protocols. The QC will include method blank results, laboratory control spike, and matrix spike results.

Method Blank Results – A method blank is a laboratory-generated sample that assesses the degree to which laboratory operations and procedures cause false-positive analytical results for a sample. The method blank results associated with the samples will be included with the analytical results.

Laboratory Control Spike – A Laboratory Control Spike (LCS) is a sample that is spiked with known analyte concentrations, and analyzed approximately 10 percent of the sample load in order to establish method-specific control limits. The LCS results associated with each sample will be attached on the LCS and LCS Duplicated Analysis Report.

Matrix Spike Results – A matrix spike is a sample that is spiked with known analyte concentrations and analyzed at approximately 10 percent of the sample load in order to establish method-specific control limits. The matrix spike results associated with these samples will be attached on the Matrix Spike and Matrix Spike Duplicate Analysis Report.

---

Accuracy – Accuracy will be measured by percent recovery as defined by:

$$\% \text{ recovery} = \frac{(\text{measured concentration}) \times 100}{(\text{actual concentration})}$$

## **2. DOCUMENTING AND REPORTING**

### **2.1 Field Notes**

A field logbook will be used to document the vital project and sample information. At a minimum, the following sample information will be recorded:

- Sampler's name(s)
- Date and time of sample collection
- Designation of sample as composite or grab
- Type of sample (soil, sediment or water)
- Type of sampling equipment used
- Field instrument reading, if applicable
- Field observations and details related to analysis or integrity of samples (e.g., weather conditions, noticeable odors, colors, etc.)
- Preliminary sample descriptions
- Sample preservation
- Sample identification numbers and explanatory code
- Name of recipient laboratory

In addition to the sampling information, deviations from the sampling plan and the level of health and safety protection required to perform sampling will also be recorded in the logbook.

### **2.2 Photographs**

Photographs will be taken at the sampling locations. The photos will verify information entered in the field logbook. Each photo taken will have a caption in the logbook with the approximate time, date, and location.

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## 2.3 Reporting

Once the excavation activities, waste sampling are completed and the analytical results are received and evaluated, SWT will prepare a completion report for submittal to the City, LEA and CVRWQCB within 30 days after receipt of the final analytical results.

**ATTACHMENT 1**  
**CLOSURE TURF INSTALLATION GUIDELINES MANUAL**



# Installation Guidelines Manual

December 2018

**Before utilizing this document as an installation tool, Installer should download the latest version of the Installation Guidelines Manual from the website at [www.watershedgeo.com](http://www.watershedgeo.com).**



ClosureTurf®, HydroTurf®, VersaCap® and HydroBinder® products are U.S. registered trademarks that designate products by Watershed Geosynthetics, LLC. These products are the subjects of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications.

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1.0 Introduction

ClosureTurf® is a patented, 3-component system\* that serves as the final cover system on landfills. The 3 components of this unique system are:

- Component 1 - An Agru Super Gripnet® LLDPE (or HDPE) geomembrane liner, or other liner approved for use by WatershedGeo.
- Component 2 - An Engineered Turf
- Component 3 - A sand infill (and/or alternatively, Hydrobinder®)

\*A Watershed Geosynthetics® patented (patent no. 8,585,322) gas collection system is a separate component to be utilized on sites that produce gas emissions. Pressure Relief Valves are provided at one per acre of ClosureTurf® on landfills where gas emissions are expected.

1.1 Purpose and Scope

The ClosureTurf® Installation Guidelines document has been prepared to provide the Engineer / Contractor / Installer general guidance to the proper installation of the ClosureTurf® System. This document should be used in conjunction with the ClosureTurf® CSI (Construction Standards Institute) Specifications for the proper installation of the product.

This manual is meant as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for site conditions and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

2.0 Definitions

Whenever the terms listed below are used, the intent and meaning will be interpreted as indicated.

Acclimation

Physiological/thermal adjustment. Required in the geomembrane deployment process.

## **ArmorFill®**

Armor-Fill® Liquid Emulsion is a proprietary Polymer Emulsion product used to bind the ASTM-C33 sand infill component of the ClosureTurf® System.

## **ASTM**

ASTM International, known until 2001 as the American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

## **ClosureTurf®**

A patented 4 component system consisting of a Watershed Geosynthetics specific Gas Management System (if applicable), a Structured Geomembrane (LLDPE or HDPE), an Engineered Turf, and a specific grade of sand infill (or alternatively a HydroBinder®).

## **Construction Quality Assurance (CQA)**

Construction Quality Assurance includes but is not limited to observations and documentation of materials and workmanship necessary to show that a particular project is being constructed according to site-specific specifications and within regulatory guidelines.

## **Construction Quality Assurance (CQA) Personnel**

Construction Quality Assurance (CQA) personnel are representatives of the Professional of Record (POR) who work under direct supervision of the POR. The CQA personnel are responsible for quality assurance monitoring, applicable conformance sampling and performing onsite tests and observations.

## **Construction Quality Assurance Professional of Record (POR)**

The POR is an authorized representative of the Owner and has overall responsibility for CQA efforts and to confirm the project was constructed in general accordance with site-specific specifications approved by the regulatory authority and contract documents. The POR must be licensed as a Professional Engineer in the State the project is located and experienced in geosynthetics.

## **Construction Quality Control (CQC) Personnel**

CQC Personnel are representatives of the Geosynthetics Installer who work under direct supervision of the Geosynthetics Installer. The Geosynthetics Installers' CQC Personnel are responsible for construction quality control, applicable conformance sampling and performing onsite tests and observations.

## **Contract Documents**

Written, printed, or electronic matter that provides information or evidence that serves as an official record and are issued by the owner or operator. The documents include bidding requirements that include but are not limited to, contract forms, contract conditions, contract specifications, CQA plan, contract drawings, addenda, and contract modifications.

**Contract Specifications**

The requirements which are to be followed in the construction of the ClosureTurf® System. The standard specifications, supplemental specifications, special provisions, and all written or printed agreements and instructions that pertain to the method and manner of performing the work.

**Contractor**

One that agrees to furnish materials or perform services at a specified price, especially for construction work.

**Design Engineer**

An individual licensed to practice as a Professional Engineer or a Professional Service Firm that is responsible for the preparation of the project construction drawings and specifications.

**Earthwork**

A general engineering term relating to the relocation and utilization of soil during the process of construction.

**Engineered Turf**

A component of the ClosureTurf® System. A synthetic structured material consisting of one or more geotextiles tufted with polyethylene yarns that resemble grass blades.

**Final Cover System Evaluation Report (FCSER)**

Upon substantial completion of closure activities, the POR is responsible for the documentation of construction activities relating to the project, and any other inspections or verifications required by the regulatory authority. The FCSER will be signed and stamped by the POR and include documentation necessary for certification closure.

**Fish Mouth**

A semi-conical opening of the seam that is formed by an edge wrinkle in one sheet of the geomembrane component.

**Geomembrane**

A synthetic lining material that is a component of the ClosureTurf® System. Used as the primary barrier to infiltration and exfiltration of covered materials.

**GSI**

Geosynthetic Institute

475 Kedron Avenue

Folsom, PA 19033-1208 USA

TEL (610) 522-8440

FAX (610) 522-8441

**HydroTurf®**

A patented 3 component system consisting of a Structured Geomembrane Liner, a specialized Engineered Turf, and HydroBinder® infill material.

**HydroBinder®**

A proprietary pozzolanic infill utilized where higher surface water velocities may occur as well as in anchor trenches where specified.

**Geosynthetics Contractor / Installer**

The entity responsible for geosynthetic installation.

**Independent Testing Laboratory**

An organization, person, or company that tests products and materials, etc. according to agreed requirements. The entity shall be independent of ownership or control by the Owner or any party to the construction of the final cover or the manufacturer of the final cover products used. The entity shall also have proper legal authority where required to issue opinions and document the results of tests requested by the Owner.

**Installation Supervisor**

The person on-site who works for the Geosynthetics Installer and is in charge of the Geosynthetics Personnel and following the site specifications for the installation of the geosynthetics.

**Manufacturing Quality Control (MQC)**

A planned system of inspection and verification to ensure the quality of the final product.

**Nonconformance**

A deficiency in characteristics, documentation, or procedures that render the quality of an item or activity unacceptable or indeterminate. Examples of non-conformances include, but are not limited to, physical defects, test failures, and inadequate documentation.

**Operator**

The entity in control and responsible for the facility.

**Owner**

The entity that owns facility and land.

**Owner's or Operators Representative**

An official representative of the Owner or Operator responsible for planning, organizing, and controlling construction activities.

**Panel**

A general reference to a unit area of either the Structured Geomembrane (LLDPE or HDPE), or the Engineered Turf component of the ClosureTurf® System.

**Quality Assurance**

A planned and systematic pattern of procedures and documentation to ensure that items of work or services meet the requirements of the contract documents.

**Quality Control**

These actions provide a means to measure and regulate the characteristics of an item or service to comply with the requirements of the contract documents.

**Relief Valve**

A mechanical device used specifically to relieve gas buildup pressure underneath the ClosureTurf® system.

**Representative Sample**

(With respect to geomembrane destructive testing) - A random specimen of either the Structured Geomembrane (LLDPE or HDPE) or the Engineered Turf component consisting of 1 or more cut pieces (commonly referred to as coupons) from the same rectangular portion of material, oriented along a seam that is removed for field or laboratory testing purposes.

**Ripple**

Smaller in nature than a wrinkle. A result of thermal/or manufacturing that cannot be folded over.

**Snapping**

A manual method to an open-ended seam to remove tenting as a result of the welding of the geomembrane seams.

**Spike**

A systematic design for interface friction located on the bottom of the Super Gripnet®.

**Specimen**

(With respect to geomembrane destructive testing) - A specimen is the individual test strip (sometimes called coupon) from a sample location. A sample location can consist of many specimens.

**Studs**

A systematic design for drainage located on the top side of the Super Gripnet®.

**Surficial Collection Foot**

A manufactured device utilized specifically for collection of gas beneath the Super Gripnet®.

**Surficial Strip**

A strip of Super Gripnet® used for gas conveyance below the ClosureTurf® system.

**Tenting**

A vertical ridge that is caused by wedge welding geomembrane.

**Wrinkle**

A portion of the geomembrane that does not lay relatively flat and is not a result of subgrade irregularity and which can be folded over.

### 3.0 Subgrade Preparation

Prior to ClosureTurf® system installation, the subgrade (e.g., protective cover soil) will be inspected. Observe the following:

- The protective cover soil is substantially free of surface irregularities and protrusions.
- The protective cover soil surface does not contain stones or other objects that could damage any of the ClosureTurf® components.
- The surface will be substantially smooth and free of foreign and organic material, sharp objects, particles or other deleterious material.
- Maximum particle size (e.g. rocks) will be specified by the by the design and contract specifications.
- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and other deleterious material.
- Construction stakes and hubs have been removed and the resultant holes have been backfilled.
- The geosynthetics contractor, POR or his representative, and the permittee or his representatives have certified in writing that the surface on which the ClosureTurf® System will be installed is acceptable.
- Final grades on the slopes as well as benches dimensions and grades conform to the design grades.
- Survey shots and as-built drawings will be carefully reviewed and evaluated to insure the surface grades will drain as intended in the design drawings.

## **4.0 Installation – Surficial Gas Management System**

### **4.1 Minimum Requirements**

The gas management plan will include at a minimum, the use of provided ClosureTurf® Pressure Relief Valves, (See Figure 3) to meet the specific needs of the intended site. The minimum required gas emission venting devices will be installed at a rate of at least one vent per acre of installed ClosureTurf® (See Figure 1). Watershed Geosynthetics LLC supplies the minimum number of Pressure Relief Valves with delivery of the ClosureTurf® product.

The valves must be installed on sites that produce gas to validate any warranties. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves as well as any other design elements required for the site.

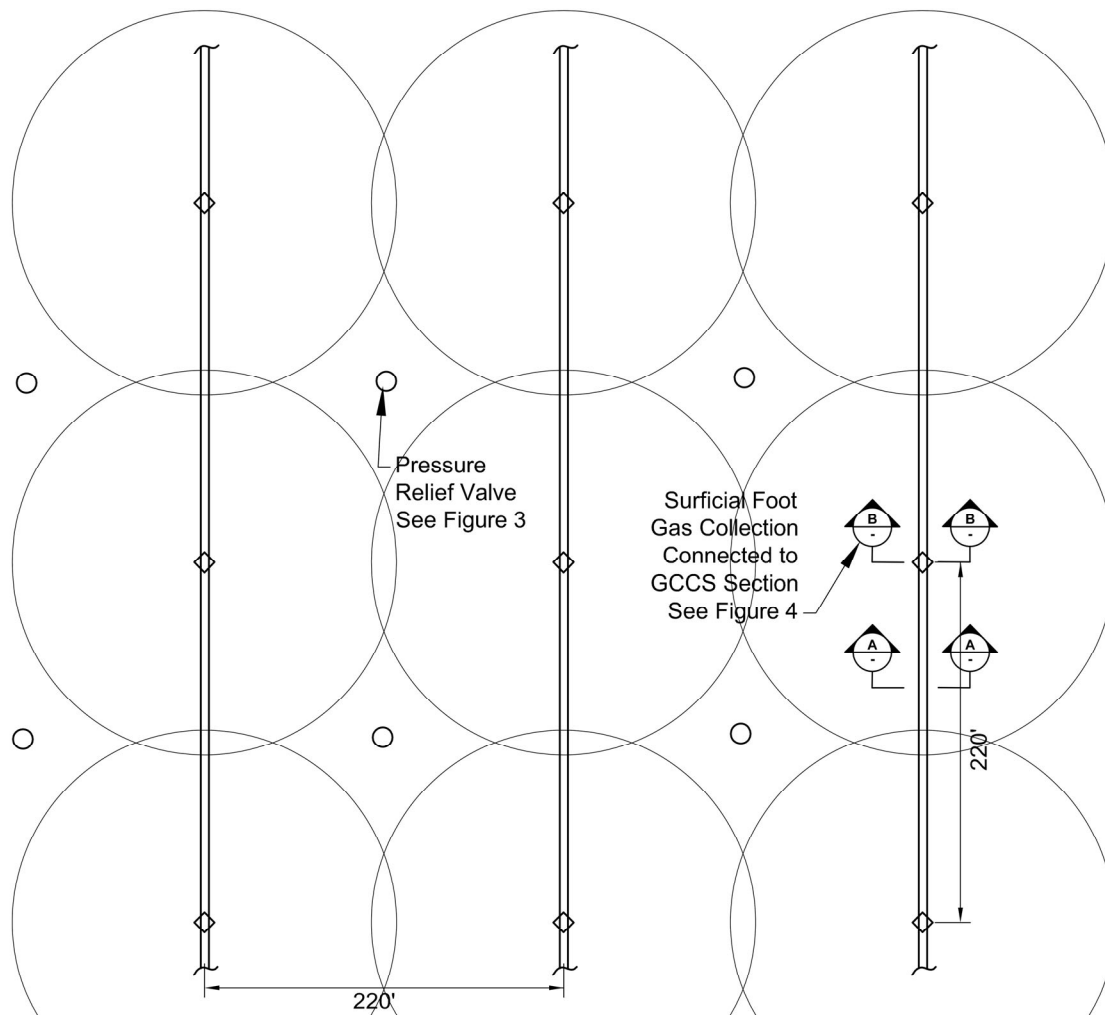
Pressure Relief Valves are designed to convey approx. 50 SCFM (Standard Cubic Feet Per Minute) under 1 inch of water column. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves required for the site.

### **4.2 Surficial Collection Design (Where Applicable)**

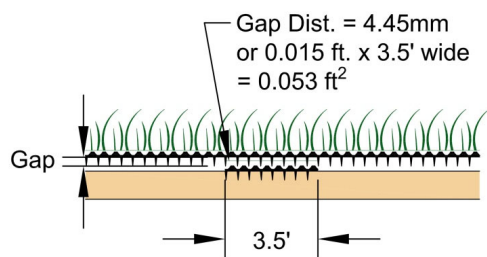
While it should be noted that not all projects will incorporate a surficial collection design, the ClosureTurf® system serves as an effective tool for control of fugitive emissions and can be incorporated into a conventional gas collection system or in some cases as a standalone gas collection and control system. A ClosureTurf® surficial collection design will incorporate the use of surficial collection strips (See Figure 1) that provide high flow capacity (See Figure 2) and a larger radius of influence. The system design will also incorporate the surficial collection foot (See Figure 4) that serves as a wellhead base, geomembrane interface and gas conveyance path from the strips to the collection wellhead (not provided).

#### **4.2.1 Surficial Strips (Where Applicable)**

Surficial strips are to be placed prior to the placement of geomembrane. Surficial Strips may consist of SuperGripnet®, single sided geocomposite or other techniques that will allow for the proper flow of gas without causing ballooning. The placement of the strips will be determined by the design engineer and included in the gas management plan.



**Figure 1: Typical Surficial Collection Strip Placement**



**Figure 2: Effective Cross Sectional Area: Surficial Strips**



### 4.2.2 ClosureTurf® Pressure Relief Valve

The Pressure Relief Valve is a mandatory component of the ClosureTurf® System. The primary purpose of this component is to provide for necessary release of pressure in the event the gas collection system malfunctions. The number of Pressure Relief Valves required will be determined by the POR and installed during construction of the **ClosureTurf®** System.

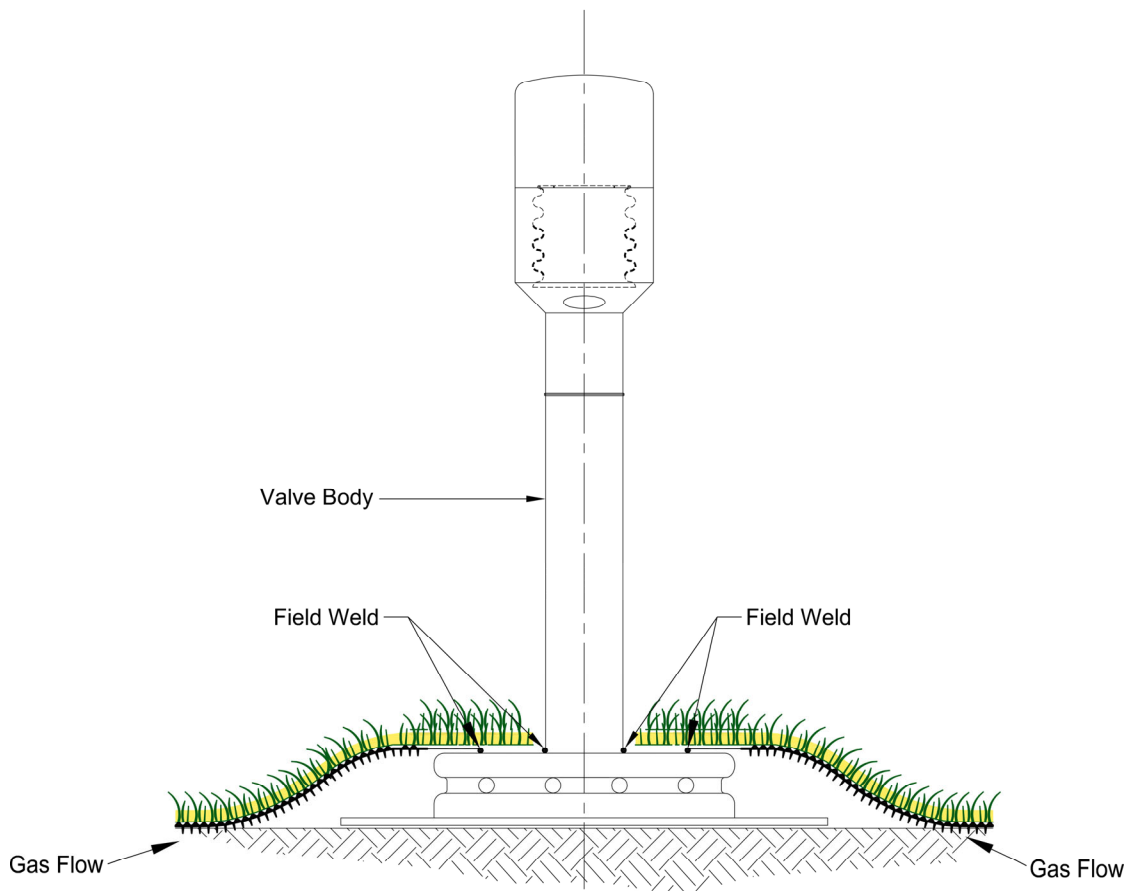
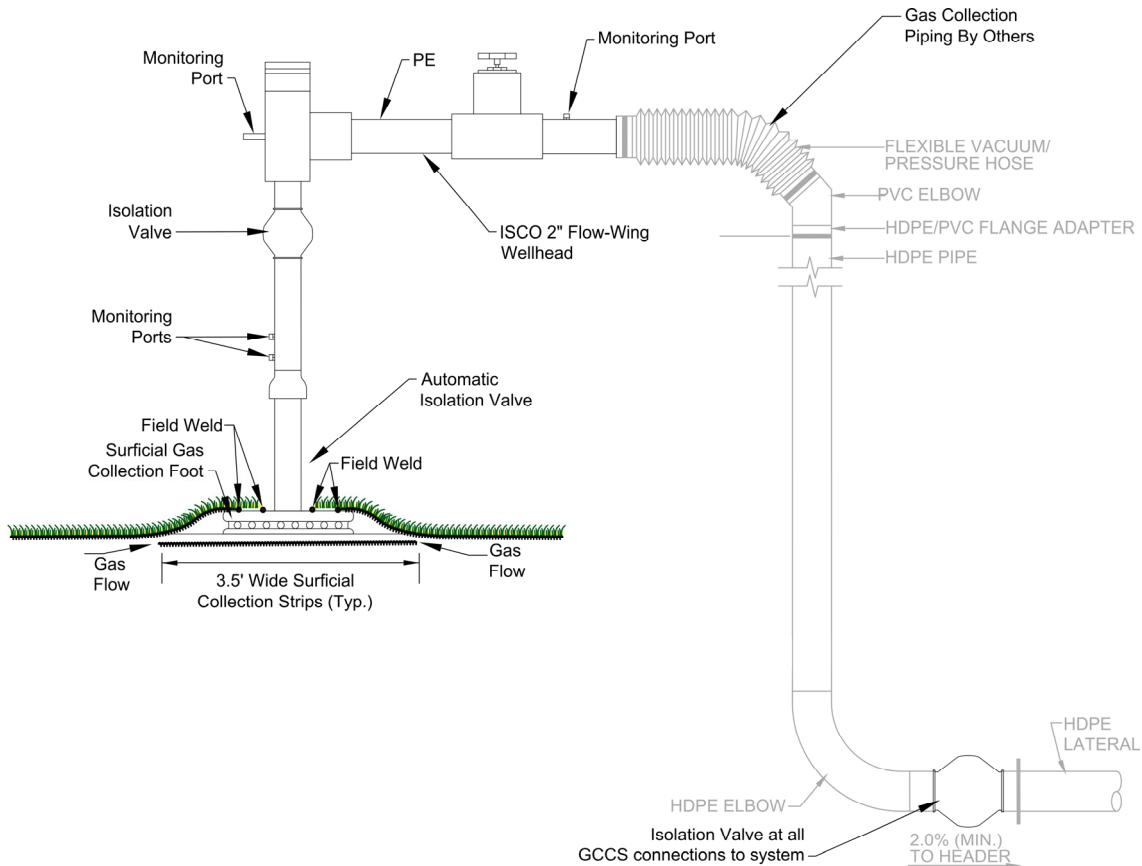


Figure 3: ClosureTurf® Pressure Relief Valve (Patent Pending)

### 4.2.3 ClosureTurf® Collection Foot

This device is designed to be the interface between the surficial collection strips, the geomembrane and a gas collection wellhead (not provided). The unit allows vacuum to flow in from beneath the geomembrane and from the surficial collection strips to create a larger radius of influence for gas collection. Placement will be determined by the gas collection system design.



**Figure 4: ClosureTurf® Surficial Collection Foot Connection to GCCS System**

#### 4.2.4 ClosureTurf® Passive Gas Vent

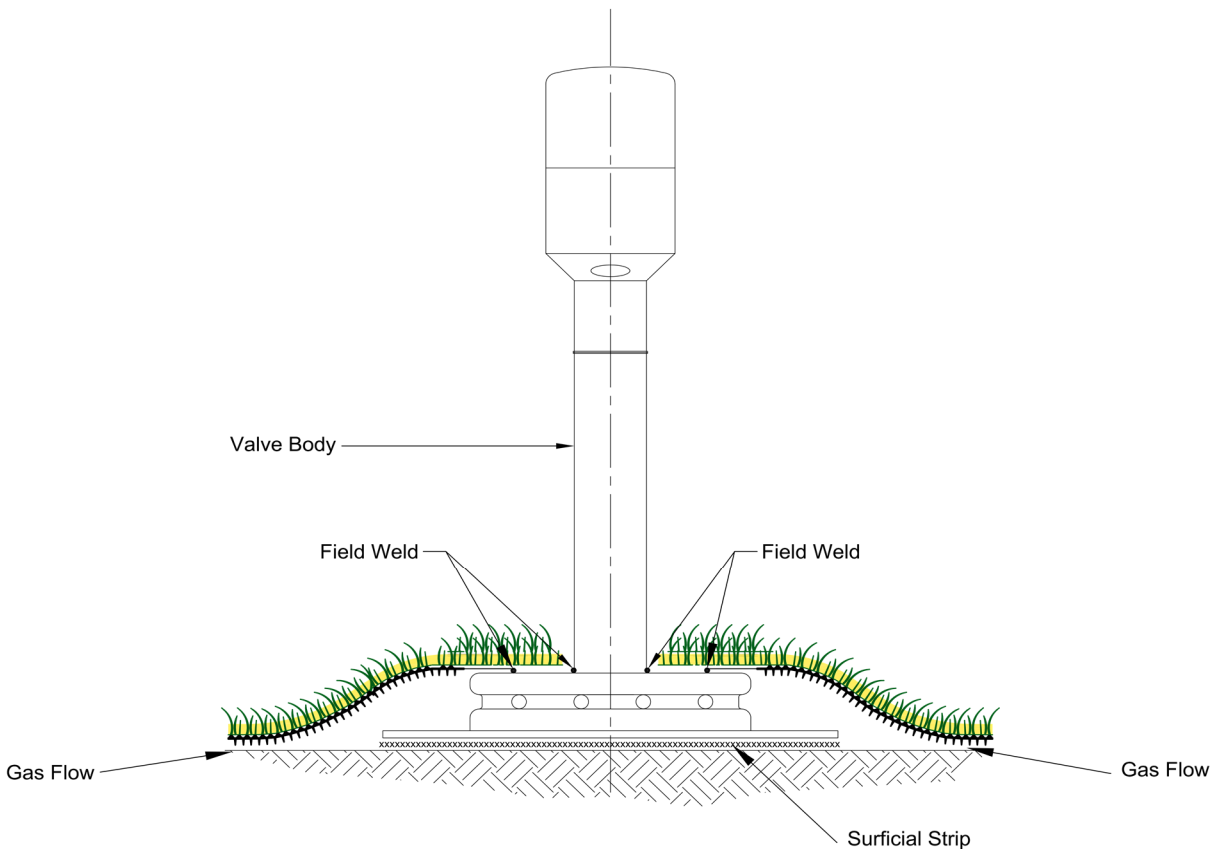


Figure 5: Passive Gas Vent

When a GCCS system is not required, Passive Gas Vents may be utilized in lieu of the Pressure Relief Valves. The number of Passive Gas Vents required will be determined by the POR and installed during construction of the **ClosureTurf®** System.

### 5.0 Installation - Geomembrane Liner

Installation of the Geomembrane Liner must be completed by a geosynthetics contractor approved by Watershed Geosynthetics. Qualification requirements for geosynthetics personnel are shown in WatershedGeo Installation Specification 01 73 19. Each component of the ClosureTurf® system will require specific testing and submittals before, during and after installation of the component. For information concerning submittals, see contract specifications. It is the responsibility of the contractor to ensure that each prior component installation has been approved by the POR before continuing with installation of the next ClosureTurf® component.

#### 5.1 Delivery – Geomembrane Liner

Upon delivery of the geomembrane, observe that:

- The geomembrane is delivered in rolls and not folded. Any evidence of folding or other shipping damage is cause for rejection of the material.
- Equipment used to unload and store the rolls or pallets does not damage the geomembrane component.

- The geomembrane is stored in an acceptable location in accordance with the specifications and stacked no more than five rolls high.
- The geomembrane component is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.
- Manufacturing documentation required by the specifications has been received and reviewed for compliance with the technical specifications. This documentation will be included in the FCSER.
- The geosynthetics receipt log form has been completed for materials received.
- Geomembrane component that is damaged or has been rejected due to improper manufacturer documentation will be removed from the site or stored at a location separate from the accepted geomembrane component.

## 5.2 Installation - Panel Deployment and Field Seaming

ClosureTurf® installation requires some additional care and techniques beyond those of the typical geomembrane installation. General panel deployment techniques as well as special techniques are listed below. The contractor should always notify Watershed Geo prior to installing the geomembrane and afford the opportunity to be present at the initial startup to support the approved installer program.

### General

- Observe that the geomembrane component is placed in direct and uniform contact with underlying protective cover soil or subgrade soil.
- Observe the sheet surface as it is deployed and record panel defects and repair of the defects (e.g. panel rejected, patch installed, etc.) on the repair sheet. Repairs must be made in accordance with the contract specifications and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane component during handling (See Section 6.4).
- Observe that the subgrade beneath the geomembrane component has not deteriorated since previous acceptance.
- Observe that there are no stones, construction debris, soil clogs or other deleterious items on the subgrade that could cause damage to the geomembrane component.
- The geomembrane component will not be deployed during inclement weather conditions as defined in the site-specific specifications.
- Observe that people working on the geomembrane component do not smoke, wear boots/shoes that could damage the ClosureTurf® system components or engage in activities that could damage the ClosureTurf® system components.
- Observe that the method used to deploy the sheet reduces wrinkles but does not cause bridging and that the sheets are anchored to prevent lifting or movement by the wind (geosynthetics contractor is responsible for any damage to or from windblown geomembrane).
- Observe that horizontal or cross seams on the side slopes are staggered so that long horizontal seams across the slope are not produced.
- The POR shall be responsible for approving the integrity of horizontal seams.

## Acclimation and Adjustments

- The geomembrane component requires acclimation to ambient temperature after being deployed and before seaming operations begin.
- Acclimation time is dependent on the current weather conditions.
- By allowing the panels to acclimate, excessive wrinkling can be avoided.
- Final panel adjustments can be completed after the panel has properly acclimated to ambient temperature.
- After the panel has acclimated and before seaming operations begin, wrinkles will be worked toward the toe of slope. Either manpower or equipment may be utilized for working out excess material.
- Reduce seam bridging by placing sand bags along concave areas.

## Wedge Welding

- After proper acclimation and final adjustments/wrinkle removal, wedge welding may proceed.
- Wedge welding machines are a low-profile machine with a vertical height (wedge height) not to exceed 3 inches, measured from flat surface to top of heating wedge.
- Wedge welding will be completed in accordance with the contract specifications.
- Sand bags will be applied as the wedge welding progresses to reduce tenting.

## Snapping

- As a result of wedge welding, “ridges” or “tenting” of the seams may occur. A process called “snapping” must be employed to remove the excess slack caused by the welding process.
- Normally, this technique requires several people lined up along the open seam at the edge of the geomembrane and applying clamps to the edge. The panel is then “snapped” into position and when applied properly, the excess slack is removed.
- The snapping technique will be applied while the welding seam is still warm.
- Previously applied sand bags along the wedge welded seam will reduce rebound tenting.

## 5.3 Anchor Trench Backfill

ClosureTurf® only relies on the anchor trenches to serve as a termination point. Top anchor trenches should be backfilled as quickly as practical after Engineered Turf Component is installed (prior to sand infill placement).

Vertical anchor trenches as well as anchor trenches along the toe will not be backfilled until sand infill of the engineered turf is in place, unless previously approved by the POR. Anchor trench dimensions will be shown in the drawings.

Backfilling or sand bag loading the bottom and side anchor trenches should be considered and applied when cool temperatures are anticipated to assist with creep reduction.

When HDPE material is utilized, additional anchoring methods may be required to reduce wrinkling due to the overnight contraction of the material. Contraction of the HDPE material may be site specific/seasonal and should be discussed onsite to develop an effective method to alleviate potential issues.

## 5.4 Equipment on ClosureTurf® Geomembrane

Construction equipment on the ClosureTurf® geomembrane component will be limited to reduce the potential for geosynthetics damage. Observe/provide the following:

- Use power source generators capable of providing constant voltage to all required equipment under combined-line load.
- Secondary containment to catch spilled fuel under equipment where applicable.
- No equipment with tire or track pressures exceeding 5 psi will be allowed on the partially constructed ClosureTurf® system until after the completed installation of the sand infill component.
- No equipment will be left running and unattended over the constructed geomembrane component.
- Equipment operators shall check for sharp edges, embedded rocks, or other foreign materials stuck into or protruding from tires prior to operating equipment on the geomembrane component.
- Path driven on geomembrane component will be as straight as possible with no sharp turns, sudden stops or quick starts.

## 5.5 Wrinkles

Wrinkles occur during the geomembrane installation due to changes in geomembrane temperatures and deployment methods. The wrinkles may interfere with the installation of the engineered turf layer as well as the final appearance of the ClosureTurf® system. Observe that:

- Snapping procedures are followed.
- Wrinkles are repaired if they can be folded over as defined the morning after the seam is developed and the liner is in a cool state.

## 6.0 Installation – Engineered Turf

Qualification requirements for the personnel who install the Engineered Turf component are shown in WatershedGeo Installation Specification 01 73 19.

### 6.1 Delivery – Engineered Turf

Box trucks will deliver 27 rolls per truck. Rolls will be strapped in groups of 9 allowing equipment (i.e. pick-up truck, skid steer) to pull the grouped rolls to the front of the truck. Rolls can be pulled directly to the ground or carpet stingers can move the rolls to a designated area. Observe the following:

Observe the following:

- The engineered turf is wrapped in rolls with protective covering.
- The rolls are not stacked more than 3 high.
- The rolls are not damaged during unloading.
- Protect the engineered turf from mud, soil, dirt, dust, debris, cutting, or impact forces.
- Each roll must be marked or tagged with proper identification.
- Rolls that have been rejected due to damage are be removed from the site or stored at a location separate from accepted rolls, designated by the Owner/Operator.

- Rolls that do not have proper manufacturer's documentation will be stored at a separate location until documentation has been received and approved.

## **6.2 Installation – Engineered Turf - Surface Preparation**

Prior to installation of Engineered Turf, observe the following:

- ClosureTurf® geomembrane has been installed in accordance with the contract specifications.
- The geomembrane installation documentation has been completed and approved by the POR for areas where the Engineered Turf is to be installed.
- The supporting surface (i.e., the geomembrane) does not contain stones, debris, membrane grindings or large scraps left over from the installation process that could damage or impede surface water flow through the Engineered Turf.

### **6.2.1 Installation – Engineered Turf – Deployment & Field Seaming**

During deployment of Engineered Turf, observe the following:

- Observe the turf as it is deployed.
- Verify that equipment used does not damage the turf or underlying geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.
- Verify that during deployment, the Engineered Turf filaments point upslope.
- Verify that the turf is anchored to prevent movement by the wind (the contractor is responsible for any damage resulting to or from windblown Engineered Turf).
- Verify that the turf remains free of contaminants such as soil, grease, fuel, etc.
- Observe that the turf is laid substantially smooth and substantially free of tension, stress, folds, wrinkles, or creases.
- Observe the deployment of the sewn seam panel process to insure proper flipping to expose the turf surface up after seaming operations. After the first panel of the project is deployed, deployment will be done on the adjacent turf panel to avoid damage.
- Horizontal cross seam/panel extension on slopes will not be more than one aligned side by side (i.e., no adjacent cross seams on slopes).
- At least one complete panel shall separate any horizontal cross seam/panel extension.
- Horizontal cross seam connection will be performed prior to the vertical production seaming.
- Once the horizontal cross seam/panel extension is completed, the excess seam overlap on the bottom of the weld or seam shall be cut off.

#### **6.2.1.1 Installation – Engineered Turf – Fusion Seaming Method**

- Engineered Turf fusion seaming device will be a DemTech VM20/4/A fusion welder only.
- Fusion seams require an approx. 4 inches of overlap.
- Frayed or loose geotextile strands will be cut off or removed.
- Prior to starting the production fusion seaming, trial seams must be performed as outlined in Section 7.2.1.3 below.
- Demonstrate the preparation methods and equipment utilized for removal of the salvage from the outside edge of the rolls of turf (i.e. trimming & cutting devices).
- Electrical trimming and cutting devices will be utilized for salvage trimming.
- Box blades and knives will not be utilized for salvage trimming.

- Demonstrate and control the fraying of geotextile strands when performing the removal of salvage.
- Any damage that occurs due to production seaming will be repaired as outlined in WG Installation Guidance Documents.
- Any defects will be repaired as outlined in 7.2.2.

### **6.2.1.2 Installation – Engineered Turf – Fusion Seaming Method Trial Seam Requirements**

1. Prior to turf component welding, CQA personnel shall observe and document the following:
  - a. Turf welding apparatus are tested;
  - b. at daily start-up; and
  - c. immediately after any break; or
  - d. anytime the machine is turned off for more than 30 minutes.
2. Procedures:
  - a. The turf trial weld will be completed under conditions like the panels that will be welded.
  - b. If at any time, the CQA Personnel believe that an operator or fusion welding apparatus is not functioning properly, a Field Trial Seam Test must be performed.
  - c. Any dispute concerning proper installation techniques, or the proper function of fusion welding equipment will be resolved by the OWNER’S REPRESENTATIVE.
  - d. The trial weld must be allowed to cool to ambient temperature before seam snapping or panel adjustments are applied.
3. Trial Sample Test Results:
  - a. Trial weld samples must comply with “VISUAL PASSING CRITERIA” Visual passing criteria is verified when a manual peel/pull test is performed, and the top turf panel tufts transfer to the bottom turf panel. The transfer of approx. 75% of the tufts constitutes a passing trial weld.
4. Field Seam Test Failure:
  - a. Less than approx.75% of the top turf panel tufts do not transfer to the bottom turf panel.
5. Additional Trial Sample Testing Requirements:
  - a. Two consecutive trial welds meet the visual passing criteria.
6. The trial weld sample must be a minimum of 3 feet long and 12 inches wide, with the seam centered lengthwise.
7. If a welding apparatus exceeds 5 hours in the second half of the day, another trial seam must be performed.
8. CQA documentation of trial seam procedures will include the following:
  - a. The names of the seaming personnel;
  - b. The name of the fusion seaming technician;
  - c. the welding apparatus number, time, date;
  - d. ambient air temperature; and
  - e. welding apparatus temperature & speed setting.



### 6.2.1.3 Installation – Engineered Turf – Sewn Seam Method

- A single stitch prayer type seam is constructed using an American Newlong sewing machine or equivalent.
- The thread will be Polyester or equivalent.
- Sewing will occur between the 1<sup>st</sup> and 2<sup>nd</sup> row of tufts from the edge.

### 6.2.2 Installation – Engineered Turf Repairs and Tie-In Procedures

When Repairs and Tie-Ins to Engineered Turf occur, observe the following:

- Tie-In's to Engineered Turf will be completed by using a fusion seam.
- Seaming equipment for Engineered Turf will be a DemTech VM 20/4/A welder and/or Varimat V2.
- A hand-held heat gun should be used in smaller/concentrated areas.

### 6.2.3 Installation – Equipment on Engineered Turf

No equipment will be allowed on slopes exceeding 15% until Sand Infill is in place. On slopes less than 15%, such as top decks, ATV type vehicles will be allowed prior to infill placement if the rubber tire or track pressure is less than 5 psi. Post construction (full specified sand infill thickness) drivability tire pressures on slopes greater than 10% should be limited on the ClosureTurf® system to less than 35 psi. Allowable rubber tire or track pressures on top decks may increase to as much as 120 psi if sustained traffic load is not expected.

In all phases of construction, equipment used on the ClosureTurf® product will not be allowed to change speed or direction in a manner that could displace or damage the ClosureTurf® system. High traffic areas will require sand to be placed at the full height of the turf.

It should be noted that the above-recommended load limits assume that the subgrade, which is not part of the ClosureTurf system, is adequate to support the anticipated vehicle loading without creating rutting or bearing capacity issues.

## 7.0 Installation – Sand Infill

This component of the ClosureTurf® system is a specialized mixture of sand infill that is placed between the tufts of the Engineered Turf component.

Observe that the following general requirements regarding Sand Infill are met:

- Sand Infill will meet ASTM C-33 specifications.
- Areas that are to receive sand infill must be inspected and accepted by the POR or CQA Personnel before placement of sand infill takes place.
-

## 7.1 Submittals and Testing – Sand Infill

See contract specifications for Sand Infill MQC Submittals and submittal/testing requirements regarding the Sand Infill.

## 7.2 Installation – Sand Infill Deployment

Observe that the following installation guidelines regarding the Sand Infill:

- Sand infill thickness will be verified at a frequency of 20 measurements per acre of final cover installed.
- The sand infill layer will be placed to a ½ inch minimum thickness not to exceed ¾ inch thick.
- The sand infill will be worked into Engineered Turf as infill between the synthetic yarn blades.
- No equipment will be allowed on slopes exceeding 15% until the sand infill is in place.
- Conveyor systems and/or Express Blowers are the preferred method to spread and place the sand infill.
- Contractor shall explain in detail in the pre-construction meeting the method of sand infill deployment to be used.
- The sand infill deployment method will be approved prior to installation of the sand infill.
- For slopes 3H: 1V or steeper the sand infill will be placed using high speed conveyor belts or using air express blower methods that demonstrate achievable results.
- The sand infill placement will be done in front of the deployment equipment to improve the bearing capacity of the previously installed ClosureTurf® components.
- Sand infill placement cannot occur with snow or ice on the Engineered Turf component.
- Verify that underlying geosynthetics installations are not damaged during placement operations. Mark damaged geosynthetics and verify that damage is repaired.
- Verify no geotextiles are exposed once the sand infill is complete.

The method for measuring the Sand Infill thickness will be performed utilizing a digital caliper with depth rod capabilities, or a POR approved alternate measuring device.

## 7.3 ClosureTurf® with Rock Rip Rap Infill for Ditches

When **ClosureTurf®** is installed in ditches and rock rip rap infill is placed in lieu of sand infill, it creates a ditch lining armor that will allow high flow velocities to convey without damage or maintenance to the liner system. See Figure 5.

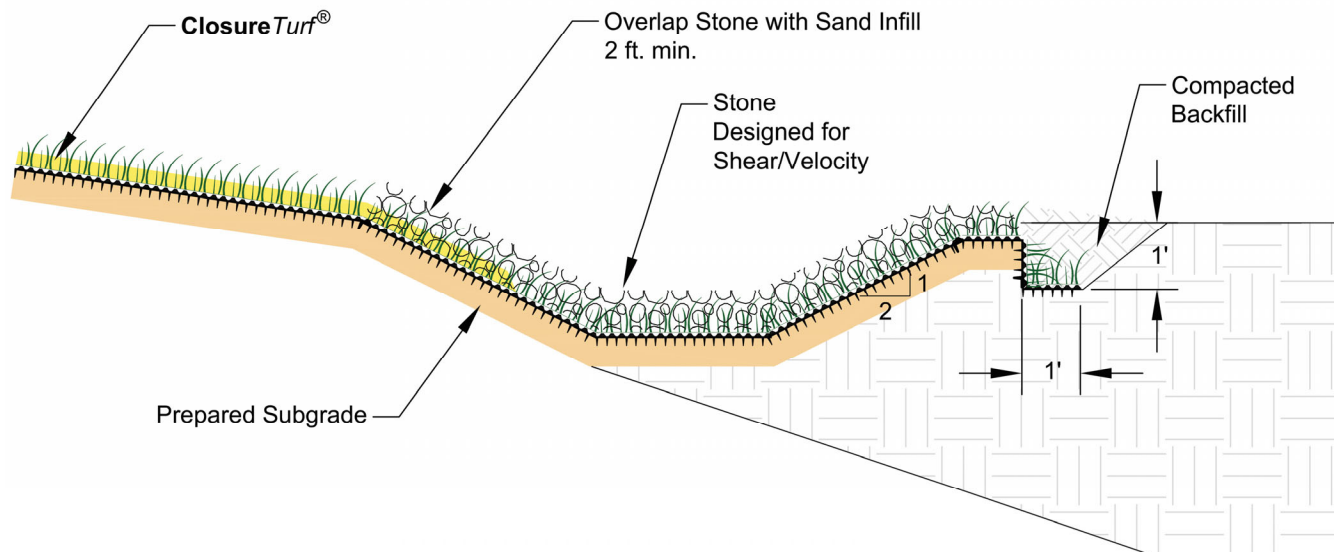


Figure 5: Typical ClosureTurf® with Rip Rap Ditch Section

### 7.3.1 Installation – Alternate Infill - HydroBinder® for Downslope Channels

HydroBinder® is typically delivered to the jobsite on pallets in either 3000# bulk bags (1 per pallet) or 80# bags (42 per pallet). It is delivered on a flatbed with 16 pallets (typical) per truckload.

Verify the following regarding installation of HydroBinder® Infill:

- The HydroBinder® infill layer may be placed using any appropriate equipment capable of completing the work while meeting loading requirements specified herein.
- Manual hand spreading is acceptable when equipment isn't practical.
- Contractor / Installer will explain in detail in the pre-construction meeting the method of HydroBinder® infill deployment.
- Installation of HydroBinder® infill will only be performed by a Watershed Geosynthetics' licensed and approved infill installer.
- The HydroBinder® will be installed into the turf while it is in a dry state.
- Prior to placing the HydroBinder®, the engineered turf will be dry.
- If the turf is wet from rain or dew, the installer shall wait until it is dry.
- The installer may attempt to speed up the drying process by using a blower (i.e., leaf blower, industrial blower, etc.).
- The HydroBinder® will be worked into the tufts so the tufts are in an upright position.
- The HydroBinder® infill layer will be placed to a ¾ inch minimum thickness not to exceed 1 inch thick.
- Reduce trapped tufts as much as practical.
- Do not backfill anchor trenches until turf has been installed with HydroBinder® infill unless approved by the POR.
- The hydration process must occur the day of the HydroBinder® infill placement.
- The desired HydroBinder® infill thickness will be achieved prior to the hydration process.
- The cemented infill is hydrated thoroughly however care must be taken to avoid displacement of the non-hydrated infill.

- The objective is to soak the area to start the hydration process but not to inundate with water beyond saturation.
- Once hydration is completed as described, backfill and compaction of the vertical anchor trenches should take place.
- The infill is to be placed / spread using a manual drop spreader, top-dresser and/or drop spreader attached to low ground pressure equipment with adequate dust control.
- If weep holes are required for draining the internal drainage layer through the engineered turf, remove the HydroBinder® in the areas of the weep holes prior to hydration or block the weep hole locations prior to infilling. Blocks may consist of pipe, dowels, etc. Weep holes are typically ½ to ¾-in diameter and are located at the toe of slope on 2-ft centers.

### 7.3.2 Installation – Brushing in the HydroBinder® Infill

The HydroBinder® infill will need to be worked into the tufted fibers of the engineered turf such that the turf fibers are in an upright position. This can be achieved as follows:

- The infill will be worked into the tuft fibers so the tuft fibers are in an upright position with the infill at a measurable ¾ inch minimum depth. This is achieved with common mechanical turf broom, power broom, shop broom, yard rakes, or greens groomer rakes.
- Brushing should be performed in all four directions starting with the direction against the lay of the fibers. Multiple passes may be required.
- The HydroBinder® may need to be placed in 2 to 3 lifts with brushing in between lifts to effectively work the material into the tufts and achieve fibers that are upright.
- The engineered turf will be visually inspected to confirm that the turf fibers are upright and that there are no trapped fibers.
- Thickness measurements of the HydroBinder® infill will be taken using a caliper or equivalent device.
- Measurements will be taken at a minimum frequency of 10 measurements per 1,000 sf (for smaller projects) or 20 per acre (for larger projects) of installed area.
- The desired HydroBinder® infill thickness will be achieved prior to the hydration process.

ClosureTurf with HydroBinder contains a unique drainage system where some water will drain on the Super Gripnet® liner. This water may build up and cause the Engineered Turf and HydroBinder® infill to lift. This is not normally an issue to the overall performance of the product. However, the Super Gripnet® must be allowed to drain at all times. If surface water flows are pinched off by various construction techniques such as placing rip rap check dams in channels, the Turf and HydroBinder® will lift as needed until the pressure can be alleviated.

### 7.3.3 Installation – Hydration of the HydroBinder® Infill

The HydroBinder® infill will be hydrated in place as follows:

- The hydration process will occur on the same day as the HydroBinder® infill placement.
- Hydrate the infill thoroughly without causing displacement of the product. This may require another pass after waiting momentarily to allow the initial water application to soak in.
- Estimated application rate is approx. 0.12 to 0.20 gallons per square foot of area.
- The installer shall not overhydrate the infill so that water begins to runoff and cause loss of cement infill during the process.
- Visual verification can be performed that the HydroBinder® infill has been fully hydrated, and not over hydrated.

- Visually observe that the top of the HydroBinder® has a wet sheen (denoting saturation) but that water is not ponding on top.
- Excavate (with finger or small tool) into the HydroBinder® at a rate of 1 probe per 100 sq. ft. on smaller jobs and 20 per acre on large jobs to confirm full hydration of the section has been achieved.
- An additional method to check saturation is to tap the surface a few minutes after saturation. Water should be brought up and pool at the surface.
- To improve curing, the hydrated area may be covered with plastic sheeting.
- If freezing temperatures are expected, the hydrated area should be covered with burlap and / or plastic sheeting.
- The HydroBinder® infill will harden within 24 hours following hydration.
- The 28-day compressive strength is tested by the HydroBinder® manufacturer before shipping.
- If the HydroBinder® should harden to the touch within 24 hours.
- Personnel access on the HydroBinder® infilled surface will be prohibited for 24-hr following the hydration of the HydroBinder®.
- Once hydration is completed and the HydroBinder® has set up, backfill and compaction of the anchor trenches may be performed.

### **7.3.4 Installation – Cold Weather Placement and Curing of the HydroBinder®**

Cold weather placement and curing techniques for HydroBinder® shall be consistent with industry standard techniques used for concrete and cement products. The following guidelines are suggested:

- Follow the procedures in American Concrete Institute (ACI) 306 – Guide to Cold Weather Concreting.
- ACI 306 defines cold weather as three consecutive days of the following:
  - Average daily temperature falls below 40 deg F; or
  - The air temperature does not rise above 50 deg F for more than half of a day in one 2-hour period.
- At the time of HydroBinder® placement, the subgrade and surface of the engineered turf will be at a temperature of at least 36 deg F and rising.
- Ensure that frost or frozen surfaces are thawed with no standing water.
- If the temperature can fall below 32 °F within 24 hours of application, heated tarps and/or insulated blankets are required to maintain the temperature above 55 deg F for at least 7 days.
- If heated tarps begin to dry out the HydroBinder®, water may need to be added to keep it moist.

The project design engineer and/or resident engineer shall provide technical specifications and guidance for cold weather concreting based upon project specific details (i.e., geographical location, weather, and time of year), and the engineer shall review and approve all proposed installation methods.

### **7.3.5 Installation – Alternate Infill - ArmorFill®**

Verify the following regarding installation of ArmorFill® Infill:

- Installation of ArmorFill® will be completed by or managed by an infill installer certified by Watershed Geosynthetics.
- Apply ArmorFill® under dry weather conditions and when precipitation is not expected for at least 72 hours after installation.
- Apply ArmorFill® on a previously installed ClosureTurf® system that is free of leaves and other material

that may inhibit the penetration of the ArmorFill® into the sand component.

- Apply ArmorFill® only after approval of the finished ClosureTurf® product installation.
- Verify ArmorFill® and water mix ratio by logging volume mixed of each component.
- Verify that ArmorFill® has saturated the sand by inserting a probe and displacing a 1 square inch area of sand for inspection.
- Check saturation randomly at a rate of 20 probes per acre.
- Verify proper application rate by marking a known area and applying the proper volume to that area.
- Adjust delivery rate to match the delivery volume per area.
- Mix in a hydraulic conveyance system such as a water truck or portable tank.
- Utilize a small agitation pump to mix and recirculate the ArmorFill® within the tank to impede separation.
- Reduce the number of equipment set-ups required and take care with the application hose so as previously applied ArmorFill® is not displaced by dragging of the hose.
- Spray product evenly.
- Apply ArmorFill® at a ratio of 6 parts water to one-part ArmorFill® on slopes.
- Do not apply ArmorFill® in inclement weather or in freezing temperatures.
- At the completion of ArmorFill® placement activities, clean the equipment thoroughly and purge the tank and hoses of the product.
- All waste product will be disposed of in accordance to site regulations
- Avoid unnecessary foot traffic on the applied product for 24 hours.
- No vehicle traffic is allowed on the applied product for 7 calendar days.

## **7.4 Installation – Coverage - ArmorFill®**

For most applications, use a 6:1 mix ratio and 3400 gallons/acre.

### **7.4.1 Installation – Coverage - HydroBinder®**

**Table 1**

### Approximate Coverage Area for HydroBinder™ Infill


Product	Bag Size	Yield (Cubic Feet)	Coverage in Sq. Ft. for 3/4 in. Thick <sup>1</sup>	Coverage in Sq. Ft. for 1 in. Thick <sup>1</sup>	Amount of Water to Mix per Bag (gal)	Amount of Water (gal) to Apply per Sq. Ft. (3/4 in. Thick) <sup>1</sup>	Amount of Water (gal) to Apply per Sq. Ft. (1 in. Thick) <sup>1</sup>
HydroBinder Infill	40 lbs.	0.3	4.8	3.6	0.6	0.12	0.16
	60 lbs.	0.45	7.2	5.4	0.9	0.12	0.16
	80 lbs.	0.6	9.6	7.2	1.2	0.12	0.16
	1 Cubic Yard (Super Sack)	27	432	324	55	0.13	0.17

<sup>1</sup> - Values are approximate





**ATTACHMENT 2**  
**CLOSURE TURF DESIGN GUIDELINES MANUAL**



# ClosureTurf®

## Design Guidelines Manual

January 2018



**WatershedGeo®**  
*Unearthing Solutions*

ClosureTurf®, HydroTurf®, VersaCap® and HydroBinder® products are U.S. registered trademarks that designate products by Watershed Geosynthetics, LLC. These products are the subjects of issued U.S. and foreign patents and/or pending U.S. and foreign patent applications.

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## 1.0 Introduction

**ClosureTurf®** is a patented, 3 Component System\* that serves as the final cover system on landfills. Two versions of **ClosureTurf®** are listed below. Note that the versions lend a unique versatility to the product as the components of each may be mixed to fit performance requirements.

### **ClosureTurf®(CT1)**

Component 1 - An Agru Super Gripnet® LLDPE (or HDPE) geomembrane liner

Component 2 - An Engineered Turf

Component 3 - A sand infill (and/or alternatively, **HydroBinder®** infill)

### **ClosureTurf®(CT2) with ArmorFill®**

Component 1 - An Agru MicroSpike® LLDPE (or HDPE) geomembrane liner

Component 2 - An Engineered Turf

Component 3 - A sand infill with **ArmorFill®** polymer emulsion added to bind the sand infill

\*A Watershed Geosynthetics patented (patent no. 8,585,322) gas collection system is a separate component to be utilized on sites that produce gas emissions. Pressure Relief Valves are provided at one per acre of **ClosureTurf®** on landfills where gas emissions are expected.

In addition to the **ClosureTurf®** Design Guidelines document, product specific Installation Guidelines documents as well as Specifications and other technical data are also available at [www.watershedgeo.com](http://www.watershedgeo.com).

## 1.1 Purpose and Scope

This manual contains guidance to aid in the design of final landfill closures utilizing **ClosureTurf®** (CT1) and (CT2) as the primary final cover system. As with any landfill liner design, it is imperative that a proper design be married to a proper installation of these products. See Figure 1 and 2 below.

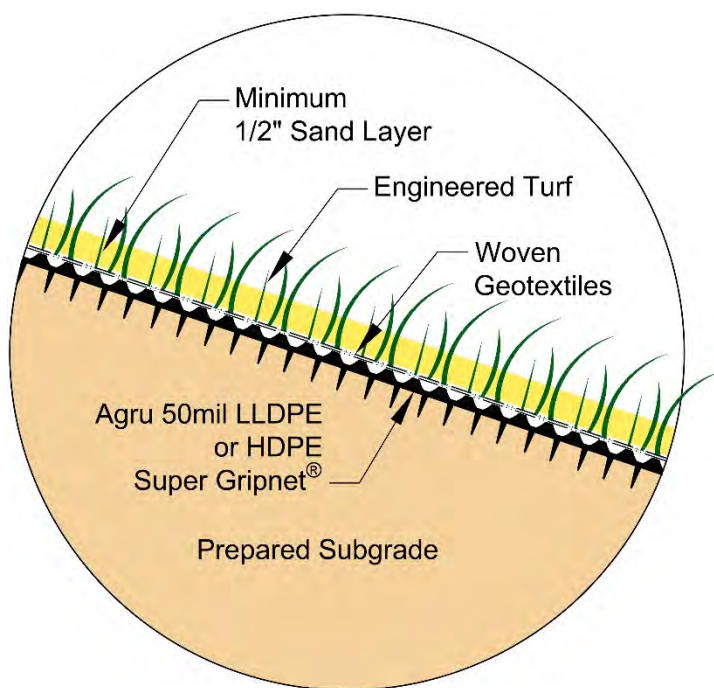


Figure 1: **ClosureTurf®** System (CT 1)

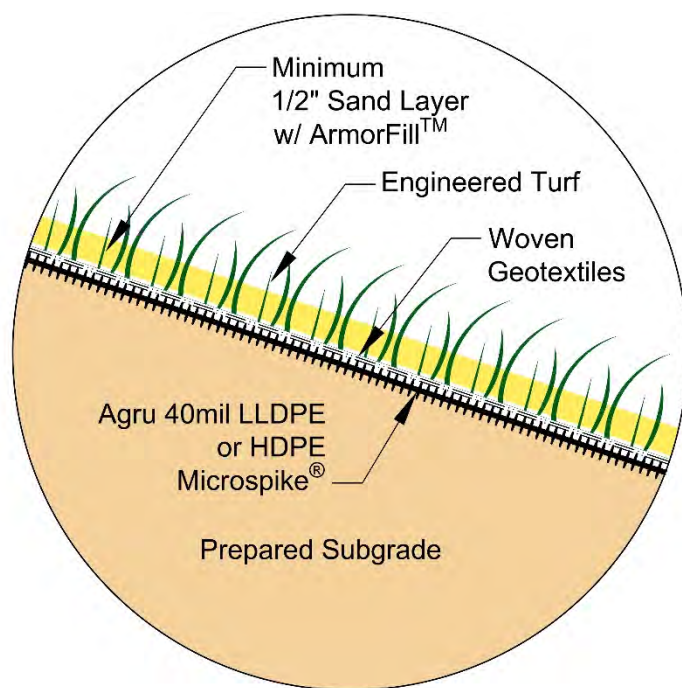


Figure 2: **ClosureTurf®** System (CT 2)

This manual is meant as a guideline only. Watershed Geosynthetics LLC cannot anticipate the many ways this product may be applied either in design or installation. Varying site conditions will require close coordination between the engineer and the installer to account for any changes and adjust accordingly. When required by state and/or local regulations, a licensed professional engineer or architect will be required.

## 2.0 Landfill Cover Design Best Practices using **ClosureTurf®**

**ClosureTurf®** is a product that is used as the final surface on top of landfills and CCR (Coal Combustion Residual) covers. Since the final application of the product should be as maintenance free as possible, certain best practices for cover design should be and implemented in advance of final closure. Over the long term, a large amount of settlement both at the base of the landfill and the differential settlement of some waste profiles can cause grades to reverse and cause pockets where surface water may not drain properly. The following sections will look at specific closure cover design techniques meant to make a **ClosureTurf®** cover system as maintenance free as possible. Additionally, this manual will explain specific

unique methods to mitigate storm water issues that have not been able to be addressed before **ClosureTurf®** was available in the marketplace.

## 2.1 Typical Landfill Cross Section

Typical closed landfills range in side slope from 2H:1V to 4H:1V. Over time, these slopes settle yet usually will not reverse grade due to their initial steeper slope. However, problems may arise when the top deck of the landfill has been designed with very slight slopes (typically less than 5%). Settlement calculations must be done for both the expected base settlement of the landfill and the expected differential settlement of the waste profile within a given landfill. Obviously, a coal ash type of waste will not have nearly the differential settlement that a MSW type of waste will have. However, over time the combination of base settlement and differential settlement can be surprising.

The settlement problem can become more of an issue when such items as diversion berms have been placed on the side slopes at typically less than 3% longitudinally to convey storm water. Again, settlement calculations are one key to a good, long lasting design. Figure 3 below shows typical settlement design concerns when planning for a **ClosureTurf®** cover system.

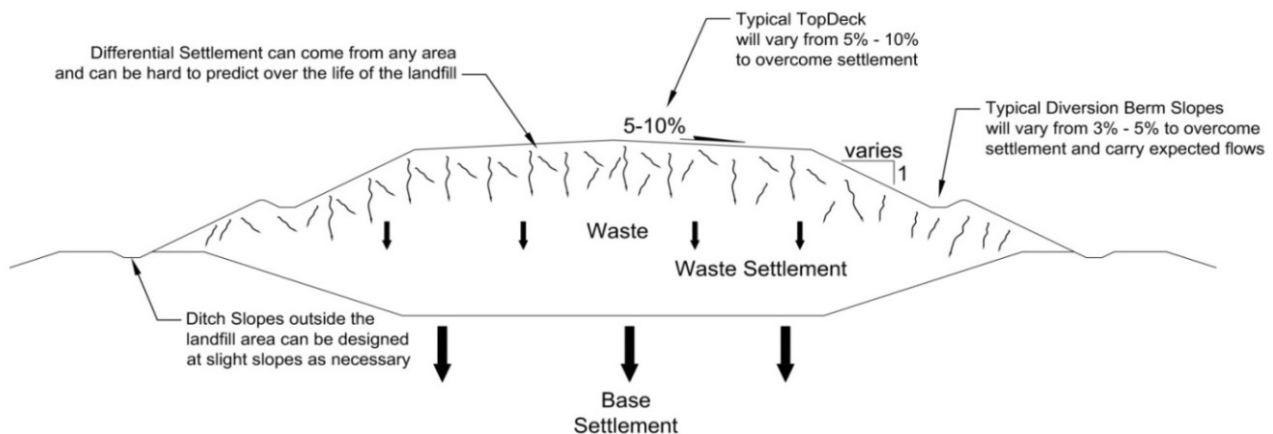


Figure 3: Typical Landfill Cross Section



## 2.2 Diversion Berms and Benches

Diversion berms and benches on **ClosureTurf®** cover systems should be designed as regulatory requirements dictate. For slopes between 3 and 5%, and where velocities are less than 4 fps, sand or gravel infill may be used. When higher flow velocities are expected velocities between 4 and 10 fps), **ArmorFill®** infill is used. When utilizing **ArmorFill®** infill, the concern for typical concentrated flows as related to erosion and other failures are no longer an issue. When velocities exceed 10 fps, **HydroBinder®** Infill is recommended. If the velocities can be conveyed into and out of the specified infill channels safely, design concerns about flows are alleviated. A hydraulic jump calculation is suggested where downslope channels abruptly change grade from super critical to sub critical flow. Figure 4 shows a typical Diversion Berm scenario.

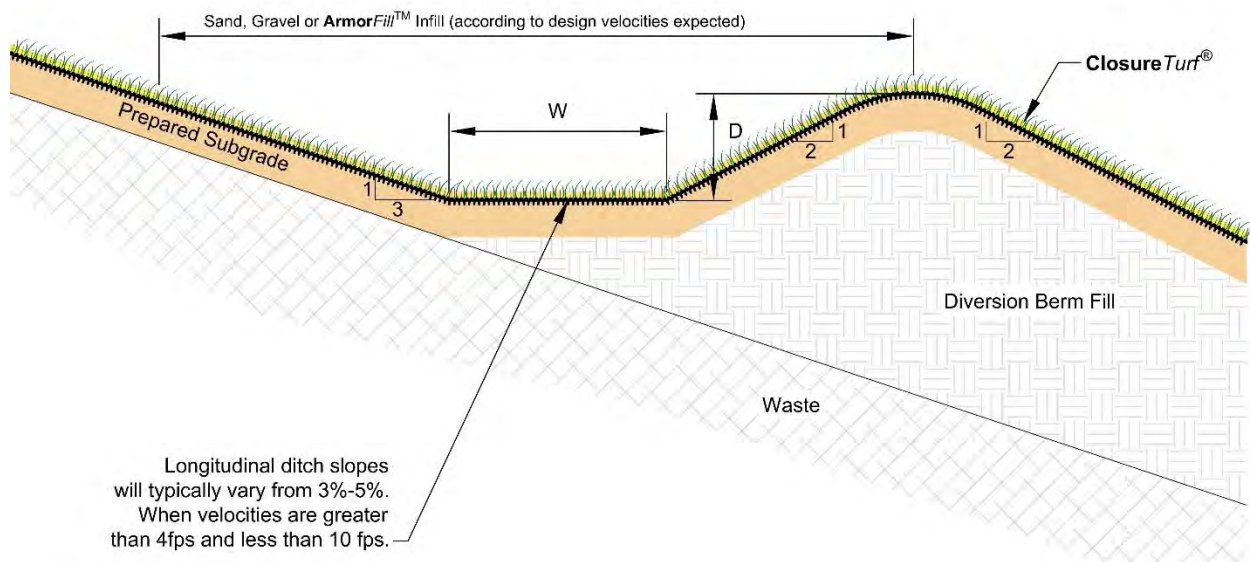


Figure 4: Typical Diversion Berm

### 2.2.1 Benchless Design with ClosureTurf®

When landfill covers are designed that utilize **ArmorFill®**, it may be possible leave diversion berms and down slope channels out of the design completely. Because **ArmorFill®** binds the sand together within the engineered turf, no drainage length limitation is necessary. This is an innovative improvement to the product that will allow storm water to stay in Sheet Flow for a longer period and therefore raise the Time of Concentration ( $T_c$ ) values.

Regardless of the 'version' of **ClosureTurf®**, the designer enjoys the savings gained from not having to account for the 67 cubic yards of sediment storage, and not having to design for Water Quality Volumes ( $W_Q$ ). The storm water conveyed from the **ClosureTurf®** is the same quality as it fell from the sky. When **ArmorFill®** is added to the infill and the  $T_c$  values are increased, it will help the sizing of the storm water conveyance system just as CT 1 did, yet there can be an additional savings by not having to place diversion berms and energy dissipaters as designers were forced to do in the past.

## 2.3 Landfill Access

The **ClosureTurf®** cover system can be driven upon under certain stress conditions (See Section 6.0 Survivability/ Drivability Calculations). Extra care will need to be used according to the load placed on the system. As shown in Figure 5, areas that receive a higher amount of light traffic will require 1 inch of sand and **ArmorFill®** to act as a cushion layer between the sand and vehicle contact.

In situations where the access roads will need to be placed in areas where **ClosureTurf®** has been applied yet heavy traffic is still ongoing, other solutions are required to protect the liner. Figure 6 shows a typical landfill access road scenario where **ClosureTurf®** has been applied, and a heavy traffic haul road is designed above the closure. This is a typical detail and will need to be designed for actual loads by the professional engineer of record.

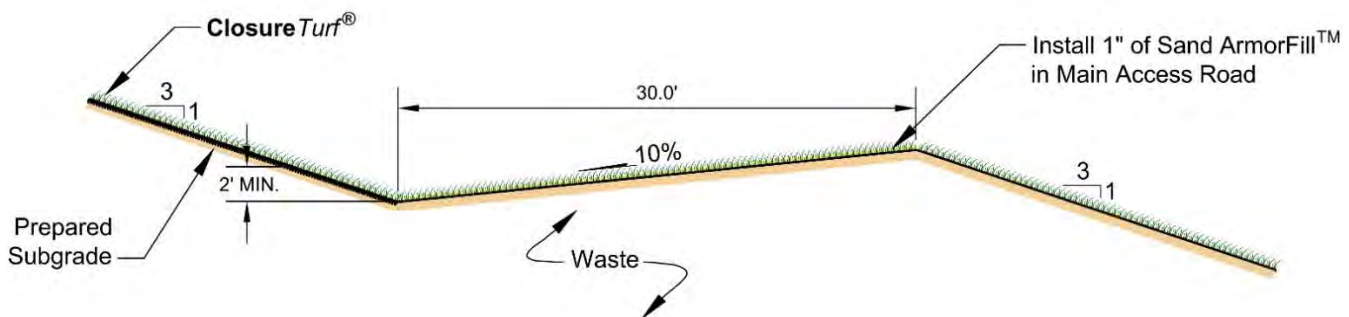


Figure 5: Light Vehicle Access Road Section

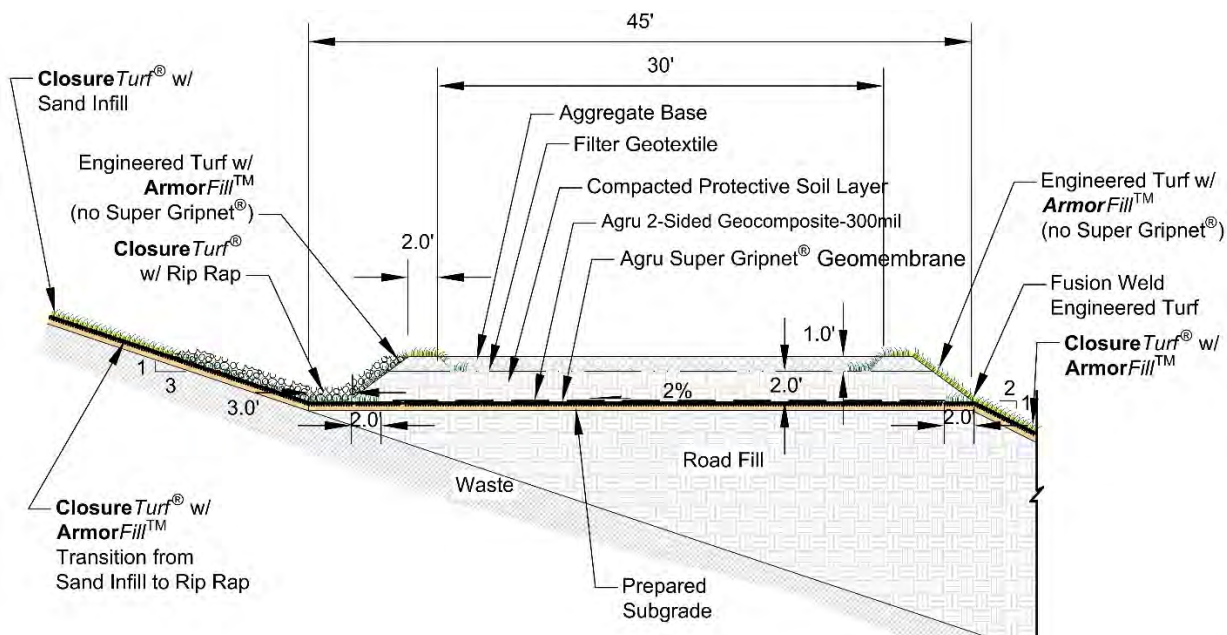


Figure 6: Landfill Access Road Section



## 2.4 Anchor Trenches

Techniques to anchor **ClosureTurf®** vary, however certain precautions should be taken in the order the anchoring occurs. To get a final aesthetic look that reduces wrinkling, the product needs to be installed and allowed to relax over the course of construction while the infill is finalized. At this point, the anchor trenches may be filled and compacted. Note that all anchor trench designs will need to be reviewed and approved by the engineer. Examples shown are typical scenarios only. The project engineer is responsible for designing the proper size anchor trench for the specific site conditions. Note that the anchor trench at the top of slope is only required in the interim situation where waste placement continues to the top deck of the landfill. If the landfill is being closed over the top deck, no anchor trench at mid-slope will be necessary.

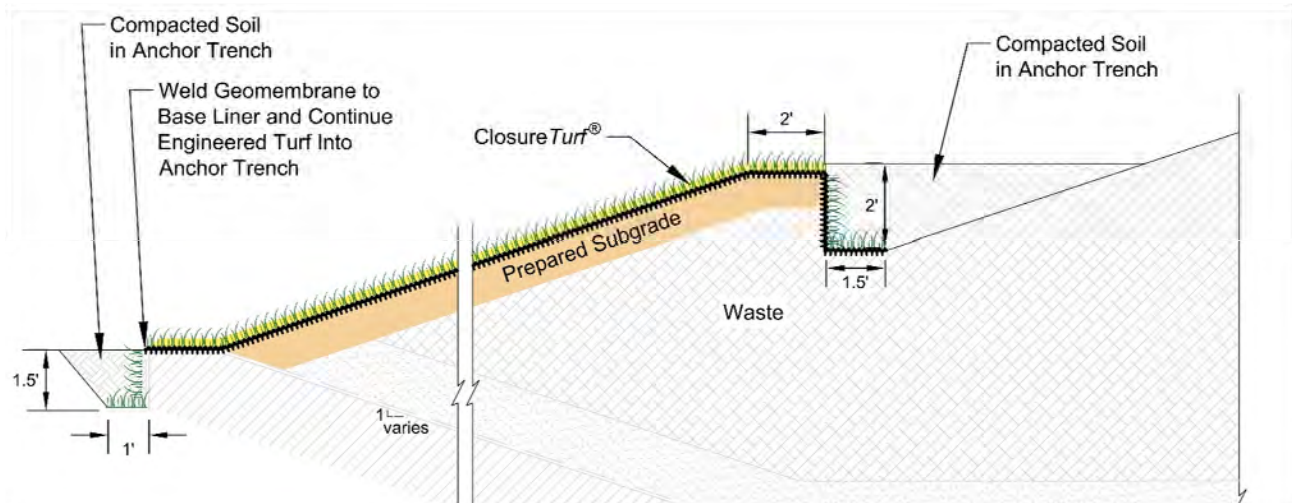


Figure 7: Typical **ClosureTurf®** Anchor Trenches at Top and Bottom of Slope

## 2.5 ArmorFill®

**ArmorFill®** is a polymer emulsion that is mixed 6 parts water to 1 part concentrated **ArmorFill®** and then sprayed onto the previously placed sand infill. Note that **ArmorFill®** should not be applied until the sand infill component is installed and approved. **ArmorFill®** may be used in addition to sand infill to protect from sand infill migration when the normal maximum drainage length is exceeded. **ArmorFill®** is normally utilized in any of the following conditions;

- When a geomembrane with a lower drainage profile is used, such as the AGRU Microspike® geomembrane.
- When concentrated flows have velocities greater than 4 fps yet less than 10 fps.
- To act as a transition point between sand infill and **HydroBinder®** infill.

## 2.6 ClosureTurf® with Stone Infill for Ditches

When **ClosureTurf®** is installed in ditches and stone infill is placed in lieu of sand infill, it creates a ditch lining armor that will allow higher flow velocities to convey without damage or maintenance to the liner system. See Figure 8.

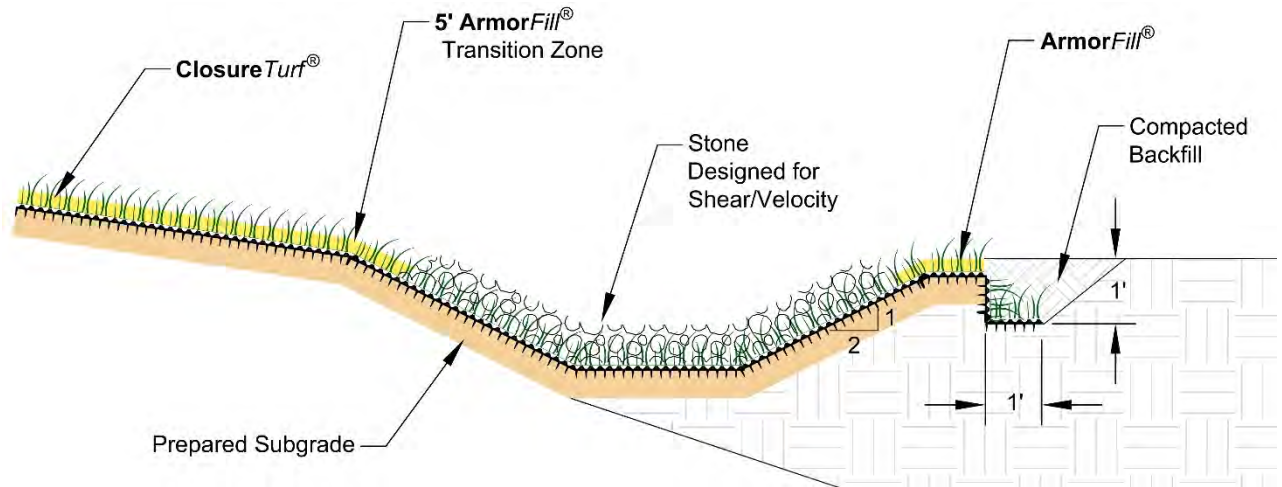
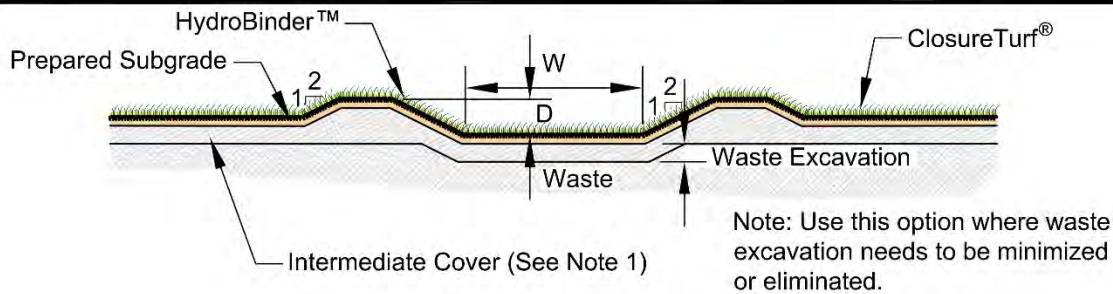


Figure 8: Typical **ClosureTurf®** with Stone Infilled Ditch

### 2.6.1 ClosureTurf® with HydroBinder® Infill for Downslope Channels

**HydroBinder®** infilled **ClosureTurf®** downslope channels are easily constructed because only the type of infill changes. By following the **HydroBinder®** Installation procedures, the final placement of **HydroBinder®** is fast and effective. Figure 9 shows typical downslope channel sections and how they may be designed according to whether waste will be removed. Figure 10 shows the typical **HydroBinder®** infill placement area for downslope channels.

**Important:** When **HydroBinder®** is utilized for high velocity flows, it is important not to block the flow that occurs in the Super Gripnet® with heavy structures such as Rip Rap Check Dams.

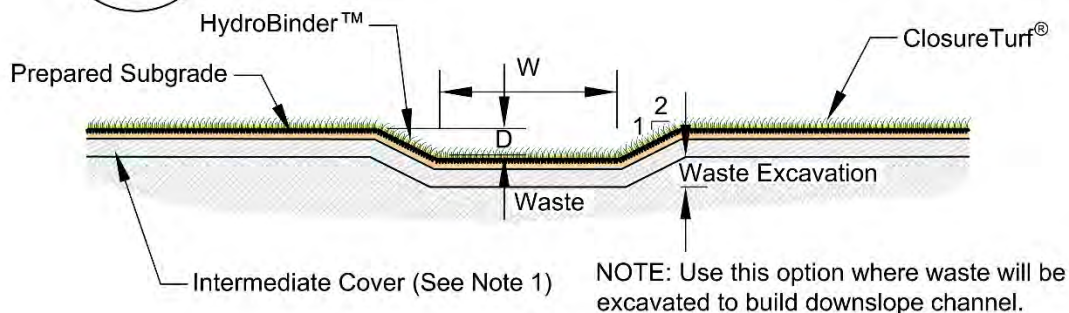


## Option 1

**A**  
**1**

### Downslope Channel Section

N.T.S.

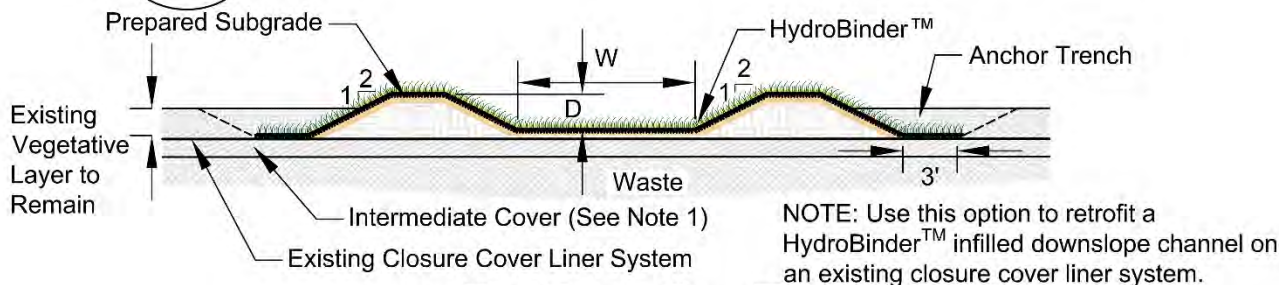


## Option 2

**A**  
**1**

### Downslope Channel Section

N.T.S.



## Option 3 - Retrofit

**A**  
**1**

### Downslope Channel Section

N.T.S.

Figure 9: Typical Downslope Channel Sections

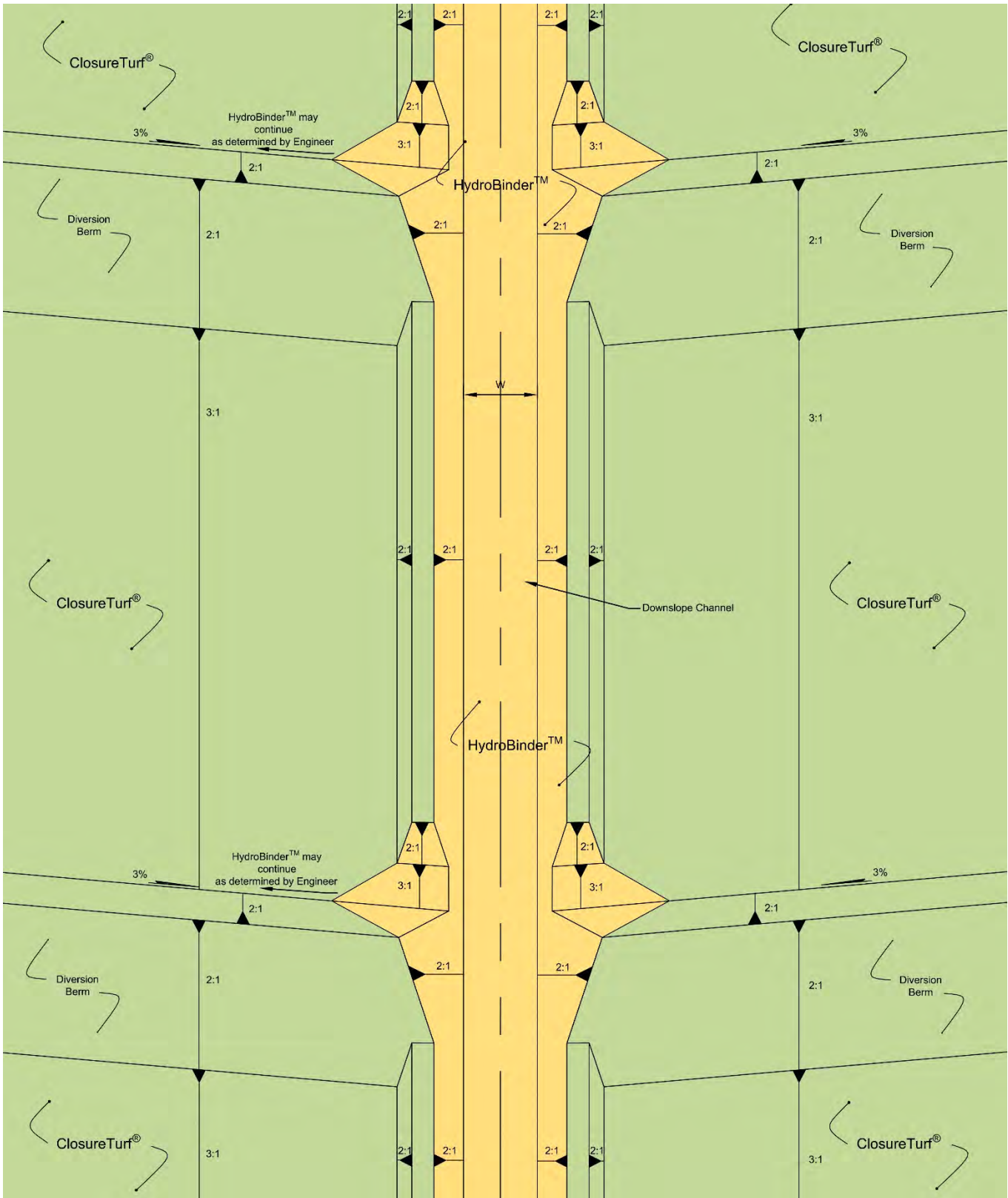


Figure 10: Typical **HydroBinder<sup>®</sup>** Infill Placement in Downslope Channels

## 2.7 Energy Dissipation

Energy dissipation at the base of the **ClosureTurf®** with **HydroBinder®** downslope channels can become significant as with any landfill closure. Internal energy dissipators, stilling basins, scour holes or a combination of these may be necessary to properly convey high surface water velocities at the toe of slope and/or around sharp angles. The velocities with most downslope channels will be high. **HydroBinder®** infilled **ClosureTurf®** will be able to better handle these high velocities and will not fail under very high shear stresses. Proper energy dissipation techniques can be found in FHWA Circular Number 14 (HEC 14) "Hydraulic Design of Energy Dissipators for Culverts and Channels," Sept. 1983, revised 1995. See Section 5.0 Hydrology for further hydrologic parameters.

**Important:** When **ClosureTurf®** with **ArmorFill®** (CT 2) is utilized, the requirement to concentrate water to get it off the cover system more readily may not be necessary. Because the **ArmorFill®** does not have a drainage length requirement, Diversion Berms are not required. Since there are no Diversion Berms, there will be no Downslope Channels. And without the need for downslope channels, the need for energy dissipation is greatly reduced. This technique will also keep stormwater in Sheet Flow for a maximum period before having to be channelized. Higher Time of Concentration (Tc) values help to alleviate peak storm timing.



## 3.0 Product Data Sheets



### ClosureTurf® w/50 mil SuperGripnet®

Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	50 (1.27)	50 (1.27)
Thickness (min. avg.), mil (mm)	ASTM D5994	47.5 (1.21)	47.5 (1.21)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	42.5 (1.08)	42.5 (1.08)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
Friction Spike Height (min. avg.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	110 (19.3)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	13
Strength@Break (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	105 (18.4)	110 (19.3)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	30 (133)	38 (169)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

### ENGINEERED TURF COMPONENT

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	800 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb./ft. min. (MARV)
Rainfall Induced Erosion	ASTM D6459	0.04% Infill Loss 6 in./hr.
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft <sup>3</sup> /ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft <sup>3</sup> /s/ft
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolan Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥19 oz. / sq. yd. (≥ 24 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

### SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft <sup>2</sup>	m <sup>2</sup>	lbs	kg
Super Gripnet®	50	1.25	23	7	300	91.4	6,900	640	~3000	~1360
Turf Component	N/A	N/A	15	4.6	300	91.4	4500	418	840	381

ClosureTurf® and HydroBinder® products (US Patent No. 7,682,105, 8,585,322, 9,163,375, and 9,199,287; Canadian Patent No. 2,663,170; and other Patents Pending) and trademarks are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

01-2018-0

## Closure Turf® w 40 mil MicroSpike®



Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	40 (1.02)	40 (1.02)
Thickness (min. avg.), mil (mm)	ASTM D5994	38 (0.97)	38 (0.97)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	34 (0.86)	34 (0.86)
Asperity Height (min. avg.), mil (mm)	ASTM D7466	20 (0.51)	20 (0.51)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	88 (15.4)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	13
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	112 (19.6)	88 (15.4)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	400	350
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	25 (111)	30 (133)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	50 (222)	90 (400)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

## ENGINEERED TURF COMPONENT

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	800 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb./ft. min. (MARV)
Rainfall Induced Erosion	ASTM D6459	Infill Loss 6 in./hr. N/D (with ArmorFill™)
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability (Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs (projected)
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft <sup>3</sup> /ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft <sup>3</sup> /s/ft
Internal Friction of Combined Components	ASTM D5321	21°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolan Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥19 oz. / sq. yd. (≥ 24 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

## SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft <sup>2</sup>	m <sup>2</sup>	lbs	kg
MicroSpike®	40	1.0	23	7	750	229	17,250	1603	~3900	~1769
Turf Component	N/A	N/A	15	4.6	300	91.44	4500	418	840	381

ClosureTurf® and HydroTurf® products (US Patent No. 7,682,105, 8,585,322, 9,163,375, and 9,199,287; Canadian Patent No. 2,663,170; and other Patents Pending) and trademarks are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

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**ClosureTurf® w/60 mil SuperGripnet®**


Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	60 (1.52)	60 (1.52)
Thickness (min. avg.), mil (mm)	ASTM D5994	57 (1.46)	57 (1.46)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	51 (1.30)	51 (1.30)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
Friction Spike Height (min. avg.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	132 (23.1)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	13
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	126 (22.1)	132 (23.1)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	40 (178)	42 (187)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	70 (311)	90 (400)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	≥140	≥140

Agru America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

**ENGINEERED TURF COMPONENT**

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	800 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb./ft. min. (MARV)
Rainfall Induced Erosion	ASTM D6459	0.04% Infill Loss 6 in./hr.
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft <sup>3</sup> /ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft <sup>3</sup> /s/ft
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolanic Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥19 oz. / sq. yd. (≥ 24 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

**SUPPLY INFORMATION (Standard Roll Dimensions)**

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft <sup>2</sup>	m <sup>2</sup>	lbs	kg
Super Gripnet®	60	1.50	23	7	300	91.4	6,900	640	~3000	~1360
Turf Component	N/A	N/A	15	4.6	300	91.4	4,500	418	840	381

ClosureTurf® and HydroTurf® products (US Patent No. 7,682,105, 8,585,322, 9,163,375, and 9,199,287; Canadian Patent No. 2,663,170; and other Patents Pending) and trademarks are the property of Watershed Geosynthetics LLC. All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, this information should not be used or relied upon for any specific application without independent professional examination and verification of its accuracy, suitability and applicability. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Watershed Geosynthetics LLC as to the effects of such use or the results to be obtained, nor does Watershed Geosynthetics LLC assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

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## ClosureTurf® w/50 mil MicroDrain® Liner



Product Data	Test Method	LLDPE Values	HDPE Values
Thickness (nominal), mil (mm)	ASTM D5994	50 (1.27)	50 (1.27)
Thickness (min. avg.), mil (mm)	ASTM D5994	47.5 (1.21)	47.5 (1.21)
Thickness (lowest indiv.), mil (mm)	ASTM D5994	42.5 (1.08)	42.5 (1.08)
Drainage Stud Height (min. avg.), mil (mm)	ASTM D7466	130 (3.30)	130 (3.30)
MicroSpike Asperity Height (min. avg.), mil (mm)	ASTM D7466	20 (0.51)	20 (0.51)
Density, g/cc	ASTM D792, Method B	0.94 (max.)	0.94 (min.)
Tensile Properties (avg. both directions)	ASTM D6693, Type IV		
Strength @Yield (min. avg.), lb/in. width (N/mm)	ASTM D6693, Type IV	N/A	110 (19.3)
Elongation @ Yield (min. avg.), % (GL=1.3 in.)	ASTM D6693, Type IV	N/A	13
Strength@Break (min. avg.), lb./in. width (N/mm)	ASTM D6693, Type IV	105 (18.4)	110 (19.3)
Elongation@Break (min. avg.), % (GL=2.0 in.)	ASTM D6693, Type IV	300	200
Tear Resistance (min. avg.), lbs. (N)	ASTM D1004	30 (133)	38 (169)
Puncture Resistance (min. avg.) lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range %)	ASTM D 4218	2-3	2-3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views in Cat. 1 or 2	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	500
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	≥140	≥140

Agri America's geomembranes are certified to pass Low Temp. Brittleness via. ASTM D746 (-80°C), and Dimensional Stability via. ASTM D1204 (± 2% @ 100°C)

## ENGINEERED TURF COMPONENT

Product Data	Test Method	Values
CBR Puncture	ASTM D6241	800 lb. (MARV)
Tensile Product (MD/XD)	ASTM D4595	1,000 lb./ft. min. (MARV)
Rainfall Induced Erosion	ASTM D6459	0.04% Infill Loss 6 in./hr.
Aerodynamic Evaluation	GTRI Wind Tunnel	120 mph with max. uplift of 0.12 lb/sf
Engineered Turf Fiber Tuft UV Stability	ASTM G147	>60% retained tensile strength at 100 yrs. (projected)
Backing System UV Stability Index Test (Single Geotextile Fully Exposed)	ASTM G1545 Modified Cycle 1.UVA340	110 lbs./ft. retained tensile strength at 6500 hrs
Steady State Hydraulic Overtopping (ClosureTurf® w/ HydroBinder®)	ASTM D7277/D7276	5 ft. overtopping resulting in 29 ft/s velocity and 8.8 psf shear stress for Manning's N Value of 0.02
Full Scale Wave Overtopping Test Cumulative Volume (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	165,000 ft <sup>3</sup> /ft
Full Scale Wave Overtopping Test Discharge (ClosureTurf® with HydroBinder®)	Colorado State University Wave Simulator	4.0 ft <sup>3</sup> /s/ft
Internal Friction of Combined Components	ASTM D5321	35°, min.
ArmorFill™ Infill	ASTM D6913	ASTM C-33 Fine Aggregates w/ Pozzolan Binder
Yarn Weight (Total Product Weight)	ASTM D5261	≥ 19 oz. / sq. yd. (≥ 24 oz. / sq. yd.)
Tensile Strength of Yarn	ASTM D2256	15 lbs. min.

## SUPPLY INFORMATION (Standard Roll Dimensions)

	Thickness		Width		Length		Area (approx.)		Weight (avg.)	
	mil	mm	ft.	m	ft.	m	ft <sup>2</sup>	m <sup>2</sup>	lbs	kg
Super Gripnet®	50	1.25	23	7	300	91.4	6,900	640	~3000	~1360
Turf Component	N/A	N/A	15	4.6	300	91.4	4500	418	840	381

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## 4.0: Sand Infill Stability (CT 1)

The bottom spiked friction surface of the Agru Super Gripnet® 4.4 mm high spikes and patterned texture provides maximum interface friction and high factor of safety against sliding at the liner/soil interface. On landfills and mine piles, sliding of the soil cover along steep side slopes is of primary concern, particularly after major storm events. On top of the Super Gripnet® liner, there are no thick, heavy cover materials to get saturated and possibly begin to creep. The sand infill is held in place by the well graded sand and the unique structure of the engineered turf that traps the sand to anchor and ballast it to the surface it covers. Additionally, the drainage studs embedded into the Super Gripnet® are designed to convey shear forces of water on the geomembrane rather than on the top of the sand. Note that:

- **ClosureTurf®** can be placed on very steep slopes
- Tests indicate 39 degree peak interface friction value

### 4.1: Sand Infill Stability (CT 2)

CT 2 will utilize **ArmorFill®**. This product greatly reduces the ability of the sand to migrate due to excessive shear forces by binding the sand within the Engineered Turf Component. Note that **ArmorFill®** may be added to the CT 1 or CT 2 profile either during construction, or when excessive sand migration is detected.

## 4.2: Interface Direct Shear Testing (CT 1)

Below are test results of the Interface Direct Shear Testing done on the **ClosureTurf®** product as it relates to the CT 1 profile.

### Low Normal Shear Box

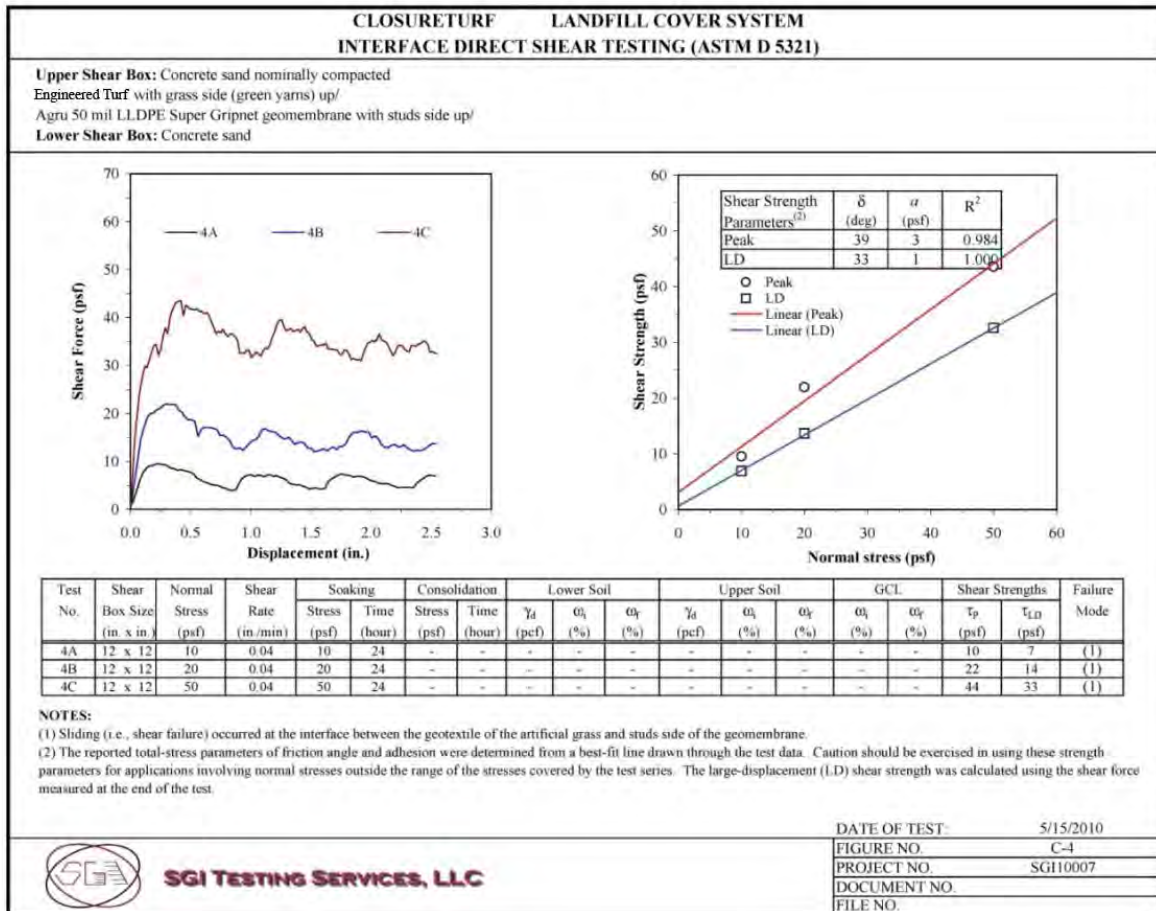
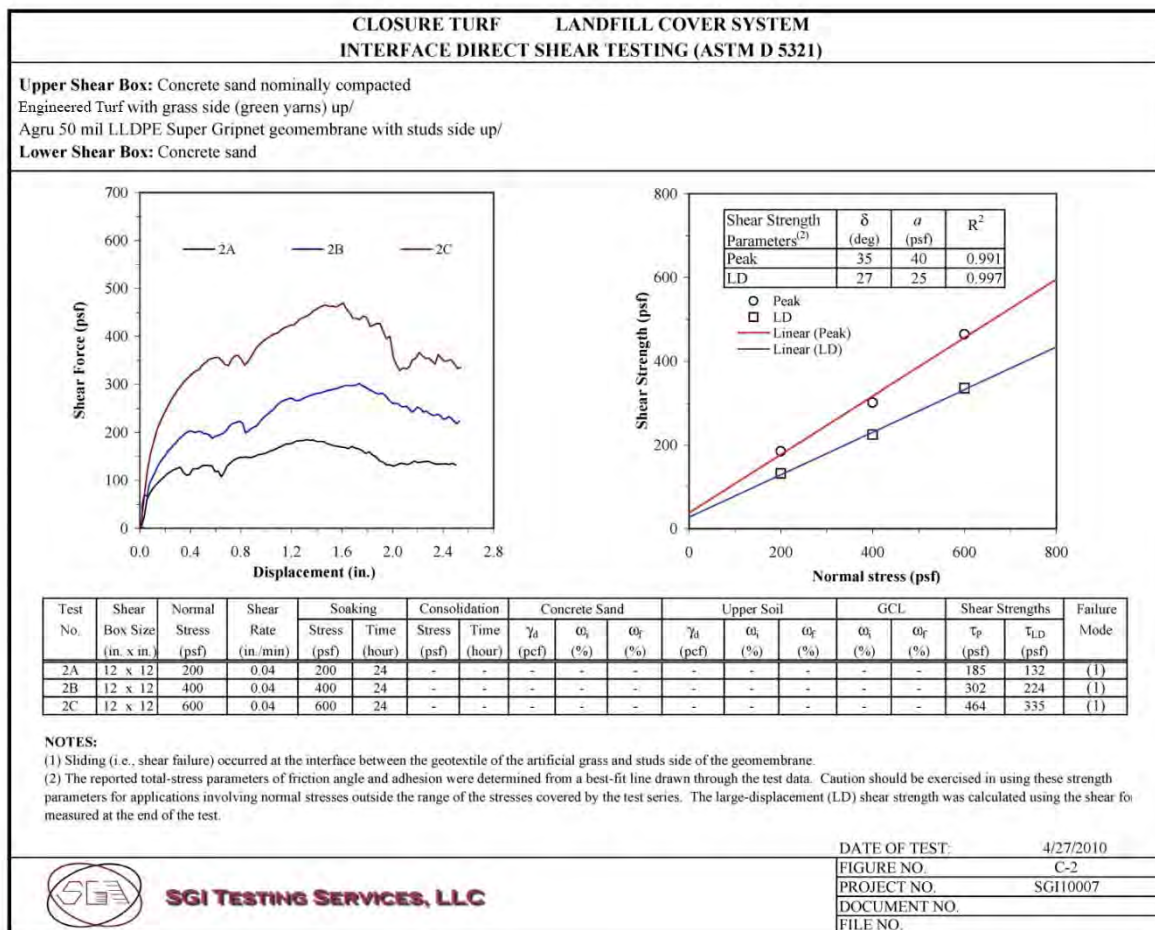


Figure 11: Interface Direct Shear with Low Normal Stress at 10, 20 and 50 (psf). Engineered Turf and Agro 50 mil LLDPE Super Gripnet®.

## High Normal Shear Box



S10007-02.ds.xls

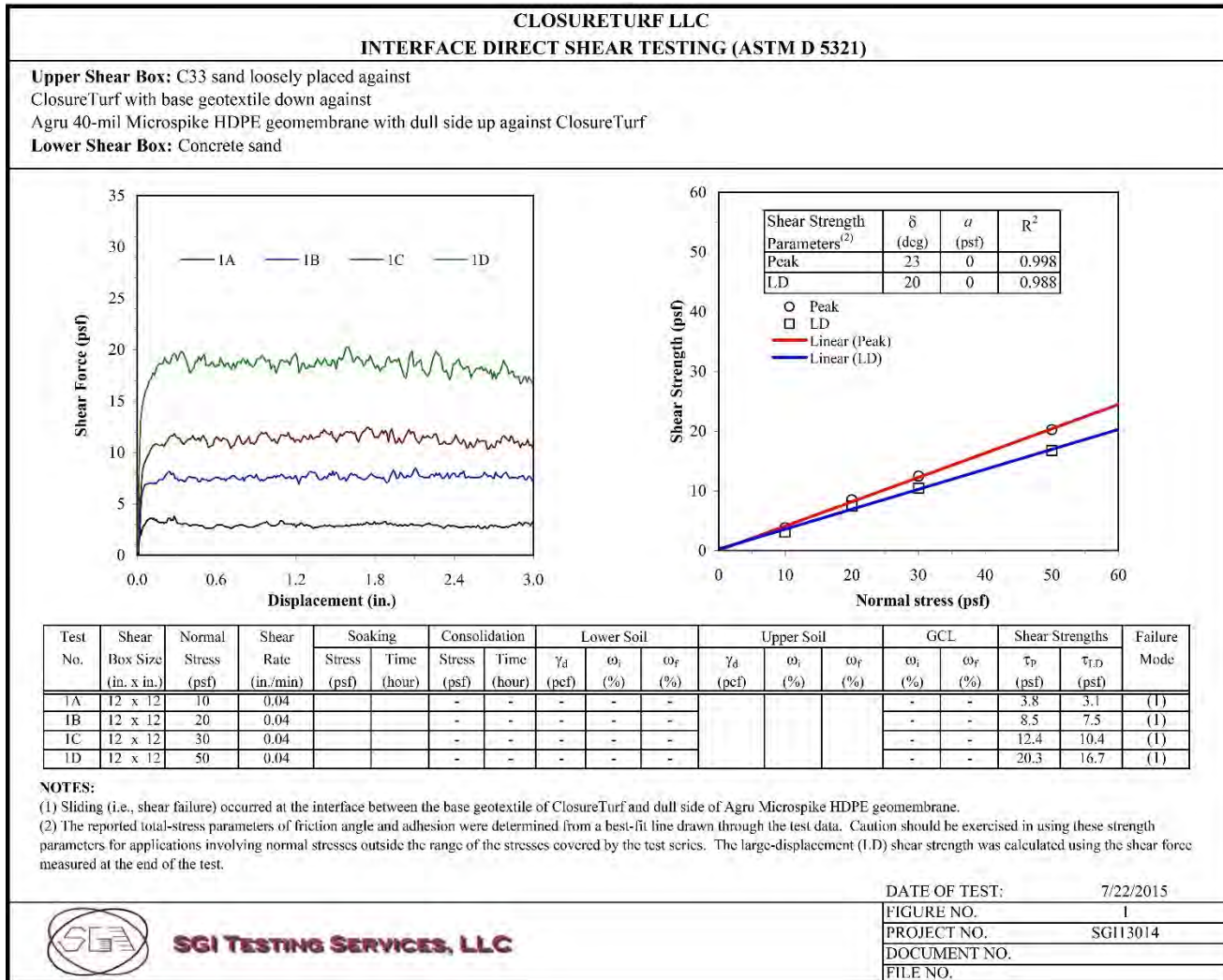
Figure 12: Interface Direct Shear Normal Stress at 200, 400 and 600 (psf). Engineered Turf and Agu 50 mil LLDPE Super Gripnet®.



## 4.3 Interface Direct Shear Testing (CT 2)

Below are test results of the Interface Direct Shear Testing done on the **ClosureTurf®** product as it relates to the CT 2 profile.

### Low Normal Shear Box



S13014-05R.ds.xls

Figure 13: Interface Direct Shear with Low Normal Stress at 10, 20 and 50 (psf). Engineered Turf and Agru 40 mil LLDPE Microspike®.

#### 4.4: Wind Uplift

Since all exposed geomembranes are susceptible to damage from hurricanes, the technology must withstand hurricane forces. A study was performed on the wind uplift reactions by the Georgia Tech Research Institute. The **ClosureTurf®** product indicated very small uplift (i.e. less than 0.13 psf) when exposed to 120mph winds. This is in contrast with other exposed geomembranes where extensive anchoring is required even for 50mph winds. **ClosureTurf®** technology provides features that help mitigate the forces of wind, such as a porous surface to break vacuum and turf blades that will increase the aerodynamic turbulent flow boundary conditions and blades bending and reacting against the wind causing a resistance to the uplift component.

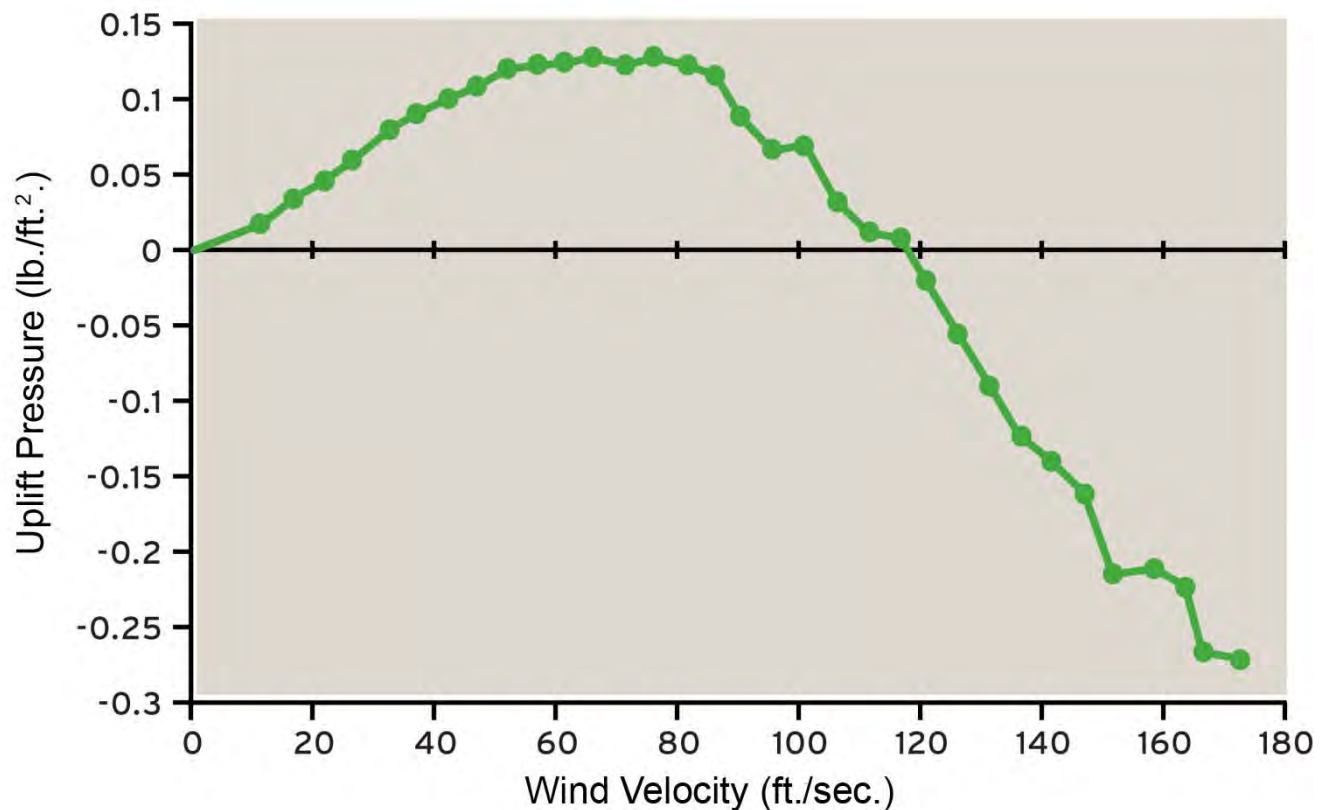


Figure 14: Georgia Tech Research Institute Wind Tunnel Chart Uplift Pressure vs. Wind Velocity

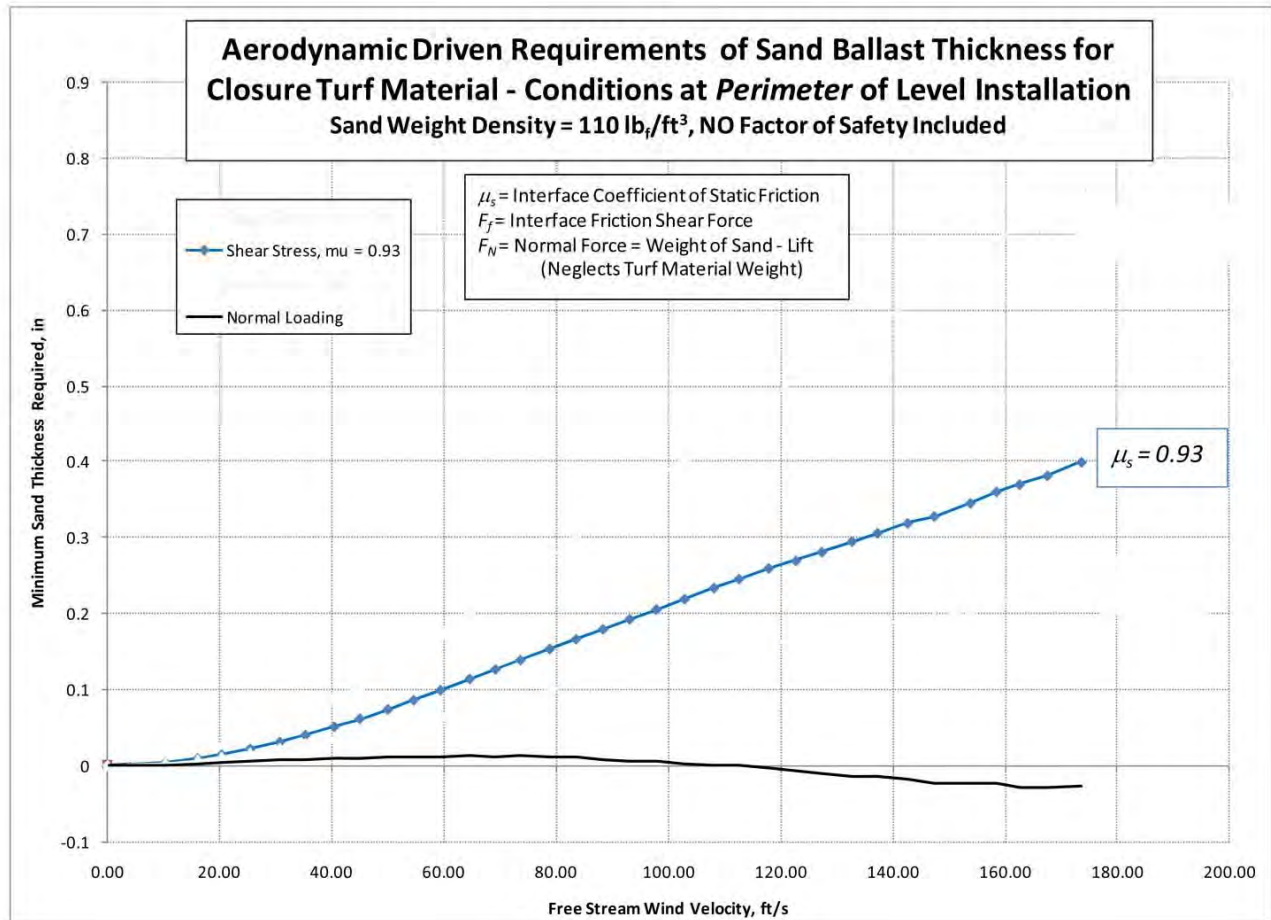


Figure 15: Sand Ballast Minimum Requirement at the Perimeter of Engineered Turf Installation

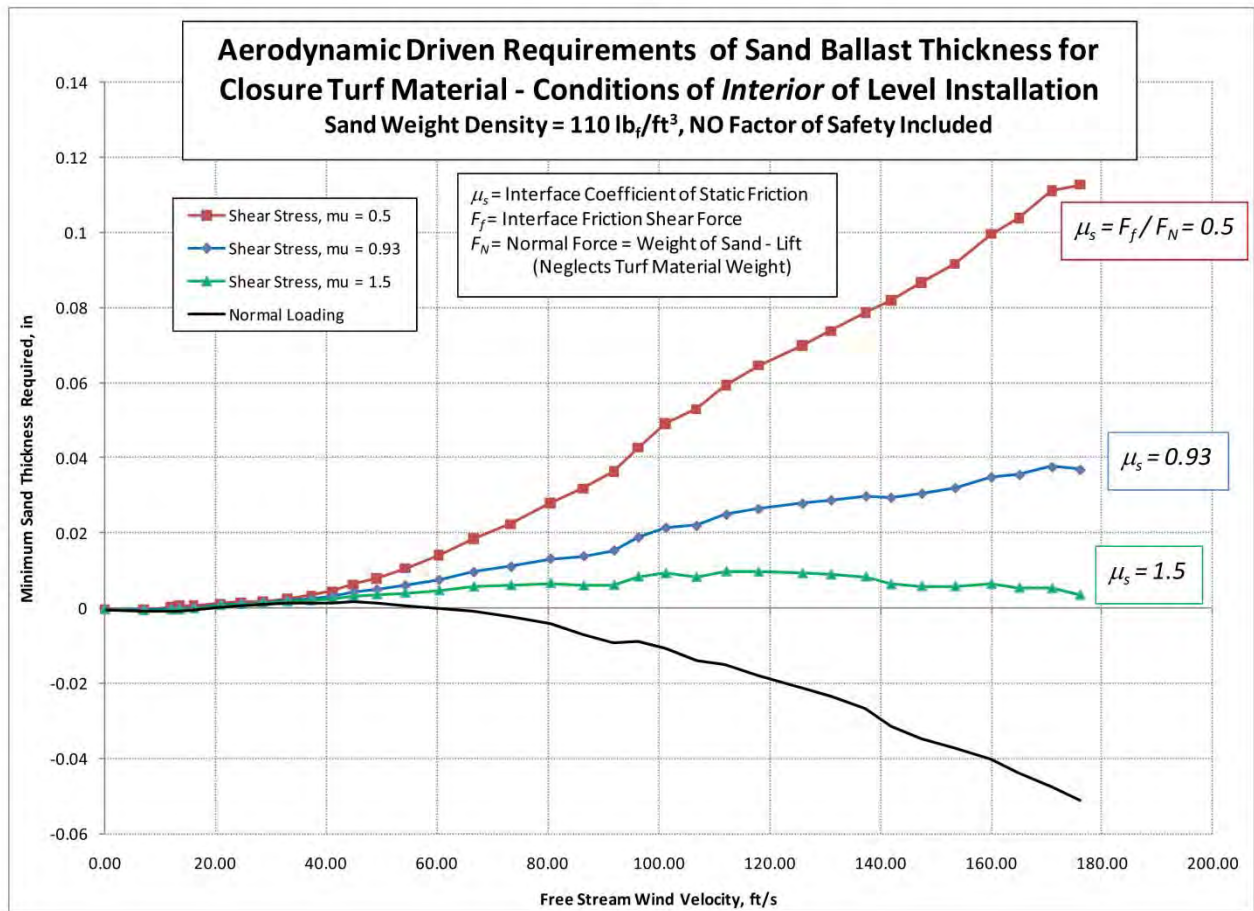


Figure 16: Minimum Sand Ballast Requirement in the Interior of Engineered Turf Installation



## 4.5 ClosureTurf® Grain Size Curve Parameters

**ClosureTurf®** requires that specialized mixture of sand infill be placed in the engineered turf. The **ClosureTurf®** Grain Size Parameters are shown in Table 1 below. Optimum Infill Sand for **ClosureTurf®** would be a medium particle size sand meeting ASTM C-33 for fine aggregates. All infill material should meet ASTM C-33 specifications unless otherwise evaluated by Watershed Geosynthetics LLC.

ASTM C-33-03	
Sieve	Percent Passing
9.5 mm (3/8 in.)	100
4.75 mm (No. 4)	95 to 100
2.36 mm (No. 8)	80 to 100
1.18 mm (No. 16)	50 to 85
600 µm (No. 30)	25 to 60
300 µm (No. 50)	5 to 30
150 µm (No. 100)	0 to 10

Table 1: ASTM C-33-03 Grain Size Parameters

## 5.0 Hydrology

### 5.1 DE-tention, Not RE-tention

Any **ClosureTurf®** design that is chosen will be able to take advantage of the Detention of storm water rather than the erosion control method of Retaining storm water. With **ClosureTurf®**, storm water is simply 'DE'-tained long enough to mitigate downstream flooding. This allows space in the pond previously allocated for sediment storage and Water Quality Volumes to be used only for the safe conveyance of the design storm event.

## 5.2 ClosureTurf® Hydrology Parameters

Currently, many regulatory agencies are requiring run-off curve numbers (RCN) of 95-98 of a typical landfill closure. **ClosureTurf®**'s RCN should be calculated between 92 and 95. This number was derived by TRI Environmental, Inc. and Colorado State University Hydraulics Laboratory in separate tests. Table 2 below shows the typical TR-55 design parameters for Hydrology using **ClosureTurf®**.

<b>ClosureTurf® Hydrology</b>		
	<b>TR-55 Data</b>	
	Curve Number Depends on Rain Intensity	92 <sup>1</sup> - 95
<b>Sheet Flow</b>	Manning's n	
	Slopes >10%	0.12
	Slopes <10%	0.22
	Flow Length	100'-300' dependent on Manning's n until a depth of not more than 0.1 foot is attained in the 2yr 24hr rainfall
	2yr-24hr Rain	SCS
	Land Slope	design
<b>Shallow Concentrated Flow</b>	Flow Length	design
	Slope	design
	Surface (paved/unpaved)	Unpaved
	X-Sect Area	ft <sup>2</sup>
<b>Channel Flow</b>	Wetted Perimeter	Linear Feet
	Channel Slope	ft/ft
	Manning's n	0.03 <sup>2</sup>
	Flow Length	design

1. RCN ranging from 92 in High Intensity Rainfalls to 95 in normal rainfall events.
2. Manning's n for channel flow will vary with depth of flow.

Table 2: **ClosureTurf®** TR-55 Data

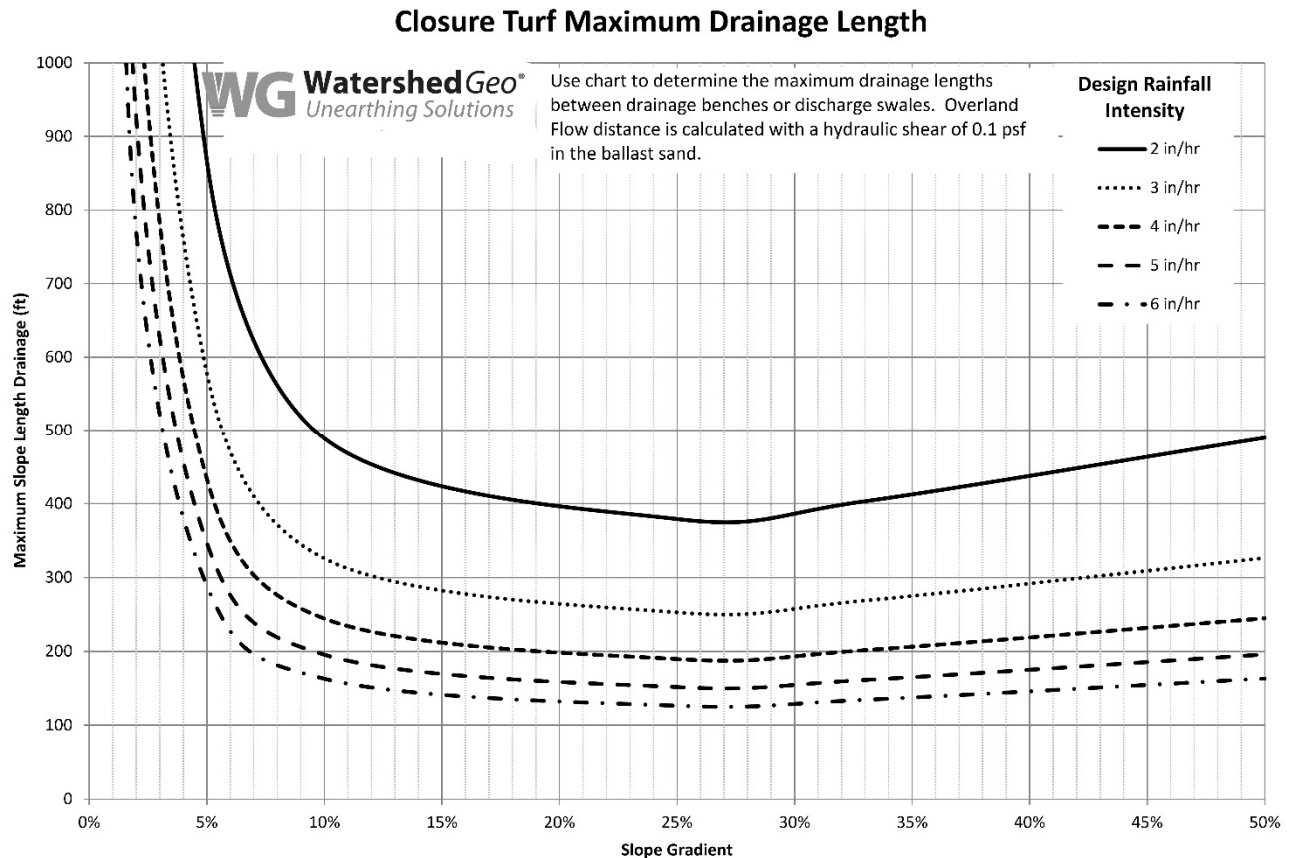
The engineered turf portion of **ClosureTurf®** will have a manning's 'n' under sheet flow that is 0.12 on slopes greater than 10% and 0.22 on slopes less than 10%. In most cases, the time of concentration for sheet flow will have the greatest impact to the overall Tc.

## 5.3 Drainage Length (CT 1)

Critical slope length is used to define the drainage length between benches or swales where the system will discharge the flow. The graphic below shows the maximum distance allowed between benches or drainage features when using CT 1. The calculations are based on the transmissivity capacity of the Super Gripnet® to handle the flow without inundating the sand for slopes 10 percent or greater. Inundation of

the sand in steep slopes can lead to erosion of the sand infill as shown on Figure 18. Note that inundation is allowed for slopes less than 10% as long as it does not produce shear values for cohesion exceeding 0.2 psf, or when velocities are below a maximum of 3 fps.

Regulations usually require adherence a particular storm event. Since storm events such as the 100 yr 24 hr event only produce fractions of inches of total rainfall per hour, the designer will need adhere to a higher intensity, shorter time period event such as the 100 year 1 hour event to reduce the likelihood of inundating the sand on steeper slopes when this occurs. Use Figure 17 below to determine the maximum drainage lengths between drainage benches or discharge swales.



\*Based on use of specified grain size sand infill.

Figure 17: **ClosureTurf®** CT 1 Maximum Drainage Length

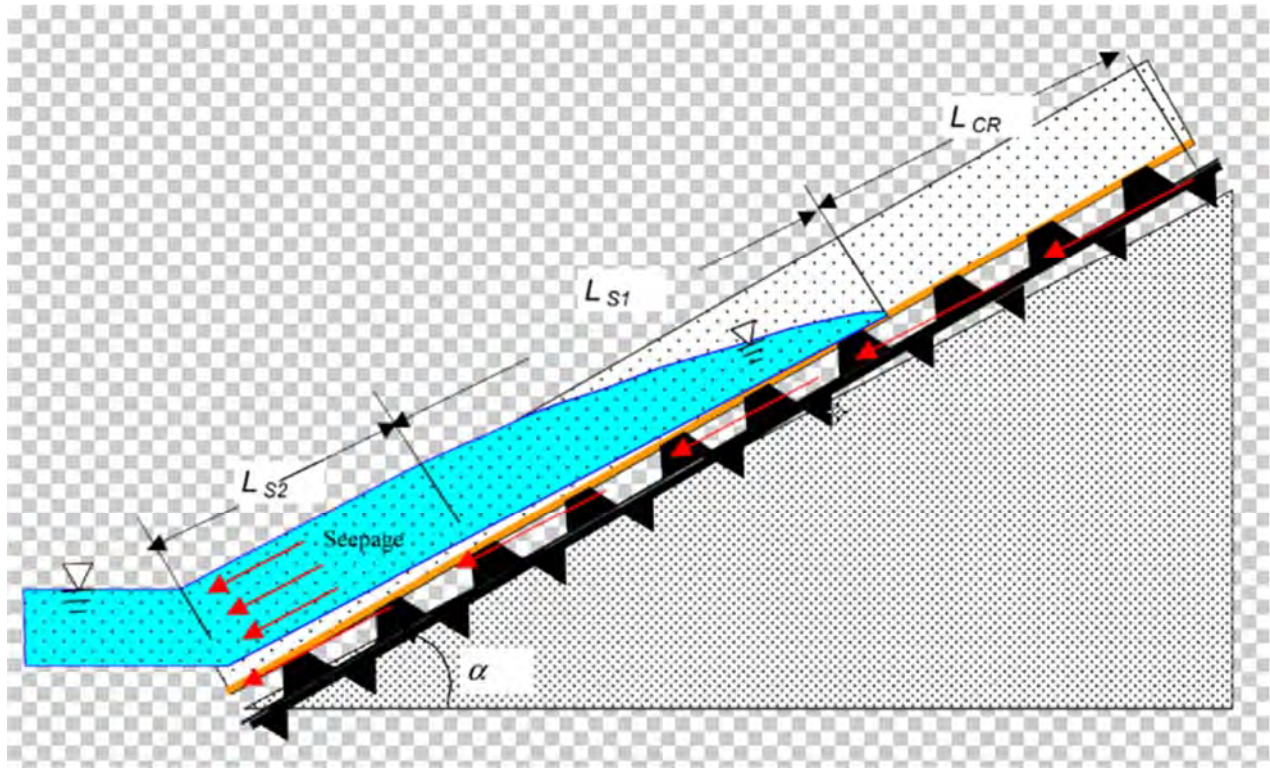


Figure 18: **ClosureTurf®** CT 1 Critical Length Section

**Problem 1 Example: For slopes less than 10%**

Determine the maximum drainage length needed for spacing of Diversion Berms.

Evaluate average slope of landfill top deck: (5%)

Pick Rainfall intensity from Figure 17 (2 in./hr).

Read Y scale on chart to determine Maximum Drainage Length. (860 ft.)

Note: Check that cohesion value does not exceed 0.2 psf.

**Problem 2 Example: For slopes greater than 10%**

Determine the maximum drainage length needed for spacing of Diversion Berms.

Evaluate average slope of landfill side slopes: (4:1, 25%)

Pick Rainfall intensity from Figure 17 (5 in./hr).

Read Y scale on chart to determine Maximum Drainage Length. (150 ft.)

Note that shear in the sand infill is greatly reduced with lessening of the slope. Therefore slopes less than 10% may not require Diversion Berms for shear stress of the sand. However, they may still be utilized on top decks where water needs to be diverted to other areas.

## 6.0 Survivability / Drivability Calculations

An evaluation of drivability was completed by SGI Testing Services. Additionally, an independent Vehicle Travel Design was completed. Parameters from those reports are used in the examples below.

### Problem:

#### 1. Evaluate the puncture resistance/material survivability of the **ClosureTurf®** system.

Vehicle Details:

- A. Kubota Crawler Dumper Weight = 6,000 lbs
- B. Kubota 1,300 lbs plus payload of 1,600 lbs Weight = 2,900 lbs
- C. Pick-Up Truck, Loaded Weight = 6,000 lbs
- D. Rubber Tire Bobcat Weight = 3,000 lbs
- E. Tire Pressure = 30 – 40 psi

#### A. Evaluate the puncture resistance of **ClosureTurf®** geotextiles under the tire pressure of access equipment.

First, using a pick-up truck with a weight of 8,000 lbs and a contact tire area of 0.53ft<sup>2</sup> or a 0.82 ft diameter circle area determine the tire contact pressure.

$$\text{Weight per Wheel} = 8,000 \text{ lbs} / 4 \text{ wheels} = 2,000 \text{ lbs} / \text{wheel}$$

$$\text{Tire Contact Pressure} = \frac{\text{Weight per Tire}}{\text{Contact Area}} = \frac{2,000 \text{ lbs}}{0.54 \text{ ft}^2} = 3,703 \text{ lbs/ft}^2 = 26 \text{ psi}$$

$$\text{Tire Contact Pressure} = 26 \text{ psi} \approx 30 \text{ psi} \quad \text{OK}$$

Then estimate the average strength of the geotextiles. The mean strength of the **ClosureTurf®** engineered turf in machine direction, Tensile MD, is shown on Figure 19 and the mean strength of the **ClosureTurf®** engineered turf in cross-machine direction, Tensile XD is on Figure 20 below.

$$T_{\text{avg}} = \frac{\text{Tensile MD} + \text{Tensile XD}}{2} = \frac{2055 + 1802}{2} = 1928.5 \text{ lb./ft.} = 161 \text{ lb./in.}$$

The Static Puncture (CBR) Testing (ASTM D6241) for the **ClosureTurf®** engineered turf is shown on Figure 21. According to the CBR the Mean Puncture Strength is 1108 lbs for the **ClosureTurf®** engineered turf. Puncture Resistance can then be calculated. Assume the entire contact area is hollow (similar to CBR testing conditions) for a more conservative approach.

$$P_r = 2 \pi r T_{\text{avg}}$$

Where  $P_r$  is the puncture resistance

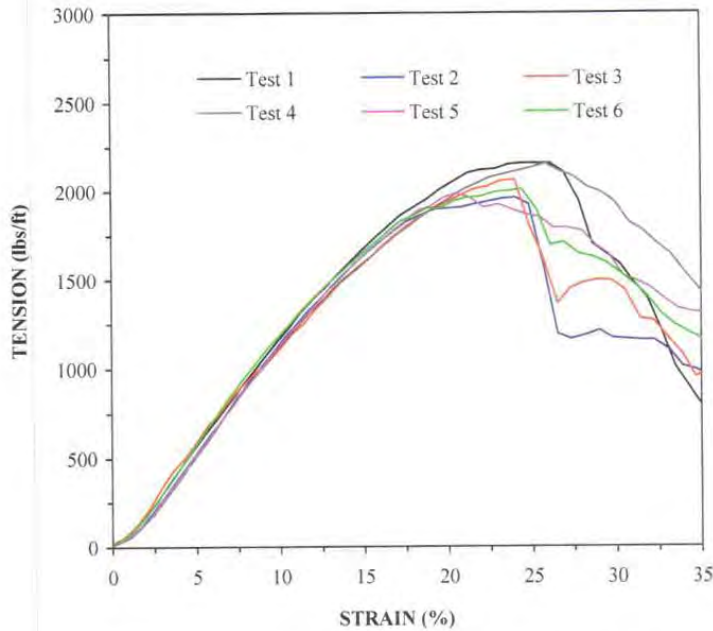
$r$  is the radius = Diameter/2 = 9.84 inches/2 = 4.92 inches  
 $T_{avg}$  = Tensile Strength Average = 161 lb/in

Puncture Resistance =  $2\pi(4.92\text{in})(161\text{ lb/in}) = 4974.5\text{ lbs}$

Factor of Safety =  $P_r / \text{Weight per Tire} = \frac{4974.5\text{ lbs.}}{2000\text{ lbs.}}$       FS = 2.48 **OK**



**SHAW INDUSTRIES**  
**WIDE-WIDTH TENSILE TESTING (ASTM D 4595)**  
 Artificial Grass Sample in MD  
 Base Layer Consisting of Two Slit-Film Woven Geotextiles  
 Roll # AA17CHY  
 SGI Sample ID No. S17296



Test No.	Tension at 2% (lb/ft)	Tension at 5% (lb/ft)	Tension at 10% (lb/ft)	Ultimate Strength (lb/ft)	Strain at Ultimate (%)
1	172	569	1173	2155	24.4
2	146	523	1143	1960	24.0
3	191	585	1109	2062	24.0
4	138	510	1127	2155	25.8
5	139	523	1131	1985	20.5
6	170	576	1191	2009	24.4
Mean	159	548	1146	2055	23.9
STD	22	32	30	85	1.8

**NOTES:**

Clamp: Curtis  
 Specimen Width (in.): 8.0  
 Yarn Count (yarns/in.): Not Measured  
 Specimen Length (in.): 8  
 Preload (lbs): 17  
 Strain Rate (% per minute): 10  
 Strains calculated based on a gauge length of 4.0 in. using LVDT

DATE TESTED: 5/5/2013



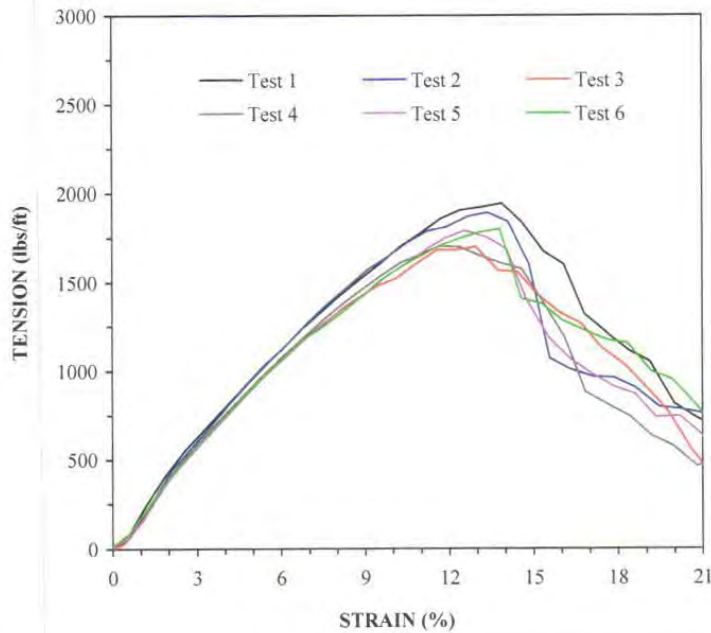
**SGI TESTING SERVICES, LLC**

FIGURE NO. 7  
 PROJECT NO. SGI3014  
 DOCUMENT NO.  
 FILE NO.

S17296M.VVV.xls

Figure 19: Wide Tensile Strength Testing Machine Direction

**SHAW INDUSTRIES**  
**WIDE-WIDTH TENSILE TESTING (ASTM D 4595)**  
Artificial Grass Sample in XD  
Base Layer Consisting of Two Slit-Film Woven Geotextiles  
Roll # AA17CHY  
SGI Sample ID No. S17296



Test No.	Tension at 2% (lb/ft)	Tension at 5% (lb/ft)	Tension at 10% (lb/ft)	Ultimate Strength (lb/ft)	Strain at Ultimate (%)
1	433	963	1665	1942	13.9
2	410	958	1661	1887	13.4
3	382	918	1512	1698	13.0
4	392	916	1583	1704	11.7
5	381	902	1555	1786	12.6
6	386	904	1554	1795	13.8
Mean	397	927	1588	1802	13.1
STD	20	27	62	98	0.8

**NOTES:**

Clamp: Curtis  
Specimen Width (in.): 8.0  
Yarn Count (yarns/in.): Not Measured  
Specimen Length (in.): 8  
Preload (lbs): 15  
Strain Rate (% per minute): 10  
Strains calculated based on a gauge length of 4.0 in. using LVDT

DATE TESTED: 5/5/2013



**SGI TESTING SERVICES, LLC**

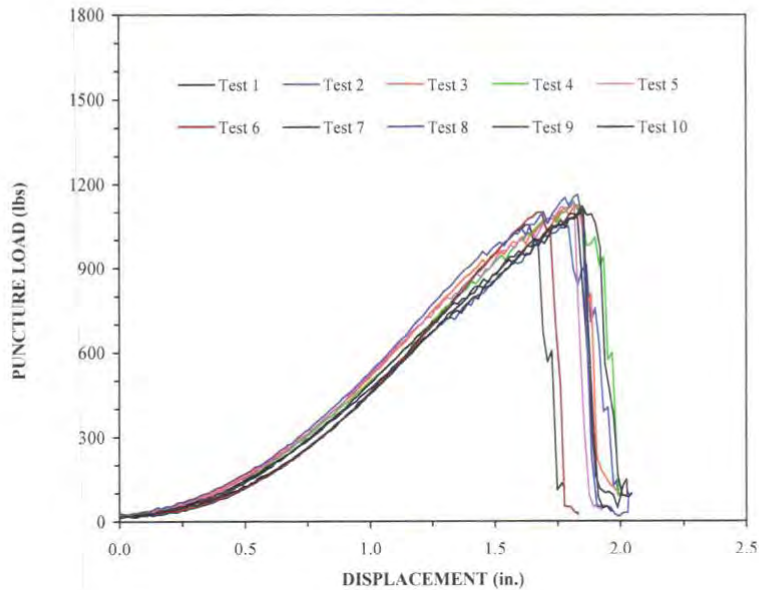
FIGURE NO. 8  
PROJECT NO. SGI3014  
DOCUMENT NO.  
FILE NO.

S17296X.WW.xls

**Figure 20: Wide Tensile Strength Testing Cross Machine Direction**



**SHAW INDUSTRIES**  
**STATIC PUNCTURE (CBR) TESTING (ASTM D 6241)**  
 Artificial Grass Sample  
 Base Layer Consisting of Two Slit-Film Woven Geotextiles  
 Roll # AA17CHY  
 SGI Sample ID No. S17296



Test No.	Puncture Strength (lbs)	Displacement at Puncture Strength (in.)	Failure Mode
1	1057	1.63	Puncture
2	1049	1.79	
3	1126	1.83	
4	1139	1.81	
5	1135	1.82	
6	1102	1.68	
7	1083	1.82	
8	1162	1.83	
9	1121	1.85	
10	1110	1.85	
Mean	1108	1.79	
STD	36	0.08	

**NOTES:**

Holding Method: specimens secured between two concentric clamping rings (plates) with 8 bolts.

DATE TESTED: 5/5/2013



**SGI TESTING SERVICES, LLC**

FIGURE NO. 4  
 PROJECT NO. SGI13014  
 DOCUMENT NO.  
 FILE NO.

S17296.CBR.xls

**Figure 21: Static Puncture Testing**

Subject: Travel way braking resistance		

#### OBJECTIVE:

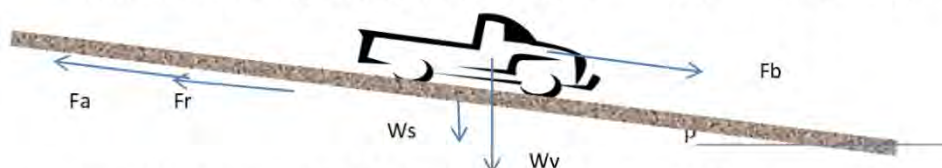
The proposed ClosureTurf™ product has been claimed to withstand vehicle traffic "without damage." This calculation determines the adequacy of the ClosureTurf™ final cover system resistance to vehicle use during the postclosure period. Travel speeds while on the the proposed final cover system should be limited to 15 MPH or lower. It is dependent on the friction angles determined within the proposed artificial turf. Regular post-closure maintenance travel will consist of an ATV and pick-up trucks. Fire Protection Districts may request site access in event of local wildfires. Fire fighting equipment types would be wildland type tankers to incident command vehicles. GVWR for these loaded (with water) vehicles can be as high as 55,000 pounds, 40,000 lbs on dual rear axles/wheels. Typical tire pressure ratings for these vehicles can be as high as 120 psi.

#### CALCULATIONS:

##### *Bench vehicle slide potential*

From interface friction testing by WGS

	Fric. Ang. $\phi$	Adhesion c	
Foundation soil vs. SGN (spiked) Res. friction angle =	44.0	118.3	
Ballast sand vs. Engineered turf Res. friction angle =	36.0	1.0	
"Grass" GT vs. SGN stud (from CTL) Res. friction angle =	33.0	32.0	<=Use



Assume a tire contact area of **83.3 sq.in.** for this calculation (eq. to 120 psi)

Assume a bench fill depth of **1.0 inches** and material weight of **110 pcf**.

Assume maximum bench slope at 10%

##### Driving Forces:

Ws = Weight of Roadway = 83.3 sq.in./144 x 0.5/12 x 110 pcf =	5 lbs
Wv = Vehicle Tire Load = 10,000 lbs (dual wheel rear axle)	
Fb = static friction force on the turf product (assumed as the lowest friction angle)	
Assuming dead stop time is 2 sec, $a = \Delta v/t = 15 \text{ MPH} / 2 \text{ sec} =$	11 ft/sec <sup>2</sup>
Vehicle tire load mass, $m = 10000/g =$	311 slugs
Fb = $ma =$ Vehicle Braking force =	3,416 lbs

##### Resisting Forces:

Fr = Frictional Force =  $(Wv + Ws) \times \cos\beta \times \tan\phi_{\min}$

Fa = Adhesion force = Bench width X Bench length X  $C_{\min}$  (neglect c)

	Static $(Ws + Wv)\sin\beta$	Dynamic Static + Fb
Driving Force	996	4,412
Fr =	6,465	6,465
FS = Resisting Forces/Driving forces		
=	6.5	1.5
	Okay	Okay

#### CONCLUSION:

The engineered turf based final cover system will resist sliding forces on benches from vehicle travel from the friction resistance alone. This calculation considered the worse case scenario of local fire district water tender vehicles traveling on the topdeck roadways. The occurrence of heavy fire equipment travel will be only in times of local fire events hence rare.

## 7.0 Gas Management Plan

Landfills produce emissions continually and have no "on or off" switch to prevent gas releases from occurring as a result of poorly tuned gas collection systems, system malfunction or even during construction phases of the landfill. It must be acknowledged by the engineer of record and operators who incorporate **ClosureTurf®** that emissions are continuous in landfills and a method of managing the emissions are a responsible part of the design and operation of a landfill. A gas management plan will be developed by the design engineer. The application and design concept of the gas venting systems described in this document are covered under U.S. Patent No. 8,585,322.

### 7.1 Minimum Requirements

The gas management plan will include at a minimum, the use of provided **ClosureTurf®** Pressure Relief Valves, (See Figure 24) to meet the specific needs of the intended site. The minimum required gas emission venting devices will be installed at a rate of at least one vent per acre of installed **ClosureTurf®** (See Figure 22). Watershed Geosynthetics LLC supplies the minimum number of Pressure Relief Valves with delivery of the **ClosureTurf®** product. The valves must be installed on sites that produce gas to validate any warranties. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves as well as any other design elements required for the site.

Pressure Relief Valves are designed to convey a maximum of 50 SCFM (Standard Cubic Feet Per Minute) under 1 inch of water column. Design Engineer will be responsible for designing the correct amount of Pressure Relief Valves required for the site.

### 7.2 Surficial Collection Design (Where Applicable)

While it should be noted that not all projects will incorporate a surficial collection design, the **ClosureTurf®** System serves as an effective tool for control of fugitive emissions and can be incorporated into a conventional gas collection system or in some cases as a standalone gas collection and control system. A **ClosureTurf®** surficial collection design will incorporate the use of surficial collection strips (See Figure 22) that provide high flow capacity (See Figure 23) and a larger radius of influence. The system design will also incorporate the surficial collection foot (See Figure 25) that serves as a wellhead base, geomembrane interface and gas conveyance path from the strips to the collection wellhead (not provided by WSG).

#### 7.2.1 Surficial Strips (Where Applicable)

Surficial strips are to be placed prior to the placement of geomembrane. Surficial Strips may consist of SuperGripnet®, single sided geocomposite or other techniques that will allow for the proper flow of gas without causing ballooning. The placement of the strips will be determined by the design engineer and included in the gas management plan.

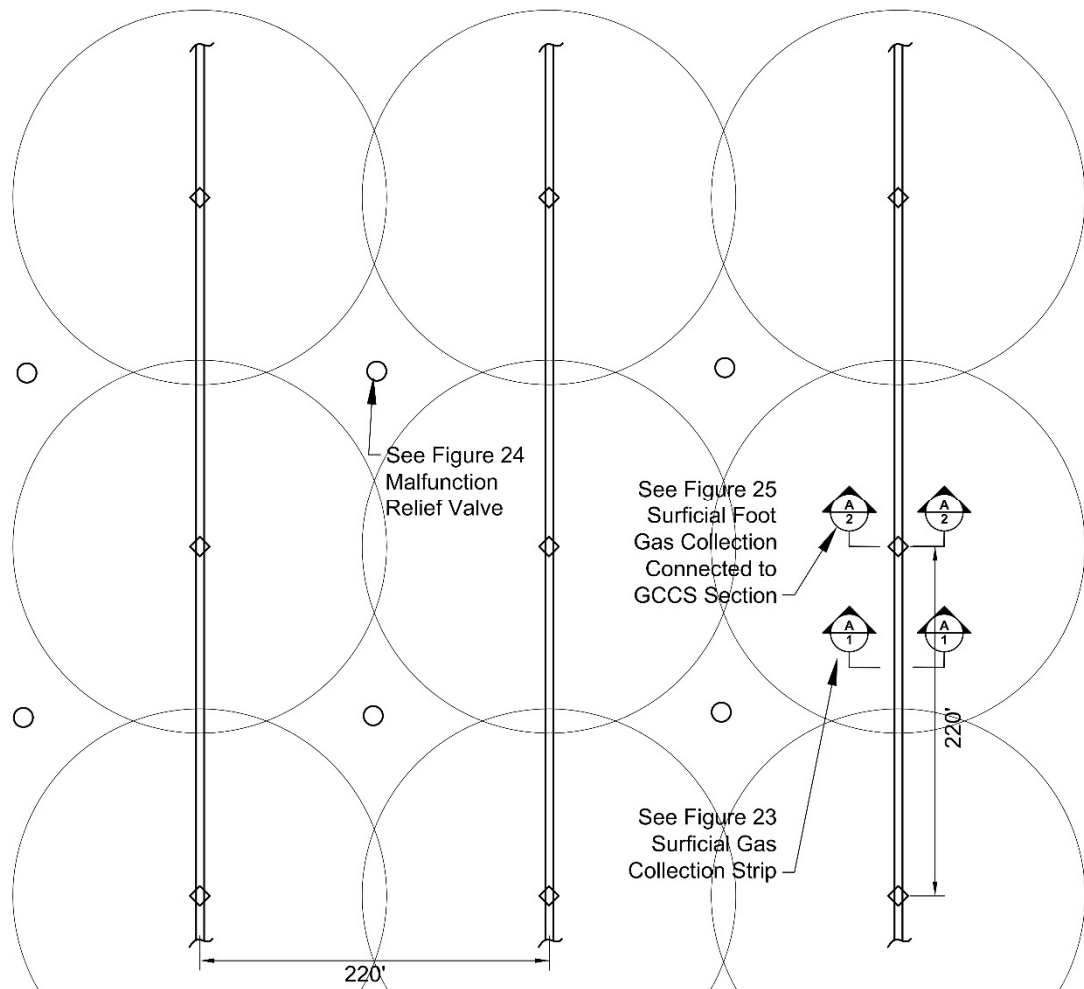
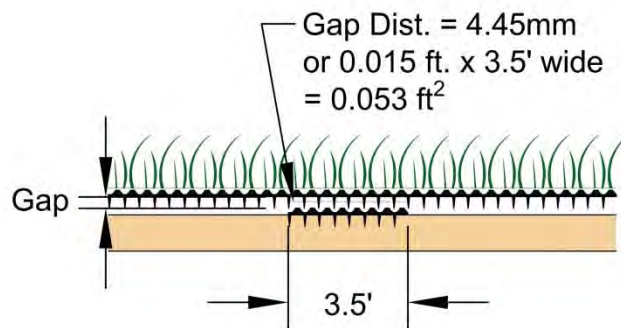


Figure 22: Typical Surficial Collection Strip Placement



Use Super Gripnet or Single Sided  
Geocomposite for Strips

Figure 23: Effective Cross Sectional Area: Surficial Strips

### 7.2.2 ClosureTurf® Pressure Relief Valve

The Pressure Relief Valve is a mandatory component of the **ClosureTurf®** System. The primary purpose of this component is to provide for necessary release of pressure in the event the gas collection system malfunctions. The number of Pressure Relief Valves required will be determined by the POR and installed during construction of the **ClosureTurf®** System.

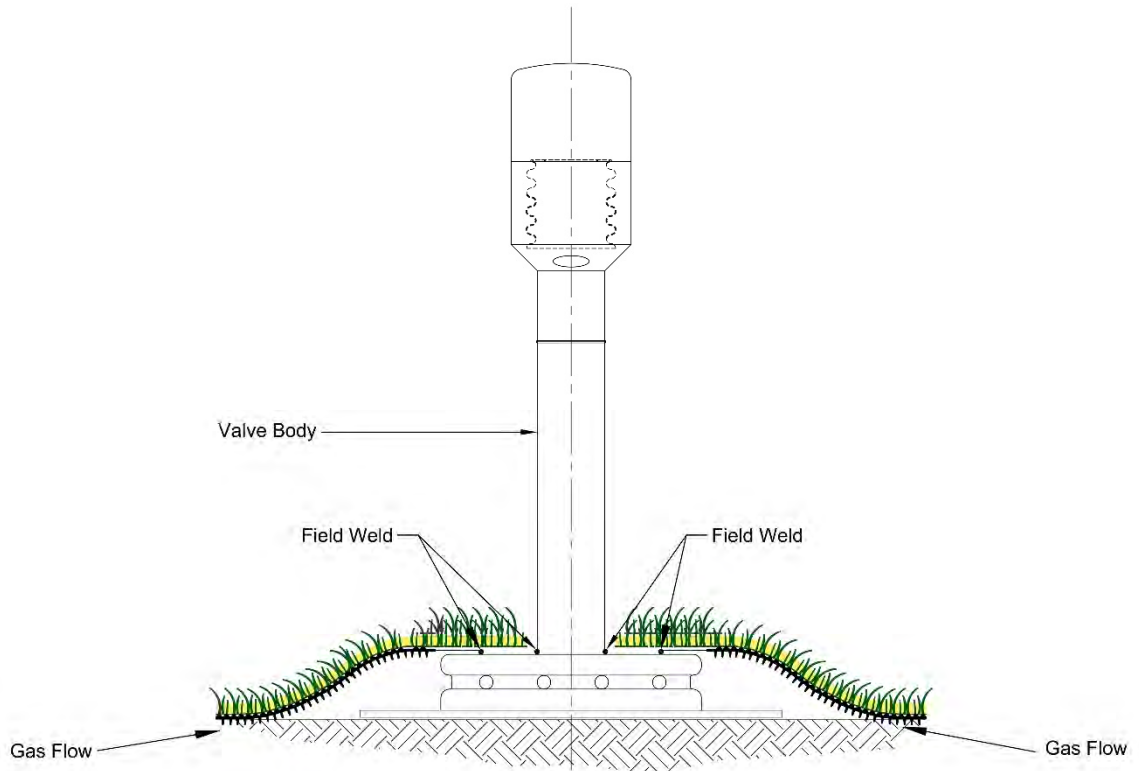


Figure 24: **ClosureTurf®** PE Pressure Relief Valve (Patent Pending)

### 7.2.3 ClosureTurf® Collection Foot

This device is designed to be the interface between the surficial collection strips, the geomembrane and a gas collection wellhead (not provided). The unit allows vacuum to flow in from beneath the geomembrane and from the surficial collection strips to create a larger radius of influence for gas collection. Placement will be determined by the gas collection system design

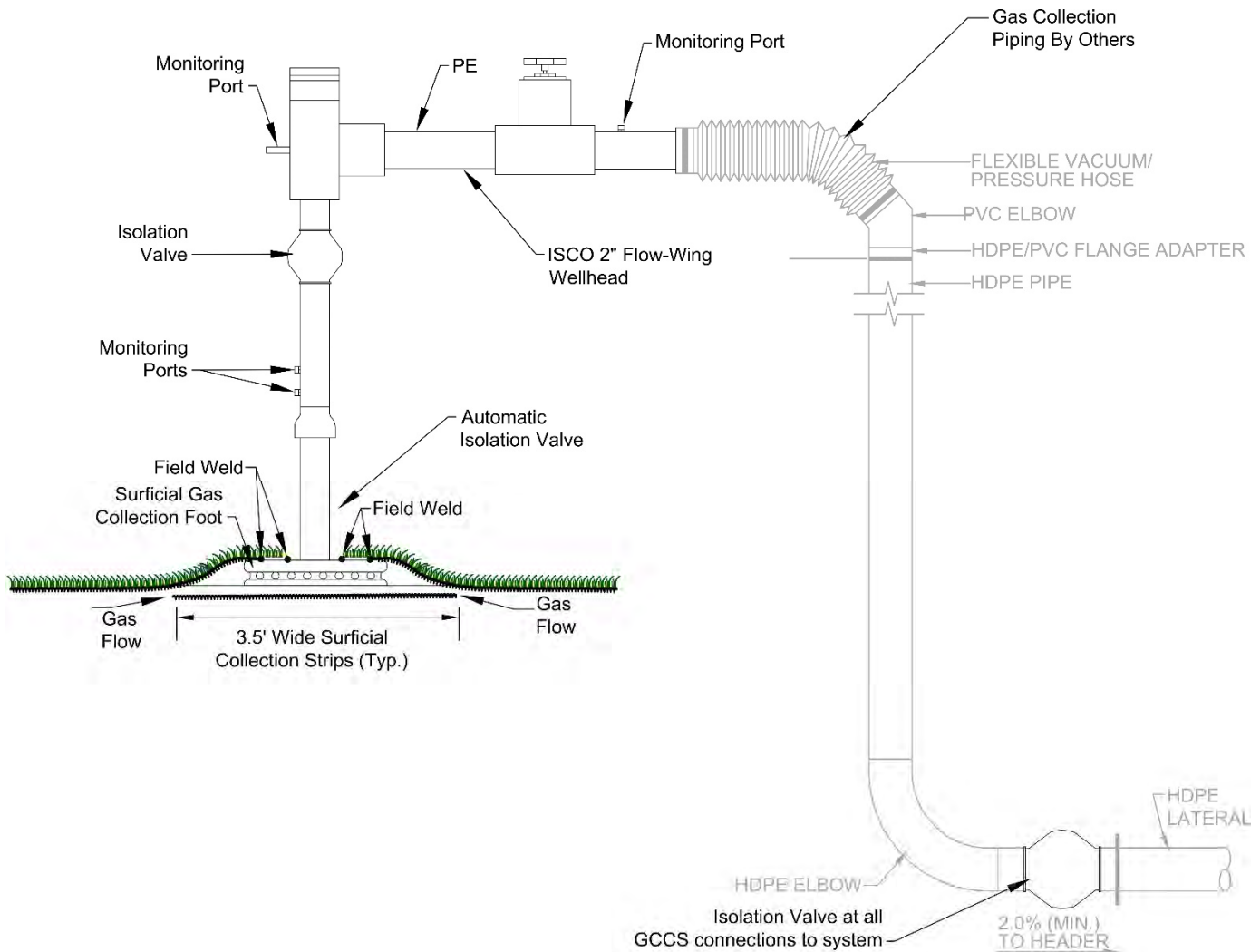


Figure 25: **ClosureTurf®** Surficial Collection Foot Connection to GCCS System



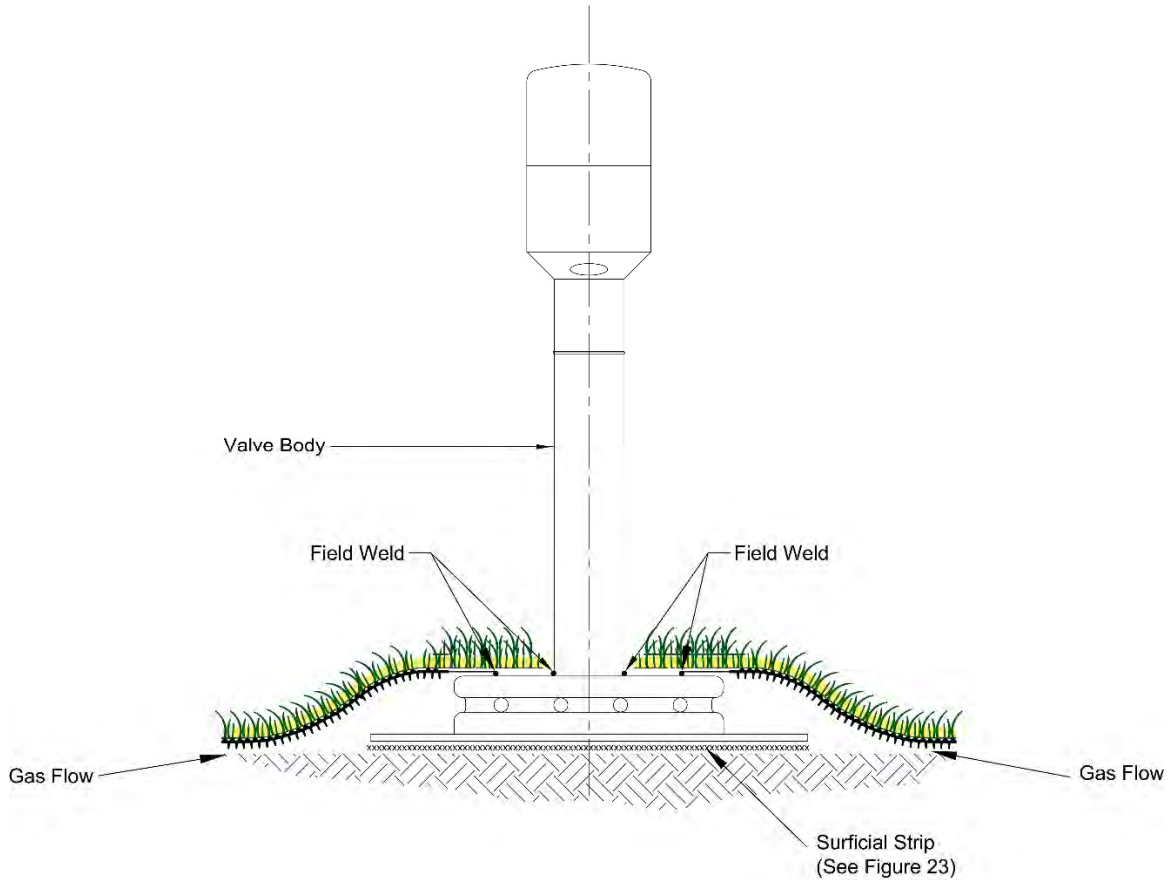


Figure 26: **ClosureTurf®** Passive Gas Vent

## 8.0 References

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