Environmental Consultants
and Contractors

4041 Park Oaks Blvd.
Suite 100
Tampa, FL 33610-9501

813 621-0080
FAX 813 623-6757
www.scsengineers.com

SCS ENGINEERS

March 6, 2017
File No. 09216163.00

Ms. Elizabeth Kromhout, PG
Florida Department of Environmental Protection
2600 Blair Stone Road, MS 4565
Tallahassee, FL 33239

Subject: Sarasota County, Central County Solid Waste Disposal Complex
Phase II Landfill Gas Collection and Control System Expansion
Operations Permit Application
FDEP Permit No. 0130542-022-SO-01

Dear Ms. Kromhout:

On behalf of the Sarasota County Solid Waste Operations (SWO), SCS Engineers is pleased to submit this permit application and an electronic copy (pdf) for the operation of the Landfill Gas Collection and Control System (LFGCCS) expansion into Phase II of the Central County Solid Waste Disposal Complex (CCSWDC).

In accordance with Rule 62-701.320(4)(d), the intermediate modification fee is one-half of that required for a substantial modification. Enclosed with this application is a check in the amount of $5,000 (one-half required for a substantial modification per Rule 62-4.050(4)(j)(1), Construction permit for a Class I facility) made payable to Florida Department of Environmental Protection.

Please do not hesitate to contact us should you have any questions or require additional information.

Sincerely,

Carlos A. Restrepo, PE
Sr. Project Engineer
SCS ENGINEERS

3-6-17
Daniel R. Cooper, PE
Project Director
SCS ENGINEERS

cc: Lois Rose, SWO
Jason Timmons, P.E., SWO

SCS ENGINEERS
Environmental Consultants

3900 Kilroy Airport Way, Suite 100
Long Beach, CA 90806-6816
562 426-9544
FIN 54-0913440

MUFG UNION BANK, N.A.
445 Figueroa Street
Los Angeles, CA 90071

16-49
1220

296089
CHECK DATE
February 13, 2017

PAY Five Thousand and 00/100 Dollars

AMOUNT 5,000.00

TO FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
2600 Blair Stone Road MS 5500
Tallahassee, FL 32399-2400

TWO SIGNATURES REQUIRED OVER FIVE THOUSAND DOLLARS
VOID IF NOT CASHED IN 90 DAYS

Nada Harlow

⑈296089⑈ ⑆122000496⑆ 5320121487⑈

S C S ENGINEERS
FIN- 54-0913440

296089

Check Date: 2/13/2017

Invoice Number	Date	Voucher	Amount	Discounts	Previous Pay	Net Amount
2/13/17 Permit Fee	2/13/2017	9999041	5,000.00			5,000.00
FLORIDA DEPARTMENT OF		TOTAL	5,000.00			5,000.00
Union Bank-Accts Payable	3	0145910				

S C S ENGINEERS
FIN- 54-0913440

Florida Department of Environmental Protection

Bob Martinez Center
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

DEP Form #: 62-701.900(1), F.A.C.

Form Title: Application to Construct, Operate, Modify, or Close a Solid Waste Management Facility

Effective Date: February 15, 2015

Incorporated in Rule: 62-701.330(3), F.A.C.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

APPLICATION TO CONSTRUCT, OPERATE, MODIFY, OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

APPLICATION INSTRUCTIONS AND FORMS

Northwest District
160 Governmental Street
Suite 308
Pensacola, FL 32502-5794
850-595-8300

Northeast District
7777 Baymeadows Way West
Suite 100
Jacksonville, FL 32256-7590
904-256-1700

Central District
3319 Maguire Boulevard
Suite 232
Orlando, FL 32803-3767
407-897-4100

Southwest District
13051 North Telecom Pkwy
Temple Terrace, FL 33637
813-470-5700

South District
2295 Victoria Ave, Suite 364
P.O. Box 2549
Fort Myers, FL 33901-3881
239-344-5600

Southeast District
3301 Gun Club Road
MSC 7210-1
West Palm Beach, FL 33406
561-681-6600

INSTRUCTIONS TO APPLY FOR A SOLID WASTE MANAGEMENT FACILITY PERMIT

I. General

Solid Waste Management Facilities shall be permitted pursuant to Section 403.707, Florida Statutes (FS) and in accordance with Florida Administrative Code (FAC) Chapter 62-701. A permit application shall be submitted in accordance with the requirements of Rule 62-701.320(5)(a), F.A.C., to the appropriate Department office having jurisdiction over the facility. The appropriate fee in accordance with Rule 62-701.315, FAC, shall be submitted with the application by check made payable to the Department of Environmental Protection (DEP).

Complete appropriate sections for the type of facility for which application is made. Entries shall be typed or printed in ink. All blanks shall be filled in or marked "Not Applicable" or "No Substantial Change". Information provided in support of the application shall be marked "Submitted" and the location of this information in the application package indicated. The application shall include all information, drawings, and reports necessary to evaluate the facility. Information required to complete the application is listed on the attached pages of this form.

II. Application Parts Required for Construction and Operation Permits

A. Landfills and Ash Monofills - Submit Parts A through S
B. Asbestos Monofills - Submit Parts A, B, C, D, E, F, I, K, M, O through S
C. Industrial Solid Waste Disposal Facilities - Submit Parts A through S

NOTE: Portions of some Parts may not be applicable.

NOTE: For facilities that have been satisfactorily constructed in accordance with their construction permit, the information required for A, B and C type facilities does not have to be resubmitted for an operation permit if the information has not substantially changed during the construction period. The appropriate portion of the form should be marked "no substantial change".

III. Application Parts Required for Closure Permits

A. Landfills and Ash Monofills - Submit Parts A, B, L, N through S
B. Asbestos Monofills - Submit Parts A, B, M, O through S
C. Industrial Solid Waste Disposal Facilities - Submit Parts A, B, L through S

NOTE: Portions of some Parts may not be applicable.

IV. Permit Renewals

The above information shall be submitted at time of permit renewal in support of the new permit. However, facility information that was submitted to the Department to support the expiring permit, and which is still valid, does not need to be re-submitted for permit renewal. Portions of the application not re-submitted shall be marked "no substantial change" on the application form.

V. Application Codes

S	-	Submitted
LOCATION	-	Physical location of information in application
N/A	-	Not Applicable
N/C	-	No Substantial Change

VI. Listing of Application Parts

PART A: GENERAL INFORMATION

PART B: DISPOSAL FACILITY GENERAL INFORMATION

PART C: PROHIBITIONS

PART D: SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL

PART E: LANDFILL PERMIT REQUIREMENTS

PART F: GENERAL CRITERIA FOR LANDFILLS

PART G: LANDFILL CONSTRUCTION REQUIREMENTS

PART H: HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS

PART I: GEOTECHNICAL INVESTIGATION REQUIREMENTS

PART J: VERTICAL EXPANSION OF LANDFILLS

PART K: LANDFILL OPERATION REQUIREMENTS

PART L: WATER QUALITY AND LEACHATE MONITORING REQUIREMENTS

PART M: SPECIAL WASTE HANDLING REQUIREMENTS

PART N: GAS MANAGEMENT SYSTEM REQUIREMENTS

PART O: LANDFILL CLOSURE REQUIREMENTS

PART P: OTHER CLOSURE PROCEDURES

PART Q: LONG-TERM CARE

PART R: FINANCIAL ASSURANCE

PART S: CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
APPLICATION FOR A PERMIT TO CONSTRUCT, OPERATE, MODIFY OR CLOSE A SOLID WASTE MANAGEMENT FACILITY

Please Type or Print

PART A. GENERAL INFORMATION

1. Type of disposal facility (check all that apply):
   - ☑ Class I Landfill
   - ☐ Class III Landfill
   - ☐ Industrial Solid Waste
   - ☐ Other (describe):
   - ☐ Ash Monofill
   - ☐ Asbestos Monofill

NOTE: Waste Processing Facilities should apply on Form 62-701.900(4), FAC;
Yard Trash Disposal Facilities should notify on Form 62-701.900(3), FAC;
Compost Facilities should apply on Form 62-709.901(1), FAC; and
C&D Disposal Facilities should apply on Form 62-701.900(6), FAC

2. Type of application:
   - ☐ Construction
   - ☑ Operation
   - ☐ Construction/Operation
   - ☐ Closure
   - ☐ Long-term Care Only

3. Classification of application:
   - ☐ New
   - ☐ Renewal
   - ☐ Substantial Modification
   - ☑ Intermediate Modification
   - ☐ Minor Modification

4. Facility name: Sarasota County Central County Solid Waste Disposal Complex

5. DEP ID number: SWD/58/51614 County: Sarasota

6. Facility location (main entrance):
   North end of Knights Trail Road, 2 miles east of I-75, northeast of Venice, FL
   4000 Knights Trail Road, Nokomis, FL 34275

7. Location coordinates:
   Section: 1-4, 9-16 Township: 38S Range: 19E
   Latitude: 27 ° 12 ‘ 10 “ Longitude: 82 ° 23 ‘ 35 “
   Datum: NAD83 Coordinate method: Google Earth
   Collected by: SCS Engineers Company/Affiliation:

8. Applicant name (operating authority): Sarasota County Solid Waste Operations

Mailing address: 4000 Knights Trail Road Nokomis, FL 34275
Street or P.O. Box City State Zip

Contact person: Lois Rose Telephone: (941) 861-1589

Title: Solid Waste Operations Manager

lerose@scgov.net
E-Mail address (if available)

9. Authorized agent/Consultant: SCS Engineers

Mailing address: 4041 Park Oaks Blvd., Tampa, FL. 33610
Street or P.O. Box City State Zip

Contact person: Daniel Cooper Telephone: (813) 621-0080

Title: Project Director

dcooper@scsengineers.com
E-Mail address (if available)

10. Landowner (if different than applicant): Same as Applicant

Mailing address:
Street or P.O. Box City State Zip

Contact person: Telephone: ( )

E-Mail address (if available)

11. Cities, towns, and areas to be served:
Unincorporated Sarasota County, City of Sarasota, City of Venice, City of Northport

12. Population to be served:
Current: 402,389 (2017) Five-Year Projection: 420,263 (2021)

13. Date site will be ready to be inspected for completion: FDEP to be notified

14. Expected life of the facility: 7.7 years

15. Estimated costs:
Total Construction: $ $1.3 M (Estimated) Closing Costs: $ N/C

16. Anticipated construction starting and completion dates:
From: July 2017 To: October 2017

17. Expected volume or weight of waste to be received:
_____ yds^3/day 1,000 tons/day _____ gallons/day

PART B. DISPOSAL FACILITY GENERAL INFORMATION

1. Provide brief description of disposal facility design and operations planned under this application:

This permit application presents information supporting the application for the operation of the Landfill Gas Collection and Control System (LFGCCS) expansion into Phase II. The LFGCCS expansion will be completed in stages to allow for additional waste to placed in the respective lift sequence. A total of four stages are proposed for the LFGCCS expansion. The proposed project will not affect the operation of the existing LFGCCS.

2. Facility site supervisor: Lois Rose

Title: Solid Waste Operations Manager Telephone: (941) 861-1589

lerose@scgov.net

E-Mail address (if available)

3. Disposal area: Total acres: 118 Used acres: 55 (Phase I) Available acres: 63 (Phase II)

4. Weighing scales used: ☑ Yes ☐ No

5. Security to prevent unauthorized use: ☑ Yes ☐ No

6. Charge for waste received: N/C $/yds^3 N/C $/ton

7. Surrounding land use, zoning:

- ☐ Residential
- ☐ Agricultural
- ☐ Commercial
- ☐ Industrial
- ☐ None
- ☑ Other (describe):

Governmental Use, Open Use Conservation, Rural

8. Types of waste received:

- ☑ Household
- ☑ Commercial
- ☐ Incinerator/WTE ash
- ☑ Treated biomedical
- ☑ Water treatment sludge
- ☐ Air treatment sludge
- ☑ Agricultural
- ☑ Asbestos
- ☑ C & D debris
- ☑ Shredded/cut tires
- ☑ Yard trash
- ☐ Septic tank
- ☑ Industrial
- ☑ Industrial sludge
- ☑ Domestic sludge
- ☑ Other (describe):

Other: Mobile homes and marine vessels when all engines, fuel tanks (either removed or punctured), appliances, air conditioners, other fluids, and batteries have been removed prior to disposal.

9. Salvaging permitted: ☐ Yes ☑ No

10. Attendant: ☑ Yes ☐ No Trained operator: ☑ Yes ☐ No

11. Trained spotters: ☑ Yes ☐ No Number of spotters used: 1

12. Site located in: ☐ Floodplain ☐ Wetlands ☑ Other (describe):
Uplands

13. Days of operation: Monday through Saturday

14. Hours of operation: 8:00am to 5:00pm Monday-Friday / 8:00am to 2:00pm Saturday

15. Days working face covered: Daily

16. Elevation of water table: 20.5 ft. Datum Used: NGVD 1929

17. Number of monitoring wells: 10

18. Number of surface monitoring points: 2

19. Gas controls used: ☑ Yes ☐ No Type controls: ☑ Active ☐ Passive

Gas flaring: ☑ Yes ☐ No Gas recovery: ☑ Yes ☐ No

20. Landfill unit liner type:

- ☐ Natural soils
- ☐ Single clay liner
- ☐ Single geomembrane
- ☑ Single composite
- ☐ Slurry wall
- ☐ Double geomembrane
- ☑ Geomembrane & composite
- ☐ Double composite
- ☐ None
- ☑ Other (describe):

Phase I is a single HDPE liner and clay layer. Phase II is a double HDPE geomembrane and drainage composite with a geosynthetic clay liner (GCL).

21. Leachate collection method:

- ☑ Collection pipes
- ☑ Geonets
- ☐ Well points
- ☐ Perimeter ditch
- ☐ Other (describe):
- ☐ Double geomembrane
- ☐ Gravel layer
- ☐ Interceptor trench
- ☐ None

See 20. above.

22. Leachate storage method:

☑ Tanks ☐ Surface impoundments

☐ Other (describe):

Prestressed concrete leachate storage tank and secondary containment tank.

23. Leachate treatment method:

☐ Oxidation ☐ Chemical treatment

☐ Secondary ☐ Settling

☐ Advanced ☐ None

☑ Other (describe):

Off-site treatment.

24. Leachate disposal method:

☐ Recirculated ☑ Pumped to WWTP

☑ Transported to WWTP ☐ Discharged to surface water/wetland

☐ Injection well ☐ Percolation ponds

☐ Evaporation ☑ Spray irrigation

☐ Other (describe):

Spray irrigation to working face and initial cover areas of Class I Landfill only for dust control.

25. For leachate discharged to surface waters:

Name and Class of receiving water:

Leachate is not discharged to surface waters.

26. Storm Water:

Collected: ☑ Yes ☐ No

Type of treatment:

Wet detention ponds and retention ditches.

Name and Class of receiving water:

Cow Pen Slough, Class III water.

27. Environmental Resources Permit (ERP) number or status:

SWFWMD Permit #407932.01

FDEP ERP Permit #58-0272622-001 (Phase II)

FDEP ERP Permit #58-0246654-003 (Roadway Widening/Swale)

PART C. PROHIBITIONS (62-701.300, FAC)

LOCATION

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	1. Provide documentation that each of the siting criteria will be satisfied for the facility; (62-701.300(2), FAC)
S ☐ N/A ☑ N/C ☐	2. If the facility qualifies for any of the exemptions contained in Rules 62-701.300(12), (13) and (16) through (18), FAC, then document this qualification(s);
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	3. Provide documentation that the facility will be in compliance with the burning restrictions; (62-701.300(3), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	4. Provide documentation that the facility will be in compliance with the hazardous waste restrictions; (62-701.300(4), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	5. Provide documentation that the facility will be in compliance with the PCB disposal restrictions; (62-701.300(5), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	6. Provide documentation that the facility will be in compliance with the biomedical waste restrictions; (62-701.300(6), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	7. Provide documentation that the facility will be in compliance with the Class I surface water restrictions; (62-701.300(7), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	8. Provide documentation that the facility will be in compliance with the special waste for landfills restrictions; (62-701.300(8), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	9. Provide documentation that the facility will be in compliance with the liquid restrictions; (62-701.300(10), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	10. Provide documentation that the facility will be in compliance with the used oil and oily waste restrictions; (62-701.300(11), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	11. Provide documentation that the facility will be in compliance with the CCA treated wood restrictions; (62-701.300(14), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	12. Provide documentation that the facility will be in compliance with the dust control restrictions; (62-701.300(15), FAC)

PART D. SOLID WASTE MANAGEMENT FACILITY PERMIT REQUIREMENTS, GENERAL (62-701.320, FAC)

LOCATION		
S ☑ Eng Rep. D.1	N/A ☐ N/C ☐	1. A minimum of one completed electronic application form, all supporting data and reports; (62-701.320(5)(a), FAC)
S ☑ Eng Rep. D.2	N/A ☐ N/C ☐	2. Engineering and/or professional certification (signature, date, and seal) provided on the applications and all engineering plans, reports, and supporting information for the application; (62-701.320(6), FAC)
S ☑ Eng Rep. D.3	N/A ☐ N/C ☐	3. A letter of transmittal to the Department; (62-701.320(7)(a), FAC)
S ☑ Eng Rep. D.4	N/A ☐ N/C ☐	4. A completed application form dated and signed by the applicant; (62-701.320(7)(b), FAC)
S ☑ Eng Rep. D.5	N/A ☐ N/C ☐	5. Permit fee specified in Rule 62-701.315, FAC in check or money order, payable to the Department; (62-701.320(7)(c), FAC)
S ☑ Eng Rep. D.6	N/A ☐ N/C ☐	6. An engineering report addressing the requirements of this rule and with the following format: a cover sheet, text printed on 8 ½ inch by 11 inch consecutively numbered pages, a table of contents or index, the body of the report and all appendices including an operation plan, contingency plan, illustrative charts and graphs, records or logs of tests and investigations, engineering calculations; (62-701.320(7)(d), FAC)
S ☐ Permit Mod 2014	N/A ☐ N/C ☑	7. Operation Plan and Closure Plan; (62-701.320(7)(e)1, FAC)
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	8. Contingency Plan; (62-701.320(7)(e)2, FAC)
S ☑ Eng Rep. D.9	N/A ☐ N/C ☐	9. Plans or drawings for the solid waste management facilities in appropriate format (including sheet size restrictions, cover sheet, legends, north arrow, horizontal and vertical scales, elevations referenced to NGVD 1929) showing: (62-701.320(7)(f), FAC)
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	a. A regional map or plan with the project location in relation to major roadways and population centers;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	b. A vicinity map or aerial photograph no more than one year old showing the facility site and relevant surface features located within 1000 feet of the facility;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	c. A site plan showing all property boundaries certified by a Florida Licensed Professional Surveyor and Mapper;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	d. Other necessary details to support the engineering report, including referencing elevations to a consistent, nationally recognized datum, and identifying the method used for collecting latitude and longitude data;

LOCATION **PART D CONTINUED**

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 10. Documentation that the applicant either owns the property or has legal authority from the property owner to use the site; (62-701.320(7)(g), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 11. For facilities owned or operated by a county, provide a description of how, if any, the facilities covered in this application will contribute to the county's achievement of the waste reduction and recycling goals contained in Section 403.706, FS; (62-701.320(7)(h), FAC)

S ☑ Eng Rep. D.12 N/A ☐ N/C ☐ 12. Provide a history and description of any enforcement actions taken by the Department against the applicant for violations of applicable statutes, rules, orders, or permit conditions relating to the operation of any solid waste management facility in the state; (62-701.320(7)(i), FAC)

S ☐ _____ N/A ☑ N/C ☐ 13. Proof of publication in a newspaper of general circulation of notice of application for a permit to construct or substantially modify a solid waste management facility; (62-701.320(8), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 14. Provide a description of how the requirements for airport safety will be achieved, including proof of required notices if applicable. If exempt, explain how the exemption applies; (62-701.320(13), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 15. Explain how the operator and spotter training requirements and special criteria will be satisfied for the facility; (62-701.320(15), FAC)

PART E. LANDFILL PERMIT REQUIREMENTS (62-701.330, FAC)

LOCATION

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 1. Regional map or aerial photograph no more than five years old showing all airports that are located within five miles of the proposed landfill; (62-701.330(3)(a), FAC)

S ☑ Eng Rep. E.2 N/A ☐ N/C ☐ 2. Plot plan with a scale not greater than 200 feet to the inch showing: (62-701.330(3)(b), FAC)

S ☑ Eng Rep. E.2 N/A ☐ N/C ☐ a. Dimensions;

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ b. Locations of proposed and existing water quality monitoring wells;

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ c. Locations of soil borings;

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ d. Proposed plan of trenching or disposal areas;

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ e. Cross sections showing original elevations and proposed final contours which shall be included either on the plot plan or on separate sheets;

LOCATION		PART E CONTINUED
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	f. Any previously filled waste disposal areas;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	g. Fencing or other measures to restrict access;
S ☑ Eng Rep. E.3	N/A ☐ N/C ☐	3. Topographic maps with a scale not greater than 200 feet to the inch with five foot contour intervals showing: (62-701.330(3)(c), FAC)
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	a. Proposed fill areas;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	b. Borrow areas;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	c. Access roads;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	d. Grades required for proper drainage;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	e. Cross sections of lifts;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	f. Special drainage devices if necessary;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	g. Fencing;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	h. Equipment facilities;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	4. A report on the landfill describing the following: (62-701.330(3)(d), FAC)
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	a. The current and projected population and area to be served by the proposed site;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	b. The anticipated type, annual quantity, and source of solid waste expressed in tons;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	c. Planned active life of the facility, the final design height of the facility, and the maximum height of the facility during its operation;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	d. The source and type of cover material used for the landfill;
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	5. Provide evidence that an approved laboratory shall conduct water quality monitoring for the facility in accordance with Chapter 62-160, FAC; (62-701.330(3)(g), FAC
S ☐ Permit Renewal 2013	N/A ☐ N/C ☑	6. Provide a statement of how the applicant will demonstrate financial responsibility for the closing and long-term care of the landfill; (62-701.330(3)(h), FAC)

PART F. GENERAL CRITERIA FOR LANDFILLS (62-701.340, FAC)

LOCATION

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 1. Describe (and show on a Federal Insurance Administration flood map, if available) how the landfill or solid waste disposal unit shall not be located in the 100 year floodplain where it will restrict the flow of the 100 year flood, reduce the temporary water storage capacity of the floodplain unless compensating storage is provided, or result in a washout of solid waste; (62-701.340(3)(b), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 2. Describe how the minimum horizontal separation between waste deposits in the landfill and the landfill property boundary shall be 100 feet, measured from the toe of the proposed final cover slope; (62-701.340(3)(c), FAC)

PART G. LANDFILL CONSTRUCTION REQUIREMENTS (62-701.400, FAC)

LOCATION

S ☑ Eng Rep. G.1 N/A ☐ N/C ☐ 1. Describe how the landfill shall be designed so the solid waste disposal units will be constructed and closed at planned intervals throughout the design period of the landfill, and shall be designed to achieve a minimum factor of safety of 1.5 using peak strength values to prevent failures of side slopes and deep-seated failures; (62-701.400(2), FAC)

S ☐ _____ N/A ☑ N/C ☐ 2. Landfill liner requirements; (62-701.400(3), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. General construction requirements; (62-701.400(3)(a), FAC)

S ☐ _____ N/A ☑ N/C ☐ (1) Provide test information and documentation to ensure the liner will be constructed of materials that have appropriate physical, chemical, and mechanical properties to prevent failure;

S ☐ _____ N/A ☑ N/C ☐ (2) Document foundation is adequate to prevent liner failure;

S ☐ _____ N/A ☑ N/C ☐ (3) Constructed so bottom liner will not be adversely impacted by fluctuations of the ground water;

S ☐ _____ N/A ☑ N/C ☐ (4) Designed to resist hydrostatic uplift if bottom liner located below seasonal high ground water table;

S ☐ _____ N/A ☑ N/C ☐ (5) Installed to cover all surrounding earth which could come into contact with the waste or leachate;

LOCATION		PART G CONTINUED
S ☐ _____ N/A ☑ N/C ☐		b. Composite liners; (62-701.400(3)(b), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Upper geomembrane thickness and properties;
S ☐ _____ N/A ☑ N/C ☐	(2)	Design leachate head for primary leachate collection and removal system (LCRS) including leachate recirculation if appropriate;
S ☐ _____ N/A ☑ N/C ☐	(3)	Design thickness in accordance with Table A and number of lifts planned for lower soil component;
S ☐ _____ N/A ☑ N/C ☐		c. Double liners; (62-701.400(3)(c), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Upper and lower geomembrane thickness and properties;
S ☐ _____ N/A ☑ N/C ☐	(2)	Design leachate head for primary LCRS to limit the head to one foot above the liner;
S ☐ _____ N/A ☑ N/C ☐	(3)	Lower geomembrane sub-base design;
S ☐ _____ N/A ☑ N/C ☐	(4)	Leak detection and secondary leachate collection system minimum design criteria ($k \geq 10$ cm/sec, head on lower liner ≤ 1 inch, head not to exceed thickness of drainage layer);
S ☐ _____ N/A ☑ N/C ☐		d. Standards for geosynthetic components; (62-701.400(3)(d), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Factory and field seam test methods to ensure all geomembrane seams achieve the minimum specifications;
S ☐ _____ N/A ☑ N/C ☐	(2)	Geomembranes to be used shall pass a continuous spark test by the manufacturer;
S ☐ _____ N/A ☑ N/C ☐	(3)	Design of 24-inch-thick protective layer above upper geomembrane liner;
S ☐ _____ N/A ☑ N/C ☐	(4)	Describe operational plans to protect the liner and leachate collection system when placing the first layer of waste above a 24-inch-thick protective layer;
S ☐ _____ N/A ☑ N/C ☐	(5)	HDPE geomembranes, if used, meet the specifications in GRI GM13, and LLDPE geomembranes, if used, meet the specifications in GRI GM17;
S ☐ _____ N/A ☑ N/C ☐	(6)	PVC geomembranes, if used, meet the specifications in PGI 1104;

LOCATION		PART G CONTINUED
S ☐ _____ N/A ☑ N/C ☐	(7)	Interface shear strength testing results of the actual components which will be used in the liner system;
S ☐ _____ N/A ☑ N/C ☐	(8)	Transmissivity testing results of geonets if they are used in the liner system;
S ☐ _____ N/A ☑ N/C ☐	(9)	Hydraulic conductivity testing results of geosynthetic clay liners if they are used in the liner system;
S ☐ _____ N/A ☑ N/C ☐	e. Geosynthetic specification requirements; (62-701.400(3)(e), FAC)	
S ☐ _____ N/A ☑ N/C ☐	(1)	Definition and qualifications of the designer, manufacturer, installer, QA consultant and laboratory, and QA program;
S ☐ _____ N/A ☑ N/C ☐	(2)	Material specifications for geomembranes, geocomposites, geotextiles, geogrids, and geonets;
S ☐ _____ N/A ☑ N/C ☐	(3)	Manufacturing and fabrication specifications including geomembrane raw material and roll QA, fabrication personnel qualifications, seaming equipment and procedures, overlaps, trial seams, destructive and non-destructive seam testing, seam testing location, frequency, procedure, sample size, and geomembrane repairs;
S ☐ _____ N/A ☑ N/C ☐	(4)	Geomembrane installation specifications including earthwork, conformance testing, geomembrane placement, installation personnel qualifications, field seaming and testing, overlapping and repairs, materials in contact with geomembranes, and procedures for lining system acceptance;
S ☐ _____ N/A ☑ N/C ☐	(5)	Geotextile and geogrids specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;
S ☐ _____ N/A ☑ N/C ☐	(6)	Geonet and geocomposites specifications including handling and placement, conformance testing, stacking and joining, repair, and placement of soil materials and any overlying materials;
S ☐ _____ N/A ☑ N/C ☐	(7)	Geosynthetic clay liner specifications including handling and placement, conformance testing, seams and overlaps, repair, and placement of soil materials and any overlying materials;

LOCATION	PART G CONTINUED	
S ☐ _____ N/A ☑ N/C ☐	f. Standards for soil liner components; (62-701.400(3)(f), FAC)	
S ☐ _____ N/A ☑ N/C ☐	(1)	Description of construction procedures including over-excavation and backfilling to preclude structural inconsistencies and procedures for placing and compacting soil components in layers;
S ☐ _____ N/A ☑ N/C ☐	(2)	Demonstration of compatibility of the soil component with actual or simulated leachate in accordance with EPA Test Method 9100, or an equivalent test method;
S ☐ _____ N/A ☑ N/C ☐	(3)	Procedures for testing in situ soils to demonstrate they meet the specifications for soil liners;
S ☐ _____ N/A ☑ N/C ☐	(4)	Specifications for soil component of liner including at a minimum:
S ☐ _____ N/A ☑ N/C ☐	(a)	Allowable particle size distribution, and Atterberg limits including shrinkage limit;
S ☐ _____ N/A ☑ N/C ☐	(b)	Placement moisture and dry density criteria;
S ☐ _____ N/A ☑ N/C ☐	(c)	Maximum laboratory-determined saturated hydraulic conductivity using simulated leachate;
S ☐ _____ N/A ☑ N/C ☐	(d)	Minimum thickness of soil liner;
S ☐ _____ N/A ☑ N/C ☐	(e)	Lift thickness;
S ☐ _____ N/A ☑ N/C ☐	(f)	Surface preparation (scarification);
S ☐ _____ N/A ☑ N/C ☐	(g)	Type and percentage of clay mineral within the soil component;
S ☐ _____ N/A ☑ N/C ☐	(5)	Procedures for constructing and using a field test section to document the desired saturated hydraulic conductivity and thickness can be achieved in the field;
S ☐ _____ N/A ☑ N/C ☐	g. If a Class III landfill is to be constructed with a bottom liner system, provide a description of how the minimum requirements for the liner will be achieved;	

S ☑ Eng Rep. G.3 N/A ☐ N/C ☐	3. Leachate collection and removal system (LCRS); (62-701.400(4), FAC)	
S ☐ _____ N/A ☑ N/C ☐	a. The primary and secondary LCRS requirements; (62-701.400(4)(a), FAC)	
S ☐ _____ N/A ☑ N/C ☐	(1)	Constructed of materials chemically resistant to the waste and leachate;
S ☐ _____ N/A ☑ N/C ☐	(2)	Have sufficient mechanical properties to prevent collapse under pressure;
S ☐ _____ N/A ☑ N/C ☐	(3)	Have granular material or synthetic geotextile to prevent clogging;
S ☐ _____ N/A ☑ N/C ☐	(4)	Have a method for testing and cleaning clogged pipes or contingent designs for reducing leachate around failed areas;
S ☐ _____ N/A ☑ N/C ☐	b. Other LCRS requirements; (62-701.400(4)(b), (c) and (d), FAC	
S ☐ _____ N/A ☑ N/C ☐	(1)	Bottom 12 inches having hydraulic conductivity ≥ 1×10^{-3} cm/sec;
S ☐ _____ N/A ☑ N/C ☐	(2)	Total thickness of 24 inches of material chemically resistant to the waste and leachate;
S ☐ _____ N/A ☑ N/C ☐	(3)	Bottom slope design to accommodate for predicted settlement and still meet minimum slope requirements;
S ☐ _____ N/A ☑ N/C ☐	(4)	Demonstration that synthetic drainage material, if used, is equivalent or better than granular material in chemical compatibility, flow under load, and protection of geomembranes liner;
S ☐ _____ N/A ☑ N/C ☐	(5)	Schedule provided for routine maintenance of LCRS.
S ☐ _____ N/A ☑ N/C ☐	4. Leachate recirculation; (62-701.400(5), FAC)	
S ☐ _____ N/A ☑ N/C ☐	a. Describe general procedures for recirculating leachate;	
S ☐ _____ N/A ☑ N/C ☐	b. Describe procedures for controlling leachate runoff and minimizing mixing of leachate runoff with storm water;	
S ☐ _____ N/A ☑ N/C ☐	c. Describe procedures for preventing perched water conditions and gas buildup;	

LOCATION **PART G CONTINUED**

S ☐ _____ N/A ☑ N/C ☐ d. Describe alternate methods for leachate management when it cannot be recirculated due to weather or runoff conditions, surface seeps, wind-blown spray, or elevated levels of leachate head on the liner;

S ☐ _____ N/A ☑ N/C ☐ e. Describe methods of gas management in accordance with Rule 62-701.530, FAC;

S ☐ _____ N/A ☑ N/C ☐ f. If leachate irrigation is proposed, describe treatment methods and standards for leachate treatment prior to irrigation over final cover, and provide documentation that irrigation does not contribute significantly to leachate generation;

S ☐ _____ N/A ☑ N/C ☐ 5. Leachate storage tanks and leachate surface impoundments; (62-701.400(6), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. Surface impoundment requirements; (62-701.400(6)(b), FAC)

S ☐ _____ N/A ☑ N/C ☐ (1) Documentation that the design of the bottom liner will not be adversely impacted by fluctuations of the ground water;

S ☐ _____ N/A ☑ N/C ☐ (2) Designed in segments to allow for inspection and repair, as needed, without interruption of service;

S ☐ _____ N/A ☑ N/C ☐ (3) General design requirements;

S ☐ _____ N/A ☑ N/C ☐ (a) Double liner system consisting of an upper and lower 60-mil minimum thickness geomembrane;

S ☐ _____ N/A ☑ N/C ☐ (b) Leak detection and collection system with hydraulic conductivity ≥ 1 cm/sec;

S ☐ _____ N/A ☑ N/C ☐ (c) Lower geomembrane place on subbase ≥ 6 inches thick with $k \leq 1 \times 10^{-5}$ cm/sec or on an approved geosynthetic clay liner with $k \leq 1 \times 10^{-7}$ cm/sec;

S ☐ _____ N/A ☑ N/C ☐ (d) Design calculation to predict potential leakage through the upper liner;

S ☐ _____ N/A ☑ N/C ☐ (e) Daily inspection requirements, and notification and corrective action requirements if leakage rates exceed that predicted by design calculations;

S ☐ _____ N/A ☑ N/C ☐ (4) Description of procedures to prevent uplift, if applicable;

LOCATION	PART G CONTINUED
S ☐ _____ N/A ☑ N/C ☐	(5) Design calculations to demonstrate minimum two feet of freeboard will be maintained;
S ☐ _____ N/A ☑ N/C ☐	(6) Procedures for controlling vectors and off-site odors;
S ☐ _____ N/A ☑ N/C ☐	b. Above-ground leachate storage tanks; (62-701.400(6)(c), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1) Describe tank materials of construction and ensure foundation is sufficient to support tank;
S ☐ _____ N/A ☑ N/C ☐	(2) Describe procedures for cathodic protection for the tank, if needed;
S ☐ _____ N/A ☑ N/C ☐	(3) Describe exterior painting and interior lining of the tank to protect it from the weather and the leachate stored;
S ☐ _____ N/A ☑ N/C ☐	(4) Describe secondary containment design to ensure adequate capacity will be provided and compatibility of materials of construction;
S ☐ _____ N/A ☑ N/C ☐	(5) Describe design to remove and dispose of stormwater from the secondary containment system;
S ☐ _____ N/A ☑ N/C ☐	(6) Describe an overfill prevention system, such as level sensors, gauges, alarms, and shutoff controls to prevent overfilling;
S ☐ _____ N/A ☑ N/C ☐	(7) Inspections, corrective action, and reporting requirements;
S ☐ _____ N/A ☑ N/C ☐	(a) Weekly inspection of overfill prevention system;
S ☐ _____ N/A ☑ N/C ☐	(b) Weekly inspection of exposed tank exteriors;
S ☐ _____ N/A ☑ N/C ☐	(c) Inspection of tank interiors when tank is drained, or at least every three years;
S ☐ _____ N/A ☑ N/C ☐	(d) Procedures for immediate corrective action if failures detected;
S ☐ _____ N/A ☑ N/C ☐	(e) Inspection reports available for Department review;
S ☐ _____ N/A ☑ N/C ☐	c. Underground leachate storage tanks; (62-701.400(6)(d), FAC)

LOCATION		PART G CONTINUED
S ☐ _____ N/A ☑ N/C ☐	(1)	Describe materials of construction;
S ☐ _____ N/A ☑ N/C ☐	(2)	A double-walled tank design system to be used with the following requirements:
S ☐ _____ N/A ☑ N/C ☐	(a)	Interstitial space monitoring at least weekly;
S ☐ _____ N/A ☑ N/C ☐	(b)	Corrosion protection provided for primary tank interior and external surface of outer shell;
S ☐ _____ N/A ☑ N/C ☐	(c)	Interior tank coatings compatible with stored leachate;
S ☐ _____ N/A ☑ N/C ☐	(d)	Cathodic protection inspected weekly and repaired as needed;
S ☐ _____ N/A ☑ N/C ☐	(3)	Describe an overfill prevention system, such as level sensors, gauges, alarms, and shutoff controls to prevent overfilling, and provide for weekly inspections;
S ☐ _____ N/A ☑ N/C ☐	(4)	Inspection reports available for Department review;
S ☑ Eng Rep. G.6 N/A ☐ N/C ☐	6. Liner systems construction quality assurance (CQA); (62-701.400(7), FAC)	
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	a. Provide CQA Plan including:	
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	(1)	Specifications and construction requirements for liner system;
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	(2)	Detailed description of quality control testing procedures and frequencies;
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	(3)	Identification of supervising professional engineer;
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	(4)	Identify responsibility and authority of all appropriate organizations and key personnel involved in the construction project;
S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐	(5)	State qualifications of CQA professional engineer and support personnel;

S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐ (6) Description of CQA reporting forms and documents;

S ☑ Eng Rep. G.6.a N/A ☐ N/C ☐ b. An independent laboratory experienced in the testing of geosynthetics to perform required testing;

S ☐ _____ N/A ☑ N/C ☐ 7. Soil liner CQA; (62-701.400(8), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. Documentation that an adequate borrow source has been located with test results, or description of the field exploration and laboratory testing program to define a suitable borrow source;

S ☐ _____ N/A ☑ N/C ☐ b. Description of field test section construction and test methods to be implemented prior to liner installation;

S ☐ _____ N/A ☑ N/C ☐ c. Description of field test methods, including rejection criteria and corrective measures to insure proper liner installation;

S ☐ _____ N/A ☑ N/C ☐ 8. For surface water management systems at aboveground disposal units, provide documentation showing the design of any features intended to convey stormwater to a permitted or exempted treatment system; (62-701.400(9), FAC)

S ☑ Eng Rep. G.9 N/A ☐ N/C ☐ 9. Gas control systems; (62-701.400(10), FAC)

S ☑ Eng Rep. G.9 N/A ☐ N/C ☐ a. Provide documentation that if the landfill is receiving degradable wastes, it will have a gas control system complying with the requirements of Rule 62-701.530, FAC;

S ☐ _____ N/A ☑ N/C ☐ 10. For landfills designed in ground water, provide documentation that the landfill will provide a degree of protection equivalent to landfills designed with bottom liners not in contact with ground water; (62-701.400(11), FAC)

PART H. HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS (62-701.410(2), FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Submit a hydrogeological investigation and site report including at least the following information:

S ☐ _____ N/A ☑ N/C ☐ a. Regional and site specific geology and hydrology;

S ☐ _____ N/A ☑ N/C ☐ b. Direction and rate of ground water and surface water flow including seasonal variations;

LOCATION **PART H CONTINUED**

S ☐ _____ N/A ☑ N/C ☐ c. Background quality of ground water and surface water;

S ☐ _____ N/A ☑ N/C ☐ d. Any on-site hydraulic connections between aquifers;

S ☐ _____ N/A ☑ N/C ☐ e. Site stratigraphy and aquifer characteristics for confining layers, semi-confining layers, and all aquifers below the site that may be affected by the disposal facility;

S ☐ _____ N/A ☑ N/C ☐ f. Description of topography, soil types, and surface water drainage systems;

S ☐ _____ N/A ☑ N/C ☐ g. Inventory of all public and private water wells within a one mile radius of the site including, where available, well top of casing and bottom elevations, name of owner, age and usage of each well, stratigraphic unit screened, well construction technique, and static water level;

S ☐ _____ N/A ☑ N/C ☐ h. Identify and locate any existing contaminated areas on the site;

S ☐ _____ N/A ☑ N/C ☐ i. Include a map showing the locations of all potable wells within 500 feet of the waste storage and disposal areas;

S ☐ _____ N/A ☑ N/C ☐ 2. Report signed, sealed, and dated by P.E. and/or P.G.

PART I. GEOTECHNICAL INVESTIGATION REQUIREMENTS (62-701.410(3) and (4), FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Submit a geotechnical site investigation report defining the engineering properties of the site including at least the following:

S ☐ _____ N/A ☑ N/C ☐ a. Description of subsurface conditions including soil stratigraphy and ground water table conditions;

S ☐ _____ N/A ☑ N/C ☐ b. Investigate for the presence of muck, previously filled areas, soft ground, and lineaments;

S ☐ _____ N/A ☑ N/C ☐ c. Estimates of average and maximum high water table across the site;

S ☐ _____ N/A ☑ N/C ☐ d. Evaluation of potential for fault areas and seismic impact zones;

S ☐ _____ N/A ☑ N/C ☐ e. Foundation analysis including:

S ☐ _____ N/A ☑ N/C ☐ (1) Foundation bearing capacity analysis;

S ☐ _____ N/A ☑ N/C ☐ (2) Total and differential subgrade settlement analysis;

S ☐ _____ N/A ☑ N/C ☐ (3) Slope stability analysis;

S ☐ _____ N/A ☑ N/C ☐ f. Evaluation of potential for sinkholes and sinkhole activity at the site that is based upon the investigations required in Rule 62-701.410(3)(f), F.A.C.;

S ☐ _____ N/A ☑ N/C ☐ g. A geotechnical report providing a description of methods used in the investigation, and includes soil boring logs, laboratory results, analytical calculations, cross sections, interpretations, conclusions, and a description of any engineering measures proposed for the site;

S ☐ _____ N/A ☑ N/C ☐ 2. Report signed, sealed, and dated by P.E. and/or P.G.

PART J. VERTICAL EXPANSION OF LANDFILLS (62-701.430, FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Describe how the vertical expansion shall not cause or contribute to any violations of water quality standards or criteria, shall not cause objectionable odors, or adversely affect the closure design of the existing landfill;

S ☐ _____ N/A ☑ N/C ☐ 2. Describe how the vertical expansion over unlined landfills will meet the requirements of Rule 62-701.400, FAC with the exceptions of Rule 62-701.430(1)(c), FAC;

S ☐ _____ N/A ☑ N/C ☐ 3. Provide foundation and settlement analysis for the vertical expansion;

S ☐ _____ N/A ☑ N/C ☐ 4. Provide total settlement calculations demonstrating that the final elevations of the lining system, gravity drainage, and no other component of the design will be adversely affected;

S ☐ _____ N/A ☑ N/C ☐ 5. Minimum stability factor of safety of 1.5 for the lining system component interface stability and for deep stability;

S ☐ _____ N/A ☑ N/C ☐ 6. Provide documentation to show the surface water management system will not be adversely affected by the vertical expansion;

S ☐ _____ N/A ☑ N/C ☐ 7. Provide gas control designs to prevent accumulation of gas under the new liner for the vertical expansion;

PART K. LANDFILL OPERATION REQUIREMENTS (62-701.500, FAC)

LOCATION

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 1. Provide documentation that the landfill will have at least one trained operator during operation and at least one trained spotter at each working face; (62-701.500(1), FAC)

S ☑ Eng Rep. K.2 N/A ☐ N/C ☐ 2. Provide a landfill operation plan including procedures for: (62-701.500(2), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ a. Designating responsible operating and maintenance personnel;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ b. Emergency preparedness and response, as required in subsection 62-701.320(16), FAC;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ c. Controlling types of waste received at the landfill;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ d. Weighing incoming waste;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ e. Vehicle traffic control and unloading;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ f. Method and sequence of filling waste;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ g. Waste compaction and application of cover;

S ☑ Eng Rep. K.2.h N/A ☐ N/C ☐ h. Operations of gas, leachate, and stormwater controls;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ i. Water quality monitoring;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ j. Maintaining and cleaning the leachate collection system;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 3. Provide a description of the landfill operation record to be used at the landfill, details as to location of where various operational records will be kept (i.e. DEP permit, engineering drawings, water quality records, etc.); (62-701.500(3), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 4. Describe the waste records that will be compiled monthly and provided to the Department annually; (62-701.500(4), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 5. Describe methods of access control; (62-701.500(5), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 6. Describe load checking program to be implemented at the landfill to discourage disposal of unauthorized waste at the landfill; (62-701.500(6), FAC)

LOCATION		PART K CONTINUED
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		7. Describe procedures for spreading and compacting waste at the landfill that include: (62-701.500(7), FAC)
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		a. Waste layer thickness and compaction frequencies;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		b. Special considerations for first layer of waste placed above the liner and leachate collection system;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		c. Slopes of cell working face and side grades above land surface, and planned lift depths during operation;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		d. Maximum width of working face;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		e. Description of type of initial cover to be used at the facility that controls:
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		(1) Vector breeding/animal attraction;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		(2) Fires;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		(3) Odors;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		(4) Blowing litter;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		(5) Moisture infiltration;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		f. Procedures for applying initial cover, including minimum cover frequencies;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		g. Procedures for applying intermediate cover;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		h. Time frames for applying final cover;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		i. Procedures for controlling scavenging and salvaging;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		j. Description of litter policing methods;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		k. Erosion control procedures;

LOCATION		PART K CONTINUED
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		8. Describe operational procedures for leachate management including: (62-701.500(8), FAC)
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		a. Leachate level monitoring;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		b. Operation and maintenance of leachate collection and removal system, and treatment as required;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		c. Procedures for managing leachate if it becomes regulated as a hazardous waste;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		d. Identification of treatment or disposal facilities that may be used for off-site discharge and treatment of leachate;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		e. Contingency plan for managing leachate during emergencies or equipment problems;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		f. Procedures for recording quantities of leachate generated in gal/day and including this in the operating record;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		g. Procedures for comparing precipitation experienced at the landfill with leachate generation rates and including this information in the operating record;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		h. Procedures for water pressure cleaning or video inspecting leachate collection systems;
S ☑ Eng Rep. K.9 N/A ☐ N/C ☐		9. Describe how the landfill receiving degradable wastes shall implement a gas management system meeting the requirements of Rule 62-701.530, FAC; (62-701.500(9), FAC)
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		10. Describe procedures for operating and maintaining the landfill stormwater management system to comply with the requirements of Rule 62-701.400(9), FAC; (62-701.500(10), FAC)
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		11. Equipment and operation feature requirements; (62-701.500(11), FAC)
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		a. Sufficient equipment for excavating, spreading, compacting, and covering waste;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		b. Reserve equipment or arrangements to obtain additional equipment within 24 hours of breakdown;
S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑		c. Communications equipment;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ d. Dust control methods;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ e. Fire protection capabilities and procedures for notifying local fire department authorities in emergencies;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ f. Litter control devices;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ g. Signs indicating operating authority, traffic flow, hours of operation, and disposal restrictions;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 12. Provide a description of all-weather access road, inside perimeter road, and other on-site roads necessary for access at the landfill; (62-701.500(12), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ 13. Additional record keeping and reporting requirements; (62-701.500(13), FAC)

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ a. Records used for developing permit applications and supplemental information maintained for the design period of the landfill;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ b. Monitoring information, calibration and maintenance records, and copies of reports required by permit maintained for at least 10 years;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ c. Maintain annual estimates of the remaining life of constructed landfills, and of other permitted areas not yet constructed, and submit this estimate annually to the Department;

S ☐ Minor Mod Sep 2016 N/A ☐ N/C ☑ d. Procedures for archiving and retrieving records which are more than five years old;

PART L. WATER QUALITY MONITORING REQUIREMENTS (62-701.510, FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. A water quality monitoring plan shall be submitted describing the proposed ground water and surface water monitoring systems, and shall meet at least the following requirements:

S ☐ _____ N/A ☑ N/C ☐ a. Based on the information obtained in the hydrogeological investigation and signed, dated, and sealed by the P.G. or P.E. who prepared it; (62-701.510(2)(a), FAC)

LOCATION		PART L CONTINUED
S ☐ _____ N/A ☑ N/C ☐		b. All sampling and analysis performed in accordance with Chapter 62-160, FAC; (62-701.510(2)(b), FAC)
S ☐ _____ N/A ☑ N/C ☐		c. Ground water monitoring requirements; (62-701.510(3), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Detection wells located downgradient from and within 50 feet of disposal units;
S ☐ _____ N/A ☑ N/C ☐	(2)	Downgradient compliance wells as required;
S ☐ _____ N/A ☑ N/C ☐	(3)	Background wells screened in all aquifers below the landfill that may be affected by the landfill;
S ☐ _____ N/A ☑ N/C ☐	(4)	Location information for each monitoring well;
S ☐ _____ N/A ☑ N/C ☐	(5)	Well spacing no greater than 500 feet apart for downgradient wells and no greater than 1500 feet apart for upgradient wells, unless site specific conditions justify alternate well spacings;
S ☐ _____ N/A ☑ N/C ☐	(6)	Properly selected well screen locations;
S ☐ _____ N/A ☑ N/C ☐	(7)	Monitoring wells constructed to provide representative ground water samples;
S ☐ _____ N/A ☑ N/C ☐	(8)	Procedures for properly abandoning monitoring wells;
S ☐ _____ N/A ☑ N/C ☐	(9)	Detailed description of detection sensors, if proposed;
S ☐ _____ N/A ☑ N/C ☐		d. Surface water monitoring requirements; (62-701.510(4), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Location of and justification for all proposed surface water monitoring points;
S ☐ _____ N/A ☑ N/C ☐	(2)	Each monitoring location to be marked and its position determined by a registered Florida land surveyor;
S ☐ _____ N/A ☑ N/C ☐		e. Initial and routine sampling frequency and requirements; (62-701.510(5), FAC)
S ☐ _____ N/A ☑ N/C ☐	(1)	Initial background ground water and surface water sampling and analysis requirements;

LOCATION **PART L CONTINUED**

S ☐ _____ N/A ☑ N/C ☐ (2) Routine monitoring well sampling and analysis requirements;

S ☐ _____ N/A ☑ N/C ☐ (3) Routine surface water sampling and analysis requirements;

S ☐ _____ N/A ☑ N/C ☐ f. Describe procedures for implementing evaluation monitoring, prevention measures, and corrective action as required; (62-701.510(6), FAC)

S ☐ _____ N/A ☑ N/C ☐ g. Water quality monitoring report requirements; (62-701.510(8), FAC)

S ☐ _____ N/A ☑ N/C ☐ (1) Semi-annual report requirements; (see paragraphs 62-701.510(5)(c) and (d), FAC for sampling frequencies)

S ☐ _____ N/A ☑ N/C ☐ (2) Documentation that the water quality data shall be provided to the Department in an electronic format consistent with requirements for importing into Department databases, unless an alternate form of submittal is specified in the permit;

S ☐ _____ N/A ☑ N/C ☐ (3) Two and one-half year, or annual, report requirements, or every five years if in long-term care, signed dated, and sealed by P.G. or P.E.;

PART M. SPECIAL WASTE HANDLING REQUIREMENTS (62-701.520, FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Describe procedures for managing motor vehicles; (62-701.520(1), FAC)

S ☐ _____ N/A ☑ N/C ☐ 2. Describe procedures for landfilling shredded waste; (62-701.520(2), FAC)

S ☐ _____ N/A ☑ N/C ☐ 3. Describe procedures for asbestos waste disposal; (62-701.520(3), FAC)

S ☐ _____ N/A ☑ N/C ☐ 4. Describe procedures for disposal or management of contaminated soil; (62-701.520(4), FAC)

S ☐ _____ N/A ☑ N/C ☐ 5. Describe procedures for disposal of biological wastes; (62-701.520(5), FAC)

PART N. GAS MANAGEMENT SYSTEM REQUIREMENTS (62-701.530, FAC)

	LOCATION		
S ☑	Eng Rep. N.1	N/A ☐ N/C ☐	1. Provide documentation for a gas management system that will: (62-701.530(1), FAC)
S ☑	Eng Rep. N.1.a	N/A ☐ N/C ☐	a. Be designed to prevent concentrations of combustible gases from exceeding 25% the LEL in structures and 100% the LEL at the property boundary;
S ☑	Eng Rep. N.1.b	N/A ☐ N/C ☐	b. Be designed for site specific conditions;
S ☑	Eng Rep. N.1.c	N/A ☐ N/C ☐	c. Be designed to reduce gas pressure in the interior of the landfill;
S ☑	Eng Rep. N.1.d	N/A ☐ N/C ☐	d. Be designed to not interfere with the liner, leachate control system, or final cover;
S ☑	Eng Rep. N.2	N/A ☐ N/C ☐	2. Provide documentation that will describe locations, construction details, and procedures for monitoring gas at ambient monitoring points and with soil monitoring probes; (62-701.530(2), FAC)
S ☑	Eng Rep. N.3	N/A ☐ N/C ☐	3. Provide documentation describing how the gas remediation plan and odor remediation plan will be implemented; (62-701.530(3), FAC)
S ☑	Eng Rep. N.4	N/A ☐ N/C ☐	4. Landfill gas recovery facilities; (62-701.530(5), FAC)
S ☐	Permit Renewal 2013	N/A ☐ N/C ☑	a. Provide information required in Rules 62-701.320(7) and 62-701.330(3), FAC;
S ☐	Permit Renewal 2013	N/A ☐ N/C ☑	b. Provide information required in Rule 62-701.600(4), FAC, where relevant and practical;
S ☑	Eng Rep. N.4.c	N/A ☐ N/C ☐	c. Provide estimates of current and expected gas generation rates and description of condensate disposal methods;
S ☑	Eng Rep. N.4.d	N/A ☐ N/C ☐	d. Provide description of procedures for condensate sampling, analyzing, and data reporting;
S ☐	Permit Renewal 2013	N/A ☐ N/C ☑	e. Provide closure plan describing methods to control gas after recovery facility ceases operation, and any other requirements contained in Rule 62-701.400(10), FAC;

PART O. LANDFILL FINAL CLOSURE REQUIREMENTS (62-701.600, FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Closure permit requirements; (62-701.600(2), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. Application submitted to the Department at least 90 days prior to final receipt of wastes;

S ☐ _____ N/A ☑ N/C ☐ b. Closure plan shall include the following:

S ☐ _____ N/A ☑ N/C ☐ (1) Closure design plan;

S ☐ _____ N/A ☑ N/C ☐ (2) Closure operation plan;

S ☐ _____ N/A ☑ N/C ☐ (3) Plan for long-term care;

S ☐ _____ N/A ☑ N/C ☐ (4) A demonstration that proof of financial assurance for long-term care will be provided;

S ☐ _____ N/A ☑ N/C ☐ 2. Closure design plan including the following requirements: (62-701.600(3), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. Plan sheet showing phases of site closing;

S ☐ _____ N/A ☑ N/C ☐ b. Drawings showing existing topography and proposed final grades;

S ☐ _____ N/A ☑ N/C ☐ c. Provisions to close units when they reach approved design dimensions;

S ☐ _____ N/A ☑ N/C ☐ d. Final elevations before settlement;

S ☐ _____ N/A ☑ N/C ☐ e. Side slope design including benches, terraces, down slope drainage ways, energy dissipaters, and description of expected precipitation effects;

S ☐ _____ N/A ☑ N/C ☐ f. Final cover installation plans including:

S ☐ _____ N/A ☑ N/C ☐ (1) CQA plan for installing and testing final cover;

S ☐ _____ N/A ☑ N/C ☐ (2) Schedule for installing final cover after final receipt of waste;

S ☐ _____ N/A ☑ N/C ☐ (3) Description of drought resistant species to be used in the vegetative cover;

S ☐ _____ N/A ☑ N/C ☐	(4)	Top gradient design to maximize runoff and minimize erosion;
S ☐ _____ N/A ☑ N/C ☐	(5)	Provisions for cover material to be used for final cover maintenance;
S ☐ _____ N/A ☑ N/C ☐	g. Final cover design requirements;	
S ☐ _____ N/A ☑ N/C ☐	(1)	Protective soil layer design;
S ☐ _____ N/A ☑ N/C ☐	(2)	Barrier soil layer design;
S ☐ _____ N/A ☑ N/C ☐	(3)	Erosion control vegetation;
S ☐ _____ N/A ☑ N/C ☐	(4)	Geomembrane barrier layer design;
S ☐ _____ N/A ☑ N/C ☐	(5)	Geosynthetic clay liner design, if used;
S ☐ _____ N/A ☑ N/C ☐	(6)	Stability analysis of the cover system and the disposed waste;
S ☐ _____ N/A ☑ N/C ☐	h. Proposed method of stormwater control;	
S ☐ _____ N/A ☑ N/C ☐	i. Proposed method of access control;	
S ☑ Eng Rep. O.2.j N/A ☐ N/C ☐	j. Description of the proposed or existing gas management system which complies with Rule 62-701.530, FAC;	
S ☐ _____ N/A ☑ N/C ☐	3. Closure operation plan shall include: (62-701.600(4), FAC)	
S ☐ _____ N/A ☑ N/C ☐	a. Detailed description of actions which will be taken to close the landfill;	
S ☐ _____ N/A ☑ N/C ☐	b. Time schedule for completion of closing and long-term care;	
S ☐ _____ N/A ☑ N/C ☐	c. Describe proposed method for demonstrating financial assurance for long-term care;	
S ☐ _____ N/A ☑ N/C ☐	d. Operation of the water quality monitoring plan required in Rule 62-701.510, FAC;	
S ☐ _____ N/A ☑ N/C ☐	e. Development and implementation of gas management system required in Rule 62-701.530, FAC;	

LOCATION **PART O CONTINUED**

S ☐ _____ N/A ☑ N/C ☐ 4. Certification of closure construction completion and final reports including: (62-701.600(6), FAC)

S ☐ _____ N/A ☑ N/C ☐ a. Survey monuments; (62-701.600(6)(a), FAC)

S ☐ _____ N/A ☑ N/C ☐ b. Final survey report; (62-701.600(6)(b), FAC)

S ☐ _____ N/A ☑ N/C ☐ c. Closure construction quality assurance report; (62-701.400(7), FAC)

S ☐ _____ N/A ☑ N/C ☐ 5. Declaration to the public; (62-701.600(7), FAC)

S ☐ _____ N/A ☑ N/C ☐ 6. Official date of closing; (62-701.600(8), FAC)

S ☐ _____ N/A ☑ N/C ☐ 7. Justification for and detailed description of procedures to be followed for temporary closure of the landfill, if desired; (62-701.600(9), FAC)

PART P. OTHER CLOSURE PROCEDURES (62-701.610, FAC)

LOCATION

S ☐ _____ N/A ☑ N/C ☐ 1. Describe how the requirements for use of closed solid waste disposal areas will be achieved; (62-701.610(1), FAC)

S ☐ _____ N/A ☑ N/C ☐ 2. Describe how the requirements for relocation of wastes will be achieved; (62-701.610(2), FAC)

PART Q. LONG-TERM CARE (62-701.620, FAC)

LOCATION

S ☑ Eng Rep. Q.1 N/A ☐ N/C ☐ 1. Maintaining the gas collection and monitoring system; (62-701.620(5), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 2. Stabilization report requirements; (62-701.620(6), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 3. Right of access; (62-701.620(7), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 4. Requirements for replacement of monitoring devices; (62-701.620(8), FAC)

S ☐ Permit Renewal 2013 N/A ☐ N/C ☑ 5. Completion of long-term care signed and sealed by professional engineer; (62-701.620(9), FAC)

PART R. FINANCIAL ASSURANCE (62-701.630, FAC)

LOCATION		
S ☑ Eng Rep. R.1 N/A ☐ N/C ☐	1. Provide cost estimates for closing, long-term care, and corrective action costs estimated by a P.E. for a third party performing the work, on a per unit basis, with the source of estimates indicated; (62-701.630(3) & (7), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	2. Describe procedures for providing annual cost adjustments to the Department based on inflation and changes in the closing, long-term care, and corrective action plans; (62-701.630(4) & (8), FAC)
S ☐ Permit Renewal 2013 N/A ☐ N/C ☑	3. Describe funding mechanisms for providing proof of financial assurance and include appropriate financial assurance forms. (62-701.630(5), (6), & (9), FAC)

PART S. CERTIFICATION BY APPLICANT AND ENGINEER OR PUBLIC OFFICER

1. Applicant:

The undersigned applicant or authorized representative of Sarasota County Solid Waste Operations is aware that statements made in this form and attached information are an application for a Operation permit from the Florida Department of Environmental Protection, and certifies that the information in this application is true, correct, and complete to the best of his/her knowledge and belief. Further, the undersigned agrees to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department. It is understood that the Permit is not transferable, and the Department will be notified prior to the sale or legal transfer of the permitted facility.

Signature of Applicant or Agent

Lois Rose, SW Ops Manager
Name and Title (please type)

lerose@scgov.net
E-Mail Address (if available)

4000 Knights Trail Road
Mailing Address

Nokomis, FL 34275
City, State, Zip Code

(941) 861-1589
Telephone Number

Date: 3/1/17

Attach letter of authorization if agent is not a government official, owner, or corporate officer.

2. Professional Engineer registered in Florida (or Public Officer if authorized under Sections 403.707 and 403.7075, Florida Statutes):

This is to certify that the engineering features of this solid waste management facility have been designed/examined by me and found to conform to engineering principles applicable to such facilities. In my professional judgment, this facility, when properly maintained and operated, will comply with all applicable statutes of the State of Florida and rules of the Department. It is agreed that the undersigned will provide the applicant with a set of instructions of proper maintenance and operation of the facility.

Signature

Daniel Cooper, P.E.
Name and Title (please type)

FL PE#66440
Florida Registration Number (please affix seal)

4041 Park Oaks Blvd.
Mailing Address

Tampa, FL 33610
City, State, Zip Code

dcooper@scsengineers.com
E-Mail Address (if available)

(813) 621-0080
Telephone Number

Date: 3-6-17

SCS ENGINEERS

OPERATION
PERMIT APPLICATION
PHASE II LFGCCS EXPANSION

CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX
SARASOTA COUNTY, FLORIDA

Prepared for:

Sarasota County Solid Waste Operations

Sarasota County

4000 Knights Trail Road
Nokomis, FL 34275
FDEP Permit No. 0130542-022-SO/01
WACS ID No. 51614

Prepared by:

SCS Engineers
4041 Park Oaks Blvd, Suite 100
Tampa, Florida 33610
(813) 621-0080

Florida Board of Professional Engineers
Certificate Number 00004892

March 6, 2017
File No. 09216113.03

Offices Nationwide
www.scsengineers.com

OPERATION PERMIT APPLICATION
PHASE II LFGCCS EXPANSION
SARASOTA COUNTY, FLORIDA

Submitted to:

Florida Department of Environmental Protection
Division of Waste Management
2600 Blairstone Road, MS 4565
Tallahassee FL, 32399

Prepared for:

Sarasota County Solid Waste Operations
4000 Knights Trail Road
Nokomis, FL 34275
FDEP Permit No. 0130542-022-SO/01
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Prepared by:

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Fax (813) 623-6757

Florida Board of Professional Engineers
Certificate Number 00004892

March 6, 2017
File No. 09216113.03

3-6-17
Daniel R. Cooper, P.E.
No. 66440

Table of Contents

List of Tables

Table No. **Page**

Attachments

Attachment A Permit Drawings (Full Size Drawings Bound Separately)
Attachment B Engineering Report
Attachment C Construction Quality Assurance Plan and Technical Specifications

SECTION A

GENERAL INFORMATION

On behalf of Sarasota County Solid Waste Operations (SWO), SCS Engineers (SCS) has prepared this Operation permit application for the Phase II Landfill Gas Collection and Control System (LFGCCS) expansion of the Central County Solid Waste Disposal Complex (CCSWDC). Information provided in this application is in accordance with and it is divided into Sections following the State of Florida Department of Environmental Protection (FDEP) Application for a Permit to Construct, Operate, Modify or Close a Solid Waste Management Facility Application Form 62-701.900(1), FAC.

A.1 LANDFILL DESCRIPTION

The CCSWDC is a multi-function solid waste management facility which includes a Class I disposal area and other associated solid waste collection and disposal activities. The Class I landfill currently consists of a closed Phase I (55 acres) area which began accepting waste on June 15, 1998 until June 9, 2011, and an active Phase II (63 acre) area which began accepting waste on August 16, 2010. The Class I landfill has a permitted design capacity greater than 2.5 million megagrams by mass and 2.5 million cubic meters by volume.

Although the landfill design capacity is greater than 2.5 million megagrams, the landfill's New Source Performance Standards (NMOC) emissions are below 50 Mg/Year, thus, the facility is not subject to the NMOC, Subpart WWW, and all installed landfill gas collection systems are not regulatory required.

The existing LFGCCS on Phase I was installed in two separate sequences. The first sequence became operational on June 2010 and the second sequence was completed in March 2012. An additional expansion into Phase II was completed on January 2016 and included header, airline, condensate piping, and connections to existing leachate cleanouts on the north slope of Subcells 1 and 2. The existing LFGCCS includes 70 vertical landfill gas extraction wells installed on Phase I, header and lateral piping of various sizes, condensate traps located at low points in the header, isolation valves for airlines, condensate, and landfill gas, condensate sumps, blower flare station, and other appurtenances.

Additional expansions to the existing LFGCCS will be constructed on Subcells 1 through 4 of Phase II. Phase II is expected to reach final grades on the top deck in November 2024 in accordance with information provided to the FDEP in the Annual Topographic Survey and Remaining Site Life Report-2015, dated April 24, 2016, by Sarasota County.

The SWO is proactively designing the LFGCCS and intends to proceed with planning, permitting and construction of the Phase II LFGCCS expansion such that it will be available for operation in accordance with the proposed expansion stages as further discussed in this permit application.

SECTION B

DISPOSAL FACILITY GENERAL INFORMATION

See Permit Application Form for this information.

SECTION C

PROHIBITIONS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to any prohibition requirements as part of this Operations Permit Application.

For additional information, refer to the following approved documents for the CCSWDC:

1. Operations Permit Renewal Application, dated September 16, 2013, and subsequent responses, prepared by Sarasota County,

2. Supplemental information, dated October 16, 2013, prepared by Sarasota County,

3. Supplemental information, Water Quality Monitoring Plan, December 9, 2013, prepared by Atkins,

4. Intermediate Modification, Construction and Operation of Landfill Gas Recovery Facility, dated February 14, 2014, prepared by S2Li, Incorporated,

5. Minor Modification Permit Application, dated December 16, 2014, and subsequent responses, prepared by SCS Engineers,

6. Supplemental information, Updated Operations Plan, dated January 16, 2015, prepared by Sarasota County and SCS Engineers,

7. Approved Operations Plan, dated January 2015, prepared by Sarasota County,

8. Operation Permit Minor Modification Application, dated September 1, 2016, prepared by Sarasota County

9. Approved Operations Plan, dated August 2016, prepared by Sarasota County.

SECTION D

SOLID WASTE FACILITY PERMITTING REQUIREMENTS, GENERAL

D.1 Application Form and Supporting Documents

One hard copy and one electronic copy of the application form, supporting data and reports are being submitted.

D.2 Engineering Certification

This permit application has been certified, signed, and sealed by Daniel R. Cooper, P.E., a Licensed Engineer in the State of Florida (License No. 66440).

D.3 Transmittal Letter

A transmittal letter is included at the beginning of this submittal.

D.4 Application Forms

DEP Form No. 62-701.900(1), effective February 15, 2015, is included with this submittal.

D.5 Permit Fee

In accordance with Rule 62-701.320(4)(d), the intermediate modification fee is one-half of that required for a substantial modification. Enclosed with this application is a check in the amount of $5,000 (one-half required for a substantial modification per Rule 62-4.050(4)(j)(1), Construction permit for a Class I facility) made payable to Florida Department of Environmental Protection.

D.6 Engineering Report

An Engineering Report meeting the requirements of Rule 62-701.320(7)(d), F.A.C., detailing plans for the construction of the LFGCCS expansion is included in Attachment B of this submittal.

D.9 Drawings

Attachment A contains the required design drawings indicating the LFGCCS expansion system. There have been no changes to the property boundaries since the last solid waste operations permit was issued and therefore a site plan signed and sealed by a Florida Licensed Professional Land Surveyor is not being submitted with this application.

D.12 Enforcement History

Table D-1 below summarizes enforcement history for the applicant, the SWO. Based on a review of the CCSWDC files and information provided by Sarasota County staff responsible for the CCSWDC, the applicant is not aware of any other enforcement actions relative to the County's other solid waste operations. Any errors or omissions are not to be construed as a misrepresentation of the facts. Should FDEP have additional information in their files, the SWO will concede to FDEP's data.

Table D.1. Enforcement Action History
Sarasota County Solid Waste Operations

FACILITY	ACTION	DATE	STATUS
17TH Street Closed Landfill	OGC – Case No. #90-1139	July 2, 1991	Closed
Central County Solid Waste Disposal Complex	OGC – Case No. #08-1728	October 8, 2008	Active
Bee Ridge Landfill	OGC – Case No. #10-3569	February 28, 2011	Closed

SECTION E

LANDFILL PERMIT REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to landfill permit requirements as part of this Operations Permit Application. For additional information, refer to the applicable documents listed in Section C.

E.2 Plot Plan

A plot plan showing the proposed LFGCCS expansion into Phase II is included in Attachment A of this submittal.

E.3 Topographic Maps

A topographic plan showing existing conditions and the proposed LFGCCS expansion into Phase II is included in Sheet 2, Attachment A, of this permit application. Construction of the LFGCCS expansion will not affect existing fill areas, borrow areas, access roads, grading for proper drainage, fencing or equipment facilities. Areas disturbed during construction of the LFGCCS expansion components, such as trenching for gas collection pipelines, will be repaired to pre-existing conditions or approved grades after construction.

SECTION F

GENERAL CRITERIA FOR LANDFILLS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed general criteria for landfills as part of this Operations Permit Application. For additional information, refer to applicable documents listed in Section C.

SECTION G

LANDFILL CONSTRUCTION REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to landfill construction requirements as part of this Operations Permit Application. For additional information refer to applicable documents listed in Section C.

G.1 Construction and Closure at Planned Intervals

The Overall Site Plan for the CCSWDC is included in Sheet 2, Attachment A. The effect of the LFGCCS expansion on Phase II waste filling operations will be minimal. There will be four stages as part the LFGCCS expansion into Phase II as shown on the permit drawings, Attachment A.

The design, location, number of gas extraction wells, and conveyance components proposed for each stage of the LFGCCS expansion into Phase II has been evaluated to provide maximum landfill gas collection efficiency, flexibility and control in the application of vacuum to the vertical extraction wells, and operation based on the estimated fill sequences. The final layout and exact location of gas extraction wells and collection piping may vary slightly based on existing field conditions, however, the functionality of the system will remain as presented herein. The design of the LFGCCS expansion is further described in detail in the Engineering Report, Attachment B, and as shown on the Permit Drawings, Attachment A.

G.3 Leachate Collection and Removal System

Condensate from the LFGCCS expansion into Phase II will be collected at condensate sumps located at engineered low points. Condensate collected in the proposed sumps will be pumped to leachate cleanout riser connections along the north and south slopes of Phase II, then flows via gravity to the Phase II Main Leachate Pump Station. The operation of the existing leachate collection and storage system will not be affected by the discharge of condensate from the LFGCCS expansion into Phase II. The design of the LFGCCS expansion is further described in detail in the Engineering Report, Attachment B, and as shown on the Permit Drawings, Attachment A.

G.6 Liner Systems Construction Quality Assurance

G.6.a CQA Plan

The CQA plan, Attachment C, contains requirements for testing materials and monitoring construction of the LFGCCS expansion, including the responsibilities of CQA personnel, documentation control, and reporting procedures.

G.9 Gas Control Systems

Landfill gas collected from Phases I and II will be processed at the existing Landfill Gas Recovery Facility (Plant). The Plant is the prime consumer of the LFG. In the event gas collected exceeds the gas needed to operate the engines or the Plant engine-generators are offline, the existing gas flaring system will ensure control of all the gas collected by burning off the excess gas. The existing gas flaring system has a capacity of 5,500 standard cubic feet per minute (scfm). The current flow rate of LFG for Phase I LFGCCS is in the range of 1,200-1,600 scfm. The existing gas flaring system has sufficient capacity to collect and combust gas from Phases I and II in the event the Plant is not operational. The design of the LFGCCS expansion is further described in detail in the Engineering Report, Attachment B, and as shown on the Permit Drawings, Attachment A. Technical specifications for construction and materials are included in Attachment C.

SECTION H

HYDROGEOLOGICAL INVESTIGATION REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to hydrogeological investigation requirements as part of this Operations Permit Application. For additional information, refer to the applicable documents listed in Section C.

SECTION I

GEOTECHNICAL INVESTIGATION REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to geotechnical investigation requirements as part of this Operations Permit Application. For additional information, refer to the applicable documents listed in Section C.

SECTION J

VERTICAL EXPANSION OF LANDFILLS

Not Applicable. A vertical expansion is not proposed for the CCSWDC.

SECTION K

LANDFILL OPERATION REQUIREMENTS

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to landfill operation requirements as part of this Operations Permit Application. For additional information, refer to applicable documents listed in Section C.

K.2 Operations Plan

K.2.h Operations of Gas, Leachate, and Stormwater Controls

The Phase II LFGCCS will be operated in accordance with the currently approved LFGCCS Operations and Maintenance Plan. No changes are proposed to the currently approved operations, last updated August 2016.

K.9 Landfill Gas Management and Monitoring

Refer to Section N of this permit application.

SECTION L

WATER QUALITY MONITORING

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to water quality monitoring requirements as part of this Operations Permit Application. For additional information, refer to applicable documents listed in Section C.

SECTION M

SPECIAL WASTE HANDLING

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to special waste handling requirements as part of this Operations Permit Application. For additional information, refer to applicable documents listed in Section C.

SECTION N

GAS MANAGEMENT SYSTEM REQUIREMENTS

N.1 Gas Management System

The Permit Drawings included in Attachment A show the proposed LFGCCS expansion layout into Phase II. The LFGCCS expansion includes new lateral collection pipes, air supply and condensate forcemain lines, header lines along the Phase II perimeter berm, condensate sump, and other conveyance components. These drawings also include typical details for items such as perforated pipe, pipe tie-ins, trench details etc. The CCSWDC is not subject to the operational or design requirements of the federal New Source Performance Standards (NSPS) for municipal solid waste landfills that are published in 40 CFR 60, Subpart WWW. However, the LFGCCS expansion proposed in this permit application meets the design requirements of NSPS.

N.1.a Gas Migration Control

The proposed LFGCCS expansion is designed to further enhance and prevent the subsurface migration of LFG and to reduce the potential for odors. This is accomplished through the installation of new vertical gas extraction wells in Phase II and by maintaining a vacuum within the landfill. By actively collecting gas from Phase II, the proposed LFGCCS expansion will decrease the possibility that gas concentrations will exceed 25 percent of the lower explosive limits (LEL) in structures and 100 percent LEL at the property boundary.

N.1.b Site-Specific Design Conditions

The design, location, number of gas extraction wells, and conveyance components proposed for the LFGCCS expansion into Phase II has been evaluated to provide maximum landfill gas collection efficiency, flexibility and control in the application of vacuum to the vertical gas extraction wells, and operation based on the respective fill sequence. Some field changes to the design, however, may be required due to conditions at the time of construction to allow for the proper performance of the LFGCCS expansion.

At locations where the actual conditions of the landfill vary significantly from what is shown in the Permit Drawings, the FDEP and the County will be notified and corrective actions will be implemented, which may include modifications to the LFGCCS design. If modifications to the LFGCCS expansion design are proposed as a corrective action, the FDEP will be notified to determine if a permit modification is necessary. No significant changes to the layout of the LFGCCS expansion or the design in general will be made without prior approval from FDEP. As-built drawings of the LFGCCS expansion, to be submitted to FDEP with the certification documentation, will include any necessary field changes made during construction.

The LFGCCS expansion into Phase II will be completed in four separate stages. The estimated timeline for construction of each stage is based on the projected waste volume received per year (cy/yr) at the landfill starting in 2016, as reported in the Annual Topographic Survey and Remaining Site Life Report-2015, dated April 24, 2016 by Sarasota County, and compared with

the estimated incremental volume for each lift, as reported in the Phase II Staging Plans, dated December 2014, by HDR Engineering, Inc. The difference between these two volumes will provide the estimated timeline in months to complete the respective lift in which the LFGCCS expansion stage will be built. Refer to the Engineering Report, Attachment B, for additional information on the proposed Stages.

N.1.c Gas Pressure

The LFGCCS is an active extraction system that will exert a negative pressure on the wells that will be regulated at each well by a wellhead at the connection to the LFGCCS. A blower will convey LFG via a vacuum to the Plant where it will be processed. These new gas extraction wells will assist in further reducing the internal gas pressures of the landfill.

N.1.d Liner, Leachate Control and Final Cover Systems

The vertical gas extraction wells will maintain at least 15 feet offset from the base liner system and the header line will be installed near the surface of the Phase II perimeter berm. Selected vertical gas extraction wells to be installed on top of drainage targets (refer to Engineering Report, Attachment B) will maintain between 10-15 feet offset from the base liner system as these wells will be drilled into the drainage target (aggregate mass).

Therefore, the LFGCCS expansion components will not interfere with the bottom liner or leachate collection system of Phase II.

N.2 Gas Monitoring Program

A landfill gas monitoring program is currently implemented at the CCSWDC. The existing gas monitoring locations and frequency will be maintained as set forth in the current Operations and Maintenance Plan as submitted as part of the Operations Permit Minor Modification Application, dated September 1, 2016, prepared by Sarasota County. No changes are proposed.

N.3 Gas and Odor Remediation Plan Implementation

There will be no changes to the gas and odor remediation plan. With the enhancement of the LFGCCS, the SWO does not anticipate any issues with gas and odor control. However, should LFG migration occur or objectionable odors be detected offsite, the SWO will take the necessary steps to protect human health as required by Rule 62-701.530, F.A.C.

N.4 Gas Recovery Facility

As previously stated, the proposed additions to the LFGCCS will not affect the operations of the existing control devices at the landfill. Any additional gas collected will only increase the percentage of gas recovery.

N.4.c Gas Generation and Condensate/ Liquids Management

Gas Generation

The existing LFGCCS is designed to handle the maximum expected LFG recovery rates over the life of the landfill. The LFG recovery models estimate the annual LFG generation/recovery rates based on the amount and age of waste in place and the organic/biodegradable fraction of the waste. Gas generation was estimated using the U.S. Environmental Protection Agency's Landfill Gas Emission Model (LandGEM). Historical and projected future filling rates were input to the model, and the standard default parameter values were used. Projected LFG generation rates are summarized in Table N-1 below. The entire LandGEM Model output was provided to FDEP as part of the New Source Performance Standard Tier 2 NMOC 5-year projection update (Title V Permit No. 1150089-009-AV), dated February 9, 2017 by Sarasota County. For this model, a conservative 5 percent increase in waste acceptance was assumed for years 2017 through 2019 and 3 percent for years 2020 through 2030.

Table N-1. Projected LFG Generation Rates
Sarasota County CCSWDC Landfill

Year	Projected LFG Generation Rate (scfm)
2015	3,207
2016	3,336
2017	3,468
2018	3,608
2019	3,757
2020	3,915
2021	4,075
2022	4,238
2023	4,404
2024	4,573

The addition of the new landfill gas infrastructure will not cause additional gas flow. It will only potentially increase the percentage of LFG collected in comparison to the total amount of LFG being generated. The additions to the LFGCCS could potentially increase the percentage of gas collected but it would never exceed 100 percent of expected flow which can be handled by the existing Plant or the existing gas flaring system that has a utility flare with a 5,500 scfm capacity.

Condensate/ Liquids Management

Additional condensate management features are being added to the existing LFGCCS. Condensate management operations will not be affected by this addition as all collected condensate will be directed to the leachate management system which will remain unchanged. Refer to the Engineering Report, Attachment B, for additional information on condensate management.

N.4.d Condensate Sampling, Analyzing, and Data Reporting

Condensate sampling analysis is not required under the current operations permit.

SECTION O

LANDFILL CLOSURE REQUIREMENTS

A closure construction project is not proposed as part of this Operation Permit Application. When closure of portions of the CCSWDC landfill is required, a closure plan meeting the requirements of Rule 62-701.600, FAC will be submitted to the Department for review and approval. This Section is marked as Not Applicable. Description of gas management system is included in Section O.2.j below. For additional information refer to applicable documents listed in Section C.

O.2 Closure Design Plan

O.2.j Description of the Proposed or Existing Gas Management System

The proposed LFGCCS expansion into Phase II complies with the requirements of Rule 62-701.530, F.A.C. The proposed system components will utilize vertical gas extraction wells and pipe lines to convey gas to the existing Plant. Additional information regarding the design and operation of the LFGCCS expansion has been provided in the respective sections of this permit application.

SECTION P

OTHER CLOSURE PROCEDURES

This section is not applicable to this application.

SECTION Q

LONG-TERM CARE

Disposal areas at the facility have been permitted by FDEP and are located within the property boundaries of the CCSWDC. Expansion of the LFGCCS into Phase II will not require additional Subcells (disposal units) at the CCSWDC in order to operate. No changes are proposed to long-term care requirements as part of this Operations Permit Application. For additional information, refer to applicable documents listed in Section C.

Q.1 Maintaining the Gas Collection and Monitoring System

The LFGCCS and monitoring system required per Rule 62-701.620(5), F.A.C. will be maintained for the long-term care period of the landfill. The SWO may apply to the FDEP for a permit modification to reduce the long-term care schedule. FDEP will grant such a modification if SWO demonstrates that the landfill has stabilized to the point where there is no significant production of combustible gases or objectionable odors.

SECTION R

FINANCIAL ASSURANCE

The financial assurance cost estimate submitted to FDEP as part of the Operations Permit Renewal Application, dated September 16, 2013, and subsequent responses, prepared by Sarasota County, included the closure costs for Phase II LFGCCS (70 gas extraction wells) and long-term care costs for both Phases I and II LFGCCS (140 gas extraction wells). The 2013 financial assurance cost estimate has been updated annually based on inflation factors as approved by FDEP.

R.1 Cost Estimates for Closing, Long-Term Care

In accordance with previous communications with FDEP staff, the 2013 financial assurance cost estimate will be recalculated by SWO, to include current third party quotes and correct number of gas extraction wells proposed as part of the LFGCCS expansion into Phase II. The SWO will provide the recalculated financial assurance cost as part of an update scheduled for mid-year 2017.

ATTACHMENT A

PERMIT DRAWINGS

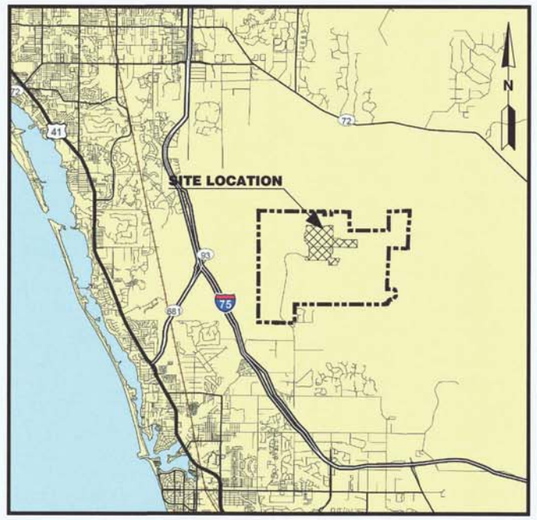
(FULL SIZE DRAWINGS BOUND SEPARATELY)

SARASOTA COUNTY

CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX

PHASE II LFGCCS EXPANSION

NOKOMIS, FLORIDA
MARCH 2017



LOCATION MAP

INDEX OF DRAWINGS

DRAWING NO.		SHEET TITLE
1	-	COVER
2	-	EXISTING LFG SYSTEM
3	-	STAGE 1A - SUBCELL 3, LIFT 2 - TARGETS
4	-	STAGE 1B - SUBCELL 3, LIFT 2 - CAISSON AND VERTICAL WELLS
5	-	STAGE 2 - SUBCELL 4, LIFT 2 - TARGETS
6	-	STAGE 3A - SUBCELLS 3&4, LIFT 4 - HORZ. COLLECTORS
7	-	STAGE 3B - SUBCELLS 3&4, LIFT 5 - HEADER
8	-	STAGE 4 - FINAL LIFT - LFG WELLS
9	-	DETAILS 1
10	-	DETAILS 2
11	-	DETAILS 3
12	-	DETAILS 4
13	-	DETAILS 5
14	-	DETAILS 6
15	-	DETAILS 7
16	-	DETAILS 8

Sarasota County

SARASOTA BOARD OF COUNTY COMMISSIONERS
4000 KNIGHTS TRAIL ROAD
NOKOMIS, FL, 34275

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS, INC.
4041 PARK OAKS BLVD., SUITE 100
TAMPA, FLORIDA 33610
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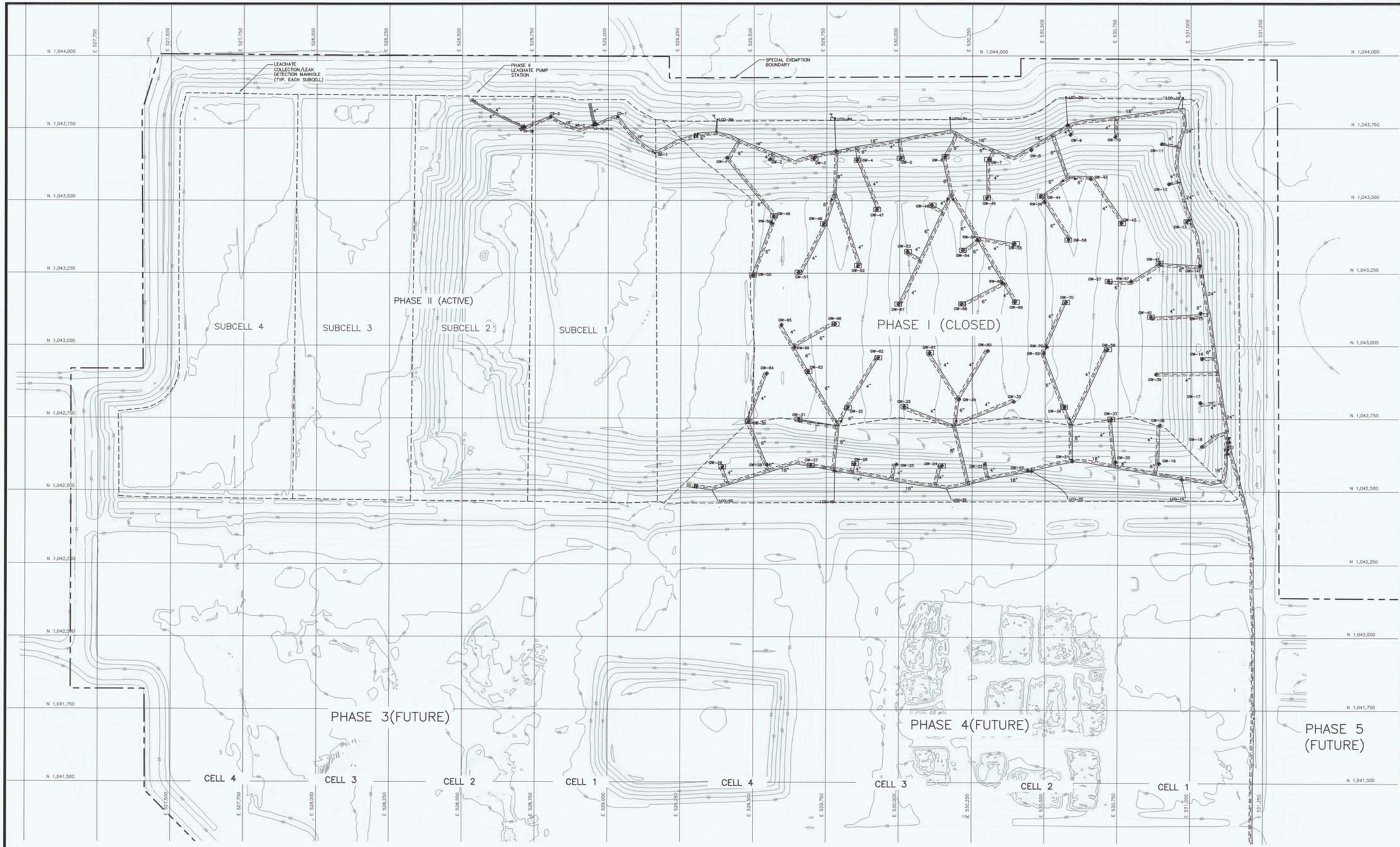
WWW.SCSENGINEERS.COM

SCS PROJECT NO. 09216163.00

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. DATE
LICENSE NO. 66440



NOTES:

1. TOPOGRAPHY WITHIN PHASE I AND II PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH (440) 975-4230 DATED: 12/3/2016.

LEGEND:

102 / 22.67	EXIST. SURVEY CONTROL POINT	CT-1	EXIST. CONDENSATE U-TRAP
	EXIST. HEADER/LATERAL TEE FOR FUTURE EXPANSION	CS-1	EXIST. CONDENSATE SUMP
AR-1	EXIST. HEADER ACCESS RISER		EXIST. ISOLATION VALVE
LC-14	EXIST. LEACHATE COLLECTION SYSTEM	4"	EXIST. HEADER/LATERAL PIPE SIZE
LCO-1N	EXIST. LEACHATE COLLECTION SYSTEM		EXIST. LFG HEADER/LATERAL
GW-3	EXIST. LFG EXTRACTION WELL		EXIST. AIR SUPPLY LINE
GW-3	EXIST. LFG EXTRACTION WELL WITH DEWATERING PUMP		EXIST. DEWATERING DISCHARGE LINE
RW-70	EXIST. REMOTE WELLHEAD		EXIST. PHASE/SUBCELL BOUNDARY

N

0 75 150 300
1" = 150'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **EXISTING LFG SYSTEM**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DWN. BY:	Q/A RVW BY:
09216163.00	AFD	CFL
DSN. BY:	CHK. BY:	APP. BY:
AFD	DRC	DRC

CADD FILE: 216163_00 EXISTING

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. **2**

SHEET 2 of 16

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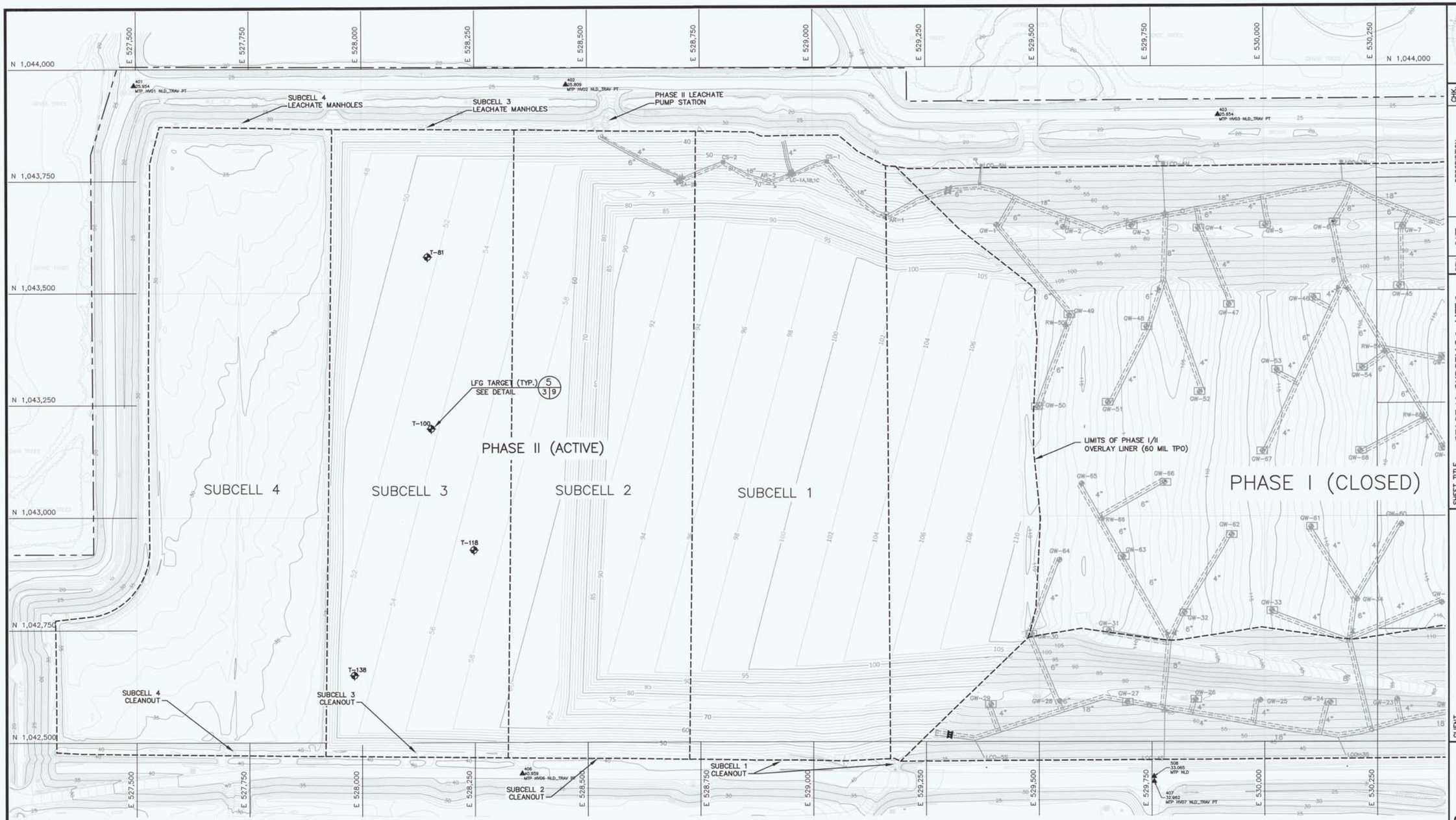

NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
4. TARGET WELLS TO BE INSTALLED BY COUNTY FORCES. TARGETS TO BE INSTALLED FOLLOWING COMPLETION OF LIFT 2 IN THE TARGET AREA. DEPTH VARIES, MAINTAIN A MINIMUM OF 4 FEET OFFSET FROM BOTTOM LINER SYSTEM.
5. EXISTING TOPOGRAPHIC CONTOURS SHOWN IN SUBCELL 4 OF PHASE II. FUTURE CONTOURS SHOWN IN SUBCELLS 1-3 IN PHASE II: SUBCELL 3 IN LIFT 2, SUBCELL 1 AND 2 IN LIFT 5.

LEGEND:

- RW-89 — EXIST. REMOTE WELL
- △ — EXIST. COUNTY SURVEY CONTROL POINT
- EXIST. LFG HEADER/LATERAL
- EXIST. AIR SUPPLY LINE
- EXIST. DEWATERING DISCHARGE
- HC-1 — HORIZONTAL COLLECTOR/REMOTE WELLHEAD
- CW-71 — CAISSON WELL
- EW-89 — EXTRACTION WELL
- AR-7 — ACCESS RISER
- H.P. — PIPING HIGH POINT
- HEADER ISOLATION VALVE
- ROAD CROSSING
- CS-1 — CONDENSATE SUMP
- SUBCELL BOUNDARY/ LANDFILL LIMITS
- LFG HEADER/LATERAL
- AIR SUPPLY LINE
- DEWATERING DISCHARGE
- E- — BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER

N

0 50 100 200
1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY:

SHEET TITLE: STAGE 1A: SUBCELLS 3 - LIFT 2 TARGETS

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DRN. BY:	Q/A RVW BY:
09216163.00	AFD	CFL
DSK. BY:	CHK. BY:	APP. BY:
AFD	DRC	DRC

CADD FILE: 216163_00 PROPOSED PERM.
DATE: MARCH 2017
SCALE: AS SHOWN
DRAWING NO. 3
SHEET 3 of 16

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LEACHATE COLLECTION MANHOLE MODIFICATIONS (TYP.) SEE DETAIL 2/4|16

LEACHATE METERING MANHOLE MODIFICATION (TYP.) SEE DETAIL 1/4|16

SUBCELL 4 LEACHATE MANHOLES

SUBCELL 3 LEACHATE MANHOLES

PHASE II LEACHATE PUMP STATION

TEMPORARY ABOVE GROUND LEACHATE CONNECTION LINE

TIE-IN TO EXISTING BLIND FLANGE (TYP.) SEE DETAIL 3/4|15

DEWATERING LINE ISOLATION VALVE (TYP.) SEE DETAIL 4/4|12

HEADER ISOLATION VALVE (TYP.) SEE DETAIL 2/4|12

HEADER ACCESS RISER (TYP.) SEE DETAIL 3/4|13

HEADER ISOLATION VALVE (TYP.) SEE DETAIL 3/4|12

AIR LINE ISOLATION VALVE (TYP.) SEE DETAIL 3/4|12

CAISSON LFG EXTRACTION WELL (TYP.) SEE DETAIL 1/4|10

LFG EXTRACTION WELL (TYP.) SEE DETAIL 2/4|10

REMOTE LFG EXTRACTION WELLHEAD (TYP.) SEE DETAIL 3/4|16

STUB-UP (TYP.) SEE DETAIL 4/4|9

HEADER/LATERAL PIPE TRENCH IN UNCAPPED AREA (TYP.) SEE DETAIL 3/4|9

LATERAL PIPE TRENCH IN CAPPED AREA (TYP.) SEE DETAIL 3/4|9

PHASE II (ACTIVE)

SUBCELL 4

SUBCELL 3

SUBCELL 2

SUBCELL 1

LIMITS OF PHASE I/II OVERLAY LINER (60 MIL TPO)

PHASE I (CLOSED)

HEADER PIPE TRENCH IN CAPPED AREA (TYP.) SEE DETAIL 1/4|9

AIR LINE ISOLATION VALVE PIT TIE-IN (TYP.) SEE DETAIL 1/4|15

IN-WASTE CONDENSATE SUMP (TYP.) SEE DETAIL 1/4|11

SUBCELL 4 CLEANOUT

SUBCELL 3 CLEANOUT

BLIND FLANGE FOR FUTURE EXPANSION (TYP.) SEE DETAIL 2/4|9

TIE IN TO EXISTING LEACHATE CLEANOUT (TYP.) SEE DETAIL 6/4|9

FORCEMAIN VALVE PIT TIE-IN (TYP.) SEE DETAIL 2/4|14

ROAD CROSSING (TYP.) SEE DETAIL 5/4|12

SUBCELL 2 CLEANOUT

SUBCELL 1 CLEANOUT

PHASE I TPO COVER TRANSITION SEE DETAIL 2/4|15

HEADER LINE ISOLATION VALVE PIT TIE-IN (TYP.) SEE DETAIL 1/4|14

NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
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- AIR SUPPLY LINE
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- BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER
- AR-7 — ACCESS RISER

N

0 50 100 200

1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: STAGE 1B: SUBCELLS 3 - LIFT 2 CAISSON AND VERTICAL WELLS

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DRW. BY:	Q/A RVW BY:
09216163.00	AFD	CFL
DSN. BY:	CHK. BY:	APP. BY:
AFD	DRC	DRC

CADD FILE: 216163_00 PROPOSED PERM.

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. 4

SHEET 4 of 16

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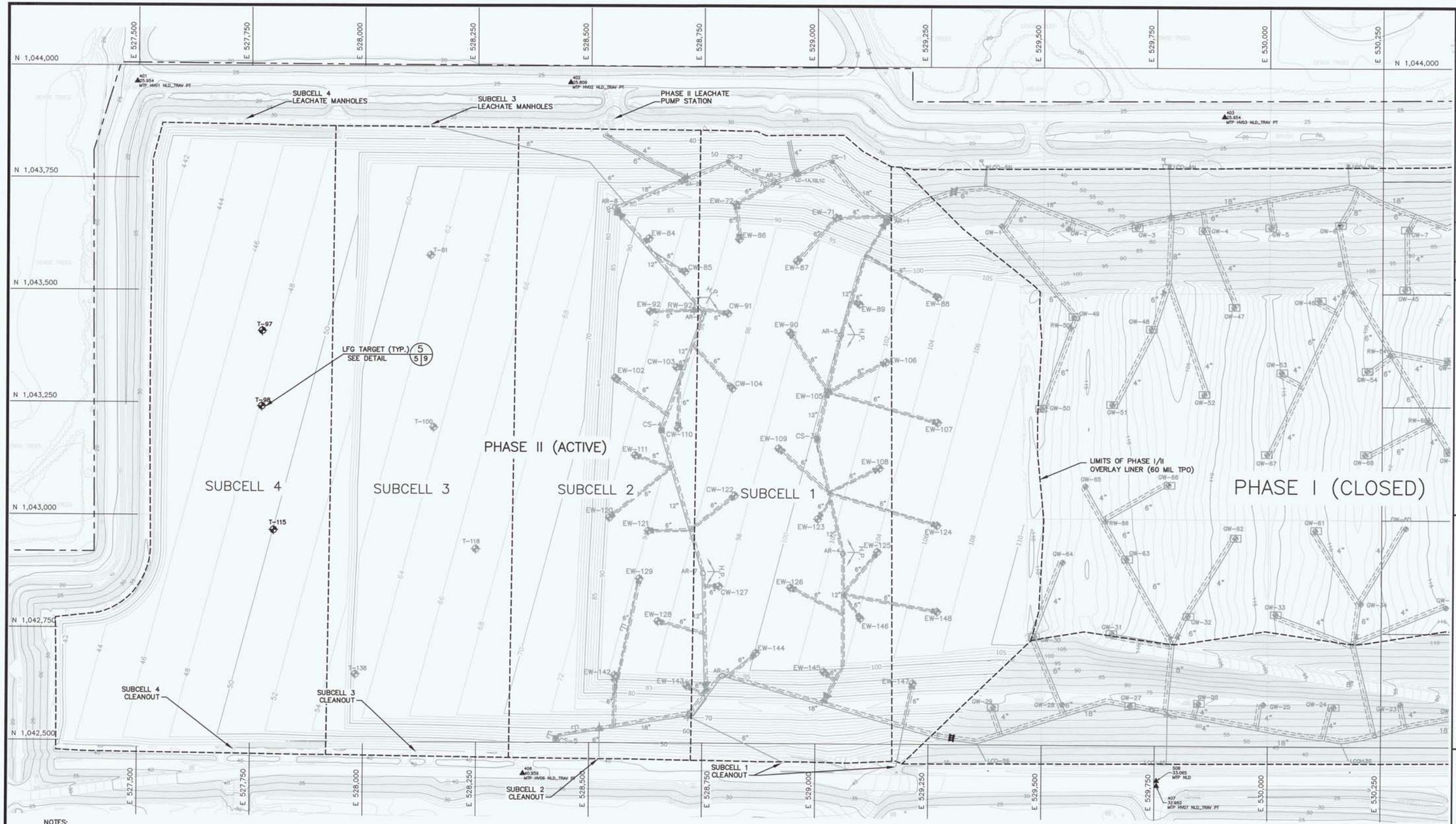


NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
4. TARGET WELLS TO BE INSTALLED BY COUNTY FORCES. TRAGET TO BE INSTALLED FOLLOWING COMPLETION OF LIFT 2 IN THE TARGET AREA. DEPTH VARIES, MAINTAIN A MINIMUM OF 4 FEET FROM BOTTOM LINER SYSTEM.
5. FUTURE CONTOURS SHOWN IN SUBCELLS 1-4 IN PHASE II: SUBCELLS 1 AND 2 IN LIFT 5, SUBCELL 3 IN LIFT 3, SUBCELL 4 IN LIFT 2.

LEGEND:

- RW-89 — EXIST. REMOTE WELL
- △ — EXIST. COUNTY SURVEY CONTROL POINT
- EXIST. LFG HEADER/LATERAL
- EXIST. AIR SUPPLY LINE
- EXIST. DEWATERING DISCHARGE
- HC-1 — HORIZONTAL COLLECTOR/REMOTE WELLHEAD
- CW-71 — CARBON WELL
- EW-89 — EXTRACTION WELL
- AR-7 — ACCESS RISER
- H.P. — PIPING HIGH POINT
- HEADER ISOLATION VALVE
- ROAD CROSSING
- CS-1 — CONDENSATE SUMP
- SUBCELL BOUNDARY/ LANDFILL LIMITS
- LFG HEADER/LATERAL
- AIR SUPPLY LINE
- DEWATERING DISCHARGE
- E- — BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER
- AR-7 — ACCESS RISER

0 50 100 200
1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: STAGE 2: SUBCELLS 4 - LIFT 2 TARGETS

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-4757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJECT NO.	DWN. BY:	Q/A REVIEW BY:
09216163.00	AFD	PTL
DSN. BY:	CHK. BY:	APP. BY:
AFD	DRC	DRC

CADD FILE: 216163_00 PROPOSED PERM.
DATE: MARCH 2017
SCALE: AS SHOWN
DRAWING NO. 5
SHEET 5 of 16

C:\Users\3661afd\Desktop\216163_00 Proposed Perm..dwg Mar 02, 2017 - 3:53pm Layout Name: ST. 2 SUB-CELLS 4 LIFT 1 By: 3661afd

SUBCELL 4 LEACHATE MANHOLES

SUBCELL 3 LEACHATE MANHOLES

PHASE II LEACHATE PUMP STATION

TEMPORARY ABOVE GROUND LEACHATE CONNECTION LINE

HORIZONTAL COLLECTOR WELLHEAD (TYP.) SEE DETAIL 2/7|13

HORIZONTAL COLLECTOR TRENCH (TYP.) SEE DETAIL 1/6|13

HC-1 HC-2 HC-3 HC-4 HC-5 HC-6 HC-7

PHASE II (ACTIVE)

SUBCELL 4 SUBCELL 3 SUBCELL 2 SUBCELL 1

PHASE I (CLOSED)

LIMITS OF PHASE I/II OVERLAY LINER (60 MIL TPO)

SUBCELL 4 CLEANOUT

SUBCELL 3 CLEANOUT

SUBCELL 2 CLEANOUT

SUBCELL 1 CLEANOUT

N 1,044,000 N 1,043,750 N 1,043,500 N 1,043,250 N 1,043,000 N 1,042,750 N 1,042,500

E 527,500 E 527,750 E 528,000 E 528,250 E 528,500 E 528,750 E 529,000 E 529,250 E 529,500 E 529,750 E 530,000 E 530,250

NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
4. FUTURE CONTOURS SHOW IN SUBCELLS 1-4 IN PHASE II: SUBCELL 3 AND 4 IN LIFT 4, SUBCELL 1 AND 2 IN LIFT 5.

LEGEND:

- RW-89 — EXIST. REMOTE WELL
- △ — EXIST. COUNTY SURVEY POINT
- EXIST. LFG HEADER/LATERAL
- EXIST. AIR SUPPLY LINE
- EXIST. DEWATERING DISCHARGE
- HC-1 — HORIZONTAL COLLECTOR/REMOTE WELLHEAD
- CW-71 — CAISSON WELL
- EW-89 — EXTRACTION WELL
- AR-7 — ACCESS RISER
- H.P. — PIPING HIGH POINT
- HEADER ISOLATION VALVE
- ROAD CROSSING
- CS-1 — CONDENSATE SUMP
- SUBCELL BOUNDARY/ LANDFILL LIMITS
- LFG HEADER/LATERAL
- AIR SUPPLY LINE
- DEWATERING DISCHARGE
- BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER
- AR-7 — ACCESS RISER

N

0 50 100 200

1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: STAGE 3A: SUBCELLS 3 AND 4 - LIFT 4 HORIZONTAL COLLECTORS

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DSN. BY:	DWN. BY:	CHK. BY:	QA/QC BY:	APP. BY:
216163.00	AFD	AFD	DRC	DTL	DRC

CADD FILE: 216163_00 PROPOSED PERM.

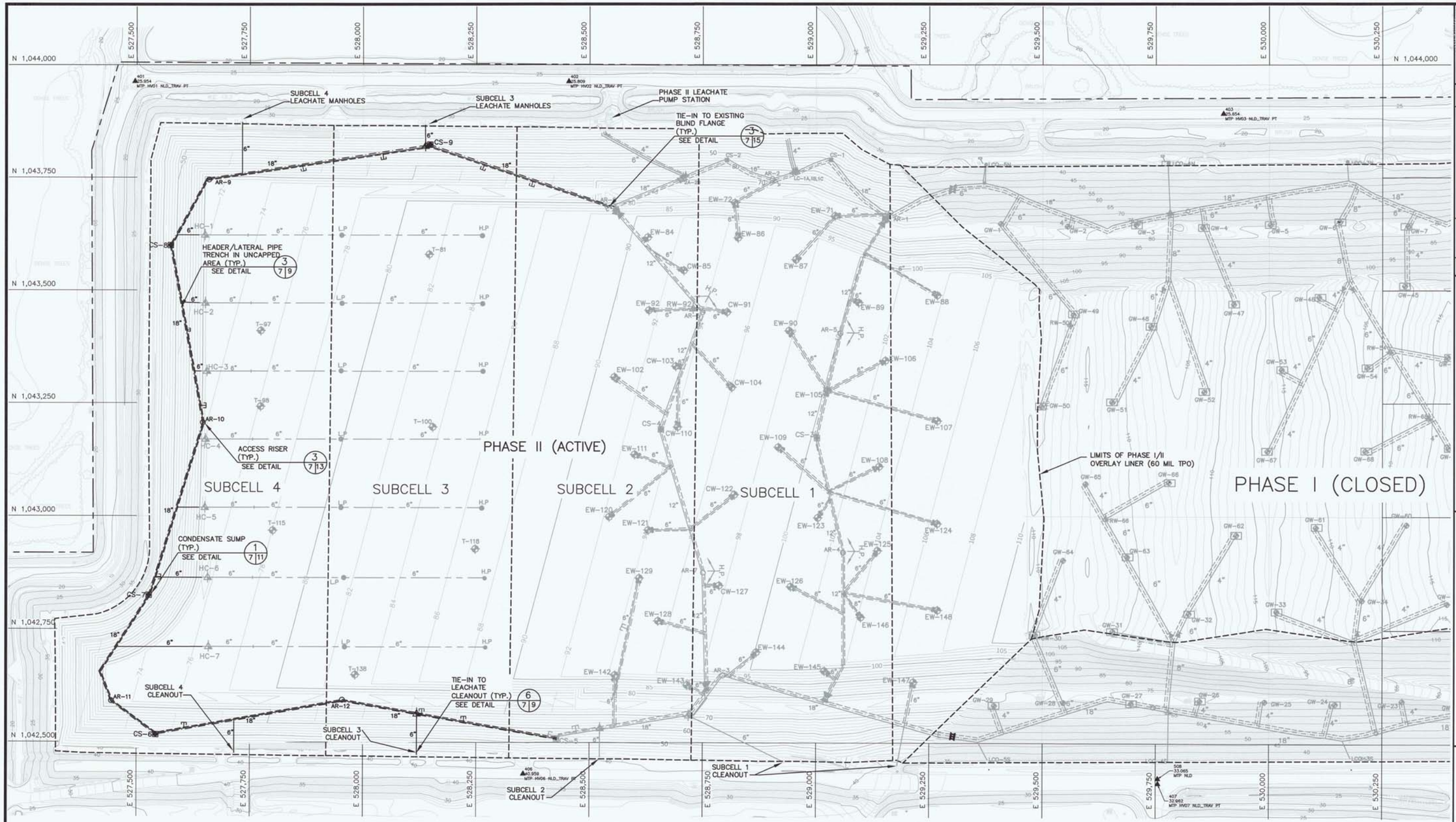
DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. 6

SHEET 6 of 16

C:\Users\3661afd\Desktop\216163_00 Proposed Perm..dwg Mar 02, 2017 - 3:55pm Layout Name: ST. 3A SUB-CELLS 3 & 4 LIFT 4 By: 3661afd



NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 38133 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
4. FUTURE CONTOURS SHOWN IN SUBCELLS 1-4 IN PHASE II: SUBCELL 3 AND 4 IN LIFT 5, SUBCELL 1 AND 2 IN LIFT 5.

LEGEND:

- RW-89 — EXIST. REMOTE WELL
- △ — EXIST. COUNTY SURVEY POINT
- EXIST. LFG HEADER/LATERAL
- EXIST. AIR SUPPLY LINE
- EXIST. DEWATERING DISCHARGE
- HC-1 — HORIZONTAL COLLECTOR/REMOTE WELLHEAD
- CW-71 — CAISSON WELL
- EW-89 — EXTRACTION WELL
- AR-7 — ACCESS RISER
- H.P. — PIPING HIGH POINT
- HEADER ISOLATION VALVE
- ROAD CROSSING
- CS-1 — CONDENSATE SUMP
- SUBCELL BOUNDARY/ LANDFILL LIMITS
- LFG HEADER/LATERAL
- AIR SUPPLY LINE
- DEWATERING DISCHARGE
- E- — BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER
- AR-7 — ACCESS RISER

N

0 50 100 200
1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: STAGE 3B: SUBCELLS 3 AND 4 - LIFT 5 HEADER

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-5757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DSN. BY:	DWN. BY:	Q/A RVW BY:	APP. BY:
09216163.00	AFD	AFD	CFL	DRC

CHK. BY: DRC

CADD FILE: 216163_00 PROPOSED PERM.

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. 7

SHEET 7 of 16

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TIE-IN TO EXISTING BLIND FLANGE (TYP.) SEE DETAIL 3/8 15

SUBCELL 4 LEACHATE MANHOLES

SUBCELL 3 LEACHATE MANHOLES

PHASE II LEACHATE PUMP STATION

4/8 9 STUB-UP (TYP.) SEE DETAIL

HEADER/LATERAL TRENCH (TYP.) SEE DETAIL 3/8 9

1/8 11 CONDENSATE SUMP (TYP.) SEE DETAIL

1/8 12 LFG LATERAL TIE-IN WITH TEE (TYP.) SEE DETAIL

3/8 12 AIR LINE ISOLATION VALVE (TYP.) SEE DETAIL

2/8 12 HEADER ISOLATION VALVE SEE DETAIL

4/8 12 DEWATERING LINE ISOLATION VALVE (TYP.) SEE DETAIL

SUBCELL 4 CLEANOUT

SUBCELL 3 CLEANOUT

SUBCELL 2 CLEANOUT

SUBCELL 1 CLEANOUT

PHASE II (ACTIVE)

SUBCELL 4

SUBCELL 3

SUBCELL 2

SUBCELL 1

PHASE I (CLOSED)

LIMITS OF PHASE I/II OVERLAY LINER (60 MIL TPO)

N 1,044,000 | N 1,043,750 | N 1,043,500 | N 1,043,250 | N 1,043,000 | N 1,042,750 | N 1,042,500

E 527,500 | E 527,750 | E 528,000 | E 528,250 | E 528,500 | E 528,750 | E 529,000 | E 529,250 | E 529,500 | E 529,750 | E 530,000 | E 530,250

NOTES:

1. LIFT SEQUENCE IN ACCORDANCE WITH THE PHASE II STAGING PLANS BY HDR ENGINEERING, DATED DECEMBER 1, 2014.
2. TOPOGRAPHY OUTSIDE OF LIFT SEQUENCE PROVIDED BY KUCERA INTERNATIONAL INC. 381.33 WESTERN PARKWAY WILLOUGHBY, OH 44094 (440) 975-4230 DATED: DECEMBER 3, 2016
3. CONTROL POINTS PROVIDED BY STANTEC, IN A DRAWING ENTITLED, "CONTROL POINTS," DATED JULY 8, 2016.
4. FUTURE CONTOURS SHOWN IN SUBCELLS 1-4 IN PHASE II: LIFT 5.

LEGEND:

- RW-89 — EXIST. REMOTE WELL
- △ — EXIST. COUNTY SURVEY CONTROL POINT
- EXIST. LFG HEADER/LATERAL
- EXIST. AIR SUPPLY LINE
- EXIST. DEWATERING DISCHARGE
- HC-1 — HORIZONTAL COLLECTOR/REMOTE WELLHEAD
- CW-71 — CAISSON WELL
- EW-89 — EXTRACTION WELL
- AR-7 — ACCESS RISER
- H.P. — PIPING HIGH POINT
- HEADER ISOLATION VALVE
- ROAD CROSSING
- CS-1 — CONDENSATE SUMP
- SUBCELL BOUNDARY/ LANDFILL LIMITS
- LFG HEADER/LATERAL
- AIR SUPPLY LINE
- DEWATERING DISCHARGE
- BLIND FLANGE FOR FUTURE EXPANSION
- 18" — PIPE DIAMETER
- AR-7 — ACCESS RISER

N

0 50 100 200

1" = 100'

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: STAGE 4: FINAL LIFT LFG WELLS

PROJECT TITLE: PHASE II LFGCCS EXPANSION

CLIENT: SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DSN. BY:	DWN. BY:	S/A RVW BY:
09216163.00	AFD	CFL	
	CHK. BY:	APP. BY:	
	DRC	DRC	

CADD FILE: 216163_00 PROPOSED PERM

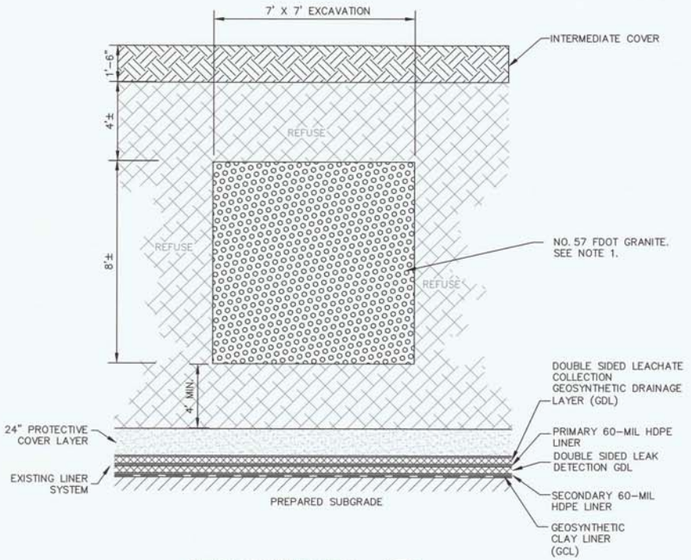
DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. 8

SHEET 8 of 16

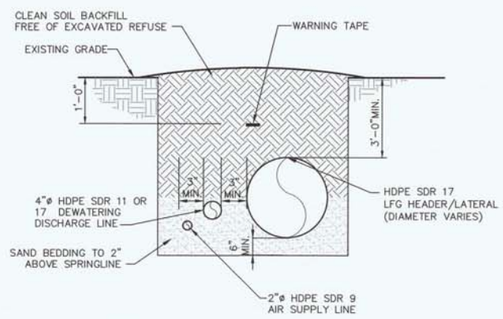
C:\Users\3661ofd\Desktop\216163_00 Proposed Perm..dwg Mar 02, 2017 - 3:57pm Layout Name: ST. 4 SUB-FINAL LIFT By: 3661ofd



LFG TARGET DETAIL (5 / 3,5 | 9)
NOT TO SCALE

NOTES:

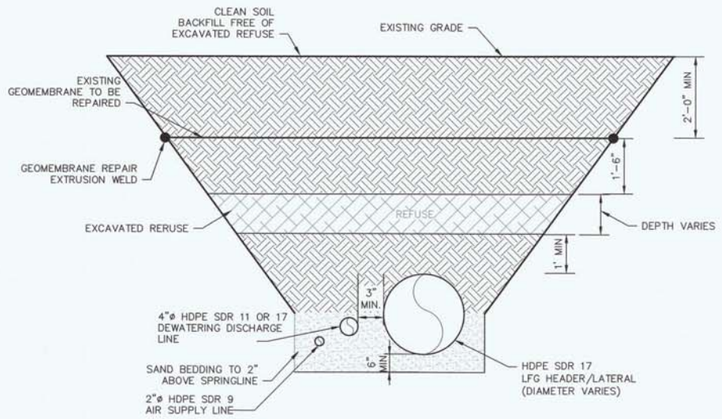
1. LFG TARGET WILL BE EXCAVATED MAINTAINING A MINIMUM 4' OFFSET FROM TOP OF PROTECTIVE COVER SAND.



NOTES:

1. WARNING TAPE TO BE MIN. 3" WIDE AND IMPRINTED WITH "GAS LINE BURIED BELOW."
2. ALL HEADER AND LATERAL PIPE TO BE INSTALLED AT 5% MIN.
3. THE NUMBER AND TYPES OF PIPES INSTALLED IN THE TRENCH MAY VARY, REFER TO SITE PLAN.
4. ALL MAIN HEADER PIPING TO BE INSTALLED AS 18" DIAMETER SDR 17 HDPE. ALL CROSSOVER HEADER PIPING TO BE 12" DIAMETER SDR 17 HDPE. REFER TO SITE PLAN FOR OTHER PIPE DIMENSIONS.
5. 2" AIR AND 4" DEWATERING LINES TO BE INSTALLED ON THE UPHILL SIDE OF THE LFG HEADER.

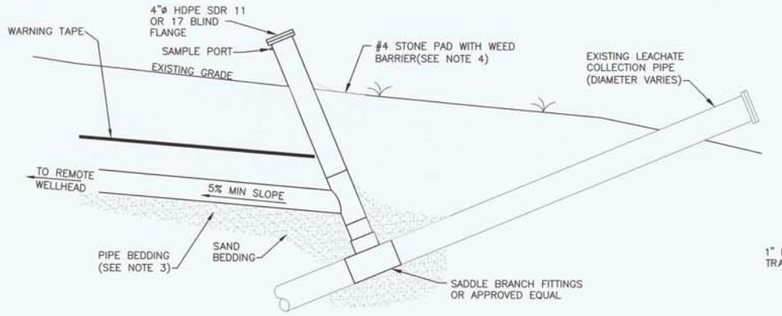
HEADER/LATERAL PIPE TRENCH IN UNCAPPED AREA DETAIL (3 / 4,8 | 9)
NOT TO SCALE



NOTES:

1. ALL LATERALS SHALL BE INSTALLED AT 5% SLOPE.
2. THE NUMBER AND TYPES OF PIPES INSTALLED IN THE TRENCH MAY VARY, REFER TO SITE PLAN.
3. 2" AIR AND 4" DEWATERING LINES TO BE INSTALLED ON THE UPHILL SIDE OF THE LFG HEADER.
4. THE EXISTING TPO IS TO BE PRESERVED TO THE EXTENT POSSIBLE AND "FLAPPED BACK" WHILE WORK IS BEING CONDUCTED.

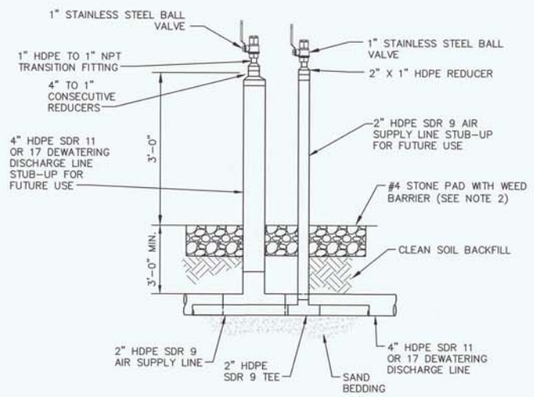
HEADER/LATERAL PIPE TRENCH IN CAPPED AREA DETAIL (1 / 4 | 9)
NOT TO SCALE



TIE-IN TO EXISTING LEACHATE CLEANOUT PIPE (6 / 4,7,8 | 9)
NOT TO SCALE

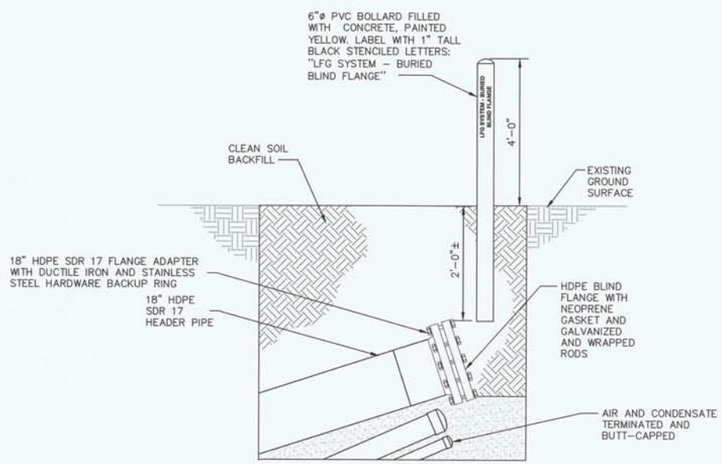
NOTES:

1. WARNING TAPE TO BE INSTALLED WITH A MIN. 3" WIDE AND IMPRINTED WITH "GAS LINE BURIED BELOW."
2. ALL HEADER AND LATERAL TO BE INSTALLED AT 5% MIN. SLOPE UNLESS APPROVED IN ADVANCE BY THE ENGINEER.
3. 1' MIN. OF SAND TO BE PLACED BELOW EACH BRANCH SADDLE. SAND INSTALLED SO IT EXTENDS 3' MIN. IN EACH DIRECTION OF THE BRANCH SADDLE AND HAND-TAMPED PROVIDING SUPPORT TO ALL POINTS OF THE BRANCH SADDLE.
4. #4 STONE PAD TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER USED TO SEPARATE GRAVEL AND CLEAN BACKFILL.



NOTES:
1. ALL 2" AND 4" PIPE AND FITTINGS TO BE BUTT WELDED.
2. #4 STONE PAD TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER TO BE INSTALLED TO SEPARATE GRAVEL AND CLEAN BACKFILL.

STUB-UP DETAIL (4 / 4,8 | 9)
NOT TO SCALE



NOTES:

1. GALVANIZED THREADED RODS, WASHERS, NUTS AND BACKUP RINGS TO BE THOROUGHLY COATED WITH POLYCOAT RUBBERIZED PRIMER, OR EQUAL, AFTER TIGHTENING BOLTS. FLANGE TO BE WRAPPED IN PLASTIC WRAP PRIOR TO BACKFILLING.
2. FLANGE TO BE INSTALLED WITH THE PROPER SLOPE TO PROVIDE FOR FUTURE CONDENSATE DRAINAGE.
3. 2" AIR AND 4" CONDENSATE LINE TO BE BUTT-CAPPED.

BURIED BLIND FLANGE FOR FUTURE EXPANSION DETAIL (2 / 4,8 | 9)
NOT TO SCALE

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 1**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3920 RIGA BLVD., SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO: 09216163.00
DSN. BY: AFD
DRW. BY: AFD
CHK. BY: DRC
Q/A BY#: CFL
APP. BY: DRC

CADD FILE: 216163_00 DETL
DATE: MARCH 2017
SCALE: AS SHOWN
DRAWING NO. 9
SHEET 9 of 16

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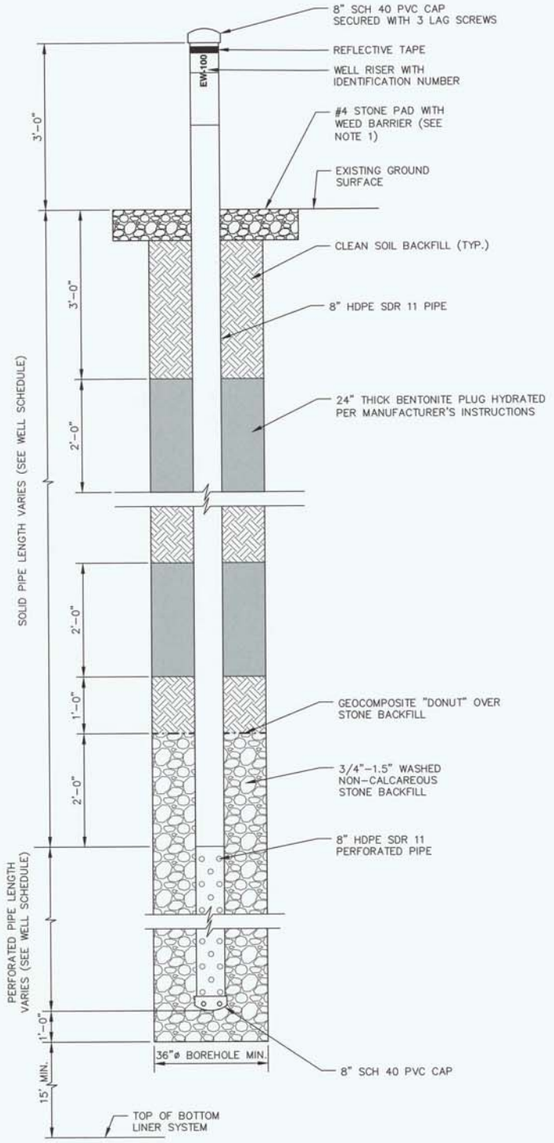


LFG EXTRACTION WELL DETAIL

NOT TO SCALE

2 | 4,8|10

NOTES:

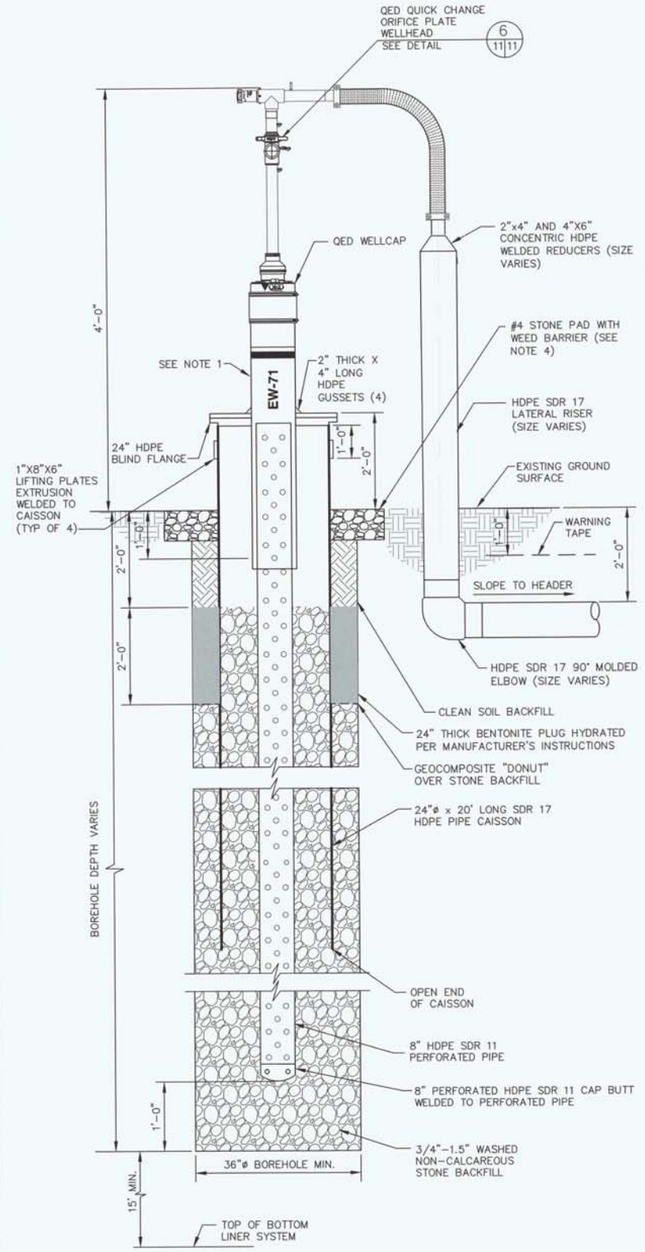
1. #4 STONE PAD TO BE 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER SEPARATES GRAVEL AND CLEAN BACKFILL.

WELL SCHEDULE

Well ID	Stage	Northing	Easting	Approx. Ground Surface	Approx. Base Grade Elevation	Well Depth	Slotted Pipe Length	Solid Pipe Length Below Grade	Solid Pipe Length Above Grade	Thickness of Gravel Pack
				(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
EW-71	1B	1043665.04	529041.47	78	28	35	14	20	3	17
EW-72	1B	1043693.76	528820.47	80	28	37	16	20	3	19
EW-73	2	1043686.54	528510.48	82	27	41	20	20	3	23
EW-74	2	1043691.96	528361.05	81	29	38	17	20	3	20
EW-75	2	1043703.15	528225.42	78	27	36	15	20	3	18
EW-76	2	1043701.51	528080.10	79	27	38	17	20	3	20
EW-77	2	1043699.40	527879.19	81	28	38	17	20	3	20
EW-78	2	1043640.09	527736.57	94	27	53	32	20	3	35
EW-79	2	1043555.80	527850.04	112	30	67	46	20	3	49
EW-80	2	1043571.77	528012.03	115	29	71	50	20	3	53
EW-81	2	1043579.74	528145.68	105	27	63	42	20	3	45
EW-82	2	1043550.71	528299.60	115	30	70	49	20	3	52
EW-83	2	1043565.37	528466.27	112	29	68	47	20	3	50
EW-84	1B	1043617.68	528628.15	90	28	47	26	20	3	29
CW-85	1B	1043544.27	528707.77	92	31	47	26	20	3	29
EW-86	1B	1043616.28	528827.39	94	29	51	30	20	3	33
EW-87	1B	1043568.16	528955.25	97	28	55	34	20	3	37
EW-88	1B	1043489.15	529267.10	103	61	27	6	20	3	9
EW-89	1B	1043472.83	529093.78	100	31	55	34	20	3	37
EW-90	1B	1043410.28	528939.79	98	29	54	33	20	3	36
CW-91	1B	1043451.56	528803.04	95	31	49	28	20	3	31
RW-92	1B	1043455.79	528630.53	92	30	47	26	20	3	29
EW-93	2	1043429.76	528428.07	115	31	69	48	20	3	51
EW-94	2	1043380.47	528272.34	113	32	66	45	20	3	48
EW-95	2	1043386.55	528124.24	108	30	63	42	20	3	45
EW-96	2	1043419.49	527966.63	118	32	71	50	20	3	53
EW-97	2	1043410.12	527774.05	107	30	62	41	20	3	44
EW-98	2	1043242.79	527773.42	107	32	60	39	20	3	42
EW-99	2	1043268.61	527969.75	118	34	70	49	20	3	52
EW-100	2	1043197.31	528153.32	107	32	60	39	20	3	42
EW-101	2	1043218.88	528384.89	118	34	70	49	20	3	52
EW-102	1B	1043307.80	528554.30	90	31	44	23	20	3	26
CW-103	1B	1043331.93	528689.80	93	33	46	25	20	3	28
CW-104	1B	1043285.19	528813.68	96	33	49	28	20	3	31
EW-105	1B	1043277.92	529025.05	100	32	53	32	20	3	35
EW-106	1B	1043344.49	529152.83	102	33	54	33	20	3	36
EW-107	1B	1043211.06	529267.43	105	61	29	8	20	3	11
EW-108	1B	1043109.62	529138.79	103	36	53	32	20	3	35
EW-109	1B	1043152.69	528916.30	99	32	52	31	20	3	34
CW-110	1B	1043197.41	528693.97	94	34	45	24	20	3	27
EW-111	1B	1043136.45	528599.13	93	33	45	24	20	3	27
EW-112	2	1043118.81	528259.02	113	35	63	42	20	3	45
EW-113	2	1043118.57	528012.71	116	35	66	45	20	3	48
EW-114	2	1043113.58	527851.22	113	34	64	43	20	3	46
EW-115	2	1042968.22	527800.24	110	34	61	40	20	3	43
EW-116	2	1042954.19	527957.18	118	36	67	46	20	3	49
EW-117	2	1042979.50	528112.80	110	33	62	41	20	3	44
EW-118	2	1042928.49	528247.23	113	35	63	42	20	3	45
EW-119	2	1043008.20	528382.84	118	35	68	47	20	3	50
EW-120	1B	1042998.39	528542.97	92	33	45	24	20	3	27
EW-121	1B	1042969.36	528629.01	94	35	45	24	20	3	27
CW-122	1B	1043047.46	528819.40	97	35	48	27	20	3	30
EW-123	1B	1042996.59	529003.41	101	34	53	32	20	3	35
EW-124	1B	1042983.64	529266.94	107	60	32	11	20	3	14
EW-125	1B	1042924.77	529135.32	104	37	53	32	20	3	35
EW-126	1B	1042845.06	528943.74	101	34	53	32	20	3	35
CW-127	1B	1042847.27	528785.74	98	36	47	26	20	3	29
EW-128	1B	1042769.39	528650.98	95	36	44	23	20	3	26
EW-129	1B	1042863.80	528609.43	94	35	44	23	20	3	26
EW-130	2	1042828.47	528376.60	118	36	67	46	20	3	49
EW-131	2	1042818.53	528248.74	113	36	62	41	20	3	44
EW-132	2	1042778.34	528147.96	109	34	60	39	20	3	42
EW-133	2	1042818.63	527998.89	117	36	66	45	20	3	48
EW-134	2	1042786.54	527844.74	113	36	62	41	20	3	44
EW-135	2	1042837.97	527693.26	86	34	38	17	20	3	20
EW-136	2	1042661.68	527607.68	93	35	44	23	20	3	26
EW-137	2	1042648.25	527825.28	89	37	38	17	20	3	20
EW-138	2	1042649.91	527982.59	91	37	39	18	20	3	21
EW-139	2	1042644.15	528133.83	89	35	40	19	20	3	22
EW-140	2	1042637.87	528289.77	89	38	37	16	20	3	19
EW-141	2	1042626.60	528434.86	86	36	35	14	20	3	17
EW-142	1B	1042649.58	528556.18	93	35	43	22	20	3	25
EW-143	1B	1042627.46	528715.39	87	40	32	11	20	3	14
EW-144	1B	1042700.31	528868.09	100	35	50	29	20	3	32
EW-145	1B	1042659.15	529018.39	98	36	47	26	20	3	29
EW-146	1B	1042777.43	529098.48	104	37	53	32	20	3	35
EW-147	1B	1042634.71	529214.99	86	45	26	5	20	3	8
EW-148	1B	1042793.32	529267.88	107	60	32	11	20	3	14
EW-149	2	1042821.67	528525.92	111	34	62	41	20	3	44
TOTALS						4040	2381	1580	237	2618

NOTES:

1. CW=CAISSON LFG EXTRACTION WELL. EW=LFG EXTRACTION WELL.



CAISSON LFG EXTRACTION WELL DETAIL

NOT TO SCALE

1 | 4|10

NOTES:

1. 6"ø HDPE SDR 17 PIPE STUB THROUGH 8" HOLE IN CENTER OF BLIND FLANGE. PIPE STUB EXTRUSION WELDED TO HDPE BLIND FLANGE AT TOP OF CAISSON.
2. CONTRACTOR SHALL TEMPORARILY CAP THE SLOTTED PIPE WHILE BACKFILLING.
3. CONTRACTOR SHALL INSTALL PVC CAP ON WELL CASING TO PREVENT FREE VENTING OF LFG PRIOR TO INSTALLING WELLHEAD.
4. #4 STONE PAD TO BE 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER SEPARATES GRAVEL AND CLEAN BACKFILL.

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 2**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJECT NO. 00216163.00 | DSN. BY: AFD | DRN. BY: AFD | CHK. BY: DRC | QA REVIEW: CFL | APP. BY: DRC

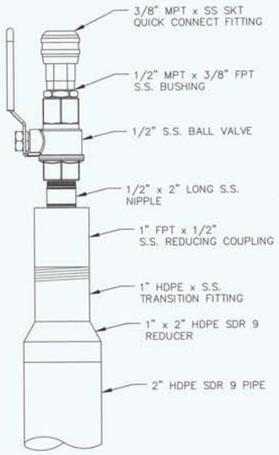
CADD FILE: 216163_00 DETL

DATE: MARCH 2017

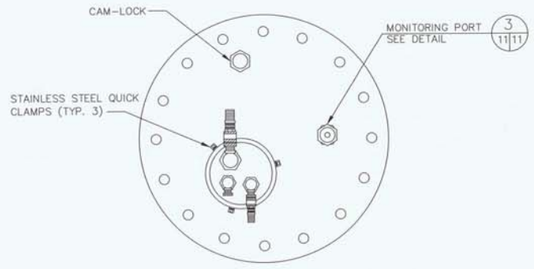
SCALE: AS SHOWN

DRAWING NO. **10**

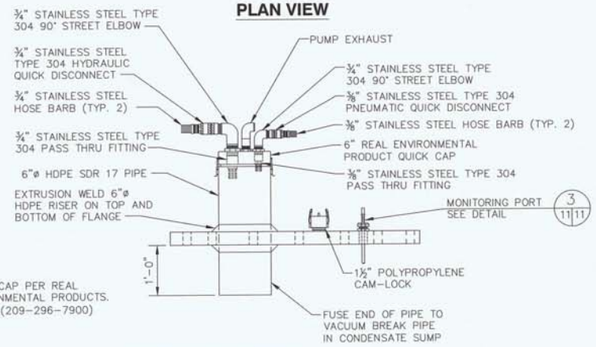
SHEET **10** of 16



AIR SUPPLY LINE VALVE DETAIL (4 | 11 | 11)
NOT TO SCALE



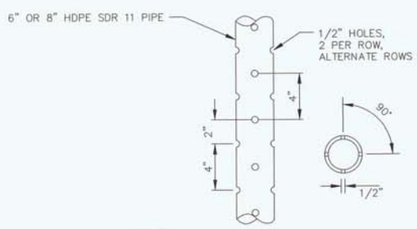
PLAN VIEW



NOTES:

1. QUICK CAP PER REAL ENVIRONMENTAL PRODUCTS. PHONE: (209-296-7900)

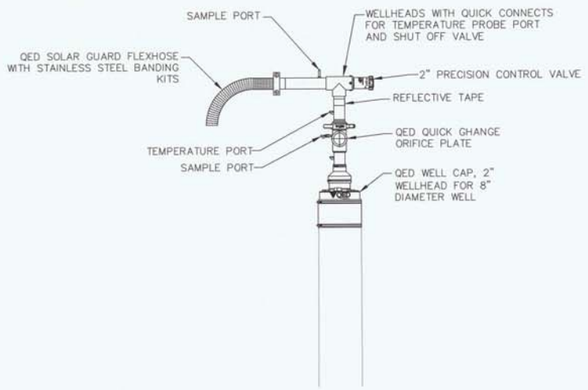
FLANGED LID WITH QUICK RELEASE CAP DETAIL (N.I.C.) (2 | 11 | 11)
NOT TO SCALE



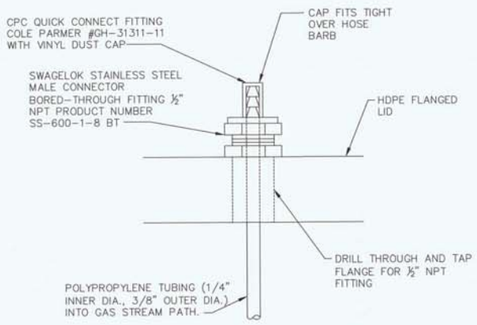
NOTES:

1. PERFORATIONS SPACED 90° APART HORIZONTALLY.
2. PERFORATIONS SPACED 4" APART VERTICALLY.
3. 90° AND 270° ROWS STAGGERED 2" BELOW 0° AND 180° ROWS.

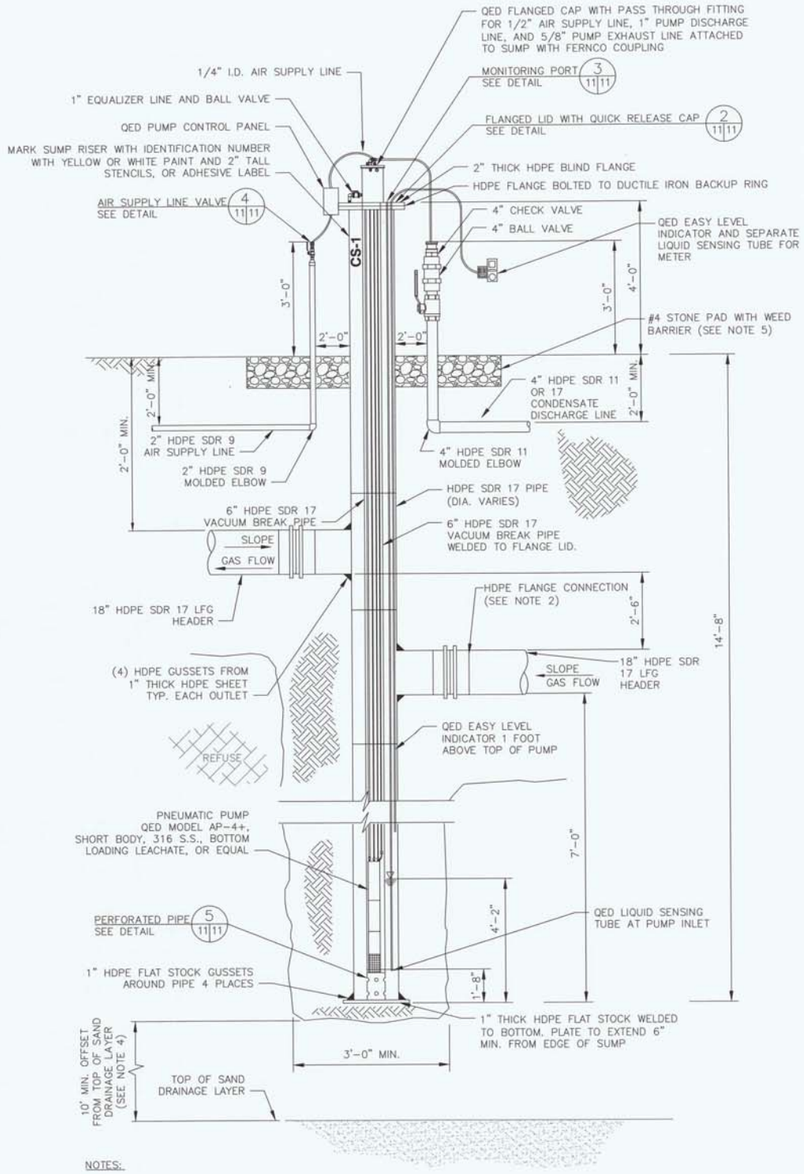
PERFORATED PIPE DETAIL (5 | 11 | 11)
NOT TO SCALE



QED PRECISION QUICK CHANGE ORIFICE PLATE WELLHEAD (6 | 11 | 11)
NOT TO SCALE



MONITORING PORT DETAIL (TYP.) (3 | 11 | 11)
NOT TO SCALE



NOTES:

1. 6"ø HDPE SDR 17 VACUUM BREAK PIPE EXTRUSION WELDED TO FLANGE LID. 1'-0" OF PIPE PROTRUDING THROUGH TOP OF FLANGE. PIPE EXTRUSION WELDED TO BOTH SIDES OF BLIND FLANGE. CENTER OF PIPE LOCATED 2" OFF CENTER OF BLIND FLANGE.
2. ENTIRE SURFACE OF BOLTS, WASHERS, NUTS AND BACKUP RINGS THOROUGHLY COATED WITH POLYCOAT RUBBERIZED PRIMER, OR EQUAL, AFTER TIGHTENING BOLTS. FLANGE WRAPPED IN PLASTIC WRAP PRIOR TO BACKFILLING.
3. CONTRACTOR SHALL VERIFY CONDENSATE SUMP CONFIGURATION IN FIELD. ADJUSTMENTS SHALL BE APPROVED BY ENGINEER PRIOR TO INSTALLATION.
4. ENGINEER SHALL APPROVE DEPTH BASED ON GROUND SURFACE ELEVATION PRIOR TO INSTALLATION.
5. #4 STONE PAD TO BE 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER SEPARATES GRAVEL AND CLEAN BACKFILL.

IN-WASTE CONDENSATE SUMP DETAIL (1 | 11 | 4,7,8)
NOT TO SCALE

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK BY

SHEET TITLE: **DETAILS - 3**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJECT NO. 216163.00 | DSN. BY: AFD | DWN. BY: AFD | CHK. BY: DRC | Q/A REVIEW BY: DTL | APP. BY: DRC

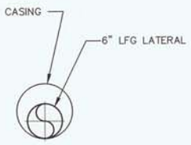
CADD FILE: 216163_00 DETL

DATE: MARCH 2017

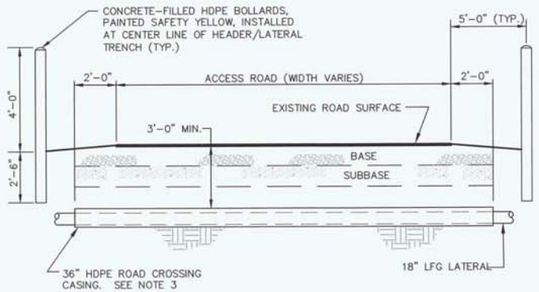
SCALE: AS SHOWN

DRAWING NO. **11**

SHEET **11** of 16



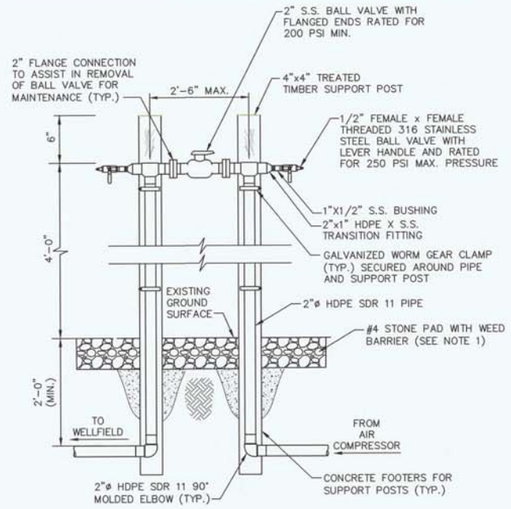
END VIEW



NOTES:

1. ROAD RESTORED TO MATCH ORIGINAL CONDITIONS.
2. BOLLARDS ARE CONCRETE-FILLED HDPE PIPE BOLLARDS 6"ø x 4'-0" TALL.
3. CASING IS 12" GREATER THAN THE CUMULATIVE DIAMETER OF THE PIPES BEING ENCASED.

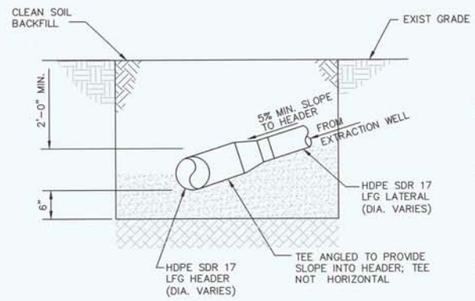
ROAD CROSSING DETAIL (5 / 4 | 12)
NOT TO SCALE



NOTES:

1. #4 STONE PADS TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER TO BE INSTALLED TO SEPARATE GRAVEL AND CLEAN BACKFILL.

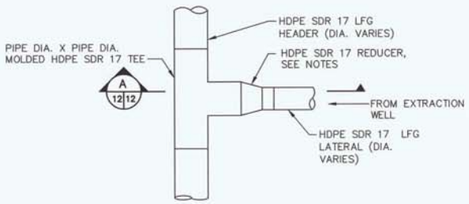
AIR LINE ISOLATION AND BLOWOFF VALVES DETAIL (3 / 4,8 | 12)
NOT TO SCALE



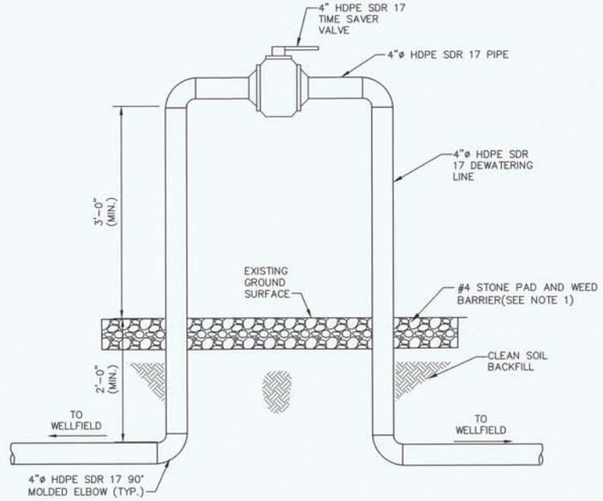
SECTION VIEW (A / 12 | 12)
NOT TO SCALE

NOTES:

1. CONSECUTIVE SIZE REDUCERS TO BE USED TO TRANSITION FROM THE MOLDED TEE TO THE LFG LATERAL.
2. MOLDED HDPE TEES INSTALLED FOR ALL TIE-INS OF LATERALS TO HEADER SMALLER THAN 12"ø. TEES ANGLED TO MAINTAIN SLOPE INTO THE HEADER AS SHOWN IN SECTION VIEW.
3. ALL HEADER NOT IN LINED AREA TO BE INSTALLED WITH A MINIMUM BURIAL DEPTH OF 2 FEET.
4. 1' MIN. OF SAND PLACED BELOW EACH TEE. THE SAND TO BE INSTALLED TO EXTEND 3' MIN. IN EACH DIRECTION OF THE TEE. SAND TO BE SLIGHTLY MOISTENED AND HAND-TAMPED PROVIDING SUPPORT TO ALL POINTS OF THE TEE. CLEAN, GRADED SOIL HAND-TAMPED ABOVE TEE (1' MIN.) BEING CAREFUL TO ELIMINATE VOIDS.



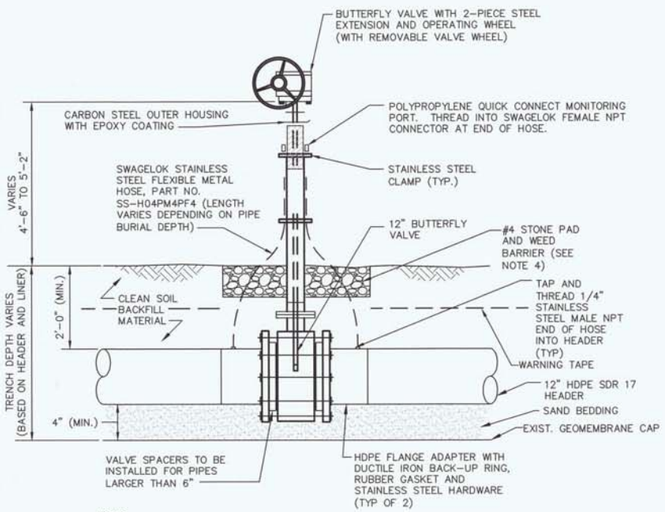
LFG LATERAL TIE-IN WITH TEE DETAIL (1 / 4,7,8 | 12)
NOT TO SCALE



NOTES:

1. #4 STONE PAD TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER TO BE INSTALLED TO SEPARATE GRAVEL AND CLEAN BACKFILL.

DEWATERING LINE ISOLATION VALVE DETAIL (4 / 4,8 | 12)
NOT TO SCALE



NOTES:

1. ENTIRE SURFACE OF BOLTS, WASHERS, NUTS AND BACKUP RINGS TO BE THOROUGHLY COATED WITH POLYCOAT RUBBERIZED PRIMER, OR EQUAL, AFTER TIGHTENING BOLTS. COATING INSTALLED WITH NO "HOLIDAYS", OR GAPS IN ITS APPLICATION.
2. FLANGE TO BE WRAPPED IN PLASTIC PRIOR TO BACK FILLING.
3. ALL HEADER NOT IN LINED AREA TO BE INSTALLED WITH A MINIMUM BURIAL DEPTH OF 2 FEET.
4. #4 STONE PAD TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER TO BE INSTALLED TO SEPARATE GRAVEL AND CLEAN BACKFILL.

HEADER ISOLATION VALVE DETAIL (2 / 4,8 | 12)
NOT TO SCALE

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 4**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO. 09216163.00
DSN. BY: AFD | DWN. BY: AFD | CHK. BY: DRC | Q/A REVIEW: DEL | APP. BY: DRC

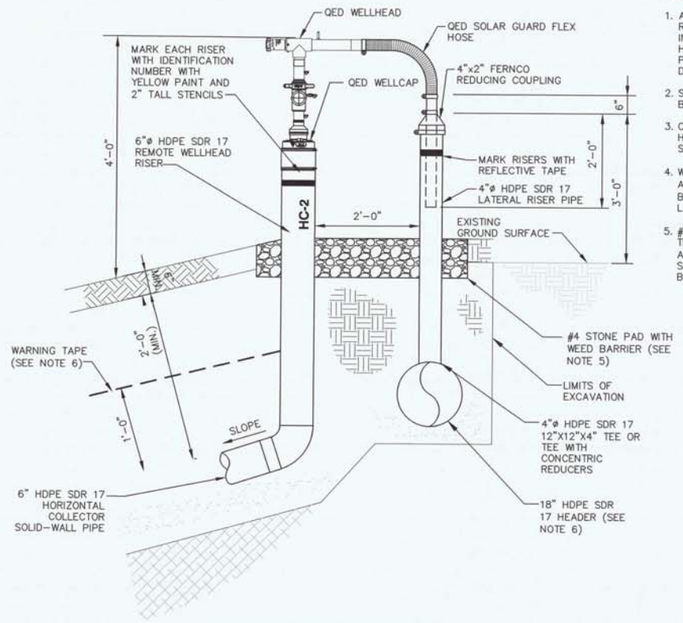
CADD FILE: 216163_00 DETL

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. **12**

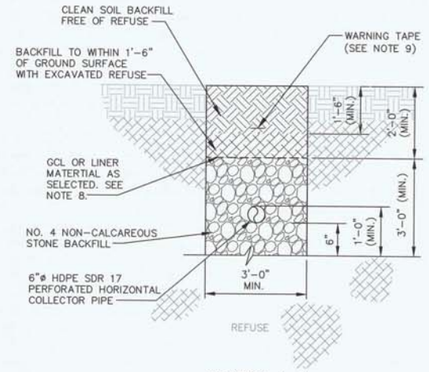
SHEET **12** of 16



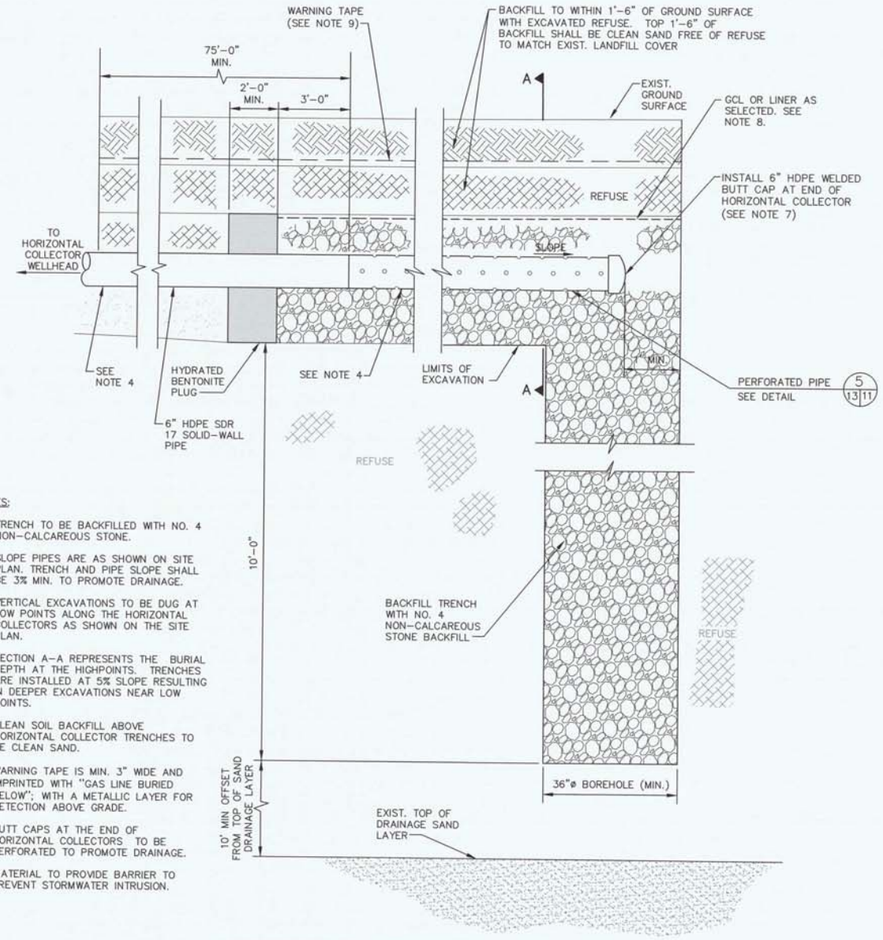
NOTES:

1. ALL HORIZONTAL COLLECTOR LATERAL RISERS AND WELLHEADS TO BE INSTALLED AT THE SIDESLOPE HIGHPOINT AS SHOWN ON THE SITE PLAN, IN ORDER TO PROMOTE DRAINAGE.
2. SIDESLOPE TRENCHES TO BE BACKFILLED WITH CLAY.
3. CLEAN SOIL BACKFILL ABOVE HORIZONTAL COLLECTOR TRENCHES SHALL BE CLEAN SAND.
4. WARNING TAPE TO BE MIN. 3" WIDE AND IMPRINTED WITH "GAS LINE BURIED BELOW"; WITH A METALLIC LAYER FOR DETECTION ABOVE GRADE.
5. #4 STONE PAD TO BE 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER SEPARATES GRAVEL AND CLEAN BACKFILL.

HORIZONTAL COLLECTOR WELLHEAD DETAIL (2 / 7 | 13)
NOT TO SCALE



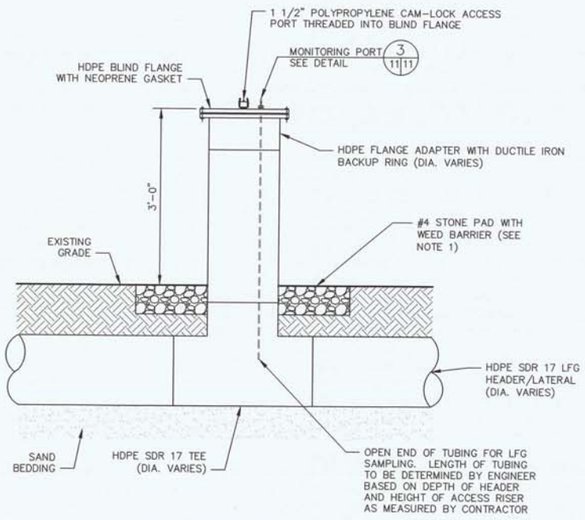
SECTION A-A



NOTES:

1. TRENCH TO BE BACKFILLED WITH NO. 4 NON-CALCAREOUS STONE.
2. SLOPE PIPES ARE AS SHOWN ON SITE PLAN. TRENCH AND PIPE SLOPE SHALL BE 3% MIN. TO PROMOTE DRAINAGE.
3. VERTICAL EXCAVATIONS TO BE DUG AT LOW POINTS ALONG THE HORIZONTAL COLLECTORS AS SHOWN ON THE SITE PLAN.
4. SECTION A-A REPRESENTS THE BURIAL DEPTH AT THE HIGHPOINTS. TRENCHES ARE INSTALLED AT 5% SLOPE RESULTING IN DEEPER EXCAVATIONS NEAR LOW POINTS.
5. CLEAN SOIL BACKFILL ABOVE HORIZONTAL COLLECTOR TRENCHES TO BE CLEAN SAND.
6. WARNING TAPE IS MIN. 3" WIDE AND IMPRINTED WITH "GAS LINE BURIED BELOW"; WITH A METALLIC LAYER FOR DETECTION ABOVE GRADE.
7. BUTT CAPS AT THE END OF HORIZONTAL COLLECTORS TO BE PERFORATED TO PROMOTE DRAINAGE.
8. MATERIAL TO PROVIDE BARRIER TO PREVENT STORMWATER INTRUSION.

HORIZONTAL COLLECTOR TRENCH DETAIL (1 / 6 | 13)
NOT TO SCALE



NOTES:

1. #4 STONE PAD TO BE 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER SEPARATES GRAVEL AND CLEAN BACKFILL.

ACCESS RISER DETAIL (3 / 13)
NOT TO SCALE
4,7,8

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 5**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT CONSULTING ENGINEERS
3012 U.S. HWY 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO. 09216163.00 | DWN. BY: AFD | CHK. BY: DRC | QA/A RVW BY: CFL | APP. BY: DRC | DSN. BY: AFD

CADD FILE: 216163_00 DETL

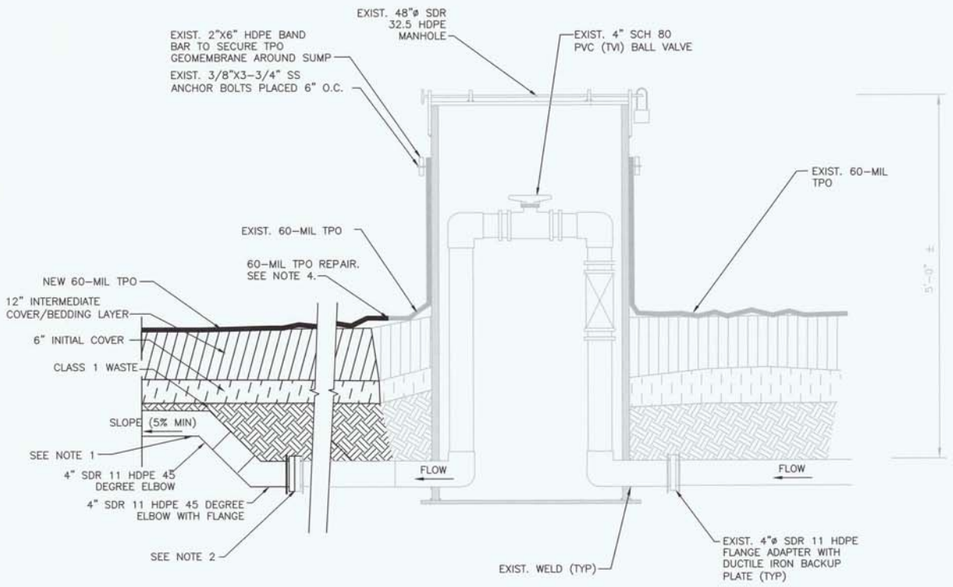
DATE: MARCH 2017

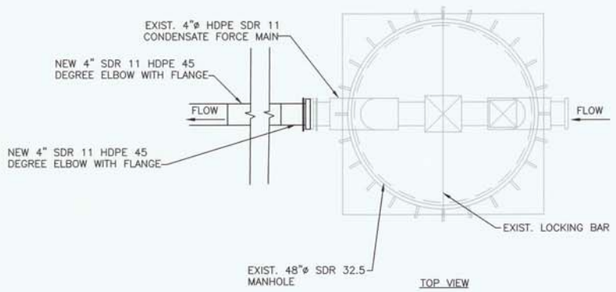
SCALE: AS SHOWN

DRAWING NO. **13**

SHEET **13** of 16

G:\PROJECT\Sarasota\09216163.00-Phase II Design_DRAWINGS\Engineering Drawings\216163_00 DETL.dwg Mar 03, 2017 - 12:39pm Layout Name: Sheet 13 By: 3661afd

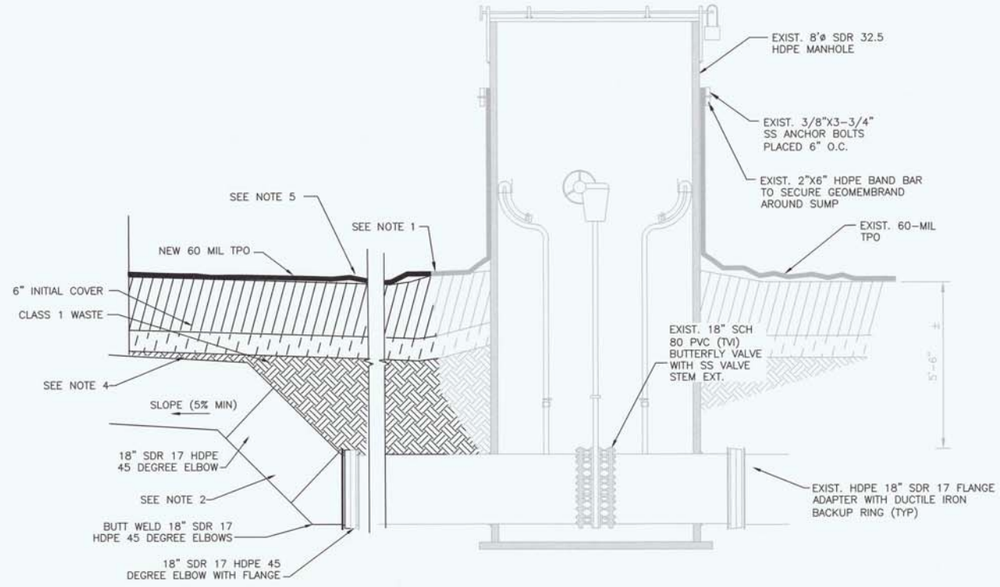


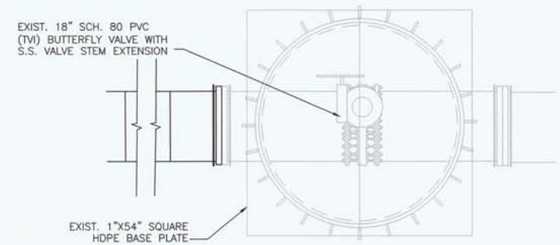


TOP VIEW

NOTES:
1. PIPE TO BE INSTALLED AT 5% SLOPE TO ACCESS RISER TO THE WEST.
2. PIPE TO BE CONNECTED NEAR PIT WITH 45° ELBOW THEN BROUGHT TO ELEVATION 3' BELOW LINER THEN PROCEEDED TO HIGH POINT AT 5% SLOPE ON PIPE.
3. PIPE TO MAINTAIN A 30" BURIAL DEPTH OUTSIDE OF LINED AREA.
4. SLACK TO BE LEFT IN REPAIR TO ALLOW FOR SLIGHT MOVEMENT OF TPO WHEN NECESSARY DUE TO EXPANSION AND CONTRACTION.

FORCEMAIN VALVE PIT TIE-IN (2 / 4 | 14)
NOT TO SCALE





TOP VIEW

NOTES:
1. EXISTING GRADE TO SLOPED FOR POSITIVE DRAINAGE IN A 1'ø SURROUNDING SURFACE EXPRESSION.
2. PIPE TO BE CONNECTED NEAR PIT WITH 45° ELBOW. PIPE THEN TO BE BROUGHT TO ELEVATION 3' BELOW LINER THEN PROCEED TO HIGH POINT WITH 5% SLOPE ON PIPE.
3. OUTSIDE OF LINER AREA A 30" BURIAL DEPTH SHALL BE MAINTAINED.
4. PIPE TO RUN BELOW OR AT BOTTOM OF ANCHOR TRENCH.
5. SLACK TO BE LEFT IN REPAIR TO ALLOW FOR SLIGHT MOVEMENT OF TPO WHEN NECESSARY DUE TO EXPANSION AND CONTRACTION.

HEADER LINE ISOLATION VALVE PIT TIE-IN (1 / 4 | 14)
NOT TO SCALE

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 6**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

SCS ENGINEERS
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PROJ. NO. 09216163.00 | DWN. BY: AFD | QA/A BY: CFL | DSN. BY: AFD | CHK. BY: DRC | APP. BY: DRC

CADD FILE: 216163_00 DETL

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. 14

SHEET 14 of 16

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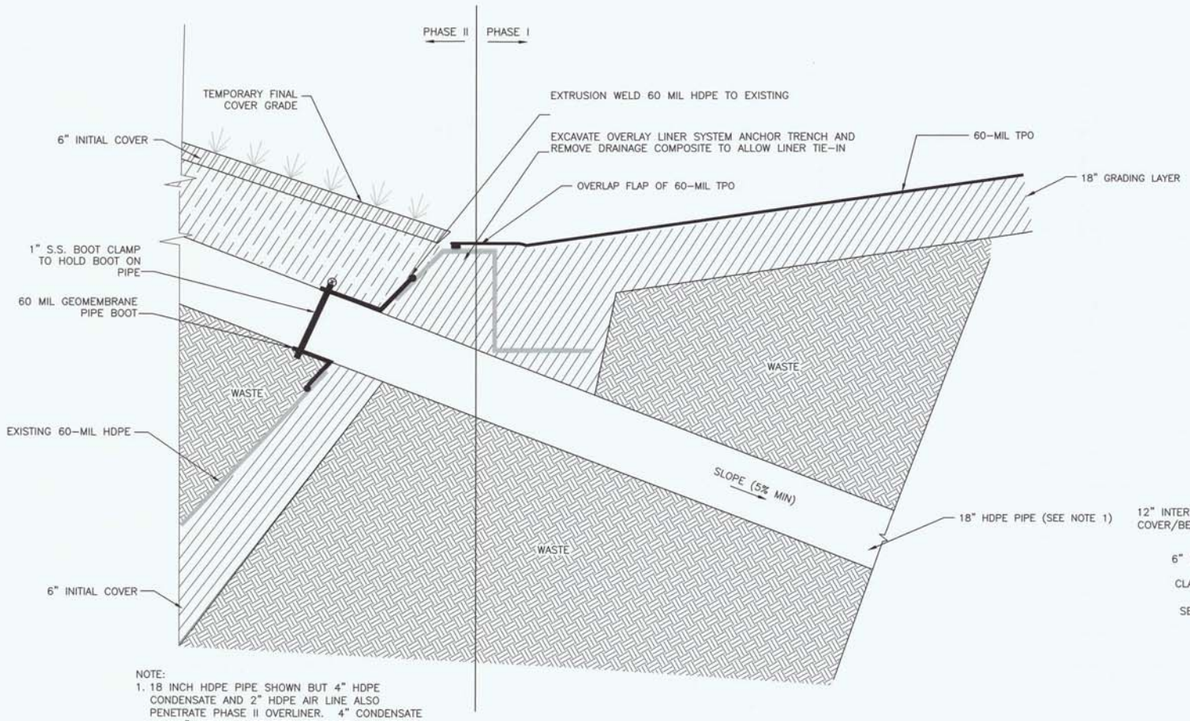
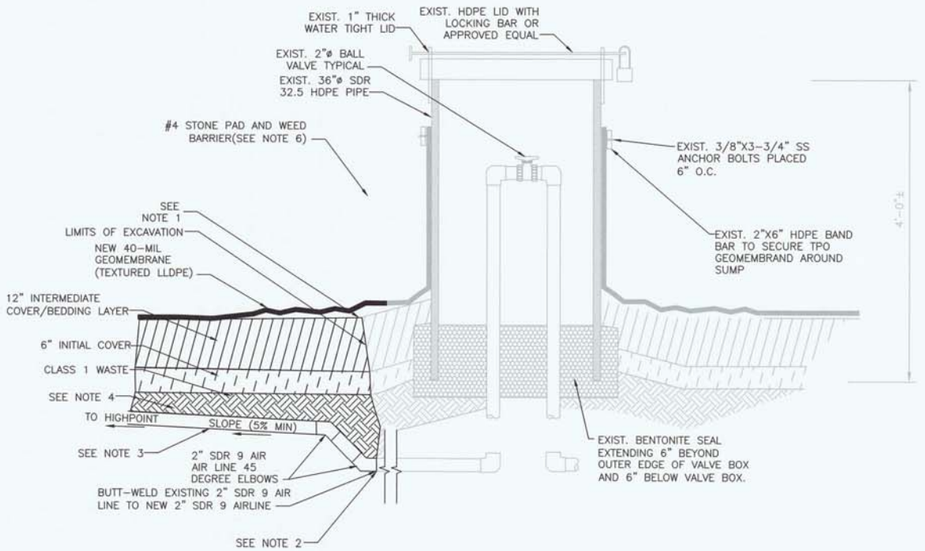
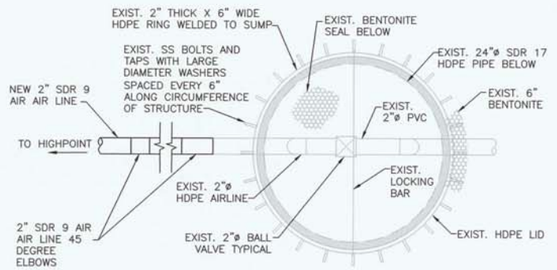


NOTE:
1. 18 INCH HDPE PIPE SHOWN BUT 4" HDPE CONDENSATE AND 2" HDPE AIR LINE ALSO PENETRATE PHASE II OVERLINER. 4" CONDENSATE AND 2" AIRLINE ALSO REQUIRE BOOT AND REPAIR THROUGH LINER.
2. ONCE PIPE IS OUT OF LINER AREA A 30" BURIAL DEPTH TO BE MAINTAINED.
3. PIPE TO RUN BELOW ANCHOR TRENCH.

PHASE I TPO COVER TRANSITION (2 / 4 | 15)
NOT TO SCALE

TIE-IN TO EXISTING BLIND FLANGE (3 / 4,7,8 | 15)
NOT TO SCALE





TOP VIEW

AIR LINE ISOLATION VALVE PIT TIE-IN (1 / 4 | 15)
NOT TO SCALE

NOTES:
1. EXISTING GRADE TO BE SLOPED FOR POSITIVE DRAINAGE IN A 1'ø SURROUNDING SURFACE EXPRESSION.
2. PIPE TO BE CONNECTED NEAR PIT WITH 45° ELBOW THEN BROUGHT TO ELEVATION 3' BELOW LINER THEN PROCEEDED TO HIGH POINT WITH 5% SLOPE ON PIPE.
3. ONCE PIPE IS IN UNLINED AREA A 30" BURIAL DEPTH TO BE MAINTAINED.
4. PIPE TO RUN BELOW OR AT BOTTOM OF ANCHOR TRENCH.
5. #4 STONE PAD TO BE INSTALLED 36" BEYOND THE RISER PIPE IN ALL DIRECTIONS AND 4" THICK. WEED BARRIER TO BE USED TO SEPARATE GRAVEL AND CLEAN BACKFILL.

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 7**
PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT
SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA

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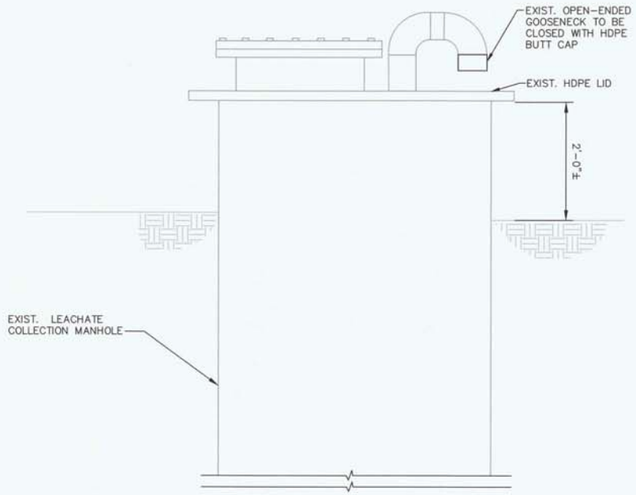
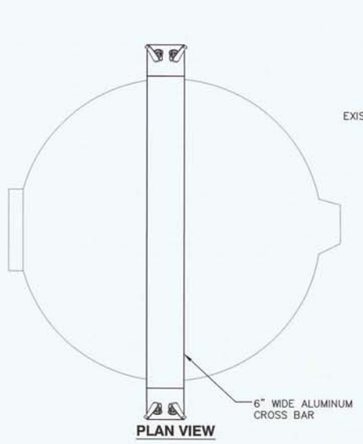
PROJ. NO. 09216163.00 | DSN. BY: AFD | DWN. BY: AFD | CHK. BY: DRC | QA/A RVW BY: CFL | APP. BY: DRC

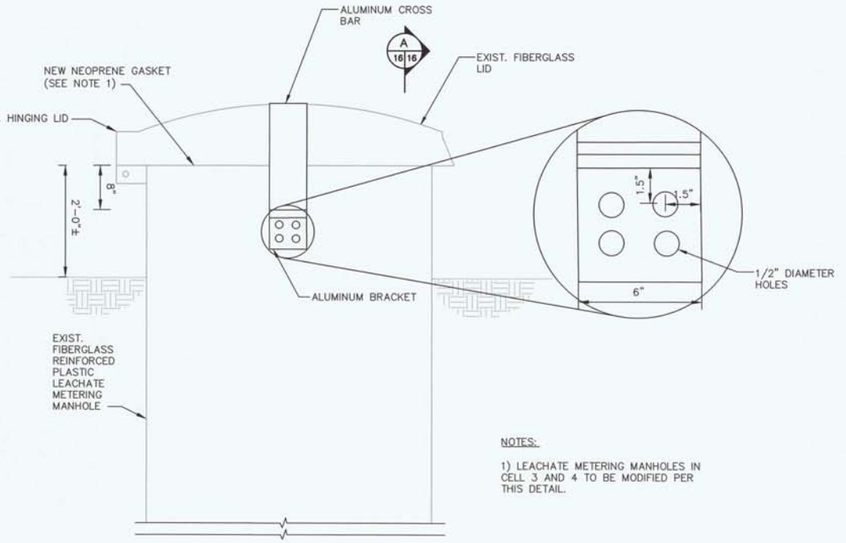
CADD FILE: 216163_00 DETL
DATE: MARCH 2017
SCALE: AS SHOWN
DRAWING NO. **15**
SHEET **15** of 16



LEACHATE COLLECTION MANHOLE MODIFICATIONS (2 / 4 | 16)
NOT TO SCALE



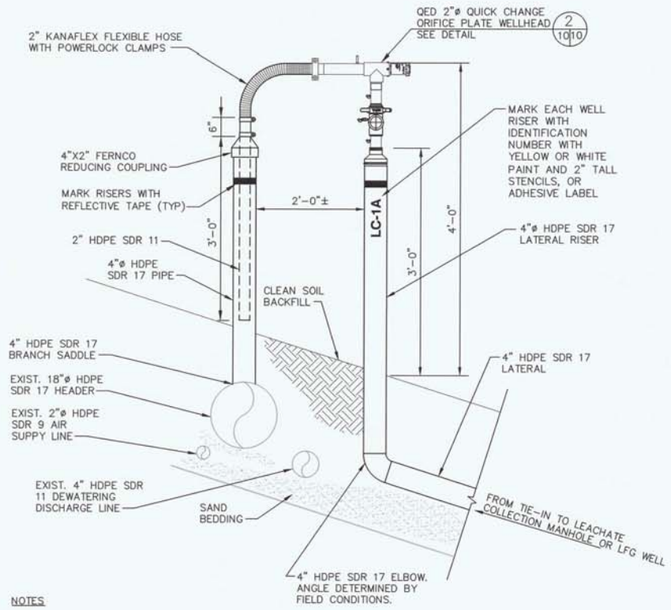
PLAN VIEW



NOTES:

1) LEACHATE METERING MANHOLES IN CELL 3 AND 4 TO BE MODIFIED PER THIS DETAIL.

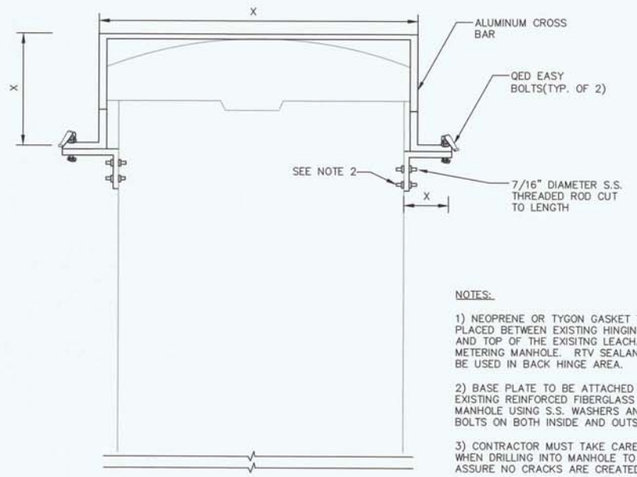
LEACHATE METERING MANHOLE MODIFICATION DETAIL (1 / 4 | 16)
NOT TO SCALE



NOTES

1. EACH CLEANOUT TIE-IN OR LFG WELL WILL HAVE A REMOTE WELLHEAD DESIGNATED FOR IT.

REMOTE LFG EXTRACTION WELLHEAD DETAIL (3 / 4 | 16)
NOT TO SCALE



NOTES:

1) NEOPRENE OR TYGON GASKET TO BE PLACED BETWEEN EXISTING HINGING LID AND TOP OF THE EXISITNG LEACHATE METERING MANHOLE. RTV SEALANT TO BE USED IN BACK HINGE AREA.

2) BASE PLATE TO BE ATTACHED TO EXISTING REINFORCED FIBERGLASS MANHOLE USING S.S. WASHERS AND BOLTS ON BOTH INSIDE AND OUTSIDE.

3) CONTRACTOR MUST TAKE CARE WHEN DRILLING INTO MANHOLE TO ASSURE NO CRACKS ARE CREATED.

SECTION VIEW (A / 16|16)
NOT TO SCALE

DESIGN DRAWINGS
MARCH 2017

DANIEL R. COOPER, P.E. LICENSE NO. 66440

REV	DATE	DESCRIPTION	CHK. BY

SHEET TITLE: **DETAILS - 8**

PROJECT TITLE: **PHASE II LFGCCS EXPANSION**

CLIENT: **SARASOTA COUNTY CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX NOKOMIS, FLORIDA**

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PROJ. NO. 09216163.00 | DWN. BY: AFD | Q/A R/W BY: CFL | SSE. BY: AFD | CHK. BY: DRC | APP. BY: DRC

CADD FILE: 216163_00 DETL

DATE: MARCH 2017

SCALE: AS SHOWN

DRAWING NO. **16**

SHEET **16** of 16

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ATTACHMENT B

ENGINEERING REPORT

SCS ENGINEERS







ENGINEERING REPORT
PHASE II LFGCCS EXPANSION

CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX
SARASOTA COUNTY, FLORIDA

Sarasota County

Prepared for:

Sarasota County
Solid Waste Operations
4001 Knights Trail Road
Nokomis, FL 34275

Prepared by:

SCS ENGINEERS
4041 Park Oaks Blvd, Suite 100
Tampa, FL 33610
(813) 621-0080

File No. 09216163.00
March 6, 2017

ENGINEERING REPORT
PHASE II LFGCCS EXPANSION

Sarasota County

Prepared for:

Sarasota County
Solid Waste Operations
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Nokomis, FL 34275

Prepared by:

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File No. 09216163.00
March 6, 2017

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TABLE OF CONTENTS

Section **Page**

APPENDICES

SECTION A INTRODUCTION

A.1 PROJECT SCOPE AND OBJECTIVES

SCS Engineers (SCS) has prepared this Engineering Report (Report) for the design and permit application of the Landfill Gas Collection and Control System (LFGCCS) Expansion into Phase II of the Central County Solid Waste Disposal Complex (CCSWDC). This Report is submitted in accordance with Rule 62-701.320(7)(d) F.A.C., to document that the proposed LFGCCS expansion into Phase II complies with the regulatory requirements of the Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP).

A.2 FACILITY DESCRIPTION

The CCSWDC is a multi-function solid waste management facility which includes a Class I disposal area and other associated solid waste collection and disposal activities. The Class I landfill currently consists of a closed Phase I (55 acres) area which began accepting waste on June 15, 1998 until June 9, 2011, and an active Phase II (63 acre) area which began accepting waste on August 16, 2010. The Class I landfill has a permitted design capacity greater than 2.5 million megagrams by mass and 2.5 million cubic meters by volume.

The existing LFGCCS on Phase I was installed in two separate sequences. The first sequence became operational on June 2010 and the second sequence was completed in March 2012. An initial expansion into Phase II was completed in January 2016 and included header, airline, condensate piping, and connections to existing Subcells 1 and 2 leachate cleanouts on the north slope of Phase II. The existing LFGCCS includes 70 vertical landfill gas extraction wells installed on Phase I, header and lateral piping of various sizes, condensate traps located at low points in the header, isolation valves for airlines, condensate, and landfill gas, condensate sumps, a Landfill Gas Recovery Facility (Plant), and a LFG flare which combusts excess gas.

Additional expansions to the existing LFGCCS will be constructed on Subcells 1 through 4 of Phase II. Presently, waste filling operations are being conducted in Subcell 3, Lift 1. As of February 2017, Subcells 1 and 2 have reached Lift 5 and received an additional partial Lift. This partial Lift corresponds with the future layout of Subcells 3 and 4, Lift 6 (top deck elevation between 95 and 105 feet) but has not reached design elevations. The north and south slopes of Subcells 1 and 2 are at or near final grade. Phase II is expected to reach final grades on the top deck on November 2024 in accordance with information provided in the Annual Topographic Survey and Remaining Site Life Report-2015, dated April 24, 2016, (Site Life Report-2015) by Sarasota County.

The County is proactively designing the LFGCCS and intends to proceed with planning, permitting, and construction of the entire Phase II LFGCCS expansion such that it will be available for operation in accordance with the proposed expansion stages as discussed in this Report.

SECTION B DESIGN APPROACH

In order to appropriately design the Phase II LFGCCS expansion stages, accurate estimates of future waste disposal rates, gas generation rates, and an efficient strategy must be developed. SCS conducted a review of the existing LFGCCS layout to include the following documents:

- Conceptual Gas Management Plan for the final build-out of Phases I and II, as submitted in the Phase II Class I Landfill Expansion drawings, dated February 2007, by HDR Engineering, Inc.,
- Phase II Expansion, Certification of Construction Completion Report, dated February 2010, and subsequent responses, by HDR Engineering, Inc.,
- Top of Protective Cover, Cells 1 through 4, Phase II Class I Expansion, Sheet C-04A, dated May 17, 2009, by Hyatt Survey Services, Inc., provided as part of the Phase II Class I Landfill Expansion As-Built drawings.
- Phase II Staging Plans, dated December 2014, by HDR Engineering, Inc.,
- Annual Topographic Survey and Remaining Site Life Report-2015, dated April 14, 2016, by Sarasota County.

Appendix 1 shows the 2008 conceptual gas management plan based on the final build-out of Phases I and II. An updated final build-out plan delineating proposed location of the LFGCCS expansion into Phase II is included in Appendix 2.

B.1 PHASE II LFGCCS EXPANSION TIMELINE ESTIMATE

The estimated timeline for construction of each stage of the proposed LFGCCS expansion will determine any operational/construction constraints based on the selected fill sequence and also determine any special considerations based on time of the year (weather). SCS utilized the projected waste volume received per year (cy/yr) at the landfill starting in 2016, as reported in the Site Life Report-2015, by Sarasota County, and compared with the estimated incremental volume for each lift, as reported in the Phase II Staging Plans, dated December 2014. Refer to Figure 1 below for estimated construction timeline.

Projected volumes presented in the Site Life Report-2015 are based on the December 15, 2015 survey, by Kucera International, and compares the existing grades and anticipated closure grades of Phase II. Current operations estimate an apparent waste disposal density of 1,428 lb/cy.

The difference between the projected waste volume and the estimated incremental volume for each lift provides the estimated timeline in months to complete the respective lift in which the LFGCCS expansion stage will be built. It is important to note that the estimated timeline is based on the projected waste disposal rate for remaining years and a density of 1,428 lbs/cy. Any

variations to assumed rates, waste density, and waste fill progression may change the projected timeline.

Based on the Site Life Report-2015, as of December 15, 2015, waste filling operations in Subcells 1 and 2 have reached Lift 4. Using the estimated waste volume for 2016 (399,119 cy/yr) and the volume to complete Subcells 1 and 2 Lift 5, starting in December 15, 2015, of 320,669.56 cy, Subcells 1 and 2, Lift 5 will reach permitted grades in approximately 10 months (320,669 cy / 399,119 cy/yr / 12 = 9.7 months) or beginning of October 2016. Based on actual landfill operations at the CCSWDC, waste filling in Subcell 3, Lift 1 began during mid October 2016, therefore, the lift required for Stage 1A construction (Subcells 1 and 2, Lift 5) is already available and will not impact waste filling operations or Stage 1B construction. The **LFGCCS Stage 1A expansion** is estimated to begin in **August 2017**.

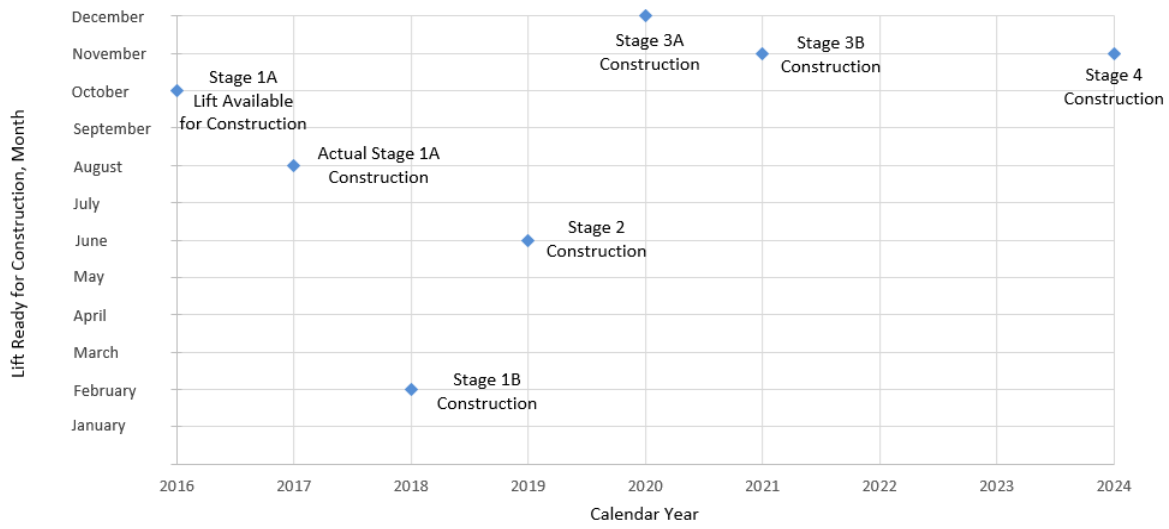
Following the same methodology, Subcell 3, Lift 2 is estimated to reach permitted grades in mid-January 2018; therefore, the landfill gas targets as part of the **LFGCCS Stage 1B expansion** may be installed in Subcell 3, Lift 2 before the Subcell 3, Lift 3 starts and impacts construction operations.

In accordance with the current approved Phase II Staging Plans, filling in Subcell 3 will include Lifts 1 through 3 before moving into Subcell 4. The **LFGCCS Stage 2 expansion** may begin when Subcell 4, Lift 2 have reached permitted grades in June 2019; therefore, the landfill gas targets may be installed in Subcell, Lift 2 before the Subcell 4, Lift 3 starts and impacts construction operations.

The **LFGCCS Stage 3A expansion** may begin when Subcells 3 and 4, Lift 4 have reached permitted grades in **December 2020,** the **LFGCCS Stage 3B expansion** may begin when Subcells 3 and 4, Lift 5 have reached permitted grades in **November 2021**, and the final **LFGCCS Stage 4 expansion** may begin when Subcells 1 through 4, have reached near final permitted grades in **November 2024**.

Note that in accordance with Section K.2.f of the currently approved Operations Plan, dated August 2016, it is the County's intent to temporarily stop operations in Phase II after completion of Lift 7 and continue landfill operations in the future Phase III if available. By leaving Phase II with only the final lift remaining, waste placed in Phase II will be allowed to settle over time and provide the County with additional airspace in Phase II. Therefore, construction timeline for the **LFGCCS Stage 4 expansion** will be dependent upon completion of the final lift in Phase II.

Figure 1. **Estimated Construction Timeline**



B.2 PHASE II LFGCCS EXPANSION DESIGN

The design, location, number of gas extraction wells, and conveyance components proposed for each stage of the Phase II LFGCCS expansion has been evaluated to provide maximum landfill gas collection efficiency, flexibility and control in the application of vacuum to the vertical extraction wells, and operation based on the estimated fill sequences. The final layout and exact location of gas extraction wells and collection piping may vary slightly based on existing field conditions, however, the functionality of the system will remain as presented herein. Refer to permit drawings, Attachment A, for additional clarification on respective Stage construction.

The **LFGCCS Stage 1A** expansion, Sheet 3, Attachment A, includes installing a header line, air supply line, and condensate discharge line extensions connected to existing blind flanges located at the north slope of Phase II Subcell 2 (vicinity of remote wellhead LC-2A and 2B) and the southwest corner of Phase I (vicinity of Gas Well GW-29). The header, air supply, and condensate lines will be extended to the west end of both Subcell 2 north and south slopes. Thirty-one (31) new gas extraction wells and seven (7) new raisable gas extraction wells (Caisson wells) are included as part of the LFGCCS Stage 1B expansion. The Caisson wells will continue to be raised as the waste filling progresses within Subcells 1 and 2. Gas collected in these wells will be conveyed through a network of lateral and header pipes connected to the perimeter header line extension. Stage 1B will also include a temporary connection to existing leachate manholes for Subcell 3 on the north slope and permanent connections to Subcells 1 and 2 leachate cleanouts on the south slope and at the Phase I west toe of slope leachate cleanout. Construction of the LFGCCS Stage 1B expansion is estimated to begin in August 2017 when

Subcells 1 and 2, Lift 5 has been completed. The design of the wells and pipelines is further described in the following sections of this Report.

The **LFGCCS Stage 1B** expansion, Sheet 4, Attachment A, will not include new gas extraction wells due to limited amount of waste present within Subcell 3, Lift 2 at the time of construction. Four (4) gas extraction well targets will be installed within Subcell 3 after the second 10-foot layer of waste (Lift 2) has been placed. These targets will function as an underdrain system for selected wells to be installed as part of Stage 4. The targets will be approximately 7 feet x 7 feet x 8 feet deep (maintaining 4 feet offset from the bottom liner system) and backfilled with FDOT No. 57 non-calcareous aggregate (granite or equivalent). The remaining portion of the target will be backfilled with waste. The targets are designed to eliminate the need for liquid collection within selected gas extraction wells and significantly improve the overall efficiency of the system while reducing long-term maintenance and costs.

The **LFGCCS Stage 2** expansion, Sheet 5, Attachment A, will not include new gas extraction wells due to limited amount of waste present within Subcell 4, Lift 2 at the time of construction. Three (3) gas extraction well targets will be installed within Subcell 4 after the second 10-foot layer of waste (Lift 2) has been placed. These targets will function, as previously described in Stage 1B, as an underdrain system for selected wells to be installed as part of Stage 4.

The **LFGCCS Stage 3A** expansion, Sheet 6, Attachment A, may begin following placement of additional waste on Subcells 3 and 4 to complete Lift 4 and will include installing up to seven (7) horizontal collectors across Subcells 3 and 4 in an east-west direction. The horizontal collectors will be allowed to passively vent until they are connected to the future perimeter header line along the west side slope of Phase II that will be installed as part of the Stage 3B. The horizontal collectors will include vertical sections for additional gas extraction and collector drainage.

The **LFGCCS Stage 3B** expansion, Sheet 7, Attachment A, may begin following placement of additional waste on Subcells 3 and 4 to complete Lift 5 and will include installing a perimeter header, air supply, and condensate discharge line extensions to complete the Phase II perimeter loop. Stage 3B will also include connections to horizontal collectors installed as part of Stage 3A (if installed), and connections to existing Subcells 3 and 4 leachate cleanouts on the north and south slopes to provide for access to the landfill gas which is present at the base of the landfill. The perimeter header line will be provided with stub outs for future expansion.

The **LFGCCS Stage 4** expansion, Sheet 8, Attachment A, may begin following placement of additional waste on Phase II to complete the Final Lift and will include installing forty (40) new vertical gas extraction wells. Gas collected in these wells will be conveyed through a network of lateral and header pipes connected to the perimeter header line installed around Phase II during Stage 3B.

The LFGCCS expansion header and lateral pipelines are designed to have a minimum of five percent slope within the landfill in order to minimize the occurrence of localized low points due to waste settlement; and allow the condensate to flow via gravity toward existing and proposed condensate collection structures. The proposed pipelines for the LFGCCS expansion have been

sized to convey the gas and condensate anticipated for the various lift sequences throughout the life of the entire permitted landfill. Refer to Section C.3 for additional information on condensate production and vacuum management.

SECTION C PROPOSED LFGCCS COMPONENTS

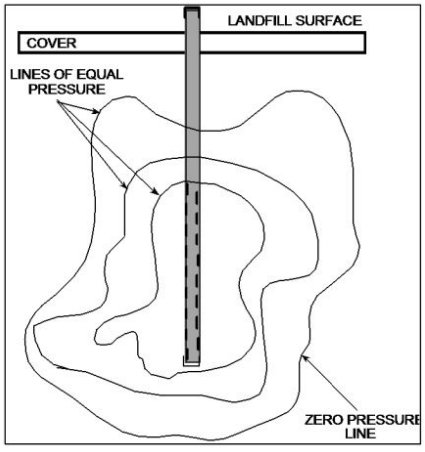
As Phase II is filled to final elevation, it will be necessary to continue to expand the LFGCCS through the installation of various gas extraction components, conveyance features, and other appurtenances. These will include vertical gas extraction wells, tie-ins to leachate cleanouts, header and lateral piping, header isolation valves, condensate sumps, and blind flanges along portions of the header to allow for future tie-ins. These features are described in more detail below.

C.1 VERTICAL GAS EXTRACTION WELLS

The LFGCCS expansion includes new gas extraction wells and new raisable gas extraction wells. The vertical gas extraction wells, as shown on the permit drawings, Attachment A, will extract gas from the landfill under a steady vacuum. Well depths are based on the depth of the waste mass at each well location using the respective Subcell Lift and permitted protective base grades, as provided in the topographic survey of protective cover by Hyatt Survey Services, Inc., dated May 17, 2009, provided as part of the Phase II Class I Landfill Expansion As-Built drawings.

The vertical wells will typically terminate no closer than 15 feet above the bottom liner system and will have an effective Radius of Influence (ROI) that ranges from approximately 2.0 to 2.25 times the well depth. Consequently, the well spacing will vary generally from 100 to 200 feet on center, depending on the estimated ROI of the wells. Due to the variability of the actual configuration of the ROI, it is desirable to install wells so that their ROIs partially overlap in order to ensure adequate gas collection coverage. The updated ROI coverage for the entire LFGCCS expansion into Phase II is included in Appendix 2. It should be noted that actual ROI shape is defined by variations in waste characteristics, interim cover and cell configuration, and presence of liquids in the waste. Figure 2 below shows a depiction of how an actual ROI can take shape.

Figure 2. **Typical Landfill Gas Well Radius of Influence**



Reference: SCS Engineers.

C.1.a Vertical Well Construction

A review of different materials for vertical well construction were considered for the Phase II LFGCCS expansion design, including, Polyvinyl Chloride (PVC), Stainless Steel, and High Density Polyethylene (HDPE). Although PVC material can resist collapse caused by heat and pressure in deep waste better than HDPE, PVC pipes can become brittle over time, crack, and ultimately collapse, rendering the system inoperable and requiring replacing the entire vertical well. Stainless Steel can resist higher temperatures and corrosive materials but the cost is expensive and not required for the temperatures and materials within this project. HDPE has been used successfully in previous on-site LFG projects, provides a strong resistance to failure from landfill settlement, and is cost effective. Due to its flexibility, it can withstand movement as the landfill settles without becoming brittle and cracking and has good chemical resistance to LFG and leachate. For these reasons, HDPE is the preferred construction material. Refer to Attachment C, CQA Plan and Technical Specifications, for detailed vertical extraction well material and testing requirements.

The vertical gas extraction wells for the Phase II LFGCCS expansion are designed using an eight-inch HDPE SDR-9 pipe with an effective well diameter of three feet. Vertical gas extraction wells as shown on the permit drawings, Attachment A, will be designed to include the following features:

- Approximately one-third of the well casing below grade will be solid-wall pipe, with a minimum of 15-feet of solid pipe installed. This design criterion is used to minimize the potential for pulling ambient air into the extraction well.
- Perforations will typically be 5/8-inch diameter holes, 4 rows at 90 degrees, 16 perforations per foot.
- Perforations for Caisson wells will not be closer than 15 feet from the landfill surface unless the wells are being installed in an active area and additional refuse will be filled around the wells within a reasonable period of time.
- Non-calcareous aggregate will be sized as specified on the Drawings to prevent penetration or blockages of the gas extraction well pipe perforations.

C.1.b Raisable Gas Extraction Wells(Caisson Wells)

The Caisson gas extraction wells as shown on the permit drawings, Attachment A, have been designed to allow for the wells to be raised as the filling of the waste in the area around the wells occurs in order to maintained the greatest area of influence. The Caisson well is constructed of 24-inch HDPE SDR 17 with a flange adapter welded to the top of the pipe.

The external Caisson housing will be lifted vertically using an excavator, or other appropriate heavy equipment, while additional filter pack (aggregate) and perforated pipe is added to the top of the well. The length of the Caisson wells is not fixed as a typical vertical extraction well.

Caisson wells can be extended more than once as required until the waste reaches final design elevation in the area surrounding the well. Once the final design elevation has been reached, the perforated section will not be closer than 15 feet from the landfill surface unless the wells are being installed in an active area and additional refuse will be filled around the wells within a reasonable period of time. The Caisson wells integrate seamlessly into the LFGCCS expansion design without having to drill a new well.

The location of the Caisson wells was determined based on the amount of waste still to be placed in the specific well location. In general, Caisson wells are installed where an additional 8 to 10 feet of additional waste would be placed in the future.

C.1.c Wellhead Assemblies

In order to standardize the LFGCCS, improve maintenance procedures, and facilitate for an expedient gas data collection, QED type wellhead assemblies will be installed at each new well. The wellhead assemblies will include the following features:

- QED wellhead with fine tune control valve and quick-change orifice plate assembly.
- QED highly visible well cap with easy level / high level indicator.
- QED Solarguard Flex Hose.

All wellhead assemblies will be provided with a metal nameplate with well number and lanyard system for sampling port caps.

C.1.d Pneumatic Pumps

In some cases where significant liquids are encountered during the drilling of a well it may be determined that a well shall receive a pneumatic pump to remove the liquids. There are a number of potential negative impacts to gas wells that can be caused by high liquid levels in the waste fill. Blockage of the perforated section of the gas well with liquid is the most obvious negative impact. Other negative “collateral” impacts include clogging of the porous gravel in the well backfill material and silt deposits in the bottom of the well pipe. In addition, saturated conditions in the waste reduces the porosity of the waste and thereby the radius of influence of wells. QED AP4 short bottom loading pumps have been selected and will provide the liquid removal capabilities required to potentially mitigate the negative impacts of liquids in the well. Wells that receive pumps will be noted on the final as-built drawings.

C.1.e Horizontal Collectors

The LFGCCS expansion design incorporates horizontal collectors for the interior area of Subcells 3 and 4, Lift 4 in order to accommodate ongoing filling activities and keep LFG extraction components such as wellheads away from the active area. The horizontal collectors will be connected to the future perimeter header line along the west side slope of Phase II that

will be installed as part of the Stage 3B. The horizontal collectors will include vertical boring sections for additional gas extraction and liquid drainage.

Horizontal collectors typically have a horizontal zone of influence of approximately 75 feet, which results in a lateral spacing of approximately 150 feet, on center, between collectors. Horizontal collector lengths will vary depending on site conditions at the time of system expansion, but generally will be less than 1,000 feet long.

Horizontal collectors will be constructed to include the following features:

- Collector pipe will normally be 6-inch diameter solid HDPE pipe with a smooth interior wall with sufficient strength to resist crushing force due to the overburden of the landfill.
- The perforated collector pipe will be installed in a trench filled with appropriate aggregate material such as chipped tires or rock. The permeable backfill material will be sized so as to not pose significant risk of clogging the pipe perforations.
- Perforated pipe will cease at least 75 feet inward from the end of the collector. The remaining length of collector will be solid-wall pipe. This will reduce the potential for air infiltration into the collectors and short-circuiting.
- Perforations in the pipe will be sufficiently large to not cause excessive head loss detrimental to LFG collection. Typical perforations will be 5/8-inch diameter holes, 4 rows at 90 degrees, 16 perforations per foot.

Note that Sarasota County may elect to install the horizontal collectors in relatively close proximity to the interim ground surface prior to resuming waste disposal activities in the area. Horizontal collectors typically have a vertical zone of influence of at least 20 feet; therefore, if there is less than 20 feet of waste on top of them, ambient air can be pulled into the landfill.

Due to the potential for air intrusion, as described above, and the possibility of some horizontal collectors sitting idle for long periods of time while waste is being placed on other areas of Subcells 3 and 4, Lift 4, Sarasota County reserves the option to install the horizontal collectors as desired or to wait until gas collection is required in Subcells 3 and 4.

C.2 HEADER AND LATERAL COLLECTION PIPING

The proposed header and lateral pipes are sized to accommodate maximum projected flow rates over the useable life of the system. Header sizes are determined based on expected flow patterns of the gas and the projected LFG generation based on historical and projected waste tonnages.

The proposed lateral and header pipes will consist of 6-inch to 18-inch diameter HDPE pipe. The header and lateral collection pipes will be fusion-welded HDPE SDR 11 or SDR 17 pipe and designed to have a minimum of 5 percent slope within the landfill. Refer to Attachment C, CQA

Plan and Technical Specifications, for detailed pipe and pipe fitting materials and testing requirements. Criteria considered in sizing the proposed header piping include:

- Unit Header Loss - Head losses in any given section of piping are standardized to 100-foot sections with a maximum allowable head loss of 1 inch of water column (in-w.c.).
- Gas Velocity - In general, design gas velocities will not exceed 1,800 feet per minute (30 feet per second) for countercurrent gas and condensate flow.
- The pipes will be designed to have a minimum of 5 percent slope within the landfill to assure condensate drainage in countercurrent flow situations.
- Future Expansions – As part of Stage 1A and 3B designs, the header piping will include blind flanges to accommodate future expansion. These blind flanges will be buried to prevent potential damage from landfill operations. Buried flanges and bolts will be coated with corrosion-resistant coatings.

C.2.a Header Access Risers

Access risers are vertical tees installed in sections of pipe that penetrate the surface of the landfill in order to allow for the vacuum piping to be reached above grade. These risers are important for accessing the system for operational issues and for locating below grade piping. The risers can also be used to determine if areas need additional vacuum or liquids removal. Ultimately, access risers allow for system diagnostics, as well as alternative tie-in locations to circumvent damaged piping areas. SCS has implemented the access risers into the LFGCCS design.

C.2.b Header Isolation Valves

In order to allow for isolation of certain sections of header in case of the need to perform repairs without shutting down the entire system, or for troubleshooting purposes, header isolation valves will be installed throughout the system. These valves will be constructed of corrosion resistant materials such as PVC, and all metal parts potentially exposed to LFG will be coated with enamel or similar coatings to increase corrosion resistance. Both the seals and valve bodies will be appropriate for the specified application. Additional sample ports will be installed at each header isolation valve to allow for gas screening. Refer to Attachment C, CQA Plan and Technical Specifications, for detailed valve materials and testing requirements

C.2.c Header Road Crossing

As part of Stage 1A, the perimeter header, air supply, and condensate discharge line extensions will be connected to the existing blind flange located on the southwest corner of Phase I (vicinity of Gas Well GW-29). The perimeter header, air supply, and condensate discharge line extensions will cross the existing all weather access road along the south slope of Phase II.

The perimeter header, air supply, and condensate discharge line extensions will be designed to include a Corrugated Metal Pipe or traffic rated ADS N-12 watertight corrugated pipe sleeve where crossing occurs to protect the pipes from deflection under heavy loads. These two types of pipe provide the necessary resistance and watertight capabilities within the landfill. Road crossing construction will be coordinated between the Contractor and the County to minimize any obstruction to landfill operations.

C.3 CONDENSATE PRODUCTION AND VACUUM ASSESSMENT

Condensate is formed as LFG that is extracted from the landfill cools in the header piping. The rate at which it is generated is dependent on the LFG flow rates and the temperature differential between the warmer gas and the cooler surrounding soil or air. For the LFGCCS at CCSWDC, condensate generation rates were estimated assuming the LFG temperature drops from 100 degrees Fahrenheit (^{o}F) to 50 ^{o}F prior to reaching the condensate collection devices. Typically, the temperature on the LFG system will be above 90 ^{o}F resulting in lower condensate generation than indicated herein; therefore, the estimated condensate generation for both Phases I and II is conservative.

Table 2 below provides the gas generation rates estimated for the CCSWDC using the U.S. Environmental Protection Agency's Landfill Gas Emission Model (LandGeEM) and compared with the average gas data collected at the Plant for 2015 and 2016, provided by Sarasota County.

Table 2
Phase I and II Gas Generation and Collection Efficiency

Year	LGFCCS	Projected Generation Rate (scfm)	County Average Data (scfm)	Estimated Collection Efficiency (%)
2015	Phase I	3,207	1,247	39
2016	Phase I	3,336	1,458	44
2024	Phase I and II	4,573	3,430[1]	75[1]

1. Estimated average collection efficiency for 2024

It is estimated that for 1,458 scfm collected in 2016, the maximum daily condensate generation rate based on a 50 ^{o}F temperature differential is 569 gallons per day (gpd).

Based on the estimated future generation rate of 4,573 scfm in 2024 and using a collection efficiency of 75% at Phase II closure, it is estimated that approximately 3,430 scfm will be collected at the Plant. The total maximum estimated daily condensate generation rate for 3,430 scfm (includes both Phase I and II LFGCCS), and based on a 50 ^{o}F temperature differential is 1,340 gpd or an additional 771 gpd from the current Phase I LFGCCS condensate generation.

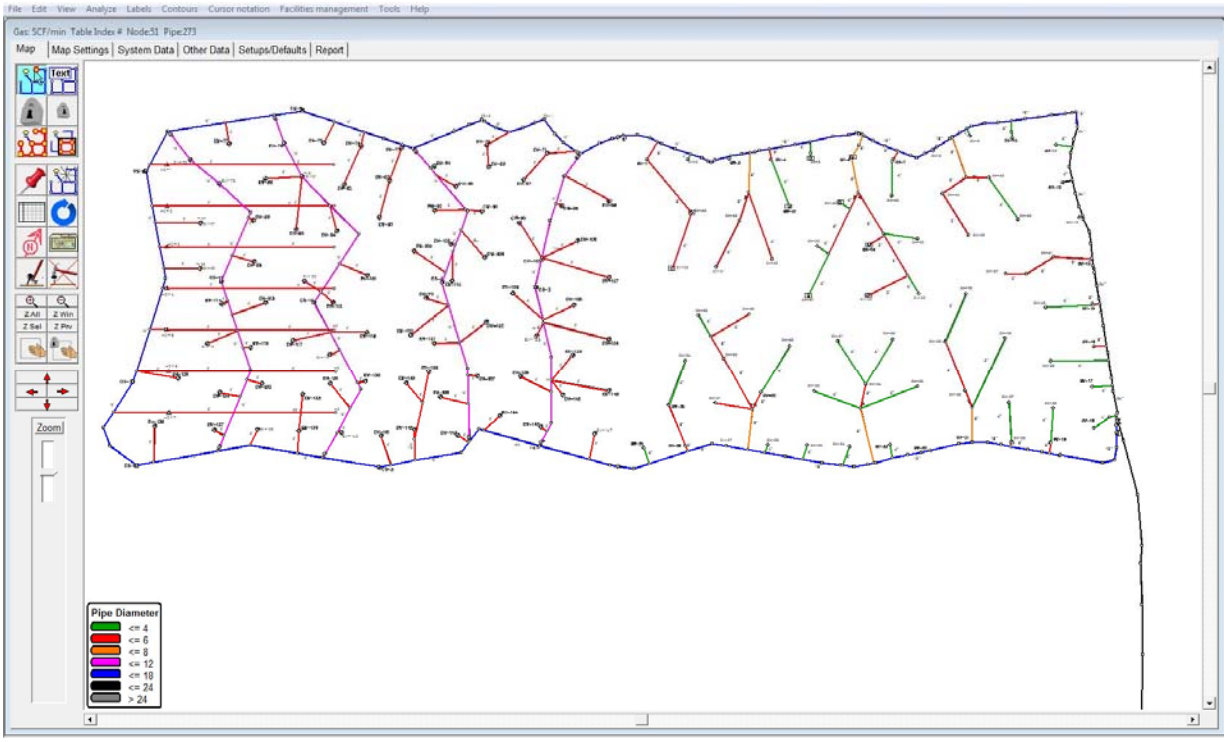
This value of 1,340 gpd represents the anticipated maximum daily amount of condensate (Year 2024) that would be generated during cool days in winter months when temperature differentials between collected LFG and ambient air are greatest. This is not expected to be the typical daily condensate generation rate. The current Phase II leachate collection system can handle this additional flow (771 gpd) without requiring any modifications. Refer to Appendix 4 for condensate generation calculations.

C.3.a Vacuum Modeling

Gas system vacuum modeling was performed with KY Pipes software. KY Pipes is a pipe network analysis software that models the behavior of landfill gas within the proposed system. The proposed and existing pipe network was entered into the software to identify potential areas of restricted gas flow. Each piping section and gas production point (well) were entered into the model to accurately depict how the vacuum is distributed throughout the system and to estimate friction losses. Other specifications for landfill gas such as: operating temperature, molecular weight, specific gravity, specific heat ratio, viscosity, and reference density were all defined in order to accurately identify the behavior of the gas for modeling purposes. Figure 3 below provides an illustration of the gas model created for the LFGCCS expansion into Phase II.

After completion of the model, it was determined that the system sizing and connectivity were adequate to allow for proper flow regime and vacuum allocation to all wells. The KY Pipe model output report is included in Appendix 4. The maximum velocity within the proposed system is 22.50 feet/second which is below the 30 feet/second maximum desired velocity.

Figure 3. **KY Pipe Model**



C.3.b Condensate Sumps

The LFGCCS expansion design includes two condensate sumps as part Stage 1A, five condensate sumps located along the perimeter header as part of Stage 3B, and two condensate sumps as part of Stage 4. Refer to the permit drawings, Attachment A.

The purpose of the condensate sump is to remove condensate from the gas stream at engineered low points. Condensate collected in the proposed sumps will be pumped to leachate cleanout riser connections along the north and south slopes of Phase II, then flows via gravity to the Phase II Main Leachate Pump Station

C.4 LFGCCS DRAINAGE TARGETS

The LFGCCS drainage targets will be installed in Subcells 3 and 4 after the second 10-foot layer of waste (Lift 2) has been placed in each Subcell. These targets will function as an underdrain system for selected wells to be installed as part of Stage 4. The drainage layer consists of FDOT No. 57 non-calcareous aggregate (granite or equivalent material). Each target will be approximately 7 feet x 7 feet x 8 feet deep (maintaining 4 feet offset from the bottom liner system).

Selected target locations will require accurate delineation. The installation will include waste removal within the respective target area ensuring that the minimum offset of 4 feet from the bottom liner system is maintained. Once the target area has been excavated it will be backfilled with FDOT No. 57 non-calcareous aggregate (or approved material). The target area will be delineated using GPS coordinates along the perimeter and center. Waste filling operations can continue at the target locations without any special consideration.

Once Stage 4 is ready for construction, the vertical gas extraction wells that have been selected to be part of the drainage targets will be drilled at the locations obtained as part of the target delineation in Stage 1B and Stage 2. Due to variations in waste characteristics, boreholes may not align directly on top of the target. Obstructions encountered during borehole advancement may require the borehole to be abandoned or relocated. If the borehole does not align perfectly on top of the target, the vertical gas extraction well will still function as any other well previously installed without a target.

C.5 CONNECTIONS TO EXISTING LFGCCS AND LEACHATE COLLECTION SYSTEM (LCS)

Connections to the existing LFGCCS will be completed as part of Stage 1A and includes installing a header line, air supply line, and dewatering discharge line extensions connected to existing blind flanges located at the north slope of Subcell 2 (vicinity of remote wellhead LC-2A and 2B) and the southwest corner of Phase I (vicinity of Gas Well GW-29). The header, air supply, and dewatering discharge lines extensions will also be fitted with blind flanges for future expansion as part of Stage 3B.

C.5.a Connections to Phase I Blind Flanges

The LFGCCS Stage 1A expansion will require connections to existing blind flanges located at the southwest corner of Phase I (vicinity of Gas Well GW-29). The construction will require the temporary removal of adjacent temporary final cover which includes from top to bottom: 60-mil Thermoplastic Polyolefin (TPO) geomembrane cover, 12 inches of intermediate cover, 6 inches of initial cover, and waste. Extreme caution will be exercised during construction as to not interfere with the TPO boots around the existing LFGCCS sumps. Actual blind flange location may dictate additional construction requirements to minimize or limit any impact to the existing LFGCCS system.

After connecting the LFGCCS expansion to the existing blind flanges, the area will be backfilled, graded and rolled smooth prior to re-installation of the TPO geomembrane. The area will be inspected to be free of rocks, stones, sticks, roots, sharp objects, and debris. The surface preparation and the welding/repairs of TPO panels will conform to the approved specifications and Construction Quality Assurance procedures provided as part of the Phase I Closure construction project. Refer to Attachment C for the Construction Quality Assurance and Technical Specifications for the LFGCCS Expansion.

C.5.b Connections to Phase II Leachate Cleanouts

To provide supplemental LFG collection, the LFGCCS expansion design includes tie-ins to existing leachate cleanout rises along the north and south slopes of Phase II. These connections are intended to provide supplemental drainage for the forcemain system, should it be necessary. Connections to existing Subcells 1 and 2 leachate cleanouts (south slope), Phase I west toe of slope leachate cleanout (south side), and temporary connection to Subcell 3 leachate cleanout (north slope) will be completed as part of Stage 1A. Subcells 3 and 4 leachate cleanouts (north and south slopes) will be completed as part of Stage 3B.

C.5.c Sealing of Phase II Leachate Collection and Metering Manholes

In order to minimize air intrusion to the LFGCCS, the existing Phase II leachate detection and metering manhole covers and goosenecks for Subcells 3 and 4 (north slope) leachate collection system will be modified as part of Stage 1A.

The metering manhole covers will be carefully removed to prepare the surface and create a uniform connection between the cover and the manhole frame. Holes may be drilled into the manhole frame for the installation of a cover locking mechanism (if required). A sealant injection will be applied between the cover and the manhole frame and to any drilled holes to provide for a watertight seal.

The leachate collection manhole lids will be replaced with a prefabricated lid designed with stub outs for gate valve stem access. Once the lid is installed, a flexible coupling will be placed around the stub outs to provide for a complete seal. Both leachate collection and metering manholes will include flexible hose connections to facilitate LFG extraction. A more detailed process will be included as part of the construction drawings.

C.6 BLOWER/FLARE STATION

The landfill has a voluntary (i.e., not required by NSPS Subpart WWW) LFG collection system in Phase I. A blower conveys LFG via a vacuum to the Plant or to an open candlestick flare used to combust excess LFG. Expansion of the LFGCCS into Phase II could potentially increase the percentage of gas collected but it would never exceed 100% of expected flow which can be handled by the Plant or the candlestick flare that has a 5,500 scfm capacity.

SECTION D COMPLIANCE EVALUATION

D.1.a Integration with Closure End Use

Waste disposal activities are on-going at the site. At landfill closure, the closure plan will address any integration of the LFGCCS with the intended end use, which has not yet been determined.

D.1.b Air Intrusion Control

Air intrusion control for the LFGCCS will be provided by the engineered final cover system installed over areas filled to final grade. Air intrusion control also will be provided by the extraction well design, in as much as the slotted pipe in vertical wells is set no closer than 15 feet of ground surface. The Sarasota County will conduct wellfield tuning to reduce the oxygen content of the LFG to a level desired by the LFGTE facility. Air intrusion control in future years will be accomplished by the final cover system after completion of filling in the respective Subcells and by proper tuning of the wellfield during operation of the LFGCCS.

Sarasota County likely will use an instrument such as the Landtec GEM-2000 gas meter, or equal, to meet measurement of oxygen.

D.1.c Corrosion Resistance

In general, the system components described in Section C of this report represent "state-of-the-practice" materials, and have proven to be resistant to corrosion with proper installation, operation, and maintenance in LFGCCS applications across the United States.

D.1.d Fill Settlement

Settlement or subsidence of waste fill due to decomposition can affect a LFGCCS in numerous ways, including:

- Damage or destruction of below grade header and lateral piping systems.
- Blockage of header and lateral piping systems as a result of condensate collecting in the piping (at locations where settlement has caused an unintended low point in the pipe), thereby blocking the flow of gas.
- Damage, displacement, or destruction of well casings, seals, and filter materials as a result of settlement in the landfill mass adjacent to the well.

Components or features that are incorporated into the LFGCCS expansion design to address potential effects of settlement include:

- Installation of below grade laterals and headers installed within the waste mass will have a minimum 5 percent slope within the landfill, thereby providing allowance for some settlement without damage or blockage of the piping systems.

- Installation of header access risers, which allow landfill personnel to identify the location of the below grade header in order to aid troubleshooting and repairs as settlement occurs.

- Use of fusion-welded HDPE piping for the headers and laterals. Fusion-welded HDPE pipe is less susceptible than PVC pipes to damage or collapse due to settlement of the waste. HDPE also is less susceptible to damage resulting from loss of plasticizers over time (i.e., aging), which can cause PVC pipe to become brittle.

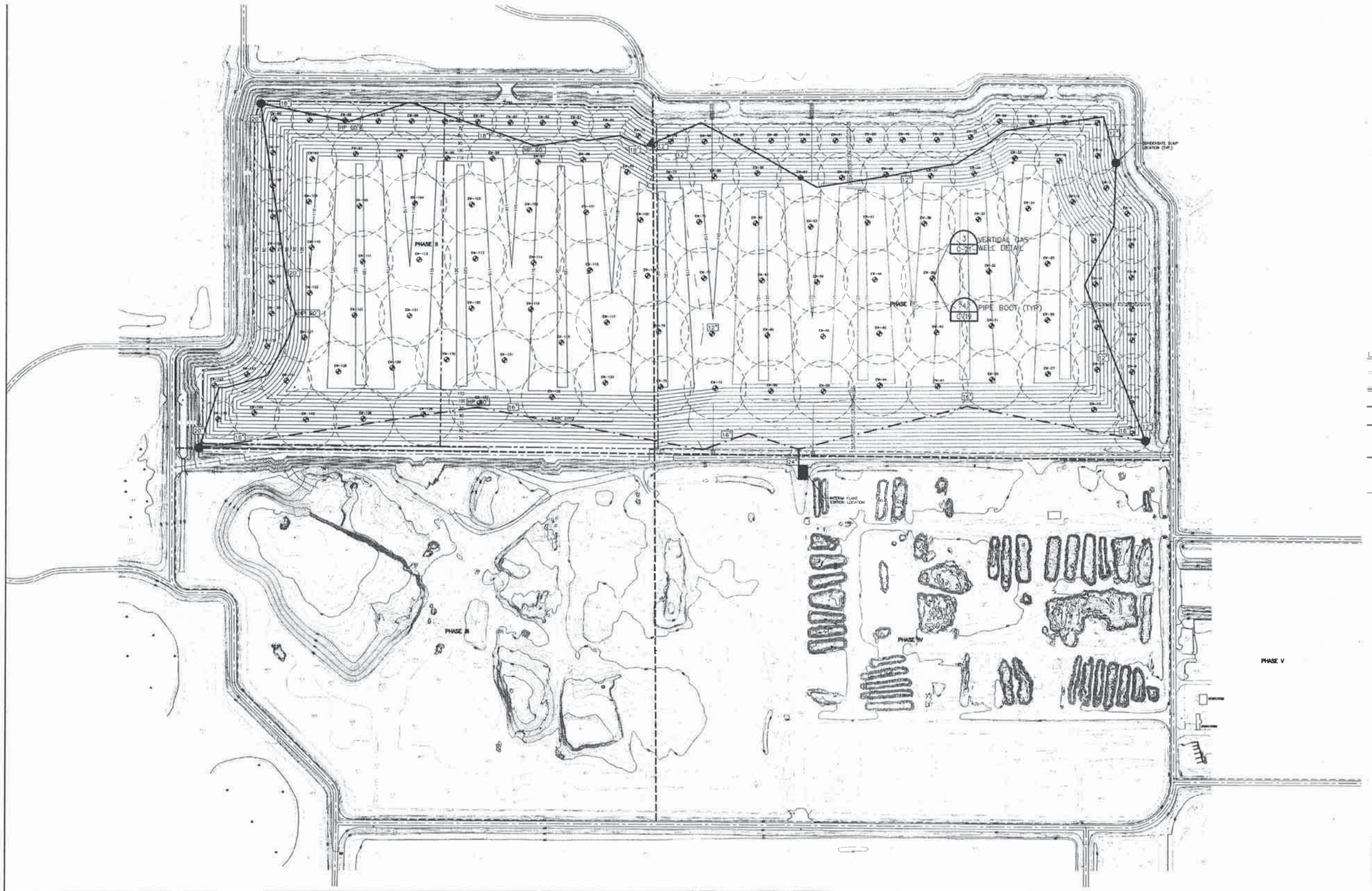
- Placement of the well casings in 36-inch diameter boreholes, which provide additional separation between the waste and the well casings, thereby reducing the potential for differential stresses being placed on the casings.

D.1.e Resistance to Decomposition Heat

The components incorporated into the LFGCCS expansion design have a track record of good performance when subjected to the heat of decomposition under normal operating conditions. Typically, the components used in modern LFGCCSs are resistive to temperatures up to 150 ^{o}F. The LFGCCS components most susceptible to heat damage are the well casings and any lateral or header piping systems installed within the waste mass. HDPE pipes have proven successful for numerous LFGCCS applications across the United States.

Appendix 1

2008 Conceptual Gas Management Plan (HDR)



NOTES:

1. CONTOURS WITHIN PHASES I AND II REPRESENT TOP OF FINAL COVER EXCEPT FOR THE SOUTH SLOPES WHICH REPRESENT TOP OF INTERMEDIATE COVER.
2. MINIMUM OF 5% SLOPE HAS BEEN USED IN THE HEADER LAYOUT.
3. GAS WELL LOCATIONS ON SOUTH SLOPES OF PHASES I AND II REPRESENT INTERIM CONDITIONS PRIOR TO THE CONSTRUCTION AND OPERATION OF PHASE III AND IV.

LEGEND

- 50 — EXISTING ELEVATION CONTOUR
- 50 — PROPOSED ELEVATION CONTOUR
- PERMANENT LANDFILL GAS HEADER
- INTERIM LANDFILL GAS HEADER
- 12" PROPOSED LANDFILL GAS HEADER DIAMETER
- PHASE LIMITS
- CHAIN LINK FENCE
- CENTER LINE OF ROAD
- VEGETATION
- HP HIGH POINT
- LP LOW POINT
- EW PROPOSED LANDFILL GAS EXTRACTION WELL LOCATION
- ESTIMATED RADIUS OF INFLUENCE FOR PROPOSED LANDFILL GAS EXTRACTION WELLS

FOR PERMITTING

HDR
HDR Engineering, Inc.
2202 N. West Shore Blvd., Suite 250
Tampa, FL 33607-6755
(813) 282-2300
Florida Certificate of Authorization
No. 00004213

ISSUE	DATE	DESCRIPTION
C	01/2008	REVISED PER RAI #3
B	06/2007	REVISED PER RAI #1
A	02/2007	ISSUED FOR APPROVAL

PROJECT MANAGER	T.M. YANOSCHAK
REVIEWED BY	J.C. READLING
DRAWN BY	J.E. GAUL
PROJECT NUMBER	000000000043485

Thomas M. Yanoschak, P.E.
Certificate No. 44200
01/11/08

SARASOTA COUNTY

Central County Solid Waste Disposal Complex

PHASE II CLASS I LANDFILL EXPANSION PERMIT DRAWINGS

SARASOTA COUNTY FLORIDA

CONCEPTUAL GAS MANAGEMENT PLAN

0 1" 2"

FILENAME	00C-06.dwg
SCALE	1"=200'

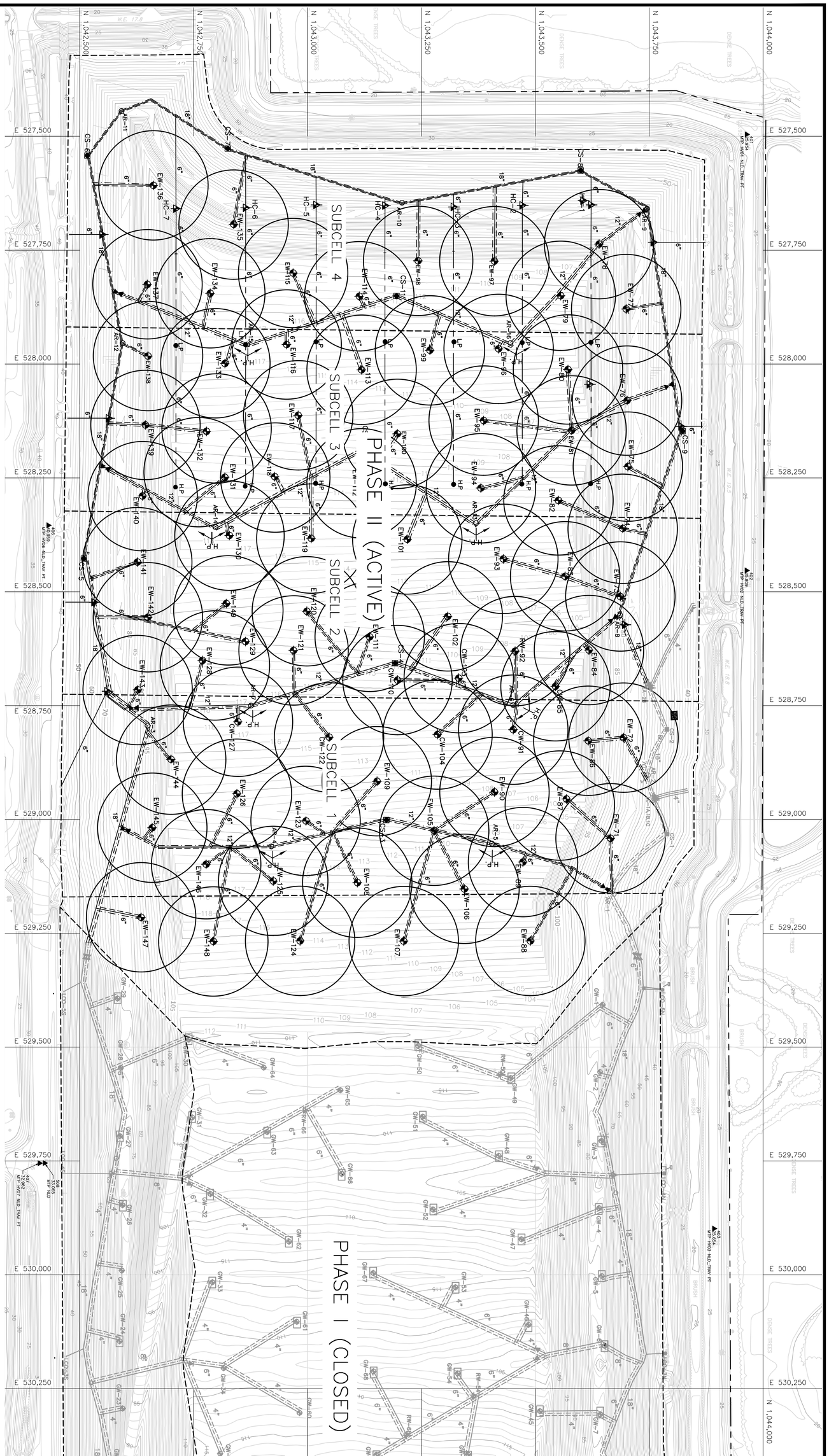
SHEET C-06

C:\PWworking\TPA\final\385836\00C-06.dwg, Plot, 1/9/2008 11:41:10 AM, gbaw

Appendix 2

2017 Conceptual Gas Management Plan (SCS)

G:\PROJECT\Sarasota\09216163.00-Phase II Design_DRAWINGS\Engineering Drawings\216163_00 PROPOSEDV3R01.dwg Jan 23, 2017 - 5:23pm Layout Name: ST. 4 FINAL FILL SEQUENCE By: 4046sml



0 50 100 200
1" = 100'

N

SHEET 1 of 1	DRAWING NO. 1	SCALE: AS SHOWN	DATE: JANUARY 2017

CADD FILE: 216163_00 PROPOSEDV3R01

SCS ENGINEERS
STEARNS, CONRAD AND SCHMIDT
CONSULTING ENGINEERS
3012 U.S. HWY. 301 NORTH, SUITE 700, TAMPA, FL 33619
PH (813) 621-0080 FAX NO. (813) 623-6757
FLORIDA CERTIFICATE OF AUTHORIZATION NO. 00004892

PROJ. NO.	DWN. BY:	Q/A RVW BY:
09216163.00	AFD	DRC
DSN. BY:	CHK. BY:	APP. BY:
AFD	CFL	DRC

CLIENT

SARASOTA COUNTY
CENTRAL COUNTY SOLID WASTE
DIPSOSAL COMPLEX
NOKOMIS FLORIDA

SHEET TITLE **APPENDIX B**
CONCEPTUAL GAS MANAGEMENT PLAN

PROJECT TITLE
BASIS OF DESIGN REPORT

REV	DATE	DESCRIPTION	CHK. BY
1			
2			
3			
4			
5			

DANIEL R. COOPER, P.E.
LICENSE NO. 66440

Appendix 3

Condensate Generation

SCS ENGINEERS

SHEET 1 of 2

CLIENT	PROJECT	JOB NO.
Sarasota County	Phase II LFGCCS Expansion	09216163.00

SUBJECT	BY	DATE
	WJS	1/19/2017
Condensate Generation Background Calculations	CHECKED	DATE
	CAR	2/23/2017

Estimate condensate generation for maximum expected LFG flow rate (existing conditions)

1. Peak daily average high and low air temperatures for Sarasota, FL from US Climate Data.

High gas temp:	100	°F	
Average low temp (January):	50	°F	
Max. LFG flow expected:	1,458	cubic feet per minute (ft^3/min)	Flow collected at GTE facility. Average for 2016
Max. LFG flow expected:	2.10E+06	ft^3/day	(1,458 ft3/min) * (60 min/hr) * (24 hr/day)

2. Use attached psychrometric charts to determine moisture carrying capacity of the LFG gas at the various temperatures

ρ_{50}: = 13 ft^3 / lb dry air $moisture_{50}$: = 0.0078 lb water / lb dry air

$Liquid_{50}$: = $flowrate_{50}$ * $moisture_{50}$ / ρ_{50}

$Liquid_{50}$: = [1,458 scfm * (0.0078 lb water / lb dry air)] / 13 ft^3 / lb dry air = 0.87 lb liquid / minute

$Liquid_{50}$: = 0.87 lb liquid / minute = **600.0** lb liquid/10^6 ft^3 LFG

ρ_{100}: = 15.2 ft^3 / lb dry air $moisture_{100}$: = 0.0435 lb water / lb dry air

$Liquid_{100}$: = $flowrate_{100}$ * $moisture_{100}$ / ρ_{100}

$Liquid_{100}$: = [1,458 scfm * (0.0435 lb water / lb dry air)] / 15.2 ft^3 / lb dry air = 4.17 lb liquid / minute

$Liquid_{100}$: = 4.17 lb liquid / minute = **2,861.8** lb liquid/10^6 ft^3 LFG

3. Moisture capacity results

At 100 °F, 2,861.8 lb liquid/10^6 ft^3 LFG
At 50 °F, 600.0 lb liquid/10^6 ft^3 LFG

4. The amount of liquid lost as LFG cools from 100 oF to 50 oF =

(2862 lb liquid/10^6 ft^3 LFG) - (600 lb liquid/ 10^6 ft^3 LFG) = **2,262** lb liquid/10^6 ft^3 LFG

5. Gallons of condensate generated:

Gallons condensate/day = (2,262 lb liquid/10^6 ft^3 LFG) * (2.10E+06 ft^3 LFG/day) * (gal/8.34 lb)
Gallons condensate/day (total) =

569	gallons condensate/day (Phase I LFGCCS)
0.40	gpm for entire Phase I LFGCCS

SCS ENGINEERS

SHEET 2 of 2

CLIENT	PROJECT	JOB NO.
Sarasota County	Phase II LFGCCS Expansion	09216163.00

SUBJECT	BY	DATE
Condensate Generation Background Calculations	WJS	1/19/2017
	CHECKED: CAR	DATE: 2/23/2017

Estimate condensate generation for maximum expected LFG flow rate (proposed conditions)

1. Peak daily average high and low air temperatures for Sarasota, FL from US Climate Data.

High gas temp: 100 °F
Average low temp (January): 50 °F
Max. LFG flow expected: 3,430 cubic feet per minute (ft^3/min) Assume 75% collection efficiency for 2024 (4,573 scfm)
Max. LFG flow expected: 4.94E+06 ft^3/day (3,430 ft3/min) * (60 min/hr) * (24 hr/day)

2. Use attached psychrometric charts to determine moisture carrying capacity of the LFG gas at the various temperatures

ρ_{50}: = 13 ft^3 / lb dry air moisture$_{50}$: = 0.0078 lb water / lb dry air

Liquid$_{50}$: = flowrate$_{50}$ * moisture$_{50}$ / ρ_{50}

Liquid$_{50}$: = [3,430 scfm * (0.0078 lb water / lb dry air)] / 13 ft^3 / lb dry air = 2.06 lb liquid / minute

Liquid$_{50}$: = 2.06 lb liquid / minute = **600.0** lb liquid/10^6 ft^3 LFG

ρ_{100}: = 15.2 ft^3 / lb dry air moisture$_{100}$: = 0.0435 lb water / lb dry air

Liquid$_{100}$: = flowrate$_{100}$ * moisture$_{100}$ / ρ_{100}

Liquid$_{100}$: = [3,430 scfm * (0.0435 lb water / lb dry air)] / 15.2 ft^3 / lb dry air = 9.82 lb liquid / minute

Liquid$_{100}$: = 9.82 lb liquid / minute = **2,861.8** lb liquid/10^6 ft^3 LFG

3. Moisture capacity results

At 100 °F, 2,861.8 lb liquid/10^6 ft^3 LFG
At 50 °F, 600.0 lb liquid/10^6 ft^3 LFG

4. The amount of liquid lost as LFG cools from 100 oF to 50 oF =

(6,040 lb liquid/1,266 ft^3 LFG) - (1,266 lb liquid/ 10^6 ft^3 LFG) = **2,262** lb liquid/10^6 ft^3 LFG

5. Gallons of condensate generated:

Gallons condensate/day = (2,262 lb liquid/10^6 ft^3 LFG) * (4.94E+06 ft^3 LFG/day) * (gal/8.34 lb)
Gallons condensate/day (total) =

1,340	gallons condensate/day (Phase I and II LFGCCS)
770.13	gallons condensate/day (Phase II LFGCCS)
0.93	gpm for entire Phase I and II LFGCCS

Note: Existing Phase II Leachate Collection System can handle the additional flow without requiring any modifications

Gas properties at high temperature threshold (100 degrees F)

15.3 CU FT

PSYCHROMETRIC CHART

EXOTHERMICS ENERGY RECOVERY SYSTEMS

DRY BULB TEMPERATURE F

WET BULB AND DEW POINT OR SATURATION TEMPERATURES

ENTHALPY AT SATURATION BTU PER POUND OF DRY AIR

ENTHALPY OF REJECTED OR ADDED WATER

TEMPERATURE OF WATER F

ENTHALPY OF WATER BTU PER POUND OF DRY AIR

GRAINS OF MOISTURE PER POUND OF DRY AIR

POUNDS OF WATER PER POUND OF DRY AIR

0.0435 LB WATER

14 CU FT

15 CU FT

16 CU FT

17 CU FT

18 CU FT

19 CUBIC FEET PER POUND OF DRY AIR

20 CU FT

0.2 BTU

0.4 BTU

0.5 BTU

0.6 BTU

0.8 BTU

1.0 BTU

1.5 BTU

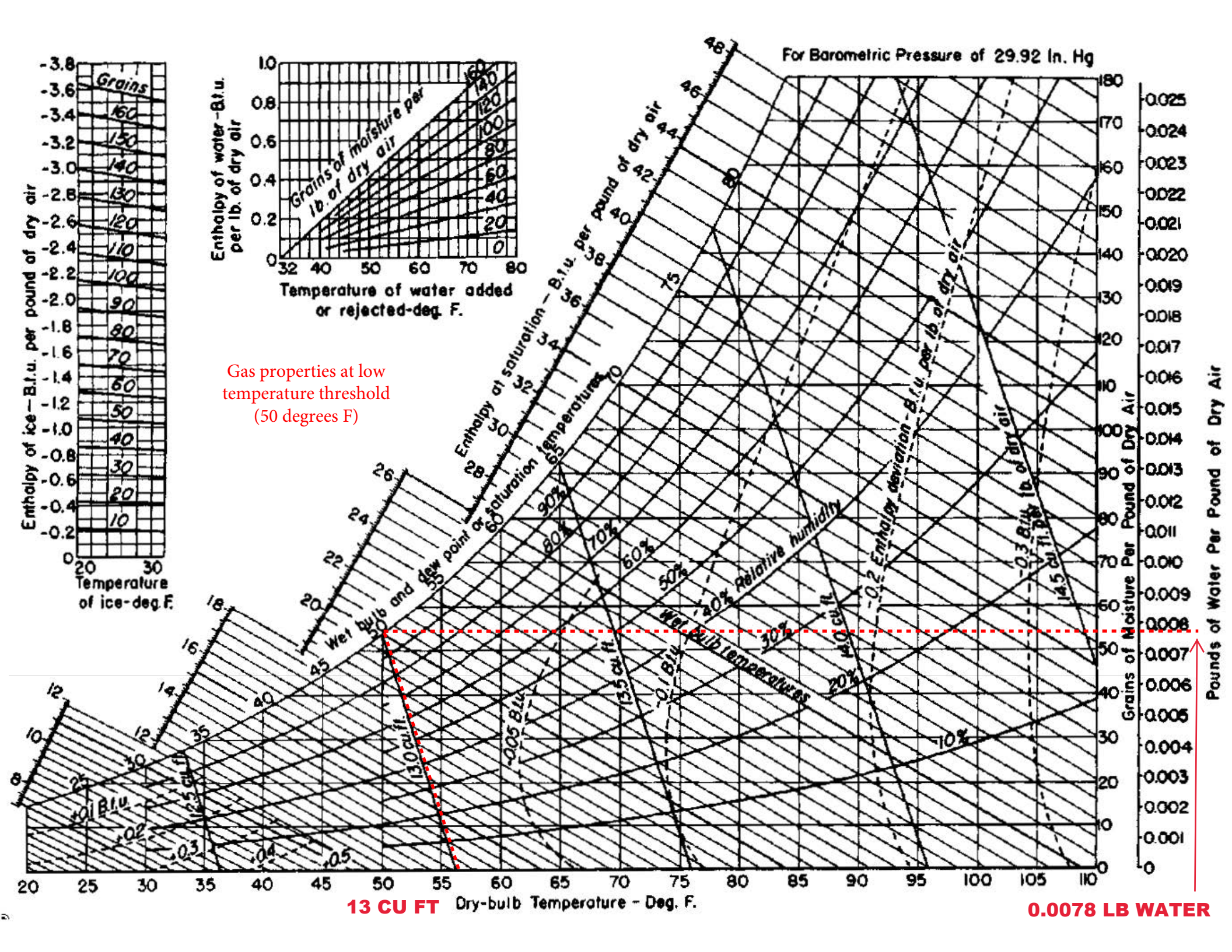
2.0 ENTHALPY DEVIATION BTU PER POUND OF DRY AIR

2.5 BTU

3.0 BTU

16% RELATIVE HUMIDITY

WET BULB TEMPERATURES


For Barometric Pressure of 29.92 In. Hg
Enthalpy of ice—B.t.u. per pound of dry air
Grains
Temperature of ice-deg. F.
Enthalpy of water—B.t.u. per lb. of dry air
Grains of moisture per lb. of dry air
Temperature of water added or rejected-deg. F.
Gas properties at low temperature threshold (50 degrees F)
Enthalpy at saturation — B.t.u. per pound of dry air
Wet bulb and dew point or saturation temperatures
Relative humidity
Wet bulb temperatures
Enthalpy deviation - B.t.u. per lb. of dry air
Grains of Moisture Per Pound of Dry Air
Pounds of Water Per Pound of Dry Air
13 CU FT
Dry-bulb Temperature - Deg. F.
0.0078 LB WATER

Appendix 4

KY Pipe Model Output

```
* * * * * * * * * * * * * K Y G A S * * * * * * * * * * * * *
*                                                             *
*  Gas Network Analysis Software                              *
*                                                             *
*  CopyRighted by KYPIPE LLC (www.kypipe.com)                 *
*  Version: 7.003  09/15/2014                                 *
*  Company:  SCSEnginee    Serial #:  500203                  *
*  Interface:  Classic                                        *
*  Licensed for Pipe2014                                      *
*                                                             *
* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *

 INPUT DATA FILE NAME FOR THIS SIMULATION  = G:\PROJECT\Sarasota\092161~1.00-\Mo
 del\BACKGR~1\SARASO~1.KYP\sarasota.DAT
 OUTPUT DATA FILE NAME FOR THIS SIMULATION = G:\PROJECT\Sarasota\092161~1.00-\Mo
 del\BACKGR~1\SARASO~1.KYP\sarasota.OT2

 DATE FOR THIS COMPUTER RUN       :  1-18-2017
 START TIME FOR THIS COMPUTER RUN :  9:43:28:65


 SUMMARY OF DISTRIBUTION SYSTEM CHARACTERISTICS:
 -----------------------------------------------


 NUMBER OF PIPES           =   280
 NUMBER OF JUNCTION NODES  =   275

 UNITS SPECIFIED           = ENGLISH



 PROPERTIES OF THE GAS FOR THIS ANALYSIS ARE:

  OPERATING TEMPERATURE               =    100.000 DEGREES FAHRENHEIT
  REFERENCE DENSITY (@ STD. PRESSURE) =    .68E-01 POUNDS/CUBIC FOOT
  GAS MOLECULAR WEIGHT                =     27.790
  GAS SPECIFIC GRAVITY                =       .959
  RATIO OF SPECIFIC HEATS             =      1.305
  GAS CONSTANT                        =     55.614
  ABSOLUTE VISCOSITY                  =   .289E-06 POUND SECONDS/SQUARE FOOT


      USER SPEC. FLOW UNITS (USFU)     = SCF / MIN.
     USER SPEC. PRESSURE UNITS(USPU)  = INCHES OF WATER (GAUGE)


 -------  SUMMARY OF PIPE NETWORK GEOMETRIC AND OPERATING DATA  -------

-------------------------------------------------------------------------
    PIPE     NODE     NODE  LENGTH  DIAM.  ROUGHNESS SUM-M PUMP ELEVATION
    NAME      #1       #2   (FT.)  (IN.)  (MILLIFEET) FACT.  ID    CHANGE
-------------------------------------------------------------------------
       a     GW-2     J-62e    21.0    4.0       .200      .0   0        .0
```

GW	GW-147	J-5	95.0	6.0	.100	.0	0	.0
GW-110	GW-110	J-46	107.0	6.0	.100	.0	0	.0
P-1	N33	N55	64.0	18.0	.200	.0	0	.0
P-10	GW-21	GW-22	156.0	18.0	.200	.0	0	.0
P-100	J-39	N164	40.0	18.0	.100	.0	0	.0
P-101	GW-73	N164	12.0	6.0	.100	.0	0	.0
P-102	J-41	J-39	99.0	12.0	.100	.0	0	.0
P-103	GW-84	J-41	18.0	4.0	.100	.0	0	.0
P104	GW-67	N141	170.0	4.0	.200	.0	0	.0
P-104	GW-83	GW-73	128.0	6.0	.100	.0	0	.0
P105	N40	GW-48	108.0	6.0	.200	.0	0	.0
P-105	J-40	J-41	34.0	12.0	.100	.0	0	.0
P106	GW-44	N45	104.0	6.0	.200	.0	0	.0
P-106	J-42	J-40	162.0	12.0	.100	.0	0	.0
P107	GW-43	N45	82.0	6.0	.200	.0	0	.0
P-107	GW-91	J-42	60.0	6.0	.100	.0	0	.0
P108	GW-36	GW-59	197.0	6.0	.200	.0	0	.0
P-108	GW-92	J-42	114.0	6.0	.100	.0	0	.0
P109	GW-36	N38	67.0	6.0	.200	.0	0	.0
P-109	J-43	J-42	83.0	12.0	.100	.0	0	.0
P-11	N38	GW-21	125.0	8.0	.200	.0	0	.0
P-110	GW-104	J-43	133.0	6.0	.100	.0	0	.0
P111	GW-32	N54	70.0	6.0	.200	.0	0	.0
P-111	J-44	J-43	56.0	12.0	.100	.0	0	.0
P112	N54	GW-63	214.0	6.0	.200	.0	0	.0
P-112	GW-103	J-44	16.0	6.0	.100	.0	0	.0
P-113	J-45	J-46	82.0	12.0	.100	.0	0	.0
P114	N59	GW-28	20.0	6.0	.200	.0	0	.0
P-114	GW-102	J-45	139.0	6.0	.100	.0	0	.0
P115	GW-47	GW-4	182.0	4.0	.200	.0	0	.0
P-115	J-46	J-44	26.0	12.0	.100	.0	0	.0
P116	GW-45	N34	124.0	4.0	.200	.0	0	.0
P-116	J-47	J-45	126.0	12.0	.100	.0	0	.0
P-117	GW-111	J-47	87.0	6.0	.100	.0	0	.0
P-118	GW-120	J-47	177.0	6.0	.100	.0	0	.0
P-119	J-48	J-47	141.0	12.0	.100	.0	0	.0
P-12	GW-22	J-34	141.0	18.0	.200	.0	0	.0
P120	GW-52	N40	258.0	6.0	.200	.0	0	.0
P-120	GW-122	J-48	120.0	6.0	.100	.0	0	.0
P121	GW-48	GW-51	189.0	6.0	.200	.0	0	.0
P-121	GW-121	J-48	92.0	6.0	.100	.0	0	.0
P-122	J-49	J-48	127.0	12.0	.100	.0	0	.0
P123	GW-53	N141	50.0	4.0	.200	.0	0	.0
P-123	GW-127	J-49	37.0	6.0	.100	.0	0	.0
P-124	J-50	J-49	107.0	12.0	.100	.0	0	.0
P125	GW-42	GW-43	186.0	4.0	.200	.0	0	.0
P-125	GW-128	J-50	105.0	6.0	.100	.0	0	.0
P126	GW-56	GW-44	179.0	6.0	.200	.0	0	.0
P-126	J-51	J-54	215.0	18.0	.100	.0	0	.0
P-127	N245	J-51	77.0	6.0	.100	.0	0	.0
P-128	J-52	J-6	210.0	18.0	.100	.0	0	.0
P-129	GW-144	J-52	78.0	6.0	.100	.0	0	.0
P-13	J-4	J-33	115.0	18.0	.200	.0	0	.0
P130	GW-38	GW-19	126.0	4.0	.200	.0	0	.0
P-130	J-53	J-52	73.0	18.0	.100	.0	0	.0

P-131	J-54	J-53	8.0	18.0	.100	.0	0	.0
P132	N38	GW-58	285.0	4.0	.200	.0	0	.0
P-132	GW-143	J-54	45.0	6.0	.100	.0	0	.0
P133	GW-59	GW-70	191.0	4.0	.200	.0	0	.0
P-133	J-55	J-51	90.0	18.0	.100	.0	0	.0
P134	GW-35	N51	223.0	4.0	.200	.0	0	.0
P-134	GW-141	J-55	111.0	6.0	.100	.0	0	.0
P135	GW-60	GW-34	193.0	4.0	.200	.0	0	.0
P-135	J-56	J-55	253.0	18.0	.100	.0	0	.0
P136	GW-31	N54	137.0	6.0	.200	.0	0	.0
P-136	J-57	J-56	106.0	12.0	.100	.0	0	.0
P137	GW-62	GW-32	202.0	4.0	.200	.0	0	.0
P-137	J-57	GW-140	18.0	6.0	.100	.0	0	.0
P-138	J-58	J-57	101.0	12.0	.100	.0	0	.0
P139	GW-64	GW-30	176.0	4.0	.200	.0	0	.0
P-139	GW-131	J-58	114.0	6.0	.100	.0	0	.0
P-14	N51	J-4	206.0	8.0	.200	.0	0	.0
P140	GW-29	N151	60.0	4.0	.200	.0	0	.0
P-140	J-59	J-58	109.0	12.0	.100	.0	0	.0
P-141	GW-130	J-59	32.0	6.0	.100	.0	0	.0
P-142	J-60	J-59	137.0	12.0	.100	.0	0	.0
P-143	GW-118	J-60	39.0	6.0	.100	.0	0	.0
P-144	J-61	J-60	72.0	12.0	.100	.0	0	.0
P-145	GW-119	J-61	133.0	6.0	.100	.0	0	.0
P-146	GW-117	J-61	140.0	6.0	.100	.0	0	.0
P-147	J-63	GW-112	64.0	6.0	.100	.0	0	.0
P-148	J-63	J-61	172.0	12.0	.100	.0	0	.0
P-149	J-63	GW-100	71.0	6.0	.100	.0	0	.0
P-15	GW-34	GW-61	190.0	4.0	.200	.0	0	.0
P-150	J-62a	J-63	123.0	12.0	.100	.0	0	.0
P-151	GW-101	J-62a	111.0	6.0	.100	.0	0	.0
P-152	J-62d	J-62a	278.0	12.0	.100	.0	0	.0
P-153	J-62d	GW-94	96.0	6.0	.100	.0	0	.0
P-154	J-91	HC-2	666.0	6.0	.100	.0	0	.0
P-155	J-64	GW-95	200.0	6.0	.100	.0	0	.0
P-156	GW-81	GW-76	140.0	12.0	.100	.0	0	.0
P-157	J-64	GW-81	1.0	6.0	.100	.0	0	.0
P-158	J-65	J-66	113.0	18.0	.100	.0	0	.0
P-159	GW-74	J-65	52.0	6.0	.100	.0	0	.0
P-16	GW-66	N57	164.0	6.0	.200	.0	0	.0
P-160	J-66	J-67	228.0	18.0	.100	.0	0	.0
P-161	GW-75	J-66	86.0	6.0	.100	.0	0	.0
P-162	GW-76	J-67	107.0	12.0	.100	.0	0	.0
P-163	J-67	J-68	180.0	18.0	.100	.0	0	.0
P-164	J-68	J-69	210.0	18.0	.100	.0	0	.0
P-165	GW-77	J-68	79.0	6.0	.100	.0	0	.0
P-166	J-69	J-70	143.0	18.0	.100	.0	0	.0
P-167	GW-79	J-71	175.0	12.0	.100	.0	0	.0
P-168	J-70	J-91	157.0	18.0	.100	.0	0	.0
P-169	j-126	N240	148.0	12.0	.100	.0	0	.0
P-17	GW-63	N57	96.0	6.0	.200	.0	0	.0
P-170	GW-126	j-126	126.0	6.0	.100	.0	0	.0
P-171	GW-148	J-8	213.0	6.0	.100	.0	0	.0
P-172	GW-125	J-8	118.0	6.0	.100	.0	0	.0
P-173	GW-146	J-8	68.0	6.0	.100	.0	0	.0

P-174	J-71	J-72	152.0	12.0	.100	.0	0	.0
P-175	GW-96	J-71	25.0	6.0	.100	.0	0	.0
P-176	J-72	J-73	177.0	12.0	.100	.0	0	.0
P177	N164	J-65	150.0	18.0	.100	.0	0	.0
P-177	GW-99	J-72	88.0	6.0	.100	.0	0	.0
P-178	J-73	J-74	52.0	12.0	.100	.0	0	.0
P179	HC-3	J-89	638.0	6.0	.100	.0	0	.0
P-179	GW-114	J-73	22.0	6.0	.100	.0	0	.0
P18	GW-26	N33	31.0	4.0	.200	.0	0	.0
P-18	GW-65	N57	91.0	4.0	.200	.0	0	.0
P-180	J-74	J-76	63.0	12.0	.100	.0	0	.0
P-181	GW-113	J-74	130.0	6.0	.100	.0	0	.0
P-182	J-75	J-77	126.0	12.0	.100	.0	0	.0
P-183	GW-116	J-75	30.0	6.0	.100	.0	0	.0
P-184	J-76	J-75	65.0	12.0	.100	.0	0	.0
P-185	GW-115	J-76	117.0	6.0	.100	.0	0	.0
P-186	J-77	J-78	68.0	12.0	.100	.0	0	.0
P-187	GW-133	J-77	58.0	6.0	.100	.0	0	.0
P-188	J-78	J-80	155.0	12.0	.100	.0	0	.0
P189	GW-86	GW-72	81.0	6.0	.100	.0	0	.0
P-189	GW-134	J-78	75.0	6.0	.100	.0	0	.0
P-19	GW-28	GW-30	161.0	6.0	.200	.0	0	.0
P-190	J-79	J-81	177.0	18.0	.100	.0	0	.0
P-191	GW-132	GW-139	135.0	6.0	.100	.0	0	.0
P192	GW-87	GW-71	129.0	6.0	.100	.0	0	.0
P-192	J-81	J-56	94.0	18.0	.100	.0	0	.0
P-193	J-81	GW-139	81.0	6.0	.100	.0	0	.0
P-194	J-80	J-82	60.0	12.0	.100	.0	0	.0
P-195	GW-137	J-80	41.0	6.0	.100	.0	0	.0
P-196	J-82	J-79	118.0	18.0	.100	.0	0	.0
P-197	J-83	J-82	239.0	18.0	.100	.0	0	.0
P-198	GW-136	J-83	131.0	6.0	.100	.0	0	.0
P-199	J-84	J-83	323.0	18.0	.100	.0	0	.0
P-2	N55	GW-27	80.0	18.0	.200	.0	0	.0
P-20	J-5	N151	226.0	18.0	.100	.0	0	.0
P-200	J-85	J-84	175.0	18.0	.100	.0	0	.0
P-201	J-86	J-85	161.0	18.0	.100	.0	0	.0
P-202	J-87	J-86	158.0	18.0	.100	.0	0	.0
P-203	J-88	J-87	76.0	18.0	.100	.0	0	.0
P204	GW-145	N240	26.0	6.0	.100	.0	0	.0
P-204	GW-98	J-88	131.0	6.0	.100	.0	0	.0
P-205	J-89	J-88	80.0	18.0	.100	.0	0	.0
P-206	J-90	J-89	90.0	18.0	.100	.0	0	.0
P-207	GW-97	J-90	163.0	6.0	.100	.0	0	.0
P-208	J-91	J-90	61.0	18.0	.100	.0	0	.0
P-209	J-62e	J-62f	158.0	18.0	.200	.0	0	.0
P-21	J-6	J-5	188.0	18.0	.100	.0	0	.0
P-210	J-62f	J-28	69.0	18.0	.200	.0	0	.0
P-211	GW-3	J-62f	13.0	4.0	.200	.0	0	.0
P212	GW-85	J-40	82.0	6.0	.100	.0	0	.0
P-212	J-16	Blowers	1940.0	24.0	.050	.0	0	.0
P-213	J-62g	J-21	135.0	24.0	.200	.0	0	.0
P-214	GW-12	J-62g	36.0	24.0	.200	.0	0	.0
P-215	GW-27	N59	146.0	18.0	.200	.0	0	.0
P-22	N240	J-6	59.0	12.0	.100	.0	0	.0

P221	J-12	J-38	99.0	12.0	.100	.0	0	.0
P224	N245	N336	138.0	6.0	.100	.0	0	.0
P226	GW-78	GW-79	139.0	12.0	.100	.0	0	.0
P227	J-62d	GW-81	147.0	12.0	.100	.0	0	.0
P-23	J-7	J-9	11.0	12.0	.100	.0	0	.0
P235	GW-82	GW-74	158.0	6.0	.100	.0	0	.0
P238	GW-78	J-69	131.0	12.0	.100	.0	0	.0
P-24	GW-108	J-7	121.0	6.0	.100	.0	0	.0
P245	GW-93	GW-83	139.0	6.0	.100	.0	0	.0
P-25	GW-109	J-7	147.0	6.0	.100	.0	0	.0
P252	GW-138	J-79	62.0	6.0	.100	.0	0	.0
P259	GW-135	J-85	155.0	6.0	.100	.0	0	.0
P-26	J-8	j-126	44.0	12.0	.100	.0	0	.0
P262	GW-80	J-64	127.0	6.0	.100	.0	0	.0
P269	J-50	J-53	134.0	12.0	.100	.0	0	.0
P-27	J-9	J-8	216.0	12.0	.100	.0	0	.0
P273	HC-6	J-85	728.0	6.0	.100	.0	0	.0
P274	GW-149	N336	93.0	6.0	.100	.0	0	.0
P278	HC-7	J-84	813.0	6.0	.100	.0	0	.0
P-28	J-9	GW-124	248.0	6.0	.100	.0	0	.0
P281	HC-1	J-70	672.0	6.0	.100	.0	0	.0
P286	HC-5	J-86	674.0	6.0	.100	.0	0	.0
P288	HC-4	J-87	629.0	6.0	.100	.0	0	.0
P-29	GW-123	J-9	59.0	6.0	.100	.0	0	.0
P291	N70	N136	68.0	6.0	.200	.0	0	.0
P296	N138	J-28b	8.0	6.0	.200	.0	0	.0
P298	N141	N70	181.0	6.0	.200	.0	0	.0
P-3	N59	N151	147.0	18.0	.200	.0	0	.0
P-30	J-10	GW-105	7.0	12.0	.100	.0	0	.0
P307	N245	GW-142	35.0	6.0	.100	.0	0	.0
P31	GW-34	N51	91.0	6.0	.200	.0	0	.0
P-31	GW-106	J-10	141.0	6.0	.100	.0	0	.0
P316	N336	GW-129	115.0	6.0	.100	.0	0	.0
P32	N54	N55	150.0	8.0	.200	.0	0	.0
P-32	GW-107	J-10	258.0	6.0	.100	.0	0	.0
P-33	GW-90	J-10	153.0	6.0	.100	.0	0	.0
P-34	GW-105	J-7	227.0	12.0	.100	.0	0	.0
P-35	J-11	J-10	206.0	12.0	.100	.0	0	.0
P-36	GW-89	J-11	27.0	6.0	.100	.0	0	.0
P-37	J-12	J-11	108.0	12.0	.100	.0	0	.0
P-38	GW-88	J-12	192.0	6.0	.100	.0	0	.0
P-39	J-13	J-16	30.0	24.0	.200	.0	0	.0
P-4	GW-19	J-1	39.0	6.0	.200	.0	0	.0
P-40	GW-18	J-13	96.0	4.0	.200	.0	0	.0
P-41	J-14	J-13	112.0	24.0	.200	.0	0	.0
P-42	GW-17	J-14	73.0	4.0	.200	.0	0	.0
P43	GW-46	N70	46.0	4.0	.200	.0	0	.0
P-43	J-15	J-14	96.0	24.0	.200	.0	0	.0
P-44	GW-39	J-15	212.0	4.0	.200	.0	0	.0
P-45	J-16	J-1	380.0	18.0	.200	.0	0	.0
P-46	J-17	J-15	52.0	24.0	.200	.0	0	.0
P-47	GW-16	J-17	44.0	6.0	.200	.0	0	.0
P-48	J-18	J-17	158.0	24.0	.200	.0	0	.0
P49	GW-33	N51	180.0	4.0	.200	.0	0	.0
P-49	GW-40	J-19	172.0	4.0	.200	.0	0	.0

P-5	J-1	J-2	143.0	18.0	.200	.0	0	.0
P-50	J-19	J-18	27.0	6.0	.200	.0	0	.0
P-51	J-19	GW-15	5.0	6.0	.200	.0	0	.0
P-52	J-20	J-18	167.0	24.0	.200	.0	0	.0
P-53	GW-57	GW-41	193.0	6.0	.200	.0	0	.0
P-54	J-21	J-20	163.0	24.0	.200	.0	0	.0
P-55	GW-13	J-21	14.0	4.0	.200	.0	0	.0
P-56	GW-11	J-23	59.0	4.0	.200	.0	0	.0
P-57	J-23	J-62g	123.0	24.0	.200	.0	0	.0
P-58	J-22	J-24	292.0	18.0	.200	.0	0	.0
P-59	GW-10	J-22	64.0	4.0	.200	.0	0	.0
P-6	GW-37	J-3	146.0	4.0	.200	.0	0	.0
P-60	J-24	J-23	76.0	24.0	.200	.0	0	.0
P-61	J-25	J-22	165.0	18.0	.200	.0	0	.0
P-62	GW-9	J-25	30.0	4.0	.200	.0	0	.0
P-63	J-26	J-25	65.0	18.0	.200	.0	0	.0
P-64	J-26	N45	156.0	8.0	.200	.0	0	.0
P-65	J-27	J-26	84.0	18.0	.200	.0	0	.0
P-66	J-31	J-27	138.0	18.0	.200	.0	0	.0
P-67	GW-8	J-27	6.0	4.0	.200	.0	0	.0
P-68	N138	J-28a	170.0	6.0	.200	.0	0	.0
P-69	J-28a	GW-69	78.0	4.0	.200	.0	0	.0
P-7	J-2	GW-21	144.0	18.0	.200	.0	0	.0
P-70	J-28a	GW-68	165.0	6.0	.200	.0	0	.0
P-71	J-28b	N136	175.0	6.0	.200	.0	0	.0
P-72	N138	GW-54	64.0	6.0	.200	.0	0	.0
P-73	GW-55	J-28b	127.0	4.0	.200	.0	0	.0
P-74	GW-6	N136	135.0	8.0	.200	.0	0	.0
P-75	GW-6	J-29	88.0	8.0	.200	.0	0	.0
P-76	J-29	J-31	142.0	18.0	.200	.0	0	.0
P-77	GW-5	J-28c	62.0	4.0	.200	.0	0	.0
P-78	J-28c	J-29	201.0	18.0	.200	.0	0	.0
P-79	J-28	J-30	71.0	18.0	.200	.0	0	.0
P-8	J-3	J-2	15.0	6.0	.200	.0	0	.0
P-80	N40	J-28	147.0	8.0	.200	.0	0	.0
P-81	J-30	J-28c	150.0	18.0	.200	.0	0	.0
P-82	GW-4	J-30	42.0	6.0	.200	.0	0	.0
P-83	GW-7	J-31	35.0	6.0	.200	.0	0	.0
P84	GW-14	J-20	6.0	6.0	.200	.0	0	.0
P-84	J-32	N33	140.0	18.0	.200	.0	0	.0
P-85	GW-25	J-32	54.0	4.0	.200	.0	0	.0
P-86	J-33	J-32	149.0	18.0	.200	.0	0	.0
P-87	GW-24	J-33	73.0	4.0	.200	.0	0	.0
P-88	J-34	J-4	70.0	18.0	.200	.0	0	.0
P-89	GW-23	J-34	49.0	4.0	.200	.0	0	.0
P-9	GW-20	J-3	8.0	6.0	.200	.0	0	.0
P-90	J-35	J-62e	130.0	18.0	.200	.0	0	.0
P-91	GW-1	J-35	76.0	6.0	.200	.0	0	.0
P-92	GW-50	GW-49	217.0	6.0	.200	.0	0	.0
P-93	GW-49	GW-1	255.0	6.0	.200	.0	0	.0
P-94	J-36	J-38	19.0	18.0	.100	.0	0	.0
P-95	J-37	J-36	302.0	18.0	.100	.0	0	.0
P-96	J-38	J-35	299.0	18.0	.100	.0	0	.0
P97	N34	GW-7	10.0	6.0	.200	.0	0	.0
P-97	GW-71	J-36	106.0	6.0	.100	.0	0	.0

P-98	GW-72	J-37	95.0	6.0	.100	.0	0	.0
P99	GW-41	GW-14	134.0	6.0	.200	.0	0	.0
P-99	J-39	J-37	380.0	18.0	.100	.0	0	.0

JUNCTION NAME	NODE TITLE	ELEV	DEMAND (USFU)	FPN PRESSURE
Blowers		.00	.00	-33.00
GW-1		.00	-17.00	
GW-10		.00	-17.00	
GW-100		.00	-27.00	
GW-101		.00	-27.00	
GW-102		.00	-27.00	
GW-103		.00	-27.00	
GW-104		.00	-27.00	
GW-105		.00	-27.00	
GW-106		.00	-27.00	
GW-107		.00	-27.00	
GW-108		.00	-27.00	
GW-109		.00	-27.00	
GW-11		.00	-17.00	
GW-110		.00	-27.00	
GW-111		.00	-27.00	
GW-112		.00	-27.00	
GW-113		.00	-27.00	
GW-114		.00	-27.00	
GW-115		.00	-27.00	
GW-116		.00	-27.00	
GW-117		.00	-27.00	
GW-118		.00	-27.00	
GW-119		.00	-27.00	
GW-12		.00	-17.00	
GW-120		.00	-27.00	
GW-121		.00	-27.00	
GW-122		.00	-27.00	
GW-123		.00	-27.00	
GW-124		.00	-27.00	
GW-125		.00	-27.00	
GW-126		.00	-27.00	
GW-127		.00	-27.00	
GW-128		.00	-27.00	
GW-129		.00	-27.00	
GW-13		.00	-17.00	
GW-130		.00	-27.00	
GW-131		.00	-27.00	
GW-132		.00	-27.00	
GW-133		.00	-27.00	
GW-134		.00	-27.00	
GW-135		.00	-17.00	
GW-136		.00	-17.00	
GW-137		.00	-17.00	
GW-138		.00	-17.00	
GW-139		.00	-17.00	
GW-14		.00	-17.00	

GW-140	.00	-17.00
GW-141	.00	-17.00
GW-142	.00	-17.00
GW-143	.00	-17.00
GW-144	.00	-17.00
GW-145	.00	-17.00
GW-146	.00	-27.00
GW-147	.00	-17.00
GW-148	.00	-27.00
GW-149	.00	-27.00
GW-15	.00	-17.00
GW-16	.00	-17.00
GW-17	.00	-17.00
GW-18	.00	-17.00
GW-19	.00	-17.00
GW-2	.00	-17.00
GW-20	.00	-17.00
GW-21	.00	-17.00
GW-22	.00	-17.00
GW-23	.00	-17.00
GW-24	.00	-17.00
GW-25	.00	-17.00
GW-26	.00	-17.00
GW-27	.00	-17.00
GW-28	.00	-17.00
GW-29	.00	-17.00
GW-3	.00	-17.00
GW-30	.00	-27.00
GW-31	.00	-27.00
GW-32	.00	-27.00
GW-33	.00	-27.00
GW-34	.00	-27.00
GW-35	.00	-27.00
GW-36	.00	-27.00
GW-37	.00	-27.00
GW-38	.00	-27.00
GW-39	.00	-27.00
GW-4	.00	-17.00
GW-40	.00	-27.00
GW-41	.00	-27.00
GW-42	.00	-27.00
GW-43	.00	-27.00
GW-44	.00	-27.00
GW-45	.00	-27.00
GW-46	.00	-27.00
GW-47	.00	-27.00
GW-48	.00	-27.00
GW-49	.00	-27.00
GW-5	.00	-17.00
GW-50	.00	-27.00
GW-51	.00	-27.00
GW-52	.00	-27.00
GW-53	.00	-27.00
GW-54	.00	-27.00
GW-55	.00	-27.00

GW-56	.00	-27.00
GW-57	.00	-27.00
GW-58	.00	-27.00
GW-59	.00	-27.00
GW-6	.00	-17.00
GW-60	.00	-27.00
GW-61	.00	-27.00
GW-62	.00	-27.00
GW-63	.00	-27.00
GW-64	.00	-27.00
GW-65	.00	-27.00
GW-66	.00	-27.00
GW-67	.00	-27.00
GW-68	.00	-27.00
GW-69	.00	-27.00
GW-7	.00	-17.00
GW-70	.00	-27.00
GW-71	.00	-17.00
GW-72	.00	-17.00
GW-73	.00	-17.00
GW-74	.00	-17.00
GW-75	.00	-17.00
GW-76	.00	-17.00
GW-77	.00	-17.00
GW-78	.00	-17.00
GW-79	.00	-27.00
GW-8	.00	-17.00
GW-80	.00	-27.00
GW-81	.00	-27.00
GW-82	.00	-27.00
GW-83	.00	-27.00
GW-84	.00	-27.00
GW-85	.00	-27.00
GW-86	.00	-27.00
GW-87	.00	-27.00
GW-88	.00	-27.00
GW-89	.00	-27.00
GW-9	.00	-17.00
GW-90	.00	-27.00
GW-91	.00	-27.00
GW-92	.00	-27.00
GW-93	.00	-27.00
GW-94	.00	-27.00
GW-95	.00	-27.00
GW-96	.00	-27.00
GW-97	.00	-17.00
GW-98	.00	-17.00
GW-99	.00	-27.00
HC-1	.00	-15.00
HC-2	.00	-15.00
HC-3	.00	-15.00
HC-4	.00	-15.00
HC-5	.00	-15.00
HC-6	.00	-15.00
HC-7	.00	-15.00

J-1	.00	.00
J-10	.00	.00
J-11	.00	.00
J-12	.00	.00
j-126	.00	.00
J-13	.00	.00
J-14	.00	.00
J-15	.00	.00
J-16	.00	.00
J-17	.00	.00
J-18	.00	.00
J-19	.00	.00
J-2	.00	.00
J-20	.00	.00
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J-26	.00	.00
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J-28	.00	.00
J-28a	.00	.00
J-28b	.00	.00
J-28c	.00	.00
J-29	.00	.00
J-3	.00	.00
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J-6	.00	.00
J-60	.00	.00
J-61	.00	.00
J-62a	.00	.00
J-62d	.00	.00
J-62e	.00	.00
J-62f	.00	.00
J-62g	.00	.00
J-63	.00	.00
J-64	.00	.00
J-65	.00	.00
J-66	.00	.00
J-67	.00	.00
J-68	.00	.00
J-69	.00	.00
J-7	.00	.00
J-70	.00	.00
J-71	.00	.00
J-72	.00	.00
J-73	.00	.00
J-74	.00	.00
J-75	.00	.00
J-76	.00	.00
J-77	.00	.00
J-78	.00	.00
J-79	.00	.00
J-8	.00	.00
J-80	.00	.00
J-81	.00	.00
J-82	.00	.00
J-83	.00	.00
J-84	.00	.00
J-85	.00	.00
J-86	.00	.00
J-87	.00	.00
J-88	.00	.00
J-89	.00	.00
J-9	.00	.00
J-90	.00	.00
J-91	.00	.00
N136	.00	.00
N138	.00	.00
N141	.00	.00
N151	.00	.00
N164	.00	.00
N240	.00	.00
N245	.00	.00
N33	.00	.00
N336	.00	.00
N34	.00	.00
N38	.00	.00

N40	.00	.00
N45	.00	.00
N51	.00	.00
N54	.00	.00
N55	.00	.00
N57	.00	.00
N59	.00	.00
N70	.00	.00

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Set = 0

========== RESULTS FOR THIS SIMULATION FOLLOW ==========

Solution was obtained in 22 trials
Flow Accuracy = .1433E-03[< .500E-02]
RV Accuracy = .0000E+00[< .100E-02]

PIPE NO.	NODE #1	NODE #2	FLOW (USFU)	LOSS (USPU)	VELOCITY (FT/S)	DENSITY (#/CF)	FRICTION FACTOR	AREA RATIO
a	GW-2	J-62e	17.000	.01	3.79	.063	.0333	.006
GW	GW-147	J-5	17.000	.00	1.68	.063	.0367	.003
GW-110	GW-110	J-46	27.000	.01	2.67	.063	.0322	.004
P-1	N33	N55	-1294.640	.03	14.25	.063	.0175	.021
P-10	GW-21	GW-22	-1514.640	.09	16.69	.063	.0171	.025
P-100	J-39	N164	-520.904	.00	5.73	.063	.0204	.009
P-101	GW-73	N164	71.000	.01	7.03	.063	.0253	.010
P-102	J-41	J-39	163.390	.01	4.04	.063	.0242	.006
P-103	GW-84	J-41	27.000	.01	6.01	.063	.0291	.009
P104	GW-67	N141	27.000	.10	6.01	.063	.0297	.009
P-104	GW-83	GW-73	54.000	.04	5.34	.063	.0269	.008
P105	N40	GW-48	-54.000	.03	5.35	.063	.0274	.008
P-105	J-40	J-41	136.390	.00	3.37	.063	.0252	.005
P106	GW-44	N45	54.000	.03	5.35	.063	.0274	.008
P-106	J-42	J-40	109.390	.01	2.71	.063	.0266	.004
P107	GW-43	N45	54.000	.02	5.35	.063	.0274	.008
P-107	GW-91	J-42	27.000	.01	2.67	.063	.0322	.004
P108	GW-36	GW-59	-54.000	.06	5.35	.063	.0274	.008
P-108	GW-92	J-42	27.000	.01	2.67	.063	.0322	.004
P109	GW-36	N38	81.000	.04	8.03	.063	.0251	.012
P-109	J-43	J-42	55.390	.00	1.37	.063	.0318	.002
P-11	N38	GW-21	108.000	.03	6.02	.063	.0248	.009
P-110	GW-104	J-43	27.000	.01	2.67	.063	.0322	.004
P111	GW-32	N54	54.000	.02	5.35	.063	.0274	.008
P-111	J-44	J-43	28.390	.00	.70	.063	.0385	.001
P112	N54	GW-63	-81.000	.13	8.02	.063	.0251	.012

P-112	GW-103	J-44	27.000	.00	2.67	.063	.0322	.004
P-113	J-45	J-46	-25.610	.00	.63	.063	.0398	.001
P114	N59	GW-28	-71.000	.01	7.03	.063	.0258	.010
P-114	GW-102	J-45	27.000	.01	2.67	.063	.0322	.004
P115	GW-47	GW-4	27.000	.11	6.02	.063	.0297	.009
P-115	J-46	J-44	1.390	.00	.03	.063	.6242	.000
P116	GW-45	N34	27.000	.08	6.02	.063	.0297	.009
P-116	J-47	J-45	-52.610	.00	1.30	.063	.0323	.002
P-117	GW-111	J-47	27.000	.01	2.67	.063	.0322	.004
P-118	GW-120	J-47	27.000	.02	2.67	.063	.0322	.004
P-119	J-48	J-47	-106.610	.00	2.64	.063	.0268	.004
P-12	GW-22	J-34	-1497.640	.08	16.50	.063	.0171	.025
P120	GW-52	N40	27.000	.02	2.67	.063	.0325	.004
P-120	GW-122	J-48	27.000	.01	2.67	.063	.0322	.004
P121	GW-48	GW-51	-27.000	.02	2.67	.063	.0325	.004
P-121	GW-121	J-48	27.000	.01	2.67	.063	.0322	.004
P-122	J-49	J-48	-160.610	.01	3.97	.063	.0243	.006
P123	GW-53	N141	27.000	.03	6.01	.063	.0297	.009
P-123	GW-127	J-49	27.000	.00	2.67	.063	.0322	.004
P-124	J-50	J-49	-187.610	.01	4.64	.063	.0234	.007
P125	GW-42	GW-43	27.000	.11	6.02	.063	.0297	.009
P-125	GW-128	J-50	27.000	.01	2.67	.063	.0322	.004
P126	GW-56	GW-44	27.000	.02	2.68	.063	.0325	.004
P-126	J-51	J-54	585.096	.02	6.43	.063	.0199	.010
P-127	N245	J-51	71.000	.04	7.03	.063	.0253	.010
P-128	J-52	J-6	833.706	.04	9.17	.063	.0185	.014
P-129	GW-144	J-52	17.000	.00	1.68	.063	.0367	.003
P-13	J-4	J-33	-1345.640	.05	14.82	.063	.0174	.022
P130	GW-38	GW-19	27.000	.08	6.03	.063	.0297	.009
P-130	J-53	J-52	816.706	.01	8.98	.063	.0186	.013
P-131	J-54	J-53	602.096	.00	6.62	.063	.0198	.010
P132	N38	GW-58	-27.000	.17	6.02	.063	.0297	.009
P-132	GW-143	J-54	17.000	.00	1.68	.063	.0367	.003
P133	GW-59	GW-70	-27.000	.12	6.02	.063	.0297	.009
P-133	J-55	J-51	514.096	.01	5.65	.063	.0204	.008
P134	GW-35	N51	27.000	.14	6.02	.063	.0297	.009
P-134	GW-141	J-55	17.000	.00	1.68	.063	.0367	.003
P135	GW-60	GW-34	27.000	.12	6.02	.063	.0297	.009
P-135	J-56	J-55	497.096	.02	5.47	.063	.0206	.008
P136	GW-31	N54	27.000	.01	2.67	.063	.0325	.004
P-136	J-57	J-56	182.794	.01	4.52	.063	.0236	.007
P137	GW-62	GW-32	27.000	.12	6.01	.063	.0297	.009
P-137	J-57	GW-140	-17.000	.00	1.68	.063	.0367	.003
P-138	J-58	J-57	165.794	.01	4.10	.063	.0241	.006
P139	GW-64	GW-30	27.000	.11	6.01	.063	.0297	.009
P-139	GW-131	J-58	27.000	.01	2.67	.063	.0322	.004
P-14	N51	J-4	135.000	.08	7.52	.063	.0237	.011
P140	GW-29	N151	17.000	.02	3.79	.063	.0333	.006
P-140	J-59	J-58	138.794	.01	3.43	.063	.0251	.005
P-141	GW-130	J-59	27.000	.00	2.67	.063	.0322	.004
P-142	J-60	J-59	111.794	.01	2.77	.063	.0265	.004
P-143	GW-118	J-60	27.000	.00	2.67	.063	.0322	.004
P-144	J-61	J-60	84.794	.00	2.10	.063	.0284	.003
P-145	GW-119	J-61	27.000	.01	2.67	.063	.0322	.004
P-146	GW-117	J-61	27.000	.01	2.67	.063	.0322	.004

P-147	J-63	GW-112	-27.000	.01	2.67	.063	.0322	.004
P-148	J-63	J-61	30.794	.00	.76	.063	.0376	.001
P-149	J-63	GW-100	-27.000	.01	2.67	.063	.0322	.004
P-15	GW-34	GW-61	-27.000	.12	6.02	.063	.0297	.009
P-150	J-62a	J-63	-23.206	.00	.57	.063	.0410	.001
P-151	GW-101	J-62a	27.000	.01	2.67	.063	.0322	.004
P-152	J-62d	J-62a	-50.206	.00	1.24	.063	.0327	.002
P-153	J-62d	GW-94	-27.000	.01	2.67	.063	.0322	.004
P-154	J-91	HC-2	-15.000	.02	1.48	.063	.0380	.002
P-155	J-64	GW-95	-27.000	.02	2.67	.063	.0322	.004
P-156	GW-81	GW-76	158.206	.01	3.91	.063	.0244	.006
P-157	J-64	GW-81	54.000	.00	5.34	.063	.0269	.008
P-158	J-65	J-66	-405.904	.01	4.46	.063	.0215	.007
P-159	GW-74	J-65	44.000	.01	4.35	.063	.0283	.006
P-16	GW-66	N57	27.000	.01	2.67	.063	.0325	.004
P-160	J-66	J-67	-388.904	.01	4.28	.063	.0217	.006
P-161	GW-75	J-66	17.000	.00	1.68	.063	.0367	.003
P-162	GW-76	J-67	175.206	.01	4.33	.063	.0238	.006
P-163	J-67	J-68	-213.698	.00	2.35	.063	.0249	.004
P-164	J-68	J-69	-196.698	.00	2.16	.063	.0254	.003
P-165	GW-77	J-68	17.000	.00	1.68	.063	.0367	.003
P-166	J-69	J-70	-72.989	.00	.80	.063	.0329	.001
P-167	GW-79	J-71	-79.709	.00	1.97	.063	.0289	.003
P-168	J-70	J-91	-57.989	.00	.64	.063	.0351	.001
P-169	j-126	N240	159.934	.01	3.96	.063	.0243	.006
P-17	GW-63	N57	-54.000	.03	5.35	.063	.0274	.008
P-170	GW-126	j-126	27.000	.01	2.67	.063	.0322	.004
P-171	GW-148	J-8	27.000	.02	2.67	.063	.0322	.004
P-172	GW-125	J-8	27.000	.01	2.67	.063	.0322	.004
P-173	GW-146	J-8	27.000	.01	2.67	.063	.0322	.004
P-174	J-71	J-72	-52.709	.00	1.30	.063	.0322	.002
P-175	GW-96	J-71	27.000	.00	2.67	.063	.0322	.004
P-176	J-72	J-73	-25.709	.00	.64	.063	.0398	.001
P177	N164	J-65	-449.904	.01	4.95	.063	.0210	.007
P-177	GW-99	J-72	27.000	.01	2.67	.063	.0322	.004
P-178	J-73	J-74	1.291	.00	.03	.063	.1089	.000
P179	HC-3	J-89	15.000	.02	1.48	.063	.0380	.002
P-179	GW-114	J-73	27.000	.00	2.67	.063	.0322	.004
P18	GW-26	N33	17.000	.01	3.79	.063	.0333	.006
P-18	GW-65	N57	27.000	.06	6.01	.063	.0297	.009
P-180	J-74	J-76	28.291	.00	.70	.063	.0386	.001
P-181	GW-113	J-74	27.000	.01	2.67	.063	.0322	.004
P-182	J-75	J-77	82.291	.00	2.04	.063	.0286	.003
P-183	GW-116	J-75	27.000	.00	2.67	.063	.0322	.004
P-184	J-76	J-75	55.291	.00	1.37	.063	.0318	.002
P-185	GW-115	J-76	27.000	.01	2.67	.063	.0322	.004
P-186	J-77	J-78	109.291	.00	2.70	.063	.0266	.004
P-187	GW-133	J-77	27.000	.01	2.67	.063	.0322	.004
P-188	J-78	J-80	136.291	.01	3.37	.063	.0252	.005
P189	GW-86	GW-72	27.000	.01	2.67	.063	.0322	.004
P-189	GW-134	J-78	27.000	.01	2.67	.063	.0322	.004
P-19	GW-28	GW-30	-54.000	.05	5.35	.063	.0274	.008
P-190	J-79	J-81	270.302	.00	2.97	.063	.0235	.004
P-191	GW-132	GW-139	27.000	.01	2.67	.063	.0322	.004
P192	GW-87	GW-71	27.000	.01	2.67	.063	.0322	.004

P-192	J-81	J-56	314.302	.00	3.46	.063	.0227	.005
P-193	J-81	GW-139	-44.000	.02	4.35	.063	.0283	.006
P-194	J-80	J-82	153.291	.00	3.79	.063	.0246	.006
P-195	GW-137	J-80	17.000	.00	1.68	.063	.0367	.003
P-196	J-82	J-79	253.302	.00	2.78	.063	.0239	.004
P-197	J-83	J-82	100.011	.00	1.10	.063	.0302	.002
P-198	GW-136	J-83	17.000	.01	1.68	.063	.0367	.003
P-199	J-84	J-83	83.011	.00	.91	.063	.0317	.001
P-2	N55	GW-27	-1132.640	.03	12.47	.063	.0179	.019
P-20	J-5	N151	1027.640	.06	11.31	.063	.0178	.017
P-200	J-85	J-84	68.011	.00	.75	.063	.0336	.001
P-201	J-86	J-85	36.011	.00	.40	.063	.0405	.001
P-202	J-87	J-86	21.011	.00	.23	.063	.0483	.000
P-203	J-88	J-87	6.011	.00	.07	.063	.1005	.000
P204	GW-145	N240	17.000	.00	1.68	.063	.0367	.003
P-204	GW-98	J-88	17.000	.01	1.68	.063	.0367	.003
P-205	J-89	J-88	-10.989	.00	.12	.063	.1801	.000
P-206	J-90	J-89	-25.989	.00	.29	.063	.0451	.000
P-207	GW-97	J-90	17.000	.01	1.68	.063	.0367	.003
P-208	J-91	J-90	-42.989	.00	.47	.063	.0384	.001
P-209	J-62e	J-62f	1078.360	.05	11.87	.063	.0180	.018
P-21	J-6	J-5	1010.640	.05	11.12	.063	.0178	.017
P-210	J-62f	J-28	1095.360	.02	12.05	.063	.0180	.018
P-211	GW-3	J-62f	17.000	.00	3.79	.063	.0333	.006
P212	GW-85	J-40	27.000	.01	2.67	.063	.0322	.004
P-212	J-16	Blowers	3618.000	1.34	22.50	.063	.0146	.034
P-213	J-62g	J-21	1680.359	.02	10.42	.063	.0174	.016
P-214	GW-12	J-62g	17.000	.00	.11	.063	.0651	.000
P-215	GW-27	N59	-1115.640	.05	12.28	.063	.0179	.018
P-22	N240	J-6	176.934	.01	4.38	.063	.0238	.007
P221	J-12	J-38	218.066	.01	5.40	.063	.0227	.008
P224	N245	N336	-54.000	.04	5.34	.063	.0269	.008
P226	GW-78	GW-79	-106.709	.00	2.64	.063	.0268	.004
P227	J-62d	GW-81	77.206	.00	1.91	.063	.0291	.003
P-23	J-7	J-9	-2.066	.00	.05	.063	.3888	.000
P235	GW-82	GW-74	27.000	.01	2.67	.063	.0322	.004
P238	GW-78	J-69	123.709	.01	3.06	.063	.0258	.005
P-24	GW-108	J-7	27.000	.01	2.67	.063	.0322	.004
P245	GW-93	GW-83	27.000	.01	2.67	.063	.0322	.004
P-25	GW-109	J-7	27.000	.01	2.67	.063	.0322	.004
P252	GW-138	J-79	17.000	.00	1.68	.063	.0367	.003
P259	GW-135	J-85	17.000	.01	1.68	.063	.0367	.003
P-26	J-8	j-126	132.934	.00	3.29	.063	.0254	.005
P262	GW-80	J-64	27.000	.01	2.67	.063	.0322	.004
P269	J-50	J-53	214.610	.02	5.31	.063	.0227	.008
P-27	J-9	J-8	51.934	.00	1.29	.063	.0324	.002
P273	HC-6	J-85	15.000	.02	1.48	.063	.0380	.002
P274	GW-149	N336	27.000	.01	2.67	.063	.0322	.004
P278	HC-7	J-84	15.000	.03	1.48	.063	.0380	.002
P-28	J-9	GW-124	-27.000	.02	2.67	.063	.0322	.004
P281	HC-1	J-70	15.000	.02	1.48	.063	.0380	.002
P286	HC-5	J-86	15.000	.02	1.48	.063	.0380	.002
P288	HC-4	J-87	15.000	.02	1.48	.063	.0380	.002
P-29	GW-123	J-9	27.000	.01	2.67	.063	.0322	.004
P291	N70	N136	81.000	.04	8.02	.063	.0251	.012

P296	N138	J-28b	81.000	.00	8.02	.063	.0251	.012
P298	N141	N70	54.000	.05	5.35	.063	.0274	.008
P-3	N59	N151	-1044.640	.04	11.49	.063	.0181	.017
P-30	J-10	GW-105	-83.066	.00	2.06	.063	.0285	.003
P307	N245	GW-142	-17.000	.00	1.68	.063	.0367	.003
P31	GW-34	N51	81.000	.06	8.03	.063	.0251	.012
P-31	GW-106	J-10	27.000	.01	2.67	.063	.0322	.004
P316	N336	GW-129	-27.000	.01	2.67	.063	.0322	.004
P32	N54	N55	162.000	.08	9.02	.063	.0228	.013
P-32	GW-107	J-10	27.000	.02	2.67	.063	.0322	.004
P-33	GW-90	J-10	27.000	.01	2.67	.063	.0322	.004
P-34	GW-105	J-7	-56.066	.00	1.39	.063	.0317	.002
P-35	J-11	J-10	-164.066	.02	4.06	.063	.0242	.006
P-36	GW-89	J-11	27.000	.00	2.67	.063	.0322	.004
P-37	J-12	J-11	-191.066	.01	4.73	.063	.0233	.007
P-38	GW-88	J-12	27.000	.02	2.67	.063	.0322	.004
P-39	J-13	J-16	1890.359	.01	11.73	.063	.0170	.018
P-4	GW-19	J-1	44.000	.01	4.37	.063	.0288	.007
P-40	GW-18	J-13	17.000	.03	3.80	.063	.0333	.006
P-41	J-14	J-13	1873.359	.02	11.63	.063	.0170	.017
P-42	GW-17	J-14	17.000	.02	3.80	.063	.0333	.006
P43	GW-46	N70	27.000	.03	6.02	.063	.0297	.009
P-43	J-15	J-14	1856.359	.02	11.52	.063	.0171	.017
P-44	GW-39	J-15	27.000	.13	6.03	.063	.0297	.009
P-45	J-16	J-1	-1727.640	.29	19.06	.063	.0167	.028
P-46	J-17	J-15	1829.359	.01	11.35	.063	.0171	.017
P-47	GW-16	J-17	17.000	.00	1.69	.063	.0369	.003
P-48	J-18	J-17	1812.359	.03	11.24	.063	.0171	.017
P49	GW-33	N51	27.000	.11	6.02	.063	.0297	.009
P-49	GW-40	J-19	27.000	.10	6.03	.063	.0297	.009
P-5	J-1	J-2	-1683.640	.10	18.56	.063	.0168	.028
P-50	J-19	J-18	44.000	.01	4.37	.063	.0288	.007
P-51	J-19	GW-15	-17.000	.00	1.69	.063	.0369	.003
P-52	J-20	J-18	1768.359	.03	10.97	.063	.0172	.016
P-53	GW-57	GW-41	27.000	.02	2.68	.063	.0325	.004
P-54	J-21	J-20	1697.359	.03	10.53	.063	.0173	.016
P-55	GW-13	J-21	17.000	.00	3.80	.063	.0333	.006
P-56	GW-11	J-23	17.000	.02	3.80	.063	.0333	.006
P-57	J-23	J-62g	1663.359	.02	10.32	.063	.0174	.015
P-58	J-22	J-24	1646.359	.20	18.15	.063	.0169	.027
P-59	GW-10	J-22	17.000	.02	3.79	.063	.0333	.006
P-6	GW-37	J-3	27.000	.09	6.02	.063	.0297	.009
P-60	J-24	J-23	1646.359	.01	10.21	.063	.0174	.015
P-61	J-25	J-22	1629.360	.11	17.96	.063	.0169	.027
P-62	GW-9	J-25	17.000	.01	3.79	.063	.0333	.006
P-63	J-26	J-25	1612.360	.04	17.76	.063	.0169	.026
P-64	J-26	N45	-108.000	.04	6.02	.063	.0248	.009
P-65	J-27	J-26	1504.360	.05	16.57	.063	.0171	.025
P-66	J-31	J-27	1487.360	.08	16.38	.063	.0171	.024
P-67	GW-8	J-27	17.000	.00	3.79	.063	.0333	.006
P-68	N138	J-28a	-54.000	.05	5.35	.063	.0274	.008
P-69	J-28a	GW-69	-27.000	.05	6.01	.063	.0297	.009
P-7	J-2	GW-21	-1639.640	.10	18.07	.063	.0169	.027
P-70	J-28a	GW-68	-27.000	.01	2.67	.063	.0325	.004
P-71	J-28b	N136	108.000	.18	10.69	.063	.0237	.016

P-72	N138	GW-54	-27.000	.01	2.67	.063	.0325	.004
P-73	GW-55	J-28b	27.000	.08	6.01	.063	.0297	.009
P-74	GW-6	N136	-189.000	.09	10.53	.063	.0221	.016
P-75	GW-6	J-29	206.000	.07	11.48	.063	.0218	.017
P-76	J-29	J-31	1443.360	.08	15.89	.063	.0172	.024
P-77	GW-5	J-28c	17.000	.02	3.79	.063	.0333	.006
P-78	J-28c	J-29	1237.360	.08	13.62	.063	.0176	.020
P-79	J-28	J-30	1176.360	.03	12.95	.063	.0178	.019
P-8	J-3	J-2	44.000	.00	4.36	.063	.0288	.007
P-80	N40	J-28	81.000	.02	4.51	.063	.0264	.007
P-81	J-30	J-28c	1220.360	.06	13.43	.063	.0177	.020
P-82	GW-4	J-30	44.000	.01	4.36	.063	.0288	.007
P-83	GW-7	J-31	44.000	.01	4.36	.063	.0288	.007
P84	GW-14	J-20	71.000	.00	7.05	.063	.0258	.011
P-84	J-32	N33	-1311.640	.06	14.44	.063	.0175	.022
P-85	GW-25	J-32	17.000	.01	3.79	.063	.0333	.006
P-86	J-33	J-32	-1328.640	.07	14.63	.063	.0174	.022
P-87	GW-24	J-33	17.000	.02	3.79	.063	.0333	.006
P-88	J-34	J-4	-1480.640	.04	16.31	.063	.0171	.024
P-89	GW-23	J-34	17.000	.01	3.79	.063	.0333	.006
P-9	GW-20	J-3	17.000	.00	1.69	.063	.0369	.003
P-90	J-35	J-62e	1061.360	.04	11.68	.063	.0181	.017
P-91	GW-1	J-35	71.000	.04	7.03	.063	.0258	.010
P-92	GW-50	GW-49	27.000	.02	2.67	.063	.0325	.004
P-93	GW-49	GW-1	54.000	.08	5.35	.063	.0274	.008
P-94	J-36	J-38	772.294	.00	8.49	.063	.0188	.013
P-95	J-37	J-36	728.294	.05	8.01	.063	.0190	.012
P-96	J-38	J-35	990.360	.08	10.89	.063	.0179	.016
P97	N34	GW-7	27.000	.00	2.68	.063	.0325	.004
P-97	GW-71	J-36	44.000	.02	4.36	.063	.0283	.006
P-98	GW-72	J-37	44.000	.02	4.35	.063	.0283	.006
P99	GW-41	GW-14	54.000	.04	5.36	.063	.0274	.008
P-99	J-39	J-37	684.294	.05	7.52	.063	.0193	.011
Blowers	Blowers	Blowers	-3618.000	.00	.01	.062	.0339	.000

JUNCTION NAME	NODE TITLE	DEMAND (USFU)	PRESSURE (USPU)	PRESSURE (PSIA)	PRESSURE (PSIG)	DENSITY #/CF
Blowers		.00	-33.00	13.51	-1.19	.062
GW-1		-17.00	-30.56	13.59	-1.10	.063
GW-10		-17.00	-31.22	13.57	-1.13	.063
GW-100		-27.00	-30.35	13.60	-1.09	.063
GW-101		-27.00	-30.35	13.60	-1.09	.063
GW-102		-27.00	-30.39	13.60	-1.10	.063
GW-103		-27.00	-30.40	13.60	-1.10	.063
GW-104		-27.00	-30.39	13.60	-1.10	.063
GW-105		-27.00	-30.48	13.60	-1.10	.063
GW-106		-27.00	-30.46	13.60	-1.10	.063
GW-107		-27.00	-30.45	13.60	-1.10	.063
GW-108		-27.00	-30.46	13.60	-1.10	.063
GW-109		-27.00	-30.46	13.60	-1.10	.063
GW-11		-17.00	-31.44	13.56	-1.13	.063

GW-110	-27.00	-30.39	13.60	-1.10	.063
GW-111	-27.00	-30.39	13.60	-1.10	.063
GW-112	-27.00	-30.35	13.60	-1.09	.063
GW-113	-27.00	-30.35	13.60	-1.09	.063
GW-114	-27.00	-30.36	13.60	-1.10	.063
GW-115	-27.00	-30.35	13.60	-1.09	.063
GW-116	-27.00	-30.36	13.60	-1.10	.063
GW-117	-27.00	-30.35	13.60	-1.09	.063
GW-118	-27.00	-30.36	13.60	-1.10	.063
GW-119	-27.00	-30.35	13.60	-1.09	.063
GW-12	-17.00	-31.48	13.56	-1.14	.063
GW-120	-27.00	-30.38	13.60	-1.10	.063
GW-121	-27.00	-30.40	13.60	-1.10	.063
GW-122	-27.00	-30.39	13.60	-1.10	.063
GW-123	-27.00	-30.47	13.60	-1.10	.063
GW-124	-27.00	-30.45	13.60	-1.10	.063
GW-125	-27.00	-30.47	13.60	-1.10	.063
GW-126	-27.00	-30.47	13.60	-1.10	.063
GW-127	-27.00	-30.41	13.60	-1.10	.063
GW-128	-27.00	-30.41	13.60	-1.10	.063
GW-129	-27.00	-30.33	13.60	-1.09	.063
GW-13	-17.00	-31.50	13.56	-1.14	.063
GW-130	-27.00	-30.36	13.60	-1.10	.063
GW-131	-27.00	-30.36	13.60	-1.10	.063
GW-132	-27.00	-30.36	13.60	-1.10	.063
GW-133	-27.00	-30.36	13.60	-1.10	.063
GW-134	-27.00	-30.36	13.60	-1.10	.063
GW-135	-17.00	-30.37	13.60	-1.10	.063
GW-136	-17.00	-30.37	13.60	-1.10	.063
GW-137	-17.00	-30.37	13.60	-1.10	.063
GW-138	-17.00	-30.38	13.60	-1.10	.063
GW-139	-17.00	-30.37	13.60	-1.10	.063
GW-14	-17.00	-31.53	13.56	-1.14	.063
GW-140	-17.00	-30.38	13.60	-1.10	.063
GW-141	-17.00	-30.40	13.60	-1.10	.063
GW-142	-17.00	-30.38	13.60	-1.10	.063
GW-143	-17.00	-30.44	13.60	-1.10	.063
GW-144	-17.00	-30.45	13.60	-1.10	.063
GW-145	-17.00	-30.49	13.60	-1.10	.063
GW-146	-27.00	-30.47	13.60	-1.10	.063
GW-147	-17.00	-30.54	13.59	-1.10	.063
GW-148	-27.00	-30.46	13.60	-1.10	.063
GW-149	-27.00	-30.33	13.60	-1.09	.063
GW-15	-17.00	-31.56	13.56	-1.14	.063
GW-16	-17.00	-31.59	13.56	-1.14	.063
GW-17	-17.00	-31.60	13.56	-1.14	.063
GW-18	-17.00	-31.62	13.56	-1.14	.063
GW-19	-17.00	-31.36	13.56	-1.13	.063
GW-2	-17.00	-30.63	13.59	-1.10	.063
GW-20	-17.00	-31.26	13.57	-1.13	.063
GW-21	-17.00	-31.16	13.57	-1.12	.063
GW-22	-17.00	-31.07	13.58	-1.12	.063
GW-23	-17.00	-30.98	13.58	-1.12	.063
GW-24	-17.00	-30.87	13.58	-1.11	.063
GW-25	-17.00	-30.81	13.58	-1.11	.063

GW-26	-17.00	-30.75	13.59	-1.11	.063
GW-27	-17.00	-30.70	13.59	-1.11	.063
GW-28	-17.00	-30.65	13.59	-1.11	.063
GW-29	-17.00	-30.59	13.59	-1.10	.063
GW-3	-17.00	-30.68	13.59	-1.11	.063
GW-30	-27.00	-30.60	13.59	-1.10	.063
GW-31	-27.00	-30.64	13.59	-1.11	.063
GW-32	-27.00	-30.63	13.59	-1.10	.063
GW-33	-27.00	-30.76	13.59	-1.11	.063
GW-34	-27.00	-30.82	13.58	-1.11	.063
GW-35	-27.00	-30.74	13.59	-1.11	.063
GW-36	-27.00	-31.09	13.57	-1.12	.063
GW-37	-27.00	-31.17	13.57	-1.12	.063
GW-38	-27.00	-31.28	13.57	-1.13	.063
GW-39	-27.00	-31.48	13.56	-1.14	.063
GW-4	-17.00	-30.73	13.59	-1.11	.063
GW-40	-27.00	-31.45	13.56	-1.13	.063
GW-41	-27.00	-31.49	13.56	-1.14	.063
GW-42	-27.00	-30.91	13.58	-1.11	.063
GW-43	-27.00	-31.02	13.58	-1.12	.063
GW-44	-27.00	-31.01	13.58	-1.12	.063
GW-45	-27.00	-30.87	13.58	-1.11	.063
GW-46	-27.00	-30.64	13.59	-1.11	.063
GW-47	-27.00	-30.62	13.59	-1.10	.063
GW-48	-27.00	-30.65	13.59	-1.11	.063
GW-49	-27.00	-30.48	13.60	-1.10	.063
GW-5	-17.00	-30.78	13.59	-1.11	.063
GW-50	-27.00	-30.46	13.60	-1.10	.063
GW-51	-27.00	-30.64	13.59	-1.11	.063
GW-52	-27.00	-30.66	13.59	-1.11	.063
GW-53	-27.00	-30.59	13.59	-1.10	.063
GW-54	-27.00	-30.52	13.59	-1.10	.063
GW-55	-27.00	-30.46	13.60	-1.10	.063
GW-56	-27.00	-31.00	13.58	-1.12	.063
GW-57	-27.00	-31.47	13.56	-1.14	.063
GW-58	-27.00	-30.96	13.58	-1.12	.063
GW-59	-27.00	-31.03	13.58	-1.12	.063
GW-6	-17.00	-30.81	13.58	-1.11	.063
GW-60	-27.00	-30.70	13.59	-1.11	.063
GW-61	-27.00	-30.70	13.59	-1.11	.063
GW-62	-27.00	-30.51	13.60	-1.10	.063
GW-63	-27.00	-30.52	13.59	-1.10	.063
GW-64	-27.00	-30.49	13.60	-1.10	.063
GW-65	-27.00	-30.44	13.60	-1.10	.063
GW-66	-27.00	-30.48	13.60	-1.10	.063
GW-67	-27.00	-30.51	13.60	-1.10	.063
GW-68	-27.00	-30.46	13.60	-1.10	.063
GW-69	-27.00	-30.43	13.60	-1.10	.063
GW-7	-17.00	-30.95	13.58	-1.12	.063
GW-70	-27.00	-30.92	13.58	-1.12	.063
GW-71	-17.00	-30.49	13.60	-1.10	.063
GW-72	-17.00	-30.45	13.60	-1.10	.063
GW-73	-17.00	-30.40	13.60	-1.10	.063
GW-74	-17.00	-30.39	13.60	-1.10	.063
GW-75	-17.00	-30.39	13.60	-1.10	.063

GW-76	-17.00	-30.37	13.60	-1.10	.063
GW-77	-17.00	-30.38	13.60	-1.10	.063
GW-78	-17.00	-30.37	13.60	-1.10	.063
GW-79	-27.00	-30.37	13.60	-1.10	.063
GW-8	-17.00	-31.03	13.58	-1.12	.063
GW-80	-27.00	-30.35	13.60	-1.09	.063
GW-81	-27.00	-30.36	13.60	-1.10	.063
GW-82	-27.00	-30.38	13.60	-1.10	.063
GW-83	-27.00	-30.37	13.60	-1.10	.063
GW-84	-27.00	-30.40	13.60	-1.10	.063
GW-85	-27.00	-30.40	13.60	-1.10	.063
GW-86	-27.00	-30.44	13.60	-1.10	.063
GW-87	-27.00	-30.48	13.60	-1.10	.063
GW-88	-27.00	-30.49	13.60	-1.10	.063
GW-89	-27.00	-30.49	13.60	-1.10	.063
GW-9	-17.00	-31.12	13.57	-1.12	.063
GW-90	-27.00	-30.46	13.60	-1.10	.063
GW-91	-27.00	-30.39	13.60	-1.10	.063
GW-92	-27.00	-30.39	13.60	-1.10	.063
GW-93	-27.00	-30.36	13.60	-1.09	.063
GW-94	-27.00	-30.35	13.60	-1.09	.063
GW-95	-27.00	-30.35	13.60	-1.09	.063
GW-96	-27.00	-30.36	13.60	-1.10	.063
GW-97	-17.00	-30.37	13.60	-1.10	.063
GW-98	-17.00	-30.37	13.60	-1.10	.063
GW-99	-27.00	-30.35	13.60	-1.09	.063
HC-1	-15.00	-30.36	13.60	-1.09	.063
HC-2	-15.00	-30.36	13.60	-1.09	.063
HC-3	-15.00	-30.36	13.60	-1.09	.063
HC-4	-15.00	-30.36	13.60	-1.09	.063
HC-5	-15.00	-30.35	13.60	-1.09	.063
HC-6	-15.00	-30.35	13.60	-1.09	.063
HC-7	-15.00	-30.35	13.60	-1.09	.063
J-1	.00	-31.37	13.56	-1.13	.063
J-10	.00	-30.48	13.60	-1.10	.063
J-11	.00	-30.49	13.60	-1.10	.063
J-12	.00	-30.50	13.60	-1.10	.063
j-126	.00	-30.48	13.60	-1.10	.063
J-13	.00	-31.65	13.55	-1.14	.063
J-14	.00	-31.62	13.56	-1.14	.063
J-15	.00	-31.60	13.56	-1.14	.063
J-16	.00	-31.66	13.55	-1.14	.063
J-17	.00	-31.59	13.56	-1.14	.063
J-18	.00	-31.56	13.56	-1.14	.063
J-19	.00	-31.56	13.56	-1.14	.063
J-2	.00	-31.26	13.57	-1.13	.063
J-20	.00	-31.53	13.56	-1.14	.063
J-21	.00	-31.50	13.56	-1.14	.063
J-22	.00	-31.24	13.57	-1.13	.063
J-23	.00	-31.45	13.56	-1.13	.063
J-24	.00	-31.44	13.56	-1.13	.063
J-25	.00	-31.13	13.57	-1.12	.063
J-26	.00	-31.08	13.57	-1.12	.063
J-27	.00	-31.03	13.58	-1.12	.063
J-28	.00	-30.71	13.59	-1.11	.063

J-28a	.00	-30.48	13.60	-1.10	.063
J-28b	.00	-30.53	13.59	-1.10	.063
J-28c	.00	-30.79	13.59	-1.11	.063
J-29	.00	-30.88	13.58	-1.11	.063
J-3	.00	-31.26	13.57	-1.13	.063
J-30	.00	-30.73	13.59	-1.11	.063
J-31	.00	-30.95	13.58	-1.12	.063
J-32	.00	-30.82	13.58	-1.11	.063
J-33	.00	-30.89	13.58	-1.11	.063
J-34	.00	-30.99	13.58	-1.12	.063
J-35	.00	-30.59	13.59	-1.10	.063
J-36	.00	-30.51	13.60	-1.10	.063
J-37	.00	-30.47	13.60	-1.10	.063
J-38	.00	-30.52	13.60	-1.10	.063
J-39	.00	-30.41	13.60	-1.10	.063
J-4	.00	-30.95	13.58	-1.12	.063
J-40	.00	-30.40	13.60	-1.10	.063
J-41	.00	-30.41	13.60	-1.10	.063
J-42	.00	-30.40	13.60	-1.10	.063
J-43	.00	-30.40	13.60	-1.10	.063
J-44	.00	-30.40	13.60	-1.10	.063
J-45	.00	-30.40	13.60	-1.10	.063
J-46	.00	-30.40	13.60	-1.10	.063
J-47	.00	-30.40	13.60	-1.10	.063
J-48	.00	-30.40	13.60	-1.10	.063
J-49	.00	-30.41	13.60	-1.10	.063
J-5	.00	-30.55	13.59	-1.10	.063
J-50	.00	-30.42	13.60	-1.10	.063
J-51	.00	-30.42	13.60	-1.10	.063
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J-53	.00	-30.44	13.60	-1.10	.063
J-54	.00	-30.44	13.60	-1.10	.063
J-55	.00	-30.41	13.60	-1.10	.063
J-56	.00	-30.39	13.60	-1.10	.063
J-57	.00	-30.38	13.60	-1.10	.063
J-58	.00	-30.37	13.60	-1.10	.063
J-59	.00	-30.37	13.60	-1.10	.063
J-6	.00	-30.49	13.60	-1.10	.063
J-60	.00	-30.36	13.60	-1.10	.063
J-61	.00	-30.36	13.60	-1.10	.063
J-62a	.00	-30.36	13.60	-1.10	.063
J-62d	.00	-30.36	13.60	-1.10	.063
J-62e	.00	-30.64	13.59	-1.11	.063
J-62f	.00	-30.69	13.59	-1.11	.063
J-62g	.00	-31.48	13.56	-1.14	.063
J-63	.00	-30.36	13.60	-1.10	.063
J-64	.00	-30.36	13.60	-1.10	.063
J-65	.00	-30.40	13.60	-1.10	.063
J-66	.00	-30.39	13.60	-1.10	.063
J-67	.00	-30.38	13.60	-1.10	.063
J-68	.00	-30.38	13.60	-1.10	.063
J-69	.00	-30.38	13.60	-1.10	.063
J-7	.00	-30.47	13.60	-1.10	.063
J-70	.00	-30.38	13.60	-1.10	.063
J-71	.00	-30.36	13.60	-1.10	.063

J-72	.00	-30.36	13.60	-1.10	.063
J-73	.00	-30.36	13.60	-1.10	.063
J-74	.00	-30.36	13.60	-1.10	.063
J-75	.00	-30.36	13.60	-1.10	.063
J-76	.00	-30.36	13.60	-1.10	.063
J-77	.00	-30.36	13.60	-1.10	.063
J-78	.00	-30.37	13.60	-1.10	.063
J-79	.00	-30.38	13.60	-1.10	.063
J-8	.00	-30.48	13.60	-1.10	.063
J-80	.00	-30.37	13.60	-1.10	.063
J-81	.00	-30.39	13.60	-1.10	.063
J-82	.00	-30.38	13.60	-1.10	.063
J-83	.00	-30.38	13.60	-1.10	.063
J-84	.00	-30.38	13.60	-1.10	.063
J-85	.00	-30.38	13.60	-1.10	.063
J-86	.00	-30.38	13.60	-1.10	.063
J-87	.00	-30.38	13.60	-1.10	.063
J-88	.00	-30.38	13.60	-1.10	.063
J-89	.00	-30.38	13.60	-1.10	.063
J-9	.00	-30.47	13.60	-1.10	.063
J-90	.00	-30.38	13.60	-1.10	.063
J-91	.00	-30.38	13.60	-1.10	.063
N136	.00	-30.71	13.59	-1.11	.063
N138	.00	-30.53	13.59	-1.10	.063
N141	.00	-30.62	13.59	-1.10	.063
N151	.00	-30.61	13.59	-1.10	.063
N164	.00	-30.41	13.60	-1.10	.063
N240	.00	-30.49	13.60	-1.10	.063
N245	.00	-30.38	13.60	-1.10	.063
N33	.00	-30.76	13.59	-1.11	.063
N336	.00	-30.34	13.60	-1.09	.063
N34	.00	-30.95	13.58	-1.12	.063
N38	.00	-31.13	13.57	-1.12	.063
N40	.00	-30.69	13.59	-1.11	.063
N45	.00	-31.04	13.58	-1.12	.063
N51	.00	-30.87	13.58	-1.11	.063
N54	.00	-30.65	13.59	-1.11	.063
N55	.00	-30.73	13.59	-1.11	.063
N57	.00	-30.50	13.60	-1.10	.063
N59	.00	-30.65	13.59	-1.11	.063
N70	.00	-30.67	13.59	-1.11	.063

* This designates the use of default density in a low pressure region

THE NET SYSTEM DEMAND (USFU) = -3618.000

SUMMARY OF INFLOWS(+).AND.OUTFLOWS(-) :

NAME	FLOW (USFU)	FPN	TITLE
Blowers	-3618.0		Blowers

MAXIMUM MACH NUMBER = .02 IN LINE NO.P-212

SUMMARY OF MINIMUM.AND.MAXIMUM VELOCITIES (FT/S)

MINIMUM			MAXIMUM	
Blowers	.01	P-212	22.50	
P-178	.03	P-45	19.06	
P-115	.03	P-5	18.56	
P-23	.05	P-58	18.15	
P-203	.07	P-7	18.07	

SUMMARY OF MINIMUM.AND.MAXIMUM LOSS/1000. (PSI)

MINIMUM			MAXIMUM	
Blowers	.00	P-71	.04	
P-178	.00	P-75	.03	
P-203	.00	P-45	.03	
P-214	.00	P-5	.03	
P-115	.00	P-58	.03	

SUMMARY OF MINIMUM.AND.MAXIMUM PRESSURES (USPU)

MINIMUM			MAXIMUM	
Blowers	-33.00	GW-129	-30.33	
J-16	-31.66	GW-149	-30.33	
J-13	-31.65	N336	-30.34	
J-14	-31.62	GW-95	-30.35	
GW-18	-31.62	GW-117	-30.35	

********** END OF KYGAS SIMULATION **********

DATE FOR THIS COMPUTER RUN : 1-18-2017
START TIME FOR THIS COMPUTER RUN : 9:43:28:70

ATTACHMENT C

CONSTRUCTION QUALITY ASSURANCE AND TECHNICAL SPECIFICATIONS

SCS ENGINEERS





TECHNICAL SPECIFICATIONS
PHASE II LFGCCS EXPANSION

CENTRAL COUNTY SOLID WASTE DISPOSAL COMPLEX
SARASOTA COUNTY, FLORIDA

Prepared for:

Sarasota County Solid Waste Operations

Sarasota County

4000 Knights Trail Road
Nokomis, FL 34275
FDEP Permit No. 0130542-022-SO/01
WACS ID No. 51614

Prepared by:

SCS Engineers
4041 Park Oaks Blvd, Suite 100
Tampa, Florida 33610
(813) 621-0080

Florida Board of Professional Engineers
Certificate Number 00004892

March 6, 2017
File No. 09216113.03

Offices Nationwide
www.scsengineers.com

TECHNICAL SPECIFICATIONS
PHASE II LFGCCS EXPANSION
SARASOTA COUNTY, FLORIDA

Submitted to:

Florida Department of Environmental Protection
Division of Waste Management
2600 Blairstone Road, MS 4565
Tallahassee FL, 32399

Prepared for:

Sarasota County Solid Waste Operations
4000 Knights Trail Road
Nokomis, FL 34275
FDEP Permit No. 0130542-022-SO/01
WACS ID No. 51614

Prepared by:

SCS Engineers
4041 Park Oaks Blvd, Suite 100
Tampa, Florida 33610
(813) 621-0080
Fax (813) 623-6757

Florida Board of Professional Engineers
Certificate Number 00004892

March 6, 2017
File No. 09216113.03

3-6-17
Daniel R. Cooper, P.E.
No. 66440

Table of Contents

Section

SECTION 02 41 16

REFUSE HANDLING, STORAGE, AND DISPOSAL

PART 1 - GENERAL

1.01 NOTIFICATION

A. The CONTRACTOR shall notify the COUNTY in advance of planned excavation of landfill refuse.

B. No excavated materials shall be removed from the site or disposed of by the CONTRACTOR except as specified below and approved by the COUNTY.

PART 2 - REFUSE HANDLING AND DISPOSAL

2.01 REQUIREMENT

A. The CONTRACTOR will be required to setup an account with the landfill scale house and pre-load the account with monies to pay the required current waste disposal tipping fee. The CONTRACTOR will submit receipts and reports with each pay application for those periods when waste is taken to the landfill for disposal for the tonnage of waste taken to the landfill working face and the value will be paid from the Waste Disposal Allowance, Bid Item No. XX.

B. The CONTRACTOR may do the following to determine the tons of waste removed and disposed in the landfill.

1. The CONTRACTOR may use on-road dump trucks to haul each load of waste from the excavation to the scales located at the site for weight and determination of tipping payment, and then haul the waste from the scales to the working face of the landfill for disposal.

2. Alternatively, if the CONTRACTOR would prefer to use off-road dump trucks, or another vehicle, to haul the excavated waste directly to the working face without taking each load to the scale, the CONTRACTOR may use the average weight of three fully loaded on-road dump trucks, no off-road dump trucks will be allowed on the scales, that shall be weighed on the scales at the start of the excavation activities. The number of on-road dump truck loads in an off-road truck will be estimated during operations. Loads will then be counted and the average weight used for determining waste hauled and allowed for billing.

C. In the event that refuse is excavated and cannot be immediately taken to the working face the refuse may be stored adjacent to the excavation until it can be taken to the working face before the end of the same working day, unless rain is forecast in the day, in which case the refuse must be immediately taken to the

working face to avoid production of leachate due to rainfall on the waste. Refuse shall remain within close proximity to the location from which it was removed. All refuse must be removed from all locations at the end of each working day.

D. The CONTRACTOR shall include all costs for the determination of tonnage, removal and all other costs for hauling the waste to the working face in CONTRACTOR in Bid Item No. XX on Bid Form. Only the value of the tipping fee to the landfill will be paid from the allowance in Bid Item No. XX on the Bid Form.

PART 3 – EXECUTION (Not Used)

END OF SECTION

SARASOTA COUNTY
"Dedicated to Quality Service"

March 22, 2013

Mr. Steve G. Morgan
Florida Department of Environmental Protection
Southwest District
Solid Waste Program
13051 North Telecom Parkway
Tampa, FL 33637-0926

RE: Submittal of Minor Permit Modifications to Project Documents
CCSWDC Phase I Class I Landfill Closure and Landfill Gas Collection System
FDEP Construction Permit No. 130542-014-SF/01 (Phase I Closure)
Sarasota County, FL

Dear Mr. Morgan:

Please find attached to this letter a Minor Permit Modification to Permit Nos. 130542-014-SF/01 for the CCSWDC Phase I Class I Landfill Closure and Gas Collection System located in Sarasota County, Florida. The Minor Permit Modification was prepared by HDR Engineering, Inc. (HDR) to reflect revisions made to the Technical Specifications and Drawings during construction of the Phase I Closure.

Attached is a check in the amount of $250, for the Minor Permit Modification processing fee.

Also attached to this letter is the Certification of Construction Completion Report for the Phase I Closure which was constructed in accordance with the revisions stated in the Minor Permit Modification.

I am aware of the statements made in the attached Minor Permit Modification and the supporting information. I certify that the information in the Minor Permit Modification is true, correct, and complete to the best of my knowledge and belief. Further, I agree to comply with the provisions of Chapter 403, Florida Statutes, and all rules and regulations of the Department.

Sincerely,

Lois Rose
Manager Solid Waste Operations

cc: Alex Boudreau, P.E., Sarasota County
Gary Bennett, Sarasota County
Jason Timmons, P.E., Sarasota County

SOLID WASTE Operations • 4000 Knights Trail Road, Nokomis, FL 34275
Tel 941-861.1573 • lerose@scgov.net or jtimmons@scgov.net

SECTION 02771
TPO GEOMEMBRANE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the scrim reinforced Thermoplastic Polyolefin (TPO) geomembrane components used in the exposed geomembrane temporary cover. The scrim reinforced TPO is 60 mil UltraPly™ TPO as manufactured by Firestone Building Products or equivalent.

B. Related Sections:
   1. Section 02200 –Earthwork - Landfill.
      Section 02778 - Geotextile.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. ASTM D751– Standard Test Methods for Coated Fabrics
      b. ASTM D6878– Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing
      c. ASTM D5261– Test Method for Measuring Mass per Unit Area of Geotextiles
      d. ASTM D4885– Standard Test Method for Determining Performance Strength of Geomembranes by the Wide Strip Tensile Method
      e. ASTM D5884– Standard Test Method for Determining Tearing Strength of Internally Reinforced Geomembranes
      f. ASTM D2137 – Standard Test Methods for Rubber Property-Brittleness Point of Flexible Polymers and Coated Fabrics
      g. ASTM D1204– Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
      h. ASTM D1149– Standard Test Methods for Rubber Deterioration; Cracking in an Ozone Controlled Environment
      i. FTM 101 C– Test Method for Puncture Resistance and Elongation Test
      j. ASTM D471– Standard Test Method for Rubber Properties—Effect of Liquids (Water Absorption)
      k. ASTM G 151 – Practice for Exposing Non-Metallic Materials in Accelerated Test Devices that use Laboratory Light Sources
      l. ASTMTM G 155 – Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
   2. The Geosynthetic Research Institute (GRI).
      a. GRI/G 16 – Observation of Surface Cracking of Geomembranes

B. Qualifications:
   1. Each manufacturing and fabricating firm shall demonstrate 5 years continuous experience with a minimum of 10,000,000 SF of TPO geomembranes.
   2. Installer:
      a. Demonstrate 5 years continuous experience with a minimum 10,000,000 SF of geomembranes.
      b. Trained and certified by at least one of the named manufacturers in this Specification (not necessarily the manufacturer supplying materials for this Project).
      c. Geomembrane Installer Personnel Qualifications:
         1) Installation Superintendent shall have worked in a similar capacity on at least five geomembrane liner jobs similar in size and complexity to the project described in the Contract Documents.

2) The Master Welder shall have completed a minimum of 5,000,000 sf geomembrane seaming work using the type of seaming apparatus proposed for use on this Project.
3) Other welders shall have seamed a minimum of 1,000,000 sf geomembrane.

3. CQC Testing Laboratory shall demonstrate 3 years of continuous experience in similar geosynthetic materials testing.

C. Quality Assurance / Control:
1. The Owner or Engineer's representative will conduct independent testing to support construction quality assurance (CQA) program and to provide documentation of such to appropriate regulatory agencies.
2. Unless specifically superseded by these contract documents or approved plans submitted by the Contractor, the geosynthetic materials shall be manufactured, stored, placed, seamed, tested and protected as described in EPA/600/R-93/182 and EPA/530/SW-91/051.
a. This specifically includes:
1) Material Composition.
2) Manufacturing.
3) Handling and Packaging.
4) Shipment.
5) Storage (Manufacturer and Site).
6) Placement:
a) Seaming and Joining.
b) Destructive and Non Destructive Testing.
c) Protection, Backfilling and Covering.
7) Conformance Testing.
8) Anchoring and Anchor Trenches.
9) Access Roads/Ramps.

D. CQA Plan Implementation: Construction Quality Control will be performed in accordance with the CQA Plan prepared for this project. The Contractor and Geomembrane Installer should familiarize themselves with the CQA Plan.

E. Installer's construction quality control programs to include, but not be limited to, product acceptance testing, installation testing, including both nondestructive and destructive quality control field testing of the sheets and seams during installation of the geomembrane, proposed methods of testing geosynthetic joints and connections at appurtenances for continuity, documentation and changes, alterations, repairs, retests, and acceptance.

F. Geomembrane Installer's installation manual to include:
1. Ambient temperature at which the seams are made
2. Control of panel lift up by wind
3. Acceptable condition of the subsurface beneath the geomembrane
4. Quality and consistency of the welding material
5. Proper preparation of the liner surfaces to be joined
6. Cleanliness of the seam interface (e.g., the amount of airborne dust and debris present)
7. Proposed details for connecting the TPO liner to appurtenances, i.e. penetrations of the containment facilities.
8. A complete description of seaming by hot-air welding and hot-wedge welding.
9. Requirements of the Manufacturer's Installation Manual unless exceptions are noted and approved by the Engineer.

1.3 DEFINITIONS AND RESPONSIBILITIES

A. Geomembrane Manufacturer: Manufacturer of geomembranes producing geomembrane sheets from resin and additives. The manufacturer is responsible for producing geomembrane sheet which complies with these Specifications. These responsibilities include but are not limited to:
1. Acceptance of the resin and additives from chemical formulators. Testing of the raw resin and additives to ensure compliance with the manufacturer's specifications and with this Specification.

2. Formulation of the resin and additives into geomembrane sheeting using mixing and extrusion equipment.
3. Testing of the geomembrane sheet to ensure compliance with manufacturer's specification and this Specification.
4. Shipping of the geomembrane sheet to installer designated facilities.
5. Certification of the raw materials and finished geomembrane sheet to comply with this Specification.
6. Certification of installer's training, experience, and methods for welding and inspection of geomembrane installations in compliance with manufacturer's standards.

B. Geomembrane Installer. Installer of geomembranes are responsible for handling, fitting, welding, and testing of geomembrane sheets or blankets in the field. These responsibilities include but are not limited to:
1. Acceptance (in writing) of the geomembrane from the manufacturer.
2. Acceptance (in writing) of the surface which will serve as a base for the geomembrane. This acceptance shall precede installation of the geomembrane, and shall state that the installer has inspected the surface, and reviewed the Specifications for material and placement, and finds all conditions acceptable for placement of geomembrane liners. The written acceptance shall explicitly state any and all exceptions to acceptance.
3. Handling, welding, testing, and repair geomembrane liners in compliance with this Specification and the Geomembrane Installer's Installation Procedures Manual.
4. Performance of QC testing and record keeping as required by the approved Geomembrane Installer's Field Installation Procedures Manual.
5. Repair or replacement of defects in the geomembrane as required by the Installer’s CQC Consultant or the CQA Inspector.

C. CQA Inspector:
1. Inspectors of TPO geomembrane are the individuals responsible for observing field installation of the geosynthetic materials and providing the Manufacturer, Installer, CQA Engineer, and Owner with verbal and written documentation of the compliance of the installation with this specification and with written procedures manuals prepared by the Manufacturer or Installer.

D. CQA Testing Laboratory shall:
1. Perform destructive testing of the TPO geomembrane.
2. Perform conformance testing of TPO geomembrane.

E. Installer’s CQC Consultant: Responsible for observing field installation of the geomembrane and performance of material conformance and CQC testing to provide the Contractor with verbal and written documentation of the compliance of the installation with these Specifications.

F. CQA Engineer: Responsible for implementing CQA Plan including overview of material conformance testing, field installation of the geomembrane, and CQC activities, and to perform limited CQA conformance testing to provide Owner with verbal and written documentation of the compliance of the installation with these Specifications. The CQA Engineer will use the written results of the CQC program and the CQA program in the preparation of the facility Certification Document. The CQA Engineer reports to the Owner and is not part of this contract.

G. Refer to the accompanying CQA Plan for additional definitions.

1.4 SUBMITTALS

A. Shop Drawings:
1. Submit for Engineer's approval Shop Drawings, including:
   a. Manufacturer's certification that raw materials and sheet materials comply with required materials, mil thickness, and material properties.
      1) Original certificates are required.
   b. Manufacturer/Fabricator/Installer quality control requirements.
   c. Qualifications and experience of key personnel per 1.2 B of this section.

d. Manufacturer's written acceptance of Geomembrane Installer's qualifications for installation of the TPO geomembrane.
e. TPO Geomembrane layout plan with proposed size, number, position and sequencing of liner panels and showing the location and direction of all field or factory joints.
    1) Proposed details for connecting the geosynthetic materials to appurtenances.
    2) Proposed methods of welding, seaming or jointing geosynthetic materials.
    3) Proposed method of testing TPO geomembrane and other geosynthetic materials, joints and connections at appurtenances for continuity.
    4) Location and configuration of haul roads and access points.
    5) Proposed details for anchor trench if different than included in Contract Documents.

B. Miscellaneous:
1. Test results:
    a. Resin test, tests of sheet material and factory seam tests at frequency specified in respective quality control manuals.
        1) Results shall include or bracket the rolls delivered for use in the Work.
    b. Daily test seam results.
    c. Daily results of production seam testing.
2. Warranties as described below.
3. Submit written certifications that:
    a. Utilize certification forms approved for use on this project by the Owner and Engineer. Make appropriate number of copies, as required.
    b. The TPO geomembrane material delivered to site meets the requirements of this Specification.
    c. The TPO geomembrane was received and accepted in undamaged condition from shipper.
    d. The TPO geomembrane liner was installed in accordance with this Specification and with approved Shop Drawings.
    e. The TPO geomembrane joints were inspected, tested for strength and continuity, and passed all inspections and tests.
        1) All test and inspection data shall be incorporated into this certification.
4. Manufacturer/Installer's Field Installation Procedures Manual shall clearly identify any exceptions taken to the specified execution of the Work.
5. Record Drawings: Submit reproducible drawings of record showing changes from the approved installation drawings. The record drawings shall include the identity and location of each repair, cap strip, penetration, boot, and sample taken from the installed geosynthetic for testing. The record drawings shall show locations of each type of material, anchor trenches and the construction baseline.

C. Provide all submittals in a single coordinated transmittal. Partial submittals will not be accepted. All submittals must be submitted prior to the Geomembrane Preconstruction Meeting and a minimum of four weeks prior to installation.

D. The acceptable color of the material will be a shade of green. The proposed color and a sample of material and color shall be submitted for acceptance and approval by the Owner and Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The TPO geomembrane should be protected from punctures, abrasions, vandalism, excessive heat or cold or other damaging conditions

B. The TPO geomembrane shall be delivered to the project site intact and free from any tears, abrasion, or damage. Store TPO geomembrane rolls in a dry area off the ground on 4 rails with each rail being a minimum of 3.5 inches wide, and protected from the direct heat of the sun, where possible, and accessories in original containers in a dry area protected from the elements.

C. Each roll shall be labeled with the manufacturers name, type, lot number, roll number, and roll dimensions (length, width, gross weight).

1. TPO geomembrane or plastic wrapping damaged as a result of storage or handling shall be repaired or replaced, as directed.
2. TPO geomembrane shall not be exposed to temperatures in excess of 60 Deg C (140 Deg F) or less if recommended by the Manufacturer.

D. No hooks, tongs or other sharp instruments shall be used for handling the TPO geomembrane.
1. Rolls shall not be lifted by use of cables or chains in contact with the TPO geomembrane.
2. TPO geomembrane shall not be dragged along the ground.

1.6 PROJECT CONDITIONS

A. When the weather is of such a nature as to endanger the integrity and quality of the installation, whether this is due to rain, high winds, cold temperatures, or other weather elements, the installation of the geomembrane shall be halted at the direction of, or with the concurrence of, the Owner until the weather conditions are satisfactory.

B. The contractor shall ensure that adequate dust control methods are in effect to prevent the unnecessary accumulation of dust and dirt on geosynthetic surfaces which hamper the efficient field seaming of geosynthetic panels or performance.

C. Maintain natural surface water drainage diversions around the work area and provide for the disposal of water which may collect in the work area directly from precipitation falling within the area or from inadequate diversion structures or practices.

D. All materials shall be placed and spread with low ground pressure equipment (10 psi ground pressure or less) as approved by the CQA Engineer to reduce potential damage to the geosynthetics. The geosynthetics surface shall be off limits to construction traffic. Hard turning of tracked equipment on the protective cover and stone must be avoided.
1. At least 12 inches of separation between the geosynthetics and all low ground pressure equipment shall be maintained.
2. Stockpiling of materials within the limits of the cell shall be subject to advanced approval by the CQA Inspector. Any hauling equipment (dump trucks, etc.) operating within the cell limits (and including access ramps), shall have a minimum of 4 feet of separation between the vehicle wheels and the geosynthetics.
3. No vehicle shall access the completed Work unless it can be demonstrated that its weight, movement or activities will not damage the Work.
4. When damage is suspected, uncover area, repair damage if required, and recover area at no cost to Owner.
5. Suspect areas may be identified by Owner or Engineer.

1.7 WARRANTIES

A. Written warranties addressing TPO geomembrane material and installation workmanship shall be furnished by the Contractor and shall be made to the Owner.

B. Submit material samples and warranties prior to shipment.

C. Suitability of geosynthetic liner system shall be subject to Owner's approval of warranty.
1. The Manufacturer's warranty shall be against manufacturing defects and workmanship and against deterioration due to ozone, ultra- violet exposure from direct sunlight, and other exposure to the elements, for a period of 20 years on a pro rata basis. The warranty shall be limited to replacement of material, and shall not cover installation of replacement geomembrane.
2. The Installer's warranty shall state that the materials were properly installed, properly (field and factory) welded, seamed and jointed and will not fail within two years of the date of final acceptance of the Work by the Owner.
   a. Warranty shall not be prorated.

D. Warranties shall provide for complete repair/replacement excluding installation costs at no additional cost to the Owner for the warranty period.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND/OR GEOMEMBRANE INSTALLERS

A. Subject to compliance with the Contract Documents, the following manufacturers and installers are acceptable:
   1. TPO Geomembrane liners manufacturers:
      a. Firestone Building Products
      b. Carlisle SynTec
   2. TPO Geomembrane Liner Installers:
      a. Authorized installers of approved manufacturers.
      b. Other installers may qualify by providing references for a minimum of 10,000,000 SF of TPO liner installations.

2.2 MATERIALS

A. The membrane will be Firestone UltraPly TPO 60 mil geomembrane or equivalent.

B. Accessories will be as supplied or approved by geomembrane manufacturer.

C. Geomembrane meets or exceeds the property values listed in Table 1.

D. Interface testing of liner and geotextile will be submitted as specified in Table 2.

Table 1: Physical Properties

Description	Test Method	Property
UNAGED PROPERTIES:		
Thickness (min average)	ASTM D751 and D6878	0.060" (1.52 mm, 60 mil) Lowest individual -10%
Thickness Over Scrim	ASTM D 4637 (Optical Method) 0.060" Membrane	0.024" (0.609 mm) ± 10%
Mass per unit area (min)	ASTM D5261	0.3 lb/sf (1.42 Kg/m^2)
Breaking Strength (TD and MD) (min)	ASTM D 4885	150 ppi (26.3 kN/m)
Elongation at Reinforcement break (TD and MD) (min)	ASTM D 4885	30%
Tearing Strength (TD and MD) (min)	ASTM D 751 (8"x8" specimen)	~~86 lbf (382 N)~~ 55lbf (245 N)
Brittleness Point (max)	ASTM D 2137	~~-50ºF (-46ºC)~~ -40ºF (-40ºC)
Linear Dimension Change (max)	ASTM D 120 (6 hrs @70º C)	4 %
Ozone Resistance	ASTM D 1149	PASS (no cracks)
Factory Seam Strength (min)	ASTM D 4885	150 ppi (26.3 kN/m)
Puncture Resistance (min)	FTM 101C Method 2031	265 lbf (1174 N)
Water Absorption (max, mass)	ASTM D471 166 hrs at 158^0F	+/- 3%
HEAT AGED PROPERTIES:		
Breaking Strength (TD and MD) (min)	ASTM D 4885	150 ppi (26.3 kN/m)*
Elongation at Reinforcement Break (TD and MD) (min)	ASTM D 4885	30%*
Tearing Strength (TD and MD) (min)	ASTM D 5884 (8"x8" specimen)	86 lbf (382N)*
Weight Change (max) (Membrane)	ASTM D 471	1% (change in mass)
AGED PROPERTIES:		
Ozone Resistance	ASTM D 1149	PASS (No cracks)
Weather resistance (Retained Values)	ASTM G 151/ G 154	
Visual Inspection		PASS
Breaking Strength, (min)		90% retained
Elongation at Reinforcement Break (min)	ASTM D 4885	90% retained
Resistance to Xenon-Arc Weathering	ASTM G 151/ G155	Pass

*ASTM D 6878 requires retained values of 90% for original breaking strength and elongation and 60% for tearing strength

Table 2: Interface Friction Angles

PROPERTIES	QUALIFIERS	UNITS	VALUES	TEST METHOD
Engineering Properties				
Interface friction between geomembrane liner and geotextile material in the anchor trench	minimum	degrees	22[(1)]	ASTM D 5321[(2)]

(1) Perform testing using normal stress range of 144 lb/sf, 288 lb/sf and 432 lb/sf.

(2) Wet the geotextile/TPO geomembrane interface prior to testing: perform test using: (i) normal stress indicator above; and (ii) a strain rate calculated in accordance with ASTM D 3080, Sections 9.12 and 9.13, not to exceed 1 mm/min. (0.04 in./min.).

2.3 MANUFACTURING QUALITY CONTROL

A. Rolls:

1. The Manufacturer will continuously monitor the TPO geomembrane sheets during the manufacturing process for inclusions, bubbles, or other defects.
2. No TPO geomembrane will be accepted that exhibits any defects.
3. The Manufacturer will continuously monitor the TPO geomembrane thickness during the manufacturing process.
4. No TPO geomembrane will be accepted that fails to meet the specified minimum thickness.
5. The Manufacturer will sample and test the geomembrane, at a minimum, at the test frequencies specified in Table 3.
   a. Samples taken from stored rolls will be taken across the entire width of the roll and will not include the first wrapping or outer layer of the roll (about 3.3 feet).
   b. Samples taken at the time of manufacturing can be obtained from the start/end of the roll.
   c. Unless otherwise specified, samples will be 2 feet long by the roll width. The Manufacturer will mark the machine direction on the samples with an arrow.
   d. Manufacturer quality control data shall accompany the geomembrane shipment.

Table 3: Manufacturer Quality Control Requirements

Material Property	Method	Test Frequency
Thickness	ASTM D751	Per roll
Tensile Properties	ASTM D4885	Once per day or 20,000 lb
Tear Resistance	ASTM D751	Once per day or 45,000 lb
Scrim Orientation	Visual	Every Lot or Every Scrim Roll
Mass per Unit Area	ASTM D5261	Once per day or 200,000 lb
Tear Resistance	ASTM D5884	Once per day or 45,000 lb
Thickness over Scrim	ASTM D6878	45,000 lb or Every other lot

6. Any TPO geomembrane sample that does not comply with the Specifications will result in rejection of the roll from which the sample was obtained. Contractor will replace any rejected rolls at no additional cost to Owner.
7. If a TPO geomembrane sample fails to meet the quality control requirements of this Section, the Manufacturer will sample and test each roll manufactured, in the same resin batch, or at the same time, as the failing roll. Sampling and testing of rolls will continue until a pattern of acceptable test results is established.
8. Additional testing may be performed at the Manufacturer's discretion and expense, to more closely identify the non-complying rolls and/or to qualify individual rolls.

2.4 CONFORMANCE TESTING

A. At the Geomembrane Manufacturer's plant or upon delivery of the rolls of geomembrane at the site, the CQA Officer will verify that samples are removed at the specified frequency and forwarded to the Geosynthetics CQA Laboratory for testing to verify conformance to both the design specifications and the list of guaranteed properties. The minimum number of tests to be performed and test procedures will be as indicated in Table 4.

B. Samples will be taken across the entire width of the roll and will not include the first linear 3 ft. Unless otherwise specified, samples will be 3-ft long by the roll width. The CQA Officer will mark the machine direction on the samples with an arrow. The required minimum sampling frequencies are provided in Table 4.

C. The CQA Officer will examine the results from laboratory conformance testing and will report non-conformance to the Project Manager.

D. The following procedure will apply whenever a sample fails a conformance test that is conducted by the Geosynthetics CQA Laboratory:
   1. Installer will replace the roll of geomembrane that is in nonconformance with the specifications with a roll that meets specifications;
   2. Installer will remove conformance samples for testing by the Geosynthetics CQA Laboratory from the closest numerical roll on both sides of the failed roll.
   3. These two samples must both conform to specifications. If either of these samples fail, then every roll of geomembrane on site and every roll delivered subsequently must be tested by the Geosynthetics CQA Laboratory for conformance to the specifications. This additional conformance testing will be at the expense of the Installer.

E. The CQA Officer will document actions taken in conjunction with conformance test failures.

Table 4: Geomembrane Conformance Testing Requirements

TEST NAME	TEST METHOD	MINIMUM FREQUENCY OF TESTING
Thickness	ASTM D ~~4637~~751	1 test per 100,000 ft^2
Tensile Strength at Break	ASTM D 4885	1 test per 100,000 ft^2
Elongation at Break	ASTM D 4885	1 test per 100,000 ft^2
Tear Strength	ASTM D 5884	1 test per 100,000 ft^2
Puncture Resistance	ASTM D ~~4833~~ FTM 101C Method 2031	1 test per 100,000 ft^2
Resistance to Xenon-Arc Weathering	ASTM G 155	Manufacturer's Certification Only
Ozone Resistance	ASTM D 1149	1 test per 100,000 ft^2

2.5 EQUIPMENT AND ACCESSORIES

A. Welding and Seaming Equipment:
   1. Equipped with gages showing temperatures at the nozzle or at the wedge (wedge welder).
   2. Maintained in adequate numbers to avoid delaying work.

3. Supplied by a power source capable of providing constant voltage under a combined-line load.
4. Electric generator shall not be placed on the TPO geomembrane.

B. Field Tensiometer:
1. Provide a tensiometer for on-site shear and peel testing of TPO geomembrane seams.
   a. Tensiometer shall be in good working order.
   b. Built to ASTM specifications.
   c. Accompanied by evidence of calibration of equipment and gages within the past six months.
2. Tension meter:
   a. Motor driven.
   b. Jaws capable of traveling a measure rate of 2 IN per minute.
   c. Equipped with a gauge that measures the force in unit pounds exerted between the jaws.
   d. Digital readout.

C. Punch Press:
1. Provide a punch press for the onsite preparation of specimens for testing.
2. Capable of cutting specimens in accordance with ASTM D4437.

D. Air Lance Test:
1. Provide equipment for air lance test per ASTM D4337.

E. Equipment necessary to perform "Pressurized Air Channel Evaluation of Dual Seamed Geomembranes" in accordance with ASTM D5820.

F. Gages:
1. Calibrated within past six months.
2. Specified test values reading near mid-range of the gage scale.

G. Equipment necessary to perform “Non-Destructive Testing of Geomembrane Seams Using The Spark Test” in accordance with ASTM D6365.

PART 3 - EXECUTION

3.1 GEOSYNTHETIC LINER SYSTEM

A. Geomembrane Subgrade:
1. Protect subgrade at all times from damage until such time as the placement of TPO geomembrane liner and other components of the geosynthetic liner system are complete.
2. The subgrade shall be prepared in a manner consistent with proper subgrade preparation techniques for the installation of TPO Geomembrane.
   a. The subgrade shall be properly compacted so as not to settle and cause excessive strains in the TPO Geomembrane or other synthetic liner materials.
   b. Prior to installation, ensure a surface free of debris, roots, or angular stones larger than 1/2 inch.
   c. In addition, ensure that the subgrade has been rolled to provide a uniform surface.
   d. During installation, ensure that rutting or ravelling is not caused by installation equipment or weathering.

B. Anchor Trenches:
1. Geosynthetic materials placed on side slopes shall be anchored into trenches as detailed on the Contract Drawings.
2. Excavation, backfill and compaction shall be in accordance with Section 02200.

C. TPO Geomembrane:
1. General:
   a. Installer of TPO geomembranes is responsible for handling, fitting, welding, seaming, jointing and testing of geosynthetic materials sheets or blankets in the field in accordance with the Construction Quality Assurance (CQA) Plan.

b. These responsibilities include but are not limited to:
    1) Acceptance (in writing) of the geosynthetic materials sheets or blankets from the transporter.
    2) Acceptance (in writing) of the surface which will serve as a base for the TPO geomembrane.
        a) This acceptance shall precede installation of the TPO geomembrane.
        b) Shall state that the Installer has inspected the surface, and reviewed the Specifications for material and placement, and finds all conditions acceptable for placement of TPO geomembrane liners.
        c) Shall explicitly state any and all exceptions to acceptance.
    3) Handling, welding, seaming, jointing, testing and repair of TPO geomembrane liners and other geosynthetic materials in compliance with this Specification and with written procedures manuals prepared by the Manufacturer or Fabricator.
        a) Manual shall be submitted to the Engineer together with Shop Drawings showing the layout of TPO geomembrane within the facility.
            (1) Do not deviate from the procedures included in the manual.
        b) TPO Geomembrane shall not be placed upon frozen foundation, standing water or other conditions which will result in deterioration of the foundation.
        c) TPO Geomembrane liner materials shall be laid out according to plans previously approved by the Engineer.
        d) Adjacent rolls of TPO geomembrane shall overlap a minimum of 3 IN.
    4) Repair or replacement of defects in the geosynthetic materials as required by the Inspector or the Owner.
    5) Installer and Manufacturer may be the same firm.

2. Panel deployment:
    a. Subgrade Preparation:
        1) Prepare subgrade in a manner consistent with proper subgrade preparation techniques for the installation of TPO geomembrane liner.
        2) Properly compact the subgrade so as not to settle and cause excessive strains in the TPO geomembrane liner.
        3) Prior to installation, ensure a surface free of debris, roots, or angular stones larger than 1/2 IN.
        4) Subgrade soils proof-rolled with a ten (10) ton drum roller, two (2) passes parallel to slope or as directed by CQA Inspector. The subbase shall be compacted and proof-rolled under observation of the CQA Inspector to assure the maximum practical compaction under the existing field conditions has been achieved. See specification Section 02200 for project specific compaction requirement.
        5) Ensure rutting or raveling is not caused by installation equipment or weather.
        6) Ensure that lines and grades have been verified by the Contractor and a subgrade acceptance form has been submitted.
    b. Construct and backfill anchor trenches
    c. Deploy TPO geomembrane liner in a manner to ensure it is not damaged
    d. On slopes, anchor the TPO geomembrane liner securely and deploy it down the slope in a controlled manner.
    e. Weight the TPO geomembrane liner with sandbags or equivalent in the presence of wind.
    f. Minimize cutting the TPO geomembrane liner. Whenever possible, overlap instead of cutting material. If cutting is required, cut TPO geomembrane liner with a cutter or other approved device. Seal all cut edges, as recommended by Manufacturer.
    g. Only those panel/sheets that can be seamed in 1 day shall be deployed.
    h. Place panels with minimal handling.
        1) Protect panels from tear, puncture or abrasion.
    i. Equipment used to deploy the geomembrane shall not damage the TPO geomembrane.
    j. Minimize foot traffic.
        1) Do not allow personnel access to wet or slippery liners without adequate safety precautions.

2) Do not allow footwear that may damage the geomembrane.

k. Ballast with sandbags to prevent wind uplift as recommended by Manufacturer based on local climatic conditions.
   1) Remove and replace all wind damaged panels at no additional cost to Owner.
   2) If wind causes panels to be displaced, displaced panel may not be reused.

l. Install TPO geomembrane in stress free, tension free and relaxed condition.
   1) Account for temperature and weather-related impacts when deploying and covering.
   2) Stretching to fit and folding are not permitted.

m. Do not allow TPO geomembrane to bubble, fold, or create ripples as a result of deployment of drainage layer or protective soil cover placement.
   1) Except as noted on Contract Drawings no folds in TPO geomembrane will be allowed.

n. Any panel exhibiting stretching caused by placement, covering techniques, or wind shall be removed and may not be incorporated in the final construction.

o. Field seaming:
   1) Field seaming shall be done in accordance with seaming recommendations furnished by the geomembrane Manufacturer, referenced EPA documents, and this specification.
   2) Each piece of seaming equipment and each operator shall perform trial seams at the start of a shift, whenever equipment has broken down or seaming is interrupted for more than 30 minutes, and at other times at the discretion of the Installer and Inspector.
   3) Trial seams shall use the same seaming materials and methods to be used in the actual construction.
   4) Surfaces to be seamed shall be clean and dry at the time of seaming.
      a) Precipitation and ponding of water on the TPO geomembrane shall cause termination of seaming operations.
      b) TPO geomembrane shall not be seamed when ambient temperatures are below 41 DegF or above 104 DegF, without written consent of TPO geomembrane Manufacturer and Engineer.
   5) TPO geomembrane sheets shall be seamed continuously without fishmouths or breaks in the seam.
      a) Where fishmouths are unavoidable, the sheet shall be slit to a point such that the sheet lies flat and with no remaining wrinkle.
      b) The two edges of the slit shall be seamed together provided that the overlap for this seam shall be a minimum of 6 IN.
      c) Areas of the slit which do not achieve an overlap of 6 IN, including the terminus of the slit, shall be provided with a patch as discussed below.
   6) All TPO geomembranes shall be seamed by thermal fusion methods as recommended by the TPO geomembrane Manufacturer.
      a) TPO geomembrane seaming shall be either hot-air or double wedge welded as approved by the Engineer.
   7) Manufacturer's seaming instructions shall specifically address seaming materials, temporary and permanent jointing, seaming temperatures including temperatures for seaming materials, seam finishing and curing.
   8) A copy of Manufacturer's seaming instructions shall be available on site at all times and shall not be deviated from without written approval of the Manufacturer and Engineer.
   9) All panels/sheets should be overlapped a minimum of 3 IN.
   10) Seaming shall not be conducted in the presence of standing water.
      a) The seamed area shall be cleaned of dust, dirt and foreign material prior to and during the seaming operation.
   11) Seaming shall extend to the outside edge of panels/sheets to be placed in anchor and/or drainage trenches.

12) Tack welds shall conform to manufacturer's seaming techniques and shall not damage underlying membrane.

p. Patching:
   1) Defects in and damage to TPO geomembrane sheets shall be repaired by seaming a patch over the defect.
      a) The patch material shall consist of an undamaged piece of TPO geomembrane cut to provide a minimum of 6 IN of overlap in all directions from the defect.
      b) Round corners shall be utilized on all patches. No bead or spot patching will be accepted.
      c) Torn or permanently twisted TPO geomembrane shall be replaced at no expense to the Owner.
   2) Test all patch seams non-destructively using the air lance tests .
      a) Test patch seams destructively if the seam is greater than 100 feet in contiguous length (i.e. a single seam greater than 100 feet).
      b) Perform a destructive test for every 100 feet of contiguous seam over 200 total feet of contiguous seam. For example if a patch seam is 340 feet, 2 destructive tests would be required for the seam.Smoking is not permitted while on the geomembrane.

q. Field Panel Identification: The Installer's CQC Consultant will document that the Geomembrane Installer labels each field panel with an "identification code" consistent with the approved panel layout plan. The location of the label and the color of marker used must be as agreed to in the QA/QC Preconstruction Meeting.

r. Exposed reinforcement from cut TPO edges must be sealed with a hot-air weld.

3.2 FIELD QUALITY CONTROL

A. The CQA inspector shall not be a part of the installation program and shall not serve as a substitute for performing the duties or certification required of the Manufacturer and Installer.
   1. The CQA inspector's responsibilities include, but are not limited to:
      a. Inspection of the material and the handling and field installation of the geomembranes. Inspection of all welds, repairs and quality control test results.
      b. All exceptions to material or installation shall be documented and furnished to the CQA firm in writing within 48 HRS of discovery.
      c. Inspection and Certification of TPO geomembrane integrity until completion of placement of protective soil cover.

B. Non-Destructive Testing:
   1. The Geosynthetics Installer will nondestructively test all field seams over their full length using a air lance test (TPO hot air weld), vaccum box (HDPE and LLDPE extrusion weld), or air pressure test (TPO, HDPE and LLDPE double fusion seams). Continuity testing will be carried out as the seaming work progresses, not at the completion of all field seaming. The Installer will complete any required repairs in accordance with specifications. The following procedures will apply to locations where seams cannot be nondestructively tested:
      a. If the seam is accessible to testing equipment prior to final installation, the seam will be nondestructively tested prior to final installation.
      b. If the seam cannot be tested prior to final installation, the seaming operations must be observed in their entirety by the CQA Officer for uniformity and completeness.
   2. Air Pressure Testing (For Double Fusion Seams Only):
      a. The following procedures are applicable to those processes that produce a double seam with an enclosed space.
      b. The equipment will comprise the following.
         1) An air pump (manual or motor driven), equipped with a pressure gauge, capable of generating and sustaining a pressure between 25 and 30 psi, mounted on a cushion to protect the geomembrane.
         2) A rubber hose with fittings and connections.
         3) A sharp hollow needle, or other approved pressure feed device.
      c. The following procedures will be followed.

1) Seal both ends of the seam to be tested.
2) Insert needle, or other approved pressure feed device, into the channel created by the fusion weld.
3) Insert a protective cushion between the air pump and the geomembrane.
4) Energize the air pump to a pressure between 25 and 30 psi, close valve, allow two minutes for pressure to stabilize, and sustain the pressure for not less than 5 minutes.
5) If loss of pressure exceeds 4 psi, or if the pressure does not stabilize, locate faulty area and repair in accordance with Section 3.3.
6) Cut opposite end to verify continuity of seam, remove needle, or other approved pressure feed device, and repair in accordance with Section 3.3.

3. Air Lance Testing
   a. Mechanical point stressing method (see ASTM D4437, article 4.5) or the air lance test method will be used to verify seam integrity for hot air seams and wedge seams without air channel. Since the mechanical point stressing method cannot evaluate the bond over its entire width, and since there is a potential for damaging the membrane with the sharp point of the probe, the air lance test method is recommended to verify seam integrity.

C. Trial Seams
   1. Trial seams shall be made prior to production seaming by all seamers and by all equipment to be used during production seaming. The trial seams shall be made on fragment pieces of geomembrane to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period, seaming operation has been suspended for more than 1/2 hour, breakdown of the seaming equipment occurs or at least once each five hours, for each seaming apparatus used that day. Also, each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams. The trial seam sample shall be at least 5 ft long by 1 ft wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as specified.
   2. Two adjoining specimens, each 1-inch wide for peel and 2-inch wide for shear, shall be cut from the trial seam sample by the Geosynthetics Installer. Fully support the test specimen within the grips across the width of the specimen. The specimens shall be tested in shear and peel, using a field tensiometer, and the specimen shall fail by film tear bond rather than in the seam. The minimum requirements for the seams strengths shall be as specified in Table 5. If a specimen fails, the entire operation shall be repeated. If the additional specimen fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial seams are achieved.

D. After completion of the above-described tests, the remaining portion of the trial seam sample can be discarded. If a trial seam sample fails a test, then a destructive test seam sample shall be taken from the seams completed by the seamer during the shift related to the considered trial seam. These samples shall be forwarded to the CQA Consultant and, if they fail the tests, the procedure indicated in Paragraph 3.3 of this section shall apply. The conditions of this paragraph shall be considered as met for a given seam if a destructive seam test sample has already been taken from the considered seam

E. Destructive Testing:

F. Destructive Seam Testing:
   1. A minimum of one destructive test per 500 LF of seam, and as many other samples as CQA firm determines appropriate, shall be obtained at locations specified by the CQA firm.
      a. Sample locations shall not be identified prior to seaming.
      b. The samples shall be a minimum of 12 IN wide by 48 IN long with the seam centered lengthwise.
      c. Each sample shall be cut into three equal pieces with one piece retained by the Installer, one piece given to a CQA Testing Laboratory, and the remaining piece given to the CQA Engineer for quality assurance testing and/or permanent record.
      d. Each sample shall be numbered and recorded on the final panel layout record drawing, and cross-referenced to a field log which identifies:

1) Panel/sheet number.
2) Seam number.
3) Top sheet.
4) Date and time cut.
5) Ambient temperature.
6) Seaming unit designation.
7) Name of seamer.
8) Seaming apparatus temperature and pressures (where applicable).

2. A minimum of four 1 IN wide replicate specimens shall be cut from the Installer's sample.
   a. A minimum of 2 specimens shall be tested for shear strength and 2 for peel adhesion using an approved field quantitative tensiometer. Jaw separation speed shall be 2 IN per minute.
   b. To be acceptable, all field test specimens must meet the specified seam strength requirements and all must fail as Film Tear Bond.
   c. If all field tests pass, 5 specimens shall be tested at the CQA Testing Laboratory for shear strength and 5 for peel adhesion in accordance with ASTM D4437.
   d. To be acceptable, 4 out of 5 replicate test specimens must meet the specified seam strength requirements and fifth sample must meet 80% required strength and fail at Film Tear Bond.
   e. Shear elongation and Peel separation shall not exceed values given in GRI GM19

Table 5: Seam Strength and Related Properties of Thermally Bonded TPO Geomembrane per ASTM D 4437/GM 19

Geomembrane Nominal Thickness	60 mils
Hot Wedge Seams[1]	
Shear strength[2], lb/in	150
Peel strength[2], lb/in	20
Hot-air Seams	
Shear strength[2], lb/in	~~150~~125
Peel strength[2], lb/in	20

Notes:
1. Also for hot air seaming methods
2. Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.

3. For destructive samples which have failed the passing criterion, the Contractor will reconstruct all the field seams between any two previous passed seam locations which include the failed seam or will go on both sides of the failed seam location (10 feet minimum), take another sample each side and test both. If both pass, the Contractor may patch or cap strip the seam between the passed samples. If either fails, the Contractor will remove and replace the entire seam. In all cases, acceptable field seams must be bounded by two passed test locations. The decision of the CQA Engineer will be final.
   a. In addition, all destructive seam sample holes shall be repaired the same day as cut.
   b. Certified test results on all field seams shall be submitted to and approved by the CQA Engineer prior to acceptance of the seam.

4. All repaired areas shall be non-destructively tested and destructively tested as described in Part 3.1B.2.p (2) of this specification.

5. Destructive testing shall be performed by a CQA Testing Laboratory not employed by the Installer.

6. A map showing the locations, number and type of all patches shall be prepared and provided to the Owner.

7. Documentation: The following documentation must be maintained at the project site for review by the CQA Engineer or Inspector.
    a. Geomembrane Installer's Documentation:
        1) Daily Log: daily record that summarizes panels deployed, seams completed, seam testing, seam repair, personnel on site, weather conditions, and equipment on site.
        2) Material Conformance: maintain original conformance certificate(s) from geomembrane manufacturer.
        3) Subgrade Acceptance Log: maintained originals of subgrade acceptance forms for each panel and signed by the Geomembrane Installer.
        4) Panel Log: provides geomembrane roll number used and subgrade acceptance for each panel deployed.
        5) Seam Testing Log: provides a complete record of all nondestructive and destructive seam tests performed as part of the Geomembrane Installer's QC program.
        6) Seam/Panel Repair Log: provides a complete record of all repairs and vacuum box testing of repairs made to defective seams or panels.
        7) As-Built Drawing: maintain an as-built drawing updated on a weekly basis.

3.3 DEFECTS AND REPAIRS

A. All seams and non-seam areas of the geomembrane will be examined by the CQA Officer for evidence of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the Geosynthetics Installer if surface contamination inhibits examination. The Geosynthetics Installer shall ensure that this examination of the geomembrane precedes any seaming of that section.

B. Each suspect location, both in seam and non-seam areas, shall be nondestructively tested using the methods described, as appropriate. Each location that fails nondestructive testing shall be marked by the CQA Consultant and repaired by the Geosynthetics Installer. Work shall not proceed with any materials that will cover repaired locations until laboratory test results with passing values are available.

C. When seaming of a geomembrane is completed (or when seaming of a large area of a geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall identify excessive geomembrane wrinkles. The Geosynthetics Installer shall cut and reseam all wrinkles so identified. The seams thus produced shall be tested like any other seams.

D. Repair Procedures:
    1. Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired by the Geosynthetics Installer. Several repair procedures are specified below. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Consultant and the Geosynthetics Installer. The procedures available include:
        a. patching - used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter;
        b. abrading and reseaming - used to repair small sections of extruded seams;
        c. spot seaming - used to repair small tears, pinholes, or other minor, localized flaws;
        d. capping - used to repair long lengths of failed seams; and
        e. removing bad seam and replacing with a strip of new material seamed into place (used with long lengths of fusion seams).
    2. In addition, the following shall be satisfied:
        a. surfaces of the geomembrane that are to be repaired shall be abraded no more than one hour prior to the repair;
        b. all surfaces must be clean and dry at the time of repair;
        c. all seaming equipment used in repair procedures must be approved by Engineer;
        d. the repair procedures, materials, and techniques shall be approved in advance, for the specific repair, by the CQA Consultant and Geosynthetics Installer;

e. patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches.; and
f. the geomembrane below large caps shall be appropriately cut to avoid water or gas collection between the two sheets.

E. Each repair shall be numbered and logged and shall be nondestructively tested using the methods described in this section, as appropriate. Repairs that pass the nondestructive test shall be taken as an indication of an adequate repair. Failed tests will require the repair to be redone and retested until a passing test result is achieved. At the discretion of the CQA Consultant, destructive testing may be required on large caps at no additional cost to OWNER.

3.4 DOCUMENTATION

A. The following documentation must be maintained at the project site for review by the CQA Engineer or Inspector as the Geomembrane Installer's Documentation:
1. Daily Log: daily record that summarizes panels deployed, seams completed, seam testing, seam repair, personnel on site, weather conditions, and equipment on site.
2. Material Conformance: maintain original conformance certificate(s) from geomembrane manufacturer.
3. Subgrade Acceptance Log: maintained originals of subgrade acceptance forms for each panel and signed by the Geomembrane Installer.
4. Panel Log: provides geomembrane roll number used and subgrade acceptance for each panel deployed.
5. Seam Testing Log: provides a complete record of all nondestructive and destructive seam tests performed as part of the Geomembrane Installer's QC program.
6. Seam/Panel Repair Log: provides a complete record of all repairs and air lance testing of repairs made to defective seams or panels.
7. As-Built Drawing: maintain an as-built drawing updated on a weekly basis.

3.5 GEOSYNTHETIC LINER SYSTEM ACCEPTANCE

A. Contractor shall retain all ownership and responsibility for the geosynthetic liner system until final acceptance by the Owner.
1. Owner will accept the geosynthetic liner system installation when the installation is finished and all required warranties, test results, and documentation from the Contractor, Manufacturer, Inspector and Installer have been received and approved, and verification of the adequacy of all field seams and repairs, including associated testing, is complete.

END OF SECTION

SECTION 31 20 00

EXCAVATING, TRENCHING, BACKFILLING, AND GRADING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope: CONTRACTOR shall provide all labor, materials, and incidentals to excavate and trench designated areas, install pipe and appurtenances, haul (on-site) and install bedding and backfill material, compact backfill, and regrade disturbed areas as shown on the Drawings, and described in this Section.

B. The WORK specified in this Section includes the trenching and trench backfilling activities associated with installation of modifications to the LFG extraction wells, LFG lateral and header pipe, horizontal collectors, air supply pipe, dewatering discharge line, and any other Work requiring drilling, excavation, trenching, trench backfilling, or grading.

C. WORK under this Section includes trenching and grading activities inside of municipal solid waste (MSW) landfill areas.

D. No classification of type of excavated materials will be made. Excavation includes all soil and refuse materials regardless of type, character, composition, moisture, or condition thereof.

E. Any damage to existing features shall be repaired as directed by the ENGINEER, at the CONTRACTOR's expense.

1.02 PROJECT CONDITIONS

A. Existing project conditions are shown on the Drawings or otherwise described herein.

B. Site information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown for the convenience of the CONTRACTOR. The CONTRACTOR shall explore ahead of the required excavation to determine the exact location of all structures, utilities, etc.

C. Structures shall be supported and protected from damage by the CONTRACTOR. If structures are broken or damaged, CONTRACTOR shall restore structures, utilities, etc. to their original condition at no additional cost to the COUNTY. Repair of damaged features or structures shall be approved by the ENGINEER and COUNTY.

1.03 SITE ACCESS

WORK shall be performed so as to not block or hinder site access, except as authorized by the PROJECT MANAGER.

1.04 SAFETY

A. All WORK shall be performed in strict accordance with the Health and Safety requirements set forth in the General Conditions of the Contract Documents.

B. All WORK shall be performed in strict accordance with all local, State, U.S. Occupational Safety and Health Administration (OSHA) and other applicable Federal regulations regarding trenching operations and trench safety.

C. Excavation may be made without sheeting and bracing within the limitations and requirements of the governmental agencies having jurisdiction. Failure of the ENGINEER to order the use of bracing or sheeting and shoring or direct changes to systems in place, shall not in any way or to any extent relieve the CONTRACTOR of any responsibility concerning the condition of excavations or of his obligations under the Contract. The CONTRACTOR shall be responsible for the condition of all excavations. All slides and caves shall be removed without extra compensation, at whatever time and under whatever circumstances that they may occur.

D. All excavation shall comply with the applicable requirements as stated in the following:

1. OSHA excavation safety standards 29 CFR, 1926-650, subpart P.

2. State (Trench Safety Act Section 553.60-553.64 Florida Statutes) and COUNTY construction safety regulations.

3. Trench safety guidelines as specified by the Landfill Gas Division of the Solid Waste Association of North America (SWANA).

E. The CONTRACTOR shall include for any excavation, temporary controls for stormwater runoff and erosion control in full conformance with all existing facility permits and/or applicable regulations. Facility's current permits will be supplied at pre-construction meeting.

1.05 SUBMITTALS

A. Health and Safety Plan.

B. Results of sieve analysis and calcium carbonate test for No. 4 stone.

C. Pipe slope calculations and survey notes for pre-construction layout, including lateral route, and air supply/dewatering discharge lines.

D. Pipe survey notes for installed pipe pursuant to Part 3.06 of this Section.

E. Proposed stationing and pipeline identification procedures. Prior to the start of any pipe installation, CONTRACTOR shall supply an example layout drawing showing how the header and laterals will be marked with stations for the conformance surveys. The example layout drawing and stations must be consistent with the requirements of Sections 01 30 10, 01 70 30, and 33 51 10 of the Contract Documents.

F. CONTRACTOR daily logs detailing length of trench excavated and backfilled, with reference to pipe stationing and details sufficient to properly describe the WORK completed to date.

G. The CONTRACTOR shall notify the ENGINEER in writing of the material source for each of the soils specified within Part 2 of this Section at least 14 calendar days prior to the date of anticipated use of such material. Notification shall include:

1. Supplier's name.

2. Borrow location.

3. Documentation confirming adequate quantities are available to complete the WORK.

4. Soil field-moisture, laboratory proctor-density tests, and field compaction test results as required within Part 2 of this Section.

5. Certification that the soil is not petroleum-contaminated or contaminated with other chemicals or compounds that may be deemed hazardous or harmful to human health or the environment.

PART 2 - PRODUCTS

2.01 SAND BEDDING MATERIAL

A. Clean dry sand shall be used for pipe bedding and backfill to at least 6 inches above the top of the installed pipe. Sand shall be coarse-grained and conform to the following gradation unless otherwise approved by the ENGINEER in writing.

Sieve Size	% Passing (by weight)
3/8"-inch	100
No. 4	95
No. 200	5

Sand shall be free of sticks, roots, vegetation, organic matter, and stones larger than 1-inch in any dimension.

2.02 NON-CALCAREOUS STONE

A. Stone backfill shall be hard, durable non-calcareous rock. Stone shall be washed as a component of the manufacturing process and be free of organics, lumps or balls of clay, and other deleterious materials.

Stone shall be FDOT No. 4 and conform to the following gradation requirements:

Sieve Size	% Passing (by Weight)
2-inch	100
1½-inch	90
1-inch	35
3/4-inch	5
3/8-inch	0

2.03 CLEAN SOIL BACKFILL MATERIALS

A. Soil material may be reused for clean soil backfill provided it is free of sticks, roots, organic matter, MSW, and stones larger than 1-inch in any dimension. Remove any material that cannot be made to compact readily and replace with suitable material. If new material must be imported for use as clean soil backfill it must meet the criteria of this Specification and the testing requirements below.

B. Material shall be well-graded (SW), poorly graded (SP) or clayey sands (SC) as classified by the Unified Soil Classification System (USCS), or other soil as approved by the ENGINEER.

C. General Fill shall be used in the following areas of work and as shown on the Drawings:

1. Above the final cover system to ground surface in all trenches, unless specified otherwise on the Drawings.

2. Any location on Drawings that calls for “general fill” or “clean soil backfill” if excavated material is waste or is otherwise not suitable for reuse.

D. Clean soil backfill will be provided by COUNTY from onsite borrow pit to be loaded and transported to work area by CONTRACTOR.

2.04 SUBGRADE SOIL MATERIALS

A. Subgrade soils are natural, in-place materials. Soils shall be well-drained and reasonably free of sticks, roots, debris, organic matter, and MSW. CONTRACTOR shall remove material that cannot be made to compact readily and replace with ENGINEER-approved soil.

B. Soils which yield or exhibit pumping due to excessive moisture shall be excavated and replaced with general fill or materials as approved by the ENGINEER.

2.05 TOPSOIL

A. Material shall be fertile, natural soil, typical of the locality, free from MSW, stones (exceeding 2-inch in any dimension), roots or sticks (exceeding 1-inch diameter), clay, and weeds, and obtained from naturally well drained areas. It shall not be excessively acid or alkaline nor contain material harmful to plant growth. The material shall comply with the requirements of FDOT's Standard Specifications for Road and Bridge Construction (2017), Section 987, prepared soil layer materials.

PART 3 – EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours and datum locations.

B. Locate, identify and protect utilities from damage.

C. Protect benchmarks, survey control points, monitoring wells, existing structures and fences from excavating equipment and vehicular traffic.

3.02 PRE-CONSTRUCTION LAYOUT

A. Prior to trenching and pipe installation, CONTRACTOR and CONTRACTOR's surveyor shall stake out the entire proposed trench alignment. The proposed alignment must be approved by the ENGINEER and PROJECT MANAGER prior to the CONTRACTOR beginning excavation activities. This pipeline route staking for both header and lateral pipes must meet the minimum pipe slopes listed in this Section and on the Drawings.

B. Survey notes with proposed pipe slope calculations shall be submitted to the ENGINEER for approval prior to pipe installation. Notes of pre-construction survey shall identify conflicts between the proposed WORK and existing features.

3.03 EXCAVATION

A. Refuse materials shall be handled as directed in Section 02 41 16, Refuse Handling, Storage, and Disposal.

B. Excavate to lines, grades and dimensions necessary to complete the WORK.

C. Trenching Tolerances:

1. Excavate to install pipes in straight runs at a uniform grade, without sags or humps, between vertical and horizontal control points in accordance with the Contract Drawings.

2. Minimum trench width shall be as shown on the Drawings.

3. Maintain thickness of soil cover over the top of the pipe, as shown on the Drawings, or approved by the ENGINEER.

D. CONTRACTOR may not excavate more trench daily than can be completely backfilled after installation of the pipe the same day. Excavations shall not be left open overnight. In the event that a trench must be left open overnight the CONTRACTOR must get permission from the COUNTY to leave trench open and trench must be encircled in safety/warning tape attached to stakes placed along the perimeter on all edges of the trench. In the event that the trench has exposed refuse, all refuse must be covered with a tarp that is secured on all corners and along its perimeter.

E. CONTRACTOR shall use appropriate survey/level instrumentation during excavation to ensure proper trench slope. Verification of installed pipe slope shall be as specified in Part 3.06.

F. Minimum trench slopes shall be at least 5 percent as shown on the Drawings or approved by the ENGINEER.

3.04 DEWATERING

A. Water that enters excavations into refuse shall be considered landfill leachate and shall not be discharged to the ground or other means that are typical for stormwater. Water in trench excavations into refuse shall be pumped into sealed tanks, hauled to the main leachate pump station, or as directed by the PROJECT MANAGER, and discharged into the pump station. The CONTRACTOR must notify the COUNTY prior to dewatering, and allow the COUNTY to witness the dewatering and discharge to the leachate sump.

B. The CONTRACTOR shall at all times during construction provide and maintain proper equipment and facilities to remove water entering excavations. CONTRACTOR shall keep such excavations dry so as to obtain a satisfactory foundation condition for all WORK.

C. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottom, and soil changes detrimental to stability of subgrades and foundations. Subgrade soils which become soft, loose, “quick”, or otherwise unsatisfactory for support of structure as a result of inadequate dewatering or other construction methods shall be removed and replaced by crushed stone or gravel as required by the ENGINEER at the CONTRACTOR’s expense. The bottom of excavations shall be firm and without standing water

before placing structures or pipes. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

D. Disposal of Water Removed by Dewatering System:

1. Water conveyed away from excavations which has not contacted refuse materials shall be discharged to areas approved by the ENGINEER.

2. Dispose of water by procedures approved by the ENGINEER in such a manner as to cause no inconvenience to the COUNTY, the ENGINEER, or others involved in work about the site.

3. Water conveyed away from excavations which has contacted refuse materials shall be pumped into spill-proof containers and discharged into the leachate sump as directed by the PROJECT MANAGER.

E. If pipe trench becomes watered-in after placement of pipe, but before backfilling, CONTRACTOR shall dewater the trench, demonstrate that the pipe bedding and pipe slope remain satisfactory, and upon approval by the ENGINEER, backfill the pipe with clean dry soil in accordance with Part 2.01 of this Section.

3.05 ROAD CROSSINGS

A. CONTRACTOR shall schedule and coordinate all road crossings with the COUNTY to minimize disruption of the COUNTY's operations.

B. HDPE pipes shall be encased in a larger diameter casing for protection. The inner diameter of the casing shall be a minimum of six (6) inches larger than the cumulative outside diameters of the HDPE pipes encased. Outer casing shall be N-12 pipe as manufactured by Advanced Drainage Systems, Inc. (800) 821-6710 or approved equivalent. See Drawings for road crossing details as applicable.

3.06 PIPE SURVEY

A. CONTRACTOR shall verify that pipe slope meets the requirements specified in this Section and on the Drawings at 10-foot intervals along LFG laterals and header and record such information in the project notes. Station numbering shall be used and marked on the pipe, as approved by the ENGINEER.

1. CONTRACTOR shall measure each length of installed pipe and mark the 10-foot stations. Stationing of laterals shall begin with 0+00 at the header, ending at the riser for the well.

2. Stationing of the header shall begin with 0+00 at a location approved by the ENGINEER. Station numbering for pipe installed each day shall be consecutive with pipe installed on previous days. The CONTRACTOR

shall not restart station numbering at 0+00 for any header segment without advance approval from the ENGINEER.

3. Survey equipment shall be used to measure the change in relative elevation between each 10-foot station prior to burial of any pipe.

4. The surveyed elevations and calculated change in elevation and slope for each 10-foot section shall be recorded in the CONTRACTOR's project notes.

5. A trench laser will not be considered acceptable survey equipment for the purpose of verifying pipe slope.

B. The project notes detailing the required pipe slope confirmation shall be provided daily to the ENGINEER.

C. An as-built survey shall be conducted on all installed pipe prior to backfilling the trench.

1. The survey shall document the horizontal and vertical location of the top of the landfill gas laterals, air supply lines, condensate discharge line and drain line pipes at minimum 50-foot intervals and at each change in pipe direction, ground surface grade break, change in pipe grade, fitting, connection, pipe crossover, and tie-in along the entire pipeline routes.

2. If a run of pipe is 100 feet or less in length, CONTRACTOR shall provide survey shots at a 20-foot interval or less. For a run of pipe of 50 feet or less, CONTRACTOR shall provide survey shots at a 10-foot interval or less to document the pipe as-built conditions.

3. The survey shall also document the type of pipe, location (horizontal and vertical coordinate) of structures and appurtenances such as, but not limited to road crossing casing, pipe crossing, and tie-ins.

4. This surveying shall be sealed by a Florida Licensed Land Surveyor as described in Section 01 70 30, Project Record Documents.

3.07 BACKFILLING

A. Backfill materials shall be as described in Part 2 of this Section.

B. CONTRACTOR shall notify the ENGINEER prior to beginning backfilling. The ENGINEER shall inspect all pipe, fittings and connections prior to approving backfilling. If CONTRACTOR backfills pipe without inspection of the pipe while pipe is installed in the open trench, CONTRACTOR shall uncover all uninspected buried pipe so that it may be properly inspected. This shall be done at no additional cost to the COUNTY or ENGINEER.

C. Place bedding material in trench to the lines and grades shown on the Drawings.

D. Bedding material (sand) shall be placed in the trench ensuring material is placed under the haunch of the pipe. The bedding shall be poured into place, not pushed, and shall be raked by hand and then compacted, using a mechanical compaction device such as walk-behind vibratory compactor, in a loose lift not to exceed six (6) inches above the top of the pipe.

E. Backfilling procedures shall be modified as necessary as approved by the ENGINEER in order to not displace (either horizontally or vertically) piping installed in the trench during backfill or bedding placement.

F. Place soil backfill in maximum 6 inch lifts above pipe bedding to the existing grade. CONTRACTOR shall compact soil backfill in 6-inch lifts with mechanical compaction such as a walk-behind vibratory compactor or excavator bucket. Compaction shall be to a density where subsequent passes with the mechanical compaction device will not reduce the surface elevation of the bedding material by more than three-quarters of an inch.

3.08 REFUSE DISPOSAL

The CONTRACTOR shall be responsible for loading and transporting refuse to the working face as specified in Section 02 41 16. No excavated waste shall be left overnight at any excavation at any time.

3.09 GRADING DISTURBED AREAS

CONTRACTOR shall regrade and return to their original condition, as determined by the PROJECT MANAGER and ENGINEER, all areas disturbed by CONTRACTOR's work. This includes, but is not limited to ruts caused by construction equipment, soil stockpile areas, and landfill benches and terraces used for access.

3.10 TESTING REQUIREMENTS DURING PLACEMENT

A. The CONTRACTOR shall place backfill and fill materials to achieve an equal or "higher" degree of compaction than undisturbed materials adjacent to the work; however, in no case shall the degree of compaction fall below minimum compaction specified in this Section.

B. Where laboratory or field testing is specified herein to verify that the constructed, in-place WORK meets the specifications and quality control requirements herein, the CONTRACTOR shall employ and bear the expense for an independent testing laboratory to conduct such tests. The CONTRACTOR shall pay for the costs of all retests required due to the initial testing not passing the requirements herein. Laboratory shall be on the approved vendors list of the COUNTY.

Where laboratory testing is specified to verify that any individual material of

construction or product meets certain quality control requirements (i.e. size, gradation, mix formula, hardness, shape, inherent strength, etc.), the CONTRACTOR shall employ and bear all expenses for an independent testing laboratory to sample the material or product and to conduct such tests and retests if necessary or required by the COUNTY.

END OF SECTION

SECTION 33 21 70

LFG EXTRACTION WELLS AND WELLHEADS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The CONTRACTOR shall provide all labor, equipment, materials, and appurtenances necessary to drill, install and make ready landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the Drawings.

B. The perforated pipe, gravel stone, geotextile, bentonite, and soil backfill shall be set at depths and thicknesses shown on the Drawings or as designated in the field by the ENGINEER. It is expected that combustible and asphixiant gases will be venting from boreholes drilled in to waste within the footprint of the landfill. The CONTRACTOR's bid price shall include provision for all equipment and procedures necessary to safely install wells and borings under this condition. All Work shall be performed by qualified workers in accordance with the best standards and practices available.

C. Upon completion of each new extraction well or boring, CONTRACTOR shall dispose of all construction and drilling refuse materials as specified in Section 02 41 16 or as directed by the PROJECT MANAGER.

D. Related Work Described Elsewhere:

1. Section 02 41 16: Refuse Handling, Storage, and Disposal
2. Section 31 20 00: Excavating, Trenching, Backfilling and Grading
3. Section 31 51 10: Pipe and Pipe Fittings

1.02 REFERENCES

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
STANDARD TEST METHODS/PRACTICE

ASTM D 420-98	Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes
ASTM D 422-63	Standard Method for Particle-Size Analysis of Soils
ASTM D 1452-80	Standard Practice for Soil Investigation and Sampling by Auger Borings

ASTM D 2487-00	Standard Classification of Soils for Engineering Purposes (Unified Classification System)
ASTM D 2488-00	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

1.03 SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, Certificates of Compliance on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, and inspection of pipe and appurtenances furnished as described in Contractor Submittals.

B. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval, Shop Drawings showing dimensions, materials, and manufacturer's information for pipe, pipe perforations, fittings, bentonite, and wellhead components.

C. One week prior to well drilling, CONTRACTOR shall submit an example well boring log and construction log. The example log shall be completed with all of the required descriptions and pertinent information required under Part 3.04 of this Section.

D. At least two weeks prior to construction, the CONTRACTOR shall submit to the ENGINEER for review and approval, results of the sieve analysis for the soil backfill, samples of all well backfill materials (if requested), the name of the vendor(s), and source of backfill materials furnished.

E. At the end of each day, CONTRACTOR shall provide copies of the handwritten well boring and completion logs for each well drilled on that day. Information to be included on the well logs is listed in Part 3.04 of this Section.

F. Final boring logs based on field information shall be typewritten and submitted with the Record Documents. Description of the boring and excavated material shall be according to the attached well boring log template at the end of this Section.

1.04 QUALITY ASSURANCE

A. A professional experienced in installation of LFG wells shall be responsible for observing and documenting information related to all boring and installation activities. The OWNER will contract with the quality assurance professional that will oversee and observe the extraction well installation.

B. Inspect well materials for cleanliness, deformations, and imperfections, and ensure conformance with Specifications prior to use.

PART 2 - PRODUCTS

2.01 SOIL

Soil backfill material shall be granular material free of clay, sticks, roots organic material from an off-site source, as specified in Section 31 20 00.

2.02 STONE

Stone shall be FDOT No. 4 stone as specified in Section 31 20 00 Part 2.02

2.03 BENTONITE

A. "Bentonite Plug" as used in the Drawings, shall refer to a well seal comprised of hydrated sodium bentonite pellets or chips of a thickness as indicated on the Drawings. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives.

B. Bentonite shall be hydrated per manufacturer's instructions prior to backfilling with soil. Bentonite shall be hydrated in 6-inch lifts as per Paragraph 3.05 B of this Section.

C. Under no circumstances will the use of granular bentonite be permitted for the vertical extraction wells.

2.04 HDPE PIPE

A. Pipe for extraction wells shall be 8-inch Standard Dimension Ration (SDR) 9 High Density Polyethylene (HDPE) pipe as shown on the Drawings and conforming to the requirements of Section 33 51 10 Part 2.02

B. The perforations in the extraction well piping shall be as specified on the Drawings.

2.05 WELLHEAD MATERIALS

A. Wellheads shall be Precision Quick-Change™ orifice plate wellheads provided by QED Environmental.

2.06 MONITORING PORTS

A. Monitoring ports shall be Easy Port™ ¼ inch male NPT screw-capped "long" barb fittings as supplied by QED Environmental, model no. 40987.

2.07 WELL IDENTIFICATION

A. Upon completion of well drilling, CONTRACTOR shall paint the well identification number on the well casing using 3-inch tall stenciled letters and white or yellow paint. Lettering any other means shall not be permitted.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION SERVICES

A. The CONTRACTOR shall survey and stake the well boring locations prior to drilling. Pre-construction layout surveying shall be done by a Florida Licensed Professional Surveyor.

B. CONTRACTOR shall supply surveyed ground elevations of the proposed new extraction wells to the ENGINEER so that the design well depths may be confirmed at least one week prior to drilling.

C. Extraction well and boring locations must be approved and may be adjusted by the ENGINEER prior to beginning drilling.

3.02 DRILLING

A. The CONTRACTOR shall coordinate the start of drilling with the ENGINEER and PROJECT MANAGER.

B. The CONTRACTOR shall provide at all times a thoroughly experienced, competent driller during all operations at the drill site.

C. The CONTRACTOR must use dry drilling equipment.

D. Wells are to be drilled to the depth and diameter as shown on the Drawings. The boring depths shown on the Drawings may be adjusted in the field by the ENGINEER. Under no circumstances are the drilling depths from the well schedule on the Drawings to be exceeded unless approved by the ENGINEER in advance.

1. Wet Borings:

a. The PROJECT MANAGER and ENGINEER shall be notified of wet boring conditions.

b. If water is encountered in a boring, the CONTRACTOR may be directed by the PROJECT MANAGER and ENGINEER to drill beyond the point at which it was encountered. If wet conditions remain, at the direction of the PROJECT MANAGER and ENGINEER, the boring may be terminated (after driller has attempted to advance boring for 2 hours) and the length of perforated pipe adjusted by the ENGINEER. If wet conditions

cease (e.g., due to a perched water layer), then drilling will continue to the design depth.

c. If water is encountered in a boring at a shallow depth, the ENGINEER may decrease the well depth and length of perforated pipe, or relocate the well.

2. Abandoned Borings:

a. If, in the opinion of the PROJECT MANAGER and ENGINEER, the borehole has not reached a sufficient depth to function as an effective extraction well, the CONTRACTOR shall abandon this borehole by backfilling it with cuttings removed during drilling. Soil shall be backfilled and compacted to ground surface. CONTRACTOR shall supply additional soil backfill to refill any settlement within the abandoned borehole, as approved by the ENGINEER.

b. If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the CONTRACTOR shall use soil backfill material.

c. Compensation for abandoned borings shall be at the unit price for boring refusal.

E. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole.

1. The CONTRACTOR shall take all necessary precautions to maintain the well pipe vertically plumb during the entire backfill operation of the borehole to the satisfaction of the ENGINEER.

2. The grate over the borehole that is used to keep the well casing plumb shall not be removed until the borehole is backfilled to within 2 feet of ground surface.

3. If the pipe is installed out of plumb, as determined by the ENGINEER, the CONTRACTOR, at his own expense, shall correct the alignment.

4. The well casing shall extend above ground surface as shown on the drawing. No pipe couplings shall be installed above grade or within 10 feet of ground surface below grade.

3.03 WELL LOGS

A. CONTRACTOR shall keep detailed well logs for all wells drilled. Information recorded on the well logs shall include the following:

1. Total depth of well.

2. Visual description of refuse at 5-foot intervals:

   a. Type of refuse encountered including the estimated percentage of the following components (by volume) on visual inspection:

      – Paper/Cardboard
      – Plastic
      – Yard refuse
      – Construction debris
      – Textiles
      – Tires
      – Sludge
      – Dirt

   b. Moisture content (in percentages) based on the guidelines attached to the end of this Section.

   c. State of decomposition based on the guidelines attached to the end of this Section.

   d. Temperature of excavated refuse

3. Occurrence, depth, and thickness of water-bearing zones

4. Length of slotted pipe and solid pipe below grade.

5. Thickness, description and depth from ground surface of backfill layers.

6. Length of above ground riser stick-up pipe.

B. CONTRACTOR shall use the well borings description sheet provided at the end of this Section as a guideline for describing excavated materials.

C. Field copies of the well logs shall be provided to the ENGINEER. If the CONTRACTOR fails to provide field copies of well logs to the PROJECT MANAGER at the end of each day, the CONTRACTOR will not be allowed to conduct any further drilling activities until the logs have been submitted and reviewed by the ENGINEER.

D. Typed final copies of the well logs shall be submitted with the Record Drawings in accordance with Section 01 70 00. Handwritten logs will not be acceptable for submittal with the Record Drawings.

3.04 JOINING OF PIPES

A. Pipes shall be joined as specified in Section 33 51 10, Pipe and Pipe Fittings, Section 3.04 Part B.

1. Heat fusion joints shall be made in accordance with manufacturer's step-by-step procedures and recommendations.

2. Mechanical joining shall be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and shall be used only where shown on the Drawings.

B. At the end of each day, CONTRACTOR shall cap the ends of all joined pipes longer than 20 feet to prevent entry by animals and debris.

3.05 BACKFILLING

A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed in the borehole.

1. Backfill materials shall be placed carefully within the wells to the dimensions shown on the Drawings and as approved by the ENGINEER.

2. Tire chip and soil backfill containing foreign material may be rejected by the PROJECT MANAGER or ENGINEER on the basis of a visual examination.

3. Both well piping and backfill shall be installed with a safety grate installed over the boring. The safety grate shall remain in place until backfill is within 2 feet of existing ground surface.

B. Bentonite Plug shall be backfilled and hydrated in 6-inch lifts. The CONTRACTOR shall soak each lift according to the manufacturer's instructions prior to filling the next one. A minimum of 6 bags of bentonite shall be poured into the center of the borehole per 6-inch lift.

C. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

3.06 REFUSE DISPOSAL

The CONTRACTOR shall dispose of excavated refuse as specified in Section 02 41 16-Refuse Handling, Storage, and Disposal.

3.07 TEMPORARY CAP

The CONTRACTOR shall temporarily cap the riser pipe of the vertical extraction well immediately after well pipe installation to prevent venting of LFG into the atmosphere. The CONTRACTOR shall remove this cap during the installation of the wellheads. Lag screws may be necessary due to the internal gas pressure within the well.

3.08 WELLHEAD INSTALLATION

A. Vertical extraction well and horizontal collector wellheads shall be installed in accordance with manufacturer's recommendations. PVC pipe sections of the wellhead shall be air-tight. Any leaks shall be repaired by CONTRACTOR at no additional cost to the COUNTY.

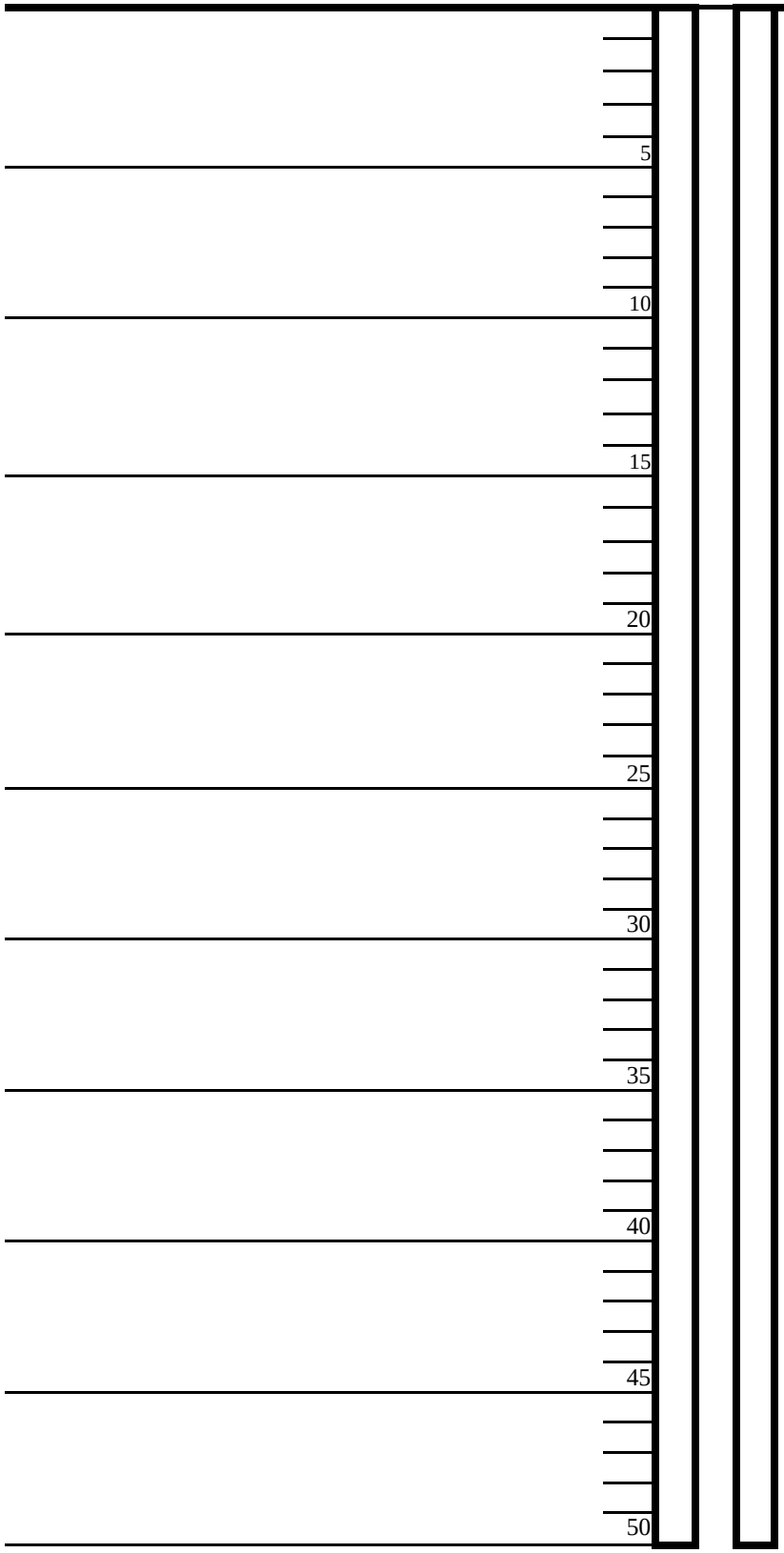
B. Install flexible Kanaflex hose on all wells so that hose has no sags, as shown on the Drawings. However, flexible hose shall not be taut. Provide enough slack to accommodate minor pipe settlement, as approved by the ENGINEER.

ATTACHMENT 33 21 70 - 1 Well Boring Log Template

END OF SECTION

Well Log - SCS Engineers

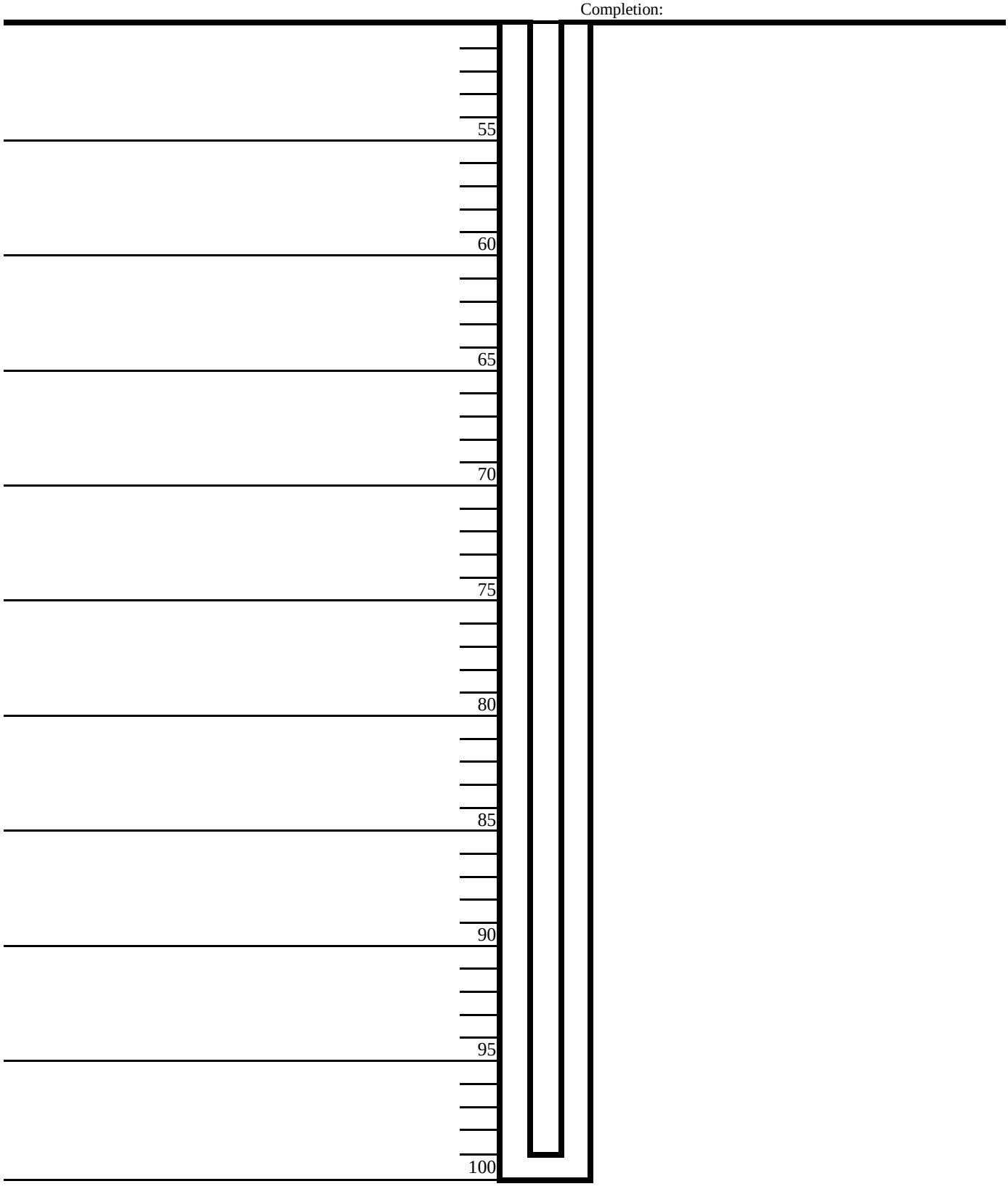
Site Name:	Well Number:
Project #: 09206066.10	Coordinates:
Start Date:	Surface Elevation:
Completed:	Top of Casing Elevation:
Contractor:	Boring Diameter:
Inspector:	Pipe Material Diameter
Driller:	Total Depth Drilled:
	Completion:



COMPLETION LOG	
RISER STICK UP	
RISER BELOW	
PERF. PIPE	
BACKFILL	
BENTONITE #1	
SILICA SAND 20/30	
BENTONITE #2	
BACKFILL	
GRAVEL PACK	
BACKFILL LOG	
Stone	
Structural fill	
Bentonite fill	
MATERIALS LIST	
TOP CAP	
SOLID PIPE	
PERF PIPE	
BOTTOM CAP	
BENTONITE	
BACKFILL	
STONE	

Well Log - SCS Engineers

Site Name:	Well Number:
Project #: 09206066.10	Coordinates:
Start Date:	Surface Elevation:
Completed:	Top of Casing Elevation:
Contractor:	Boring Diameter:
Inspector:	Pipe Material Diameter
Driller:	Total Depth Drilled:
	Completion:



SECTION 33 21 70

LANDFILL BOREHOLE AND WELL LOGGING GUIDANCE – REFUSE

Moisture Content Scale

15% Dry Refuse	20-25% Normal	25-35% Damp	35-50% Wet	50% Saturated
Rock, dirt, etc; no trace of moisture paper will be fuzzed up	Newspaper, etc; still not noticeably wet but normal moisture	Paper shows dampness lawn clippings, tree branches, stiff & hold together	Paper saturated but no free water, just getting sloppy; water emanates when squeezed	Mud or free water present

Decomposition Scale

Little	Some	Moderate	Much	Severe
Newspaper readable; refuse looks new		Newspaper not legible; branches intact		Newspaper not legible; crumble; black/brown mucky material

Log the following (in 5' intervals):

- Note apparent Intermediate cover thickness and presence of intermediate cell cover
- Ratio of refuse to cover soil
- Degree of compaction (i.e., loose, moderate, tight)
- Composition description (i.e., household, garden, commercial, demolition, sludge, medical, or other)
- Percent of refuse components (plastic, metal, yard waste, etc.)
- Note color and unusual odors or appearances
- Degree of decomposition
- Percent of moisture
- Approximate dates of refuse as an indicator (only) of dates of placement (i.e., newspaper, etc.)
- Refuse temperature
- Gas presence and relative pressure and temperature
- Presence of perched or free liquid
- Note elevations and observations of changes in refuse/soil/liquid conditions

SECTION 33 21 80

LANDFILL GAS COLLECTION SYSTEM APPURTENANCES

PART 1 - GENERAL

1.01 GENERAL

A. The CONTRACTOR shall furnish all labor, materials, equipment and incidentals necessary to perform all work and services for complete installation of landfill gas collection system appurtenances as shown on the drawings and as specified, in accordance with provisions of the Contract Documents.

B. The WORK shall include, but not necessarily be limited to construction of LFG extraction wells, installation of pneumatic pumps, valves, valve vaults, condensate trap assemblies, sumps, access risers, blind flanges, installation of pipe, fittings, and connections, bentonite/soil seal, and gravel, as specified and as shown on the drawings.

1.02 SUBMITTALS

A. Materials shall not be incorporated in construction until approved by the COUNTY and ENGINEER.

B. The CONTRACTOR shall notify the COUNTY of the source of all materials and shall furnish a representative sample for approval, at least ten calendar days prior to the date of anticipated use of such material.

PART 2 - PRODUCTS

2.01 PNEUMATIC PUMPS

A. The pneumatic pumps shall be QED AutoPump bottom inlet model Short AP4^{+}B. The pump shall have screens, casings and fittings, and a hose and hardware package with 1-inch discharge hoses and ¾ inch air hoses.

2.02 WELL CAPS

A. The well caps shall be QED 8-inch well diameter wellheads without fittings, model number GWC82.

2.03 HIGH LEVEL INDICATOR

A. The high liquid level indicator shall be QED supplied Easy Level™ Liquid Level Indicator, model number 40363 with QED supplied bubbler tubing model number 40360.

PART 3 – EXECUTION (Not Used)

END OF SECTION

SECTION 33 51 10

PIPE AND PIPE FITTINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The CONTRACTOR shall supply all materials, equipment, and labor needed to install complete and make ready for use all pipe, pipe fittings, and valves as specified herein and as indicated on the Drawings.

B. Related Work Described Elsewhere

1. Section 31 20 00 - Excavating, Trenching, Backfilling and Grading
2. Section 33 21 70 - LFG Extraction Wells and Wellheads
3. Section 44 42 60 - Condensate Management System

1.02 SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval prior to commencement of construction, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, and repair of each type of pipe, pipe fitting, and valve furnished.

B. The CONTRACTOR shall prepare and submit Shop Drawings to the ENGINEER for review and approval. The Shop Drawings shall show the following:

1. All dimensions, slopes, and invert elevations at connections to existing pipes.

2. All tie-ins to the existing leachate collection system shall be field-verified and shown on the Shop Drawings. This shall include pipe size and burial depth at a minimum.

3. Pipe Dimensions for each pipe size used:

   a. Average outside diameter.
   b. Average inside diameter.
   c. Minimum average wall thickness.

4. Each pipe and fitting size to be used.

1.03 REFERENCE

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Use of the most recent version is required.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1248	Standard Specification for Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1784	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and other gravity-flow applications.
ASTM D 2467	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2513	Standard Specification for Thermoplastic Gas Pressure Pipe Tubing and Fittings
ASTM D 2564	Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 3261	Butt Head Fusion Polyethylene (PE) Plastic Fittings for Polyethylene Plastic Pipe and Tubing
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials

AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI B 31.8	Code for Pressure Piping, Appendix N

PART 2 - PRODUCTS

2.01 FLEXIBLE PVC PIPE ON WELLHEADS

A. Flexible PVC pipe shall be UV-Resistant Solarguard™ Flexible Hose supplied by QED Environmental, model number 40946.

B. Fasteners for flexible PVC pipe shall be high strength stainless steel banding kits supplied by QED Environmental, model number 40979.

2.02 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

A. General:

1. All HDPE pipe and fittings 4-inch diameter and greater as indicated on the Drawings shall be Standard Dimension Ratio (SDR) 17 high density polyethylene pipe using a 3608 type resin or approved equal. HDPE pipe and fittings for landfill gas or condensate flow that are 2-inch diameter and less shall be SDR 11 or as indicated on the Drawings.

2. Air supply pipes and fittings shall be 2-inch diameter SDR 9 with yellow striping.

3. Pipe shall be extruded from a Type III, Class C, Category 5, Grade P36 compound as described in ASTM D 1248. It shall be classified as cell 345464C according to ASTM D 3350 and have the material designation of PE 3408. The pipe shall be manufactured to meet the requirements of ASTM D 2513. Manufacturer's literature shall be adhered to when "manufacturer's recommendations" are specified. All pipe and fittings shall be provided by one manufacturer. Acceptable manufacturers include Performance Pipe (800-527-0662), or approved equal.

B. HDPE Fittings

1. Fittings shall be manufactured from polyethylene compound having cell classification equal to or exceeding the compound used in the pipe.

2. All fittings 12 inches and smaller shall be molded, unless approved by the ENGINEER.

C. All pipe and fittings must be supplied by the same manufacturer.

2.03 FLANGES FOR HDPE PIPE

A. Flanges for HDPE pipe shall be convoluted ductile iron back-up rings with a minimum thickness of 1-inch, as manufactured by Improved Piping Products, Inc. (800) 969-0962, of Orinda, California or approved equal. Hardware and fittings shall be stainless steel, finished with blue primer, and epoxy coated.

B. The studs, nuts, and washers for the flanges shall be stainless steel. All below grade studs, nuts, and washers shall be thoroughly coated with Polyken Technologies 1027 Primer, or rubberized emulsion undercoating spray, or approved substitute, with no gaps in coverage. Below grade flanges shall be wrapped in 5-mil polyethylene sheeting just after installation and prior to backfilling to help prevent corrosion.

C. Flange gaskets shall be full-face Neoprene.

2.04 PIPE MARKINGS

All PVC and HDPE pipe shall be stamped by the manufacturer with the following information at five foot intervals:

A. Manufacturer name or trademark
B. Nominal pipe size
C. Type of plastic (e.g., PE 3608)
D. Standard dimension ration (SDR) or Schedule (SCH) value
E. ASTM designations (i.e., ASTM D 2513)

2.05 VALVES

A. All valves shall be complete with all necessary operators and other accessories or appurtenances which are required for the proper completion of the WORK. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.

B. Valves and operators shall be suitable for the exposure they are subject to, e.g., buried and landfill gas. Valves shall have all safety features required by OSHA.

C. Unless otherwise shown, valves shall be the same size as the adjoining pipe.

D. Valve position indicators shall be installed correctly to properly identify the valve position.

E. Valve spacers shall be used for all valves 6 inches and larger.

2.06 PIPELINE LOCATOR/WARNING TAPE

A. For LFG header and laterals as shown on the Drawings, tape shall be a standard locator/warning tape imprinted with the words “Caution Gas Line Buried Below,” as supplied by Reef Industries, Inc. (800-231-6074), or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A. Pipe shall be stored or stacked so as to prevent damage by marring, crushing, or piercing. Maximum stacking height shall be limited to 6 feet.

B. Pipe and pipe fittings shall be handled carefully in loading and unloading. They shall be lifted by hoists and lowered on skidways in such a manner as to avoid shock. Derricks, ropes, or other suitable equipment shall be used for lowering the pipe into the extraction well borings. Pipe and pipe fittings shall not be dropped or dumped.

3.02 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to the Specifications or for the following reasons:

1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of the pipe which could be cut off and discarded. Pipes within one shipment shall be rejected if defects exist in more than 5 percent of shipment or delivery.

2. Cracks sufficient to impair strength, durability or serviceability of pipe.

3. Defects indicating improper proportioning, mixing, or molding.

4. Damaged ends, where such damage prevents making a satisfactory joint.

5. Scratches or gouges of depth greater than 10 percent of pipe wall thickness.

B. Acceptance of fittings, stubs, or other specially fabricated pipe sections shall be based on visual inspection at job site and documentation of conformance to these Specifications.

C. The ENGINEER shall be notified by CONTRACTOR prior to burial of pipe.

D. The PROJECT MANAGER and ENGINEER reserve the right to require destructive testing of any fusion weld on HDPE pipe.

3.03 FLEXIBLE PVC PIPE CONNECTIONS

Connections to pipe shall be made with clamps in accordance with manufacturer's step-by-step procedures and recommendations, and as approved by the ENGINEER.

3.04 HDPE PIPE HANDLING

A. HDPE pipe shall not be bent more than the minimum radius recommended by the manufacturer for type, grade, and SDR. Care shall be taken to avoid imposing strains that will overstress or buckle the HDPE piping or impose excessive stress on the joints.

B. Joining HDPE Pipe:

1. Only two methods shall be utilized to join HDPE pipe: heat fusion and mechanical joining.

a. Mechanical Joining shall be accomplished with HDPE flange adapters, neoprene gaskets, and ductile iron back-up flanges, and shall be used only where shown on the Drawings. Refer also to Part 3.09.

b. Heat Fusion joints shall be made in accordance with manufacturer's step-by-step procedures and recommendations.

1) Fusion equipment and a trained operator shall be provided by the CONTRACTOR. Pipe fusion equipment shall be of the size and nature to adequately weld all pipe sizes and fittings necessary to complete the project (refer to Part 2.10).

2) Branch saddle fusions shall be made in accordance with manufacturer's recommendations and step-by-step procedures. Branch saddle fusion equipment shall be of the size to facilitate saddle fusion within the pipe trench.

3) Heat fusion shall be performed outside of the trench whenever practical.

4) Before heat fusing pipe, each length shall be inspected for the presence of dirt, sand, mud, shavings, and other debris, and any foreign material shall be completely removed.

5) At the end of each day, all open ends of fused pipe shall be capped or otherwise covered to prevent entry by animals or debris.

c. As per the manufacturer's instructions, no fusion shall be performed in precipitation unless a shelter is provided.

3.05 HDPE PIPE INSTALLATION

A. Pipe installation shall comply with the requirements of ASTM D 2321, PPI TR-31/9-79, and the manufacturer's recommendations.

B. Lengths of fused pipe to be handled as one segment shall not exceed 500 feet.

C. The PROJECT MANAGER or the ENGINEER shall be notified prior to any pipe being installed in the trench in order to have an opportunity to inspect the following items:

1. All butt and saddle fusions.
2. Pipe integrity.
3. Trench excavation and bedding material for rocks and foreign material.
4. Proper trench slope.
5. Trench contour to ensure the pipe will have uniform and continuous support.
6. Proposed backfill sand and soil.

D. Any irregularities found by the ENGINEER during this inspection must be corrected before lowering the pipe into the trench. Pipe shall be allowed sufficient time to adjust to trench temperature prior to any testing, segment tie-ins, and/or backfilling.

E. Tie-ins shall be made out of the trench whenever possible. When tie-ins are to be made in a trench, a bell hole shall be excavated large enough to ensure an adequate and safe work area.

F. Below grade piping shall be marked with warning tape to be buried in the trench above the pipe as indicated on the Drawings.

G. CONTRACTOR shall collect all pipe shavings and discard in a trash receptacle. Shavings shall not be left on the ground.

H. All installed HDPE pipe shall be marked in 10-foot intervals corresponding to the stationing required for slope confirmation and conformance surveying. For main pipeline, station numbering shall be continuous and sequential. Station numbering shall be referenced in daily logs to document pipe installation progress.

3.06 FLANGED CONNECTIONS

A. For flanged connections in virgin soil, the CONTRACTOR shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling to help protect the assembly from corrosion.

B. Flanges shall be joined with stainless steel studs and nuts. Stud lengths shall accommodate the required distance between flanges including valve spacers, if necessary.

C. For flanged connections within the limits of refuse, all below grade back-up rings, studs, nuts and washers shall be thoroughly coated with Polyken Technologies 1027 Primer, or rubberized emulsion undercoating spray, or approved substitute.

D. The CONTRACTOR shall wrap and tape the flanges and bolts in 5 mil polyethylene sheeting prior to backfilling.

3.07 PIPE SUPPORTS

All piping and valves shall be supported in such a manner as to prevent any stress being transmitted between sections and connected equipment and appurtenances.

3.08 SEGMENT TESTING

A. The HDPE laterals and connections to LFG header, air supply lines, and condensate discharge line pipelines shall be subjected to pressure tests as described herein to detect any leaks in the piping. Testing shall be performed below grade (inside the trench). The CONTRACTOR shall accept the responsibility for locating, uncovering (if previously backfilled), and repairing any leaks detected during testing.

B. Polyethylene piping shall be butt welded together into testing segments. Segments shall be connected to a testing apparatus on one end and fitted with fusion-welded caps on all openings.

C. The segment to be tested shall be allowed time to reach constant and/or ambient temperature before initiating the test.

D. The test must be performed during a period when the pipe segment will be out of direct sunlight; i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes which will occur during temperature fluctuations. No testing will be allowed during the middle of the day or when pipe segments are exposed to sunlight.

E. The test pressure for LFG laterals and header shall be 10 psig. The test pressure for air supply and condensate/dewatering pipes shall be 100 psig.

F. Pressure drop during the test shall not exceed one percent of the testing gauge pressure over a period of one hour. This pressure drop shall be corrected for temperature changes before determining pass or failure. (See Section 3.09 for test failures). The ENGINEER shall sign off on a test form to indicate test compliance.

G. The ENGINEER and CQA Consultant shall be notified prior to commencement of the testing procedure and shall be present during the test.

H. All equipment for this testing procedure, including an adequately sized air compressor, fittings, caps/pipe plugs, etc., shall be furnished by the CONTRACTOR. Other necessary equipment includes a flange adaptor with a steel or brass blind flange. Tapped and threaded into the blind flange will be a temperature gauge with a scale of 0 to 100 degrees C with 1-deg. intervals, a pressure gauge with a scale that spans the test pressure range with increments equal to 0.1 percent of the test pressure, an appropriate valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Pipe reducers shall be utilized to adapt test flange to size of pipe being tested.

3.09 TEST FAILURE

A. The following steps shall be performed when a pipe segment fails the one percent/one hour test described in Part 3.08 F, above.

1. The pipe and all fusions shall be inspected for cracks, pinholes, or perforations.

2. All blocked risers and capped ends shall be inspected for leaks.

3. Leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.

B. All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.

C. After all leaks are repaired, a retest shall be performed in accordance with Part 3.08.

3.10 TEST REPORTING

A. Each test (pass or failure) shall be reported in writing on the attached pipe testing form or another form approved by the ENGINEER.

B. If failure occurs, CONTRACTOR shall note the following:

1. Location of failure segment.
2. Nature of leaks.
3. Repairs performed.
4. Results of test.

ATTACHMENT 33 51 10 - 1 Pipe Pressure Test Data Log

END OF SECTION

HDPE PIPE PRESSURE TEST PROCEDURE

This protocol describes the method for testing the installation of HDPE pipelines and components using a low-pressure air test.

PROCEDURE

1. Isolate the section of HDPE pipe to be tested using fusion welded caps. Cap the ends of all branches, laterals, tees, wyes, and stubs included in the test to prevent air leakage. All caps shall be securely braced to prevent blowout.

2. Contractor shall install a temperature gauge, pressure gauge and fittings for connection of an air compressor hose and a ball valve to release the pressure at the completion of the test.

    - Temperature gauge shall have a range of 0 to 100 ºC.
    - Pressure gauge shall have increments equal to 1% of the test pressure.

Contractor shall not install new holes in pipeline for the exclusive purpose of performing the air test. However, tapped holes shown on the Plans for items such as header isolation valve monitoring ports may be utilized.

3. Connect the hose to the inlet tap and portable air supply source. Add air slowly to the test section until the pressure inside the pipe reaches the required level as shown below:

    - LFG header, laterals and condensate dewatering discharge lines: 4 psig
    - Air supply line and leachate forcemain: 100 psig

4. Once pressurized and the pressure has stabilized, record the initial temperature (ºC) and pressure of the air inside the pipe on the test report form.

5. Begin timing the test. At ten-minute intervals, record the temperature (ºC) and pressure of the air inside the pipe on the test report form. Record this data for 6 intervals, until the total time equals 60 minutes.

6. For pipe segments that include an isolation valve, the pressure test must be performed to demonstrate the integrity of the valve. Contractor shall close the valve and perform pressure tests on the header segments on both sides of the valve. This will serve to identify if the valve is airtight.

CALCULATIONS

In order to determine if the section of pipe tested is acceptable, the following calculations must be made.

1. Calculate the final theoretical pressure.

$$P_{final,\,theoretical}\,(psi) = \frac{[P_{initial}\,(psi) + 14.7] * [T_{final}\,(°C) + 273]}{T_{initial}\,(°C) + 273}$$

where,

$P_{final,\,theoretical}\,(psi)$ = the theoretical acceptable gauge air pressure in the pipe at the end of the 10 min. interval

$P_{initial}\,(psi)$ = the gauge air pressure in the pipe at the start of the 10 min. interval

$T_{initial}\,(^oC)$ = the air temperature in the pipe at the beginning of the 10 min. interval

$T_{final}\,(^oC)$ = the air temperature in the pipe at the end of the 10 min. interval

2. Calculate the gauge pressure (P_c) corrected for the temperature at the end of the 10-minute interval using the following equation and the value for $P_{final,\,theoretical.}$ calculated above:

$$P_c = P_{final,\,theol}\,(psi) - 14.7\ psi$$

3. Calculate the actual Percent Pressure Drop using the following equation:

$$\text{Percent Pressure Drop} = \frac{P_c - P_{f,\,actual}}{P_c} * 100\%$$

where,

$P_{f,\,actual}$ = the final gauge pressure in the pipe at the end of the interval

4. If the percent pressure drop is less than or equal to 1%, the pipe segment passes for that particular interval. If the percent pressure drop is greater than 1%, then the following steps shall be performed.

   a) All blocked risers and capped ends shall be inspected for leaks.

b) The pipe and all fusions in the section tested shall be inspected for cracks, pinholes, or perforations.

c) Air pressure leaks shall be located and/or verified by applying a soapy water solution and observing soap bubble formation.

d) All confirmed pipe and joint leaks shall be repaired by cutting out the leaking area and rewelding the pipe.

e) After all leaks are repaired, a retest shall be performed. This process shall be repeated until a successful test is achieved.

5. Each test (passed or failed) shall be reported in writing.

6. For each test failure, Inspector shall note the following:

a) Location of failure segment
b) nature of leaks
c) Repairs performed
d) Results of test

Upon completion of the test, open the ball valve and allow air to escape. Caps must not be removed until air pressure in all of the test sections has been reduced to atmospheric pressure.

DATA LOG

DATE: _____
TIME: _____

PROJECT NAME/NO: _____
CONTRACTOR: _____
PERSON PERFORMING TEST: _____
OWNER REPRESENTATIVE: _____

DESCRIPTION/LOCATION OF TEST SEGMENT: _____

Interval #	Time (min)	$T_{initial}$ (ºC)	T_{final} (ºC)	$P_{g,\ initial}$ (in-H_2O)	$P_{i,\ absolute}$ (in-H_2O)	$P_{theoretical}$* (in-H_2O)	P_c* (in-H_2O)	$P_{f,\ actual}$ (in-H_2O)	% Pressure Drop*	Retest?
1	10									
2	20									
3	30									
4	40									
5	50									
6	60									

* See equations in procedure

PIPE SIZE: _____
SDR: _____
LENGTH: _____

DESCRIPTION/NATURE OF LEAKS & REPAIRS OF RETEST SEGMENT:
_____
_____

SECTION 33 51 20

LFG HEADER ISOLATION VALVES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The CONTRACTOR shall provide all materials, equipment, and labor needed to install complete and ready-for-use all header isolation valves as specified herein and as indicated on the Plans.

B. Related Work Described Elsewhere

1. Section 33 51 10: Pipe and Pipe Fittings

1.02 SUBMITTALS

The CONTRACTOR shall prepare and submit to the ENGINEER, for review and approval, certificates of compliance on materials furnished and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, maintenance, operation, and repair of each type of valve furnished. Shop drawings shall be submitted for butterfly valve assemblies requiring spacers per paragraph 3.01 B of this Section.

PART 2 - MATERIALS

2.01 BUTTERFLY VALVES

A. All valves shall be complete with all necessary operators, actuators, handwheels, extension stems, worm gear operators, operating nuts, wrenches, and other accessories or appurtenances which are required for the proper completion of the Work. Operators and other accessories shall be sized and furnished by the valve supplier and factory mounted.

B. Valves shall be suitable for the intended service. Renewable parts including discs, packing, and seats shall be of types recommended by valve manufacturer for intended service, but not of a lower quality than specified herein.

C. Valves and operators shall be suitable for burial within a landfill.

D. Unless otherwise shown, valves shall be the same size as the adjoining pipe.

E. Header isolation valves shall be butterfly bubble tight, wafer design, with a PVC body, polypropylene disc, nitrile seats and seals, 316 SS valve stem, and compatible with a flat face flange. Valves shall be Asahi-America Type 56 series (12-inch) and Type 75 series (18-inch).

F. Stem extensions shall be stainless steel in an epoxy coated carbon steel outer housing with a diecast aluminum alloy gear box assembly mounted on top and equipped with a removable manual operating wheel.

2.02 MONITORING PORTS AT VALVES

Monitoring ports shall be installed at each isolation valve and shall include the following items, or approved substitutes. Monitoring hose shall be stainless steel with outer braid Swagelok (407-894-7191) flexible metal hose, part no. SS-FM4PM4PF4, of adequate length to extend above grade as shown on the Plans. The male NPT end shall be threaded into the top of the header. Sampling end shall be Easy Port™ ¼ inch male NPT screw-capped long barb fittings as supplied by QED Environmental, model no. 40987. The hose shall be secured to the valve stem inner boring by stainless steel brackets.

2.03 IDENTIFICATION TAGS

A. CONTRACTOR shall supply and affix to each valve an adhesive sticker marked with pre-printed letters designating the valve number (e.g., V-3, V-4, V-5, etc.). Tags shall not be marked with pen or marker.

B. Tags shall be yellow adhesive sticker with black lettering. The sticker shall contain the following information: valve point ID, and the word “CCSWDC”.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Valves shall be installed in accordance with the manufacturer’s recommendations and the following:

1. Butterfly valves shall be installed between two flanges as shown on the Drawings; care shall be taken to avoid stripping studs when tightening.

2. Flanges shall be joined with stainless steel studs and nuts. Stud lengths shall accommodate the required distance between flanges including spacers, if necessary.

3. All below grade back-up rings, studs, nuts and washers shall be thoroughly coated with Polyken Technologies 1027 Primer (508-261-6200).

4. The CONTRACTOR shall wrap and tape the valve, flanges, and bolts in 5 mil polyethylene sheeting prior to backfilling.

B. Flanged butterfly valves may require spacers between the flange adapters and the valve body in order to allow full travel of the internal disk. If spacers are necessary for any butterfly valve, the CONTRACTOR shall install valve spacers subject to approval by the ENGINEER.

END OF SECTION

SECTION 44 42 60

CONDENSATE MANAGEMENT SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all materials, equipment, labor, and incidentals needed to install the condensate sumps, condensate traps, pneumatic pumps and appurtenances in accordance with the Drawings and manufacturer's instructions.

B. Related Work Described Elsewhere

1. Section 31 20 00 – Trenching, Excavating, Backfilling and Grading
2. Section 33 51 10 – Pipe and Pipe Fittings

1.02 SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval manufacturer's literature, shop drawings, or other information pertaining to the assembly, operation, adjustments, and other maintenance and repairs of equipment to be installed under this Section, together with detailed parts lists, Drawings, dimensions, and/or photographs.

B. At start-up, CONTRACTOR shall submit Operations and Maintenance (O&M) manuals.

PART 2 - MATERIALS

2.01 CONDENSATE SUMP

A. The condensate sump system shall be capable of handling a flow rate of 7.5 gallons per minute (gpm) with a total dynamic head of 60 feet.

B. The sump shall be a welded, single-walled HDPE assembly. The reservoir shall be fabricated from SDR 17 pipe and designed to withstand a vacuum of 120 inches-w.c. and a pressure of 5 PSIG at 130 degrees F.

C. The condensate pump shall have level controls. The pump shall pump condensate to a discharge line. Discharge piping from the sump to the condensate discharge line shall be of a size and material recommended by the manufacturer such that the pneumatic pump can deliver the anticipated condensate load.

2.02 CONDENSATE TRAP

The trap shall be a welded, single-walled HDPE assembly. The reservoir shall be fabricated from SDR 17 pipe and designed to withstand a vacuum of 120 inches-w.c. and a pressure of 5 PSIG at 130 degrees F.

2.03 ACCESS PORT

Port shall be $1^1/_2$- inch diameter black polypropylene quick connect coupling consisting of two parts: a male pipe threaded adapter and cap with steel cam locking levers.

2.04 MONITORING PORT

Monitoring ports shall be QED supplied Easy Port™ capped long barb fittings, model number 40987.

2.05 PNEUMATIC PUMP

A. Pump shall be submersible air displacement pump, internally controlled and designed for leachate and condensate systems. Pump shall be bottom-loading with fiberglass body. Major metal components shall be stainless steel, this shall include the pump head assembly, center dip tube, discharge check valve assembly, chain support harness, 3.5 inch extended inlet screen, and bottom check collar. Plastic components shall be PVDF (kynar) or UHMWPE.

B. The pneumatic pumps shall be QED AutoPump bottom inlet Model Short AP4$^+$B.

C. Pump installed in condensate sump shall include the following components:

1. Air filter/regulator
2. Air inlet supply pressure gauge
3. Pump cycle counter
4. High liquid level indicator

D. Pump shall have a minimum pumping capacity of 7.5 gallons per minute at 20 feet total dynamic head and an air supply pressure of 60 pounds per square inch, gauge (psig).

E. Pump accessories to include are 4 inch vacuum fit cap and hose set, including the discharge hose (3/4-inch I.D. Nylon Tube) from the pneumatic pump to the HDPE forcemain and the 150 psig rated, 1/4-inch I.D. air hose to the HDPE air supply line.

F. Air and discharge hose lengths outside the sump/wells shall be field determined and approved by the ENGINEER.

G. Each pump will include a ½ inch nylon support rope from pump to sealing cap. A stainless steel quick link connector will be used to attach the rope to the pump support harness.

2.06 AIR SUPPLY LINE

The air supply line from the compressor shall be as specified in Section 33 51 10 and on the Drawings.

2.07 CONDENSATE DISCHARGE LINE/DRAINAGE LINE

The condensate discharge line shall be 2-inch diameter HDPE SDR 11 pipe as specified in Section 33 51 10 and shown on the Drawings.

PART 3 - EXECUTION

3.01 AIR SUPPLY LINE

The air supply line from the compressor to the pneumatic pumps shall be 2-inch diameter SDR 9 HDPE pipe with yellow stripe as specified in Section 33 511 10. Air supply line shall be located in the same trench as the header/lateral piping (where possible) at a minimum depth as shown on the Drawings.

3.02 CONDENSATE SUMP INSTALLATION

A. CONTRACTOR shall install condensate sump in the location and to the lines shown on the Drawings. Sump shall be installed vertically plumb.

B. HDPE pipe connections shall be in accordance with Section 33 51 10, Pipe and Pipe Fittings.

C. Caution shall be exercised when backfilling around the sump to prevent damaging air and discharge lines.

3.03 PUMP INSTALLATION

A. Pump shall be installed in accordance with manufacturer's recommendations. Pump vent line shall be installed to discharge inside the sump.

B. Install pump so that bottom of pump is suspended off the bottom of the sump as shown on the Drawings and recommended by the manufacturer and approved by the ENGINEER.

3.04 TESTING

A. Upon completion of the installation, tests shall be performed by the CONTRACTOR with the assistance of the manufacturer's representative, in the presence of the ENGINEER. These tests shall demonstrate condensate pump, startup, shutdown, operation, and maintenance. Test shall demonstrate the pumping of water from the sump for the full drawdown of the pump. Equipment and other requirements necessary to perform the tests shall be furnished by the CONTRACTOR.

END OF SECTION

SCS ENGINEERS

CONSTRUCTION QUALITY ASSURANCE PLAN (CQA)

Sarasota County
CCSWDC Phase II Landfill LFGCCS Design

Presented to:

Sarasota County

Sarasota County Solid Waste
4000 Knights Trail Road
Nokomis, FL 34275

Presented by:

SCS ENGINEERS
4041 Park Oaks Blvd., Suite 100
Tampa, Florida 33610
(813) 621-0080

March 6, 2017
File No. 09216163.00

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TABLE OF CONTENTS

Appendices

1 INTRODUCTION

1.1 GENERAL

This Construction Quality Assurance (CQA) Plan addresses the construction quality assurance and quality control procedures for geomembrane repairs and installation for Sarasota County Central County Solid Waste Disposal Complex (CCSWDC) Phase II Landfill LFGCCS Design at the Sarasota County CCSWDC, Sarasota County, Florida. Construction activities include earthwork, well installation, piping, installation of geosynthetic materials for the containment lining system and surveying. The CQA plan supplements the Drawings and Technical Specifications prepared for this project and has been prepared to meet requirements set forth in the Florida Administrative Code (FAC), Chapter 62-701.400.

2 DEFINITIONS

2.1 CONSTRUCTION QUALITY CONTROL (CQC)

A planned system of inspections that is used to directly monitor and control the quality of a construction project. CQC is normally performed by the geosynthetic installer, or for natural soil materials by the CONTRACTOR and is necessary to achieve quality in the constructed or installed system. CQC refers to measures taken by the installer or contractor to determine compliance with the requirements for materials and workmanship as stated in the Drawings and Specifications for the project.

2.2 CONSTRUCTION QUALITY ASSURANCE (CQA)

A planned system of activities that provides the OWNER/COUNTY and permitting agency assurance that the facility was constructed as specified in the design. CQA refers to measures taken by the ENGINEER or OWNER/COUNTY to determine compliance with the requirements for materials and workmanship as stated in the Drawings and Specifications for the project. CQA includes construction observation and monitoring, materials testing, verifications, audits and evaluations of materials and workmanship necessary to determine and document the quality of the constructed facility. CQA refers to measures taken by the CQA organization to assess if the installer or CONTRACTOR is in compliance with the Drawings and Specifications for a project.

2.3 MANUFACTURING QUALITY CONTROL (MQC)

A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in the Contract Documents.

2.4 CONTRACT DOCUMENTS

The Contract documents include the Specifications, Drawings, Agreement, CQA Plan, Permits and any other referenced reports or exhibits that were used to bid and contract the work between the OWNER/COUNTY and the CONTRACTOR.

2.5 GEOMEMBRANE

For the purpose of this project the term geomembrane applies to the Thermoplastic Polyolefin (TPO) and the 60 mil HDPE over liner between phases I and II. See section 02 77 10 for further TPO specifications.

2.6 GEOSYNTHETICS

For the purpose of this project, the term geosynthetic applies to geocomposites, geosynthetic clay liners (GCL) and geotextiles.

3 QUALIFIED PARTIES AND RESPONSIBILITIES

The principal parties involved in the CQA and CQC of the facility include the OWNER/COUNTY, ENGINEER, CQA Consultant, CONTRACTOR, Geosynthetics Manufacturer, Geosynthetics Installer and Geosynthetics CQA Laboratory. The general responsibilities of each of these parties are described in the following subsections. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific needs as construction progresses.

3.1 OWNER/COUNTY

The OWNER/COUNTY is responsible for the facility, including coordinating the design and construction of the landfill features. This responsibility includes compliance with the permit and the submission of CQA documentation demonstrating that the facility was constructed in accordance with the permit documents and the design Drawings and Specifications.

The OWNER/COUNTY has the authority to contract and manage parties charged with design, CQA and construction activities. The OWNER/COUNTY also has the authority to accept or reject design Drawings and Specifications, CQA plans, reports and recommendations of the CQA Consultant and the materials and workmanship of Contractors.

The OWNER/COUNTY may be represented as OWNER or COUNTY and shall be considered the same entity.

3.2 ENGINEER

The ENGINEER is responsible for the preparation of the design including: Drawings, project Specifications for construction and this CQA plan.

The ENGINEER is responsible for performing the engineering design, preparing the associated Drawings and Specifications, approving all design and Specification changes and making design clarifications necessitated during construction. The ENGINEER shall be a professional skilled in the appropriate discipline, licensed as required by regulation. The ENGINEER shall be familiar with the construction details and applicable regulatory requirements.

3.3 CQA CONSULTANT

The CQA Consultant is a party independent of the CONTRACTOR(s), Geosynthetic Manufacturer or Installer and is responsible for field testing, observing and documenting activities related to the construction and/or permit documents and the CQA Plan. The CQA Consultant is represented on-site by the CQA monitoring personnel and supporting on-site CQA monitoring personnel as appropriate. The CQA Consultant may be the same organization as the ENGINEER. In general, the responsibilities and authorities of the CQA Consultant include:

- Understanding the permit documents, design Drawings and Specifications in relation to all aspects of the CQA Plan.
- Scheduling, coordinating and performing CQA activities.
- Performing independent on-site observation of the work in progress to assess compliance with the CQA Plan, permit documents, design Drawings and Specifications.
- Reporting deviations from the CQA Plan, permit documents, design Drawings and/or Specifications to the OWNER/COUNTY. Secure documents from the OWNER/COUNTY which approves the changes.
- Verifying that the Installer's test equipment meets testing and calibration requirements and that test are conducted according to procedures defined in the CQA Plan.
- Recording and maintaining test data.
- Verifying that corrective measures are implemented.
- Documenting and reporting CQA activities daily and collecting data needed for record documentation, including photographs.
- Maintaining open lines of communication with other parties involved in the construction.
- Preparing the Construction Completion Certification Report, complete with certification statements.

3.4 CONTRACTOR

The CONTRACTOR is responsible for all aspects of constructing the project in accordance with the Contract Documents. The CONTRACTOR typically performs excavation of soil and rock and placement and compaction of the soil and aggregate materials using procedures and equipment necessary to produce the results in conformance with the Contract Documents. The CONTRACTOR may also prepare and complete anchor trenches, dewatering and other site-specific responsibilities as required by the Contract Documents. The CONTRACTOR will typically subcontract the manufacturing of geosynthetic products and the installation of such products; however, the CONTRACTOR is responsible to ensure these activities are completed in accordance with the Contract Documents. The CONTRACTOR is responsible for all CQC activities.

3.5 GEOSYNTHETICS MANUFACTURER

The Geosynthetics Manufacturer(s) is responsible for the production of geosynthetic products including geomembranes, geotextiles, geocomposites, GCL and geogrids, which meet the requirements in the Specifications. The Geosynthetics Manufacturer is responsible for providing adequate documentation regarding the characteristics of the raw material, final product, the testing performed to verify the characteristics and the MQC measures taken during manufacturing.

The Geosynthetics Manufacturer(s) is responsible for the transportation of the geosynthetics from the manufacturing plant to the site. The Geosynthetics Manufacturer(s) is responsible for loading and transporting geosynthetics and damage to the geosynthetics which may occur during these operations.

3.6 GEOSYNTHETICS INSTALLER

The Geosynthetics Installer is responsible for unloading, field handling, storing, deploying seaming, temporarily loading against wind and other aspects of the geosynthetics installation in accordance with this CQA plan and the Specifications.

The Geosynthetics Installer is responsible for the preparation of the panel layout drawing including dimensions and details and for providing the installation schedule and a list of proposed field personnel and their qualifications. During installation, the Geosynthetics Installer is responsible for providing CQC documentation and subbase acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane certification, the Manufacturer's warranty and the installation warranty.

3.7 CQA GEOSYNTHETICS LABORATORY

The CQA Geosynthetics Laboratory is responsible for performing the laboratory tests on geosynthetic materials as required by the Specifications. The CQA Geosynthetics Laboratory is also responsible for providing documentation of testing equipment used, analytical results and test methods followed. All results should be reported to the CQA Consultant.

4 GEOSYNTHETIC MATERIAL QUALITY ASSURANCE

4.1 GEOMEMBRANES

This quality assurance testing program has been established to verify that specified geomembranes are manufactured, installed and tested according to the project Specifications.

4.1.1 Manufacturer Quality Control Documentation

The Geomembrane Manufacturer shall provide documentation and certification that the material meets the requirements outlined in the Specifications and that adequate quality control measures have been implemented during the manufacturing process.

The following should be provided prior to shipment of the geomembrane:

- A properties value certification including at a minimum, guaranteed values for all geomembrane properties required by the Specifications.

- An inventory list of quantities with descriptions of materials which comprise the geomembrane shipment(s).

The CQA Consultant shall verify that the property values certified by the Geomembrane Manufacturer meet the test methods listed in the Specifications and Manufacturer's guaranteed minimum values.

4.1.2 Manufacturer's Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall also provide the CQA Consultant with quality control certificates for the geomembrane, signed by a responsible party employed by the Geomembrane Manufacturer. The Manufacturer shall be required to perform, at a minimum, the tests listed in the Specifications.

The CQA Consultant shall review the certificates and verify that the quality control certificates have been provided at the specified frequencies for all materials and rolls. The CQA Consultant shall also review the quality control certificates and verify that the test methods meet the requirements included in the Specifications and the Manufacturer's guaranteed minimum values which were provided prior to shipment.

4.1.2.1 Delivery and Storage

Upon delivery to the site, visual inspection by the Installer and the CQA Consultant shall be conducted on all rolls for evidence of defects or damage. This inspection shall be done without unrolling the rolls unless damage or defects are detected.

During or following this visual inspection, the CQA Consultant, with the assistance of the Installer or CONTRACTOR, shall remove samples to be tested for conformance with the Specifications.

The Installer shall be responsible for the storage of the geomembranes on-site. The storage space shall provide protection from theft, vandalism and traffic. The storage location shall be such that exposure to environmental factors, construction activities and handling are minimized.

4.1.2.2 Conformance Sampling and Testing

The CQA Consultant shall obtain the required number of conformance test samples from the geomembrane upon delivery to the site. These samples shall be sent to the CQA Geosynthetics Laboratory for testing to verify conformance to the values listed in the Specifications. These tests shall be performed prior to installation.

Samples shall be selected by the CQA Consultant and shall not include the first complete revolution. The sample shall be a minimum four feet, as measured along the width of the roll and extend three feet along the roll. Samples shall be taken at a rate of one per lot, but at a rate not less than one conformance test per 100,000 square feet or portion thereof.

Prior to the deployment of the geomembrane, the CQA Consultant shall review all conformance test results and report any nonconformance to the OWNER/COUNTY. The CQA Consultant shall be responsible for verifying that all the test results meet or exceed the property values listed in the Specifications.

If failing test results may be the result of the sampling process or due to the CQA Geosynthetics Laboratory incorrectly conducting the test, the Manufacturer may request a retest to be conducted at the CQA Geosynthetics Laboratory in the presence of a representative of the Manufacturer.

All material from a lot represented by a failing test result shall be rejected, or additional conformance test samples may be taken to isolate the portion of the lot not meeting Specifications (this procedure is valid only when rolls in a lot are consecutively produced and numbered from one manufacturing line). Additional samples shall be taken from rolls either side of the failing roll, until passing test results are achieved, to establish the range of failure within the lot. All rolls lying within this range of failure shall be rejected.

4.1.3 Field Panel Identification

The CQA Consultant shall verify that each field panel is given a unique identification code (number or letter-numbered) consistent with the installer's layout plan. This identification code shall be agreed upon by the Installer and CQA Consultant. The CQA Consultant and Installer shall establish a table or chart showing correspondence between roll numbers and field panel

identification codes. The field panel identification code shall be used for all quality assurance documentation.

The CQA Consultant shall verify that field panels are installed at the location indicated in the Installer's layout plan, as approved or modified and that the Installer has marked the identification code and roll number on each installed panel. The Installer and CQA Consultant shall also verify that the condition of the supporting soil has not changed detrimentally during installation. The CQA Consultant shall record the identification code, location and date of installation of each field panel.

4.1.4 Field Panel Placement and Deployment

Geomembrane panel placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in areas of ponded water or in the presence of strong winds. Manufacturer's recommendations or the Specifications should be followed, whichever is more stringent, for extreme ambient temperature conditions.

Panels shall be oriented according to the Installer's panel layout drawing as approved by the CQA Consultant and OWNER/COUNTY. Seams shall be located outside of areas of potential high stress conditions, at slope intersections and corners, or other areas considered critical. Horizontal seams on slopes steeper than 10 (horizontal) to one (vertical) shall be avoided. The CQA Consultant shall review the seam orientations prior to seaming operations to determine if these conditions are satisfied.

The CQA Consultant shall verify that the geomembrane handling equipment used does not pose risk of damage to the geomembrane or sub-base and that the Installer's personnel take care in handling the geomembrane at all times.

Contact between the sub-base and the geomembrane shall be maintained in all areas. The Installer shall take into account ambient temperature and its effect on the thermal expansion and contraction of the geomembrane. The geomembrane materials shall be deployed in a manner which minimizes wrinkling. Partial backfilling of anchor trenches, adequate loading of the toe of slope during lower ambient temperatures is recommended to prevent displacement by bridging.

The CQA Consultant shall also verify and notify the OWNER/COUNTY that:

- Equipment used does not damage the geomembrane during trafficking, handling, excessive heat or other means.

- The method of deploying the geomembrane does not cause excessive scratches or crimps in the geomembrane and does not damage the approved sub-base surface.

- Personnel working on the geomembrane do not smoke or wear damaging shoes.

- The geomembrane is protected by appropriate means in areas of excessive traffic.

- Adequate ballast (e.g., sand bags) has been placed to prevent wind uplift and is not likely to damage the geomembrane. Continuous loading is recommended along edges of panels in high winds, or when work is terminated for several days or longer periods.

The CQA Consultant shall visually inspect each panel for defects or damage after placement and prior to seaming. Damaged panels or portions of damaged panels shall be marked and repaired, or removed from the work area. Repairs shall be made according to procedures described in the Specifications.

4.1.5 Field Seaming

4.1.5.1 Personnel Requirements

The Installer shall be prequalified in accordance with the Specifications and approved by the OWNER/COUNTY.

The Installer's Superintendent shall be qualified based on previously demonstrated experience, management ability and authority. The Superintendent is responsible for the Installer's field crew and will represent the Installer at all project meetings.

4.1.5.2 Seam Layout

Prior to the installation of geomembrane, the Installer shall provide the OWNER/COUNTY and CQA Consultant with a panel layout drawing showing all expected major panel seams. The OWNER/COUNTY or ENGINEER shall approve in writing the panel layout drawing.

4.1.5.3 Seaming Methods

Accepted seaming methods consist of those recommended by the Manufacturer of the geomembrane product and which will result in seams that meet testing requirements as indicated in the Specifications for both destructive and non-destructive samples.

For polyethylene geomembranes, the accepted methods include extrusion and fusion-welding.

Proposed alternate methods shall be documented by the Installer and CQA Consultant. The CQA Consultant shall review all documentation regarding alternative seaming methods to be used. The OWNER/COUNTY or ENGINEER shall approve in writing any alternative seaming methods.

Fusion-welding apparatus shall be an automated, roller-mounted device. The fusion-welding apparatus shall be equipped with gauges indicating the applicable temperatures and pressures.

The CQA Consultant shall log ambient, seaming apparatus and geomembrane surface temperatures as well as seaming apparatus pressures.

Extrusion-welding apparatus shall be equipped with gauges indicating the temperature in the apparatus and at the nozzle.

The Installer shall provide documentation regarding the extrudate to the CQA Consultant and shall certify that the extrudate is compatible with the Specifications and is comprised of the same resin as the geomembrane sheeting.

The CQA Consultant shall log apparatus temperatures, extrudate temperatures, ambient temperatures and geomembrane surface temperatures at appropriate intervals.

4.1.5.4 Seam Preparation

The CQA Consultant shall verify that:

- Seams are aligned with the fewest possible number of wrinkles and "fishmouths".
- Prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind and foreign material.
- If seam overlap grinding is required, the process is completed according to the Manufacturer's instructions within one hour of the seaming operation and does not damage the geomembrane.
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding.
- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage.
- The geomembrane is protected from damage in heavily trafficked areas.
- A movable protective layer (i.e., plywood, geomembrane) may be used as necessary directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets.
- The panels of geomembrane have a finished overlap of 4 inches for extrusion welding and 6 inches for fusion welding, but in any event sufficient overlap shall be provided to allow peel tests to be performed on the seam.
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane.

4.1.5.5 Weather Conditions for Seaming

The Installer and CQA Consultant shall observe weather conditions during seaming operations to determine if excessive temperatures, moisture or humidity, or winds exist that could impact the welding process. Manufacturer's recommendations shall be followed for seaming under extreme weather conditions, unless otherwise approved by the OWNER/COUNTY and CQA Consultant based on the Installer's experience and recommendations.

As indicated in the Specifications, welding shall not occur when ambient air temperatures measured one-foot above the geomembrane are below 32-degrees F or above 104-degrees F and as noted in the Specifications. Preheating of the seams may be used if trial seams have been performed using the same preheating method(s) and meet all criteria for acceptance. Wind conditions shall also be considered in determination of acceptable ambient conditions.

4.1.5.6 General Seaming Procedures

During seaming, the CQA Consultant shall verify the following conditions:

- Seaming shall extend to the outside edge of panels placed within the anchor trench.
- A firm substrate shall be provided using a flat board or similar hard surface directly under the seam overlap to achieve proper support, if necessary.
- "Fishmouths" or wrinkles at the seam overlap shall be cut along the ridge in order to achieve a flat overlap. The cut "fishmouth" or wrinkle shall be seamed and any portion where the overlap is inadequate shall be patched with an oval or round geomembrane patch that extends a minimum of 6 inches beyond the cut in all directions.
- Adequate lighting shall be provided if seaming operations are performed at night or during periods of diminished natural light.
- Startup testing is conducted and recorded prior to initiating welding.

4.1.6 Seam Testing

4.1.6.1 Nondestructive Testing of Field Seams

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (double fusion seams only), or other approved method. The purpose of this testing is to determine the continuity of the seams only. Nondestructive testing shall be performed as work progresses and not at project completion.

The CQA Consultant shall observe nondestructive testing procedures and inform the Installer and OWNER/COUNTY of required repairs. The CQA Consultant shall record the location, date, name and outcome of all testing.

The Installer shall complete required repairs in accordance with the Specifications. The CQA Consultant shall observe the repair and testing of the repair, document the repair and test results and mark on the geomembrane that the repair has been completed. All non-destructive repairs shall be shown on the record Drawings and noted on daily reports.

Vacuum testing equipment and methods are discussed in the Specifications.

Air pressure testing procedures are applicable to fusion-welding that produces a double seam with an enclosed air channel. The equipment and methods are discussed in the Specifications.

4.1.6.2 Destructive Testing

Destructive seam tests shall be performed on seam samples cut from the geomembrane locations selected by the CQA Consultant. 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.

The CQA Consultant shall select locations where seam samples will be cut by the installer for laboratory testing. Those locations shall be established as follows:

- A minimum average frequency of one test location per 500 feet of seam length or one test location per seam, whichever is the greater.
- At least one location for each seaming machine each day.
- At locations where the CQA Consultant suspects that inadequate seaming methods or conditions occurred or other factors causing to reduce seam strength exist.

The Installer shall not be informed in advance of the locations where the destructive seam samples will be taken.

4.1.6.3 Sampling Procedures

Samples shall be cut by the Installer at locations selected by the CQA Consultant as the seaming progresses, such that laboratory test results are available before the geomembrane is covered by another material.

The CQA Consultant shall observe the sample cutting, assign a number to each sample, mark it accordingly and record the sample location on the layout drawing.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with specified repair procedures. The continuity of the new seams in the repaired area shall be non-destructively tested according to procedures described herein.

The sample for laboratory testing shall be 12 inches wide by 36 inches long with the seam centered lengthwise. The sample shall be cut into three segments and distributed as follows:

- 12 inches x 14 inches to the Installer for laboratory testing.
- 12 inches x 14 inches to the CQA Geosynthetics Laboratory for testing.
- 12 inches x 14 inches to the OWNER/COUNTY for archive storage.

The CQA Consultant is responsible for packaging and shipping samples to the CQA Geosynthetics Laboratory in a manner which will not damage the samples.

4.1.6.4 CQA Geosynthetics Laboratory

Testing shall include ASTM D 6392 "Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods". The minimum acceptable values to be obtained in these tests are those indicated in the Specifications. At least five specimens shall be tested for each test method. Specimens shall be selected from the samples and tested alternately (i.e., peel, shear, peel, shear, etc.). For double wedge welds, both inner and outer seams shall be tested and determined to be acceptable.

The CQA Geosynthetics Laboratory shall provide verbal test results no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Installer.

4.1.6.5 Procedures for Destructive Test Failures

All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 feet (50 m) of reconstructed seam, a sample taken from the zone in which the seam has been reconstructed must pass destructive testing.

The procedures outlined in the Specifications shall apply whenever a sample fails a destructive test, whether that test is conducted by the CQA Consultant, the Installer, the CONTRACTORs independent CQC laboratory, or by field tensiometer.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

4.1.6.6 Defects, Repairs and Wrinkles

The entire geomembrane, including seams, shall be visually examined by the CQA Consultant for identification of visual defects, holes, blisters, undispersed raw materials and signs of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if dust, mud or other matter inhibits examination. All areas having defects and/or requiring repairs shall be repaired.

Work shall not proceed with any materials which will cover locations which have been repaired until the CQA Consultant has re-examined the repaired area and applicable laboratory test results with passing values are available.

Panels or portions of panels which are, in the opinion of the CQA Consultant, damaged beyond repair shall be removed from the site and replaced. Damage, which in the CQA Consultant's opinion, can be repaired may be repaired or replaced.

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the CQA Representative, Installer and ENGINEER.

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in the Specifications as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the CQA Consultant. In the case of failed tests, the repair shall be redone and retested until a passing test results. The CQA Consultant shall observe all repairs and all non-destructive testing of repairs, note on the membrane that it has been repaired and document each repair thoroughly.

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying materials, the CQA Consultant shall indicate which wrinkles should be cut and re-seamed by the Installer. Wrinkle size shall be evaluated during the time of day and under conditions similar to those expected when overlying material is to be placed. All wrinkles higher than they are wide across their base or, more than 6 inches high shall be removed by repair methods and retested.

5 WELL DRILLING AND INSTALLATION

5.1 SURVEYING AND WELL SCHEDULE

The CQA Consultant shall coordinate with CONTRACTOR when drilling will begin to allow sufficient time for SURVEYOR to survey proposed well locations.

SURVEYOR must survey and stake all well locations prior to drilling with the ground surface elevation and well number written on the stake. Once surveyor supplies ground elevations of the proposed well locations, ENGINEER can finalize the well schedule. The well schedule shall be signed by the ENGINEER, OWNER/COUNTY, CQA Consultant and driller. If a proposed well location is relocated in the field or any other changes need to be made to the well schedule with the approval of the ENGINEER, its new location must be resurveyed and an updated well schedule shall be prepared and resigned by all parties.

5.2 DRILLING

CQA Consultant shall verify all proposed well locations if surveyor stakes are present with the well number and ground surface elevation written on the stake. If stake is not present or information does not match the well schedule, CQA Consultant shall notify the ENGINEER, EM and CONTRACTOR.

If an obstruction is encountered during drilling, driller must advance boring for 2 hours unless otherwise directed by ENGINEER. If borehole is decided to be abandoned, CONTRACTOR shall backfill borehole with cutting removed during drilling. Soil shall be backfilled and compacted to a ground surface. CONTRACTOR shall supply addition soil backfill to refill any settlement within the abandoned borehole, as approved by the ENGINEER. CQA Consultant shall notify ENGINEER and document that CONTRACTOR has followed the above procedures for well abandonment and the procedures outlined in the technical specifications.

5.3 WELL LOGS

CQA Consultant shall maintain separate Well Logs for each well drilled using the Landfill Borehole and Well Logging Guidance. Well logs and landfill borehole and well logging guidance are shown in section 33 21 70. Each well log shall contain the following:

1. Total depth of well

2. Visual description of refuse at 5-foot intervals:

    a. Type of refuse encountered including the estimated percentage of the following components (by volume) on visual inspection:

- Paper/Cardboard
- Plastic
- Yard refuse
- Construction debris
- Textiles
- Tires
- Sludge
- Dirt

b. Moisture content (in percentages) based on the guidelines in Attachment 2

c. State of decomposition based on the guidelines in Attachment 2

d. Temperature of excavated refuse

3. Occurrence, depth, and thickness of water-bearing zones

4. Length of slotted pipe and solid pipe below grade

5. Thickness, description and depth from ground surface of backfill layers

6. Length of above ground riser stick-up pipe

Final copies of well logs shall be typed and submitted with Construction Certification Report.

5.4 WELL INSTALLATION

CQA Consultant shall verify that lengths of solid pipe above and below grade and perforated pipe matches the well schedule and borehole depth.

CQA Consultant shall verify that well cap was properly installed according to design details.

Location and thickness of stone backfill, bentonite plugs and soil backfill shall be documented by the CQA Consultant on the well logs and correspond to well schedule and design details. Bentonite hydration shall be observed and documented.

All open boreholes are to be covered by steel safety grates. The steel safety grate shall remain in place during all backfilling and well installation activities and removed from the completed well with drill rig or other equipment.

5.5 WELLHEAD INSTALLATION

CQA Consultant shall verify and document new and/or replacement wellheads were properly installed on the well and the wellhead valve is in the closed position or else otherwise directed by ENGINEER.

6 DOCUMENTATION

An effective CQA Program depends largely on recognition of all construction activities that shall be monitored and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall maintain at the site a complete file of design plans, project Specifications, test procedures, daily logs and other pertinent documents.

6.1 REPORTS

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of:

- A daily summary report including memoranda of meetings and discussions with the OWNER/COUNTY and/or site CONTRACTORs.

- Observation logs detailing construction activities for the day and test results, as appropriate.

Other forms of daily recordkeeping to be used as appropriate include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the OWNER/COUNTY.

6.1.1 Daily Logs and Summary Reports

The CQA Consultant shall prepare daily logs and summary reports which shall include the following information:

- An identifying report number for cross referencing and document control.
- Date, project name, location and other identification.
- Data on weather conditions.
- Information on meetings held or discussions which took place:

    1. Names of parties to discussion.
    2. Relevant subject matter or issues.
    3. Decisions reached.
    4. Activities and their schedule.

- A reduced-scale site plan or sketch showing work areas and test locations.

- Descriptions and locations of ongoing construction.

- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented.

- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found.

- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets.

- Calibrations of test equipment.

- Off-site materials received, including quality verification documentation.

- Decisions made regarding acceptance of units of work and/or corrective actions to be taken in instances of substandard quality.

- The CQA Consultant's signature.

- Photographs of representative activities.

6.1.2 Observation and Testing Reports

The CQA Consultant shall record observations of construction and CQA-related activities on project specific observation and testing reports. At a minimum, the observation and testing reports shall include the following information:

- An identifying sheet numbered for cross referencing and document control.
- Date, project name, location and other identification.
- Description or title of activity monitored.
- Location of activity and locations of samples collected.
- Locations of field tests performed and their results.
- Results of laboratory tests received.
- Results of monitoring activity in comparison to Specifications.
- The CQA Consultant's signature.

Reports describing problem identification, corrective measures reports or special construction situations shall be prepared by the CQA Consultant and cross-referenced to specific observation and testing reports. These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control.

- A detailed description of the situation or deficiency.

- The location and probable cause of the situation or deficiency.
- How and when the situation or deficiency was found or located.
- Documentation of the response to the situation or deficiency.
- Final results of any responses.
- Any measures taken to prevent a similar situation from occurring in the future.
- The signature of the CQA Consultant and the signature of the OWNER/COUNTY or ENGINEER indicating concurrence.

The OWNER/COUNTY shall be made aware of nonconformance with the project Specifications. The OWNER/COUNTY shall then determine the cause of the nonconformance and recommend appropriate changes in procedures or Specifications. These changes will be submitted to the Design Engineer for approval. When this type of evaluation is made, the results shall be documented and any revision to procedures or project Specifications will be approved by the OWNER/COUNTY, Design Engineer and, if necessary, the Permitting Agency.

6.2 PHOTODOCUMENTATION AND REPORTING DATA SHEETS

Photo documentation and reporting data sheets shall be cross-referenced with observation and test reports and/or problem identification and corrective measure reports.

These photographs will serve as a pictorial record of work progress, problems and mitigation activities. All photographs of a problem shall be paired with a photograph of the corrected problem. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO CONFIRM THE PHOTOGRAPH OF THE CORRECTION HAS BEEN MADE PRIOR TO COVERING THE EFFECTED LOCATION. The basic file shall contain color prints; a digital file shall be retained in a separate file in chronological order. These records will be presented to the OWNER/COUNTY upon completion of the project.

In support of photographic documentation, videotaping may be used to record work progress, problems and mitigation activities.

6.2.1 Design and/or Specification Changes

Design and/or project Specification changes may be required during construction. In such cases, the CQA Consultant shall notify the OWNER/COUNTY and the Design Engineer. The OWNER/COUNTY shall then notify the Permitting Agency if necessary.

Design and/or project Specification changes shall be made only with the written agreement of the OWNER/COUNTY and the Design Engineer and shall take the form of an Addendum to the project Specifications.

6.3 FINAL DOCUMENTATION REPORT AND CERTIFICATION

At the completion of the work, the CQA Consultant shall submit to the OWNER/COUNTY the signed Final Documentation Report. At a minimum, the Final Documentation Report shall include:

- Summaries of all construction activities.
- Observation logs and test data sheets including sample location plans and supporting field and laboratory test results.
- Construction problems and solutions reports.
- Changes from design and material specifications.
- Record Drawings.
- If required by the regulatory agency, a summary statement sealed and signed by a professional engineer registered in the state that the construction has been completed in substantial conformance with project Specifications and design plans.

APPENDIX A

DAILY FIELD REPORT

SCS ENGINEERS DAILY FIELD REPORT

Page _____ **of** _____

Project: CCSWDC Phase II Landfill LFGCCS Design **Project number**: _____

Owner: Sarasota County **Contractor:** _____

Date: _____ **Contract Day:** _____ **Contract Duration** _____

Weather
Temperature: (AM) _____ **(PM)** ____ **Rain** _____ **Rainfall (inches)** _____
Description of weather: _____

List of Active Equipment on site **Equipment Not Used/Down:**

Personnel on site:

No. of Superintendents **No. of Skilled** **No. of Laborers**

Description of Construction Activity

List of Subcontractors

List of Materials Delivered

Contract Issues/Conflicts
Description: _____

Field Representative _____ **Date** _____

APPENDIX B

GEOMEMBRANE PLACEMENT LOG

SCS Engineers

GEOMEMBRANE PLACEMENT LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO. _____

DATE _____

PANEL NO.	ROLL NO.	LENGTH	WIDTH	THICKNESS	ORIENTATION	TIME	WEATHER/CONDITIONS/COMMENTS
Page Total							
Cumulative Total							

PRINT NAME: _____

SIGNATURE: _____

APPENDIX C

GEOMEMBRANE SEAMING LOG

SCS Engineers

GEOMEMBRANE SEAMING LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO.

DATE

SEAM NO.	LENGTH OR SIZE	TECH. ID	MACH. NO.	WELD TYPE	SPEED SET	TIME	AIR TEMP (deg. F)	MACH. TEMP	WEATHER/CONDITIONS/COMMENTS
Page Total									
Cumulative Total									

PRINT NAME: _____

SIGNATURE: _____

APPENDIX D

GEOMEMBRANE REPAIR LOG

SCS Engineers

GEOMEMBRANE REPAIR LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO. _____

DATE _____

DATE REPAIRED	REPAIR NO.	SEAM /PANEL ID	LOCATION	DEFECT CODE	SIZE OF REPAIR	TECH ID	MACHINE NO.	DATE TESTED	TESTED BY	COMMENTS

DEFECT CODES:

AD	-ANIMAL RELATED DAMAGE	DS	-DESTRUCTIVE SAMPLE	IO	-INSUFFICIENT OVERLAP	SS	-START/STOP
B	-UNDISPERSED RESIN BEAD	EE	-EARTHWK EQUIP DAMAGE	LB	-LEISTER BURN	SSI	-SOIL SURFACE IRREGULARITY
BO	-BURN OUT	EXT	-EXTENSION	MOT	-MACHINE OFF TRACK	T	-MULTIPLE PANEL INTERSECTION
BS	-BOOT SKIRT	FB	-FUSION WELDER BURN	N	-NODULE	VL	-VACUUM TEST LEAK
C	-COUPON	FD	-FACTORY DAMAGE	PTC	-PRESSURE TEST CUT	WC	-WRINKLE CUT
CO	-CHANGE OF OVERLAP	FM	-FISH MOUTH	SI	-SUBGRADE IRREGULARITY	WR	-WRINKLE
CR	-CREASE	FS	-FAILED SEAM	SL	-SLAG ON TEXTURED SHEET	WS	-WELDER RESTART
D	-INSTALLATION DAMAGE	HT	-HEAT TACK BURN	SO	-SHARP OBJECT		

PRINT NAME: _____

SIGNATURE: _____

APPENDIX E

TRIAL WELD LOG

SCS Engineers

TRIAL WELD LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO.

DATE

TIME	TECH I.D.	MACH. I.D.	AMB. TEMP	EXTRUSION WELDS		FUSION WELDS		PEEL					SHEAR				P/F
				BARREL TEMP.	PREHEAT TEMP.	WEDGE TEMP	WEDGE SPEED										

PRINT NAME: _____

SIGNATURE: _____

APPENDIX F

NON-DESTRUCTIVE TEST LOG

SCS Engineers

NON-DESTRUCTIVE TEST LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO. _____

DATE _____

SEAM NO.	TECH I.D.	AIR TEST							VACUUM BOX P/F	COMMENTS
		PRESSURE (psi)			TIME			P/F		
		START	END	DROP	START	END	DURATION			

PRINT NAME: _____

SIGNATURE: _____

APPENDIX G

DESTRUCTIVE TEST LOG

SCS Engineers

DESTRUCTIVE TEST LOG

SHEET: of

PROJECT TITLE: **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO:

DATE:

SAMPLE NO.	SEAM I.D.	MACHINE NO.	WELD TYPE	DATE SEAMED	DATE SAMPLED	TEST STATUS PASS/FAIL			COMMENTS
						INSTALLER	SCS	ARCH	

PRINT NAME: _____

SIGNATURE: _____

APPENDIX H

PANEL PLACEMENT LOG

SCS Engineers

PANEL PLACEMENT LOG

SHEET _____ of _____

PROJECT TITLE **CCSWDC Phase II Landfill LFGCCS Design**

PROJECT NO. _____

DATE _____

PANEL NO.	ROLL NO.	LENGTH	WIDTH	THICK-NESS	ORIENTATION	TIME	WEATHER/CONDITIONS/COMMENTS

PRINT NAME: _____

SIGNATURE: _____