October 2019

C-147 Registration Package for Gamma Ridge Recycling Containment and Recycling Facility Section 14, T24-S, R34-E, Lea County

Volume 2 - Above-Ground Storage Tank Containments

- Previously-Approved Variance Requests
- Engineering Drawings and Liner Specifications
- Design Plan
- Master Assembly Manual for AST
- Operation Plan
- Closure Plan

View from the southeast corner of the freshwater containment facing east.

Prepared for:
Solaris Midstream LLC
9811 Katy Freeway Suite 900
Houston, TX 77024

Prepared by:
R.T. Hicks Consultants, Ltd.
901 Rio Grande NW F-142
Albuquerque, New Mexico

VARIANCES

Previous Variances

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Mr. Randall Hicks, PG
R.T. Hicks Consultants Ltd.
901 Rio Grande Boulevard
Suite F-142
Albuquerque, New Mexico 87104

June 6, 2019

RE: Technical Memorandum
LLDPE as Alternative Primary/Secondary Liner System
Solaris – MYOX: Modular Steel AST Impoundment

Dear Mr. Hicks:

At your request, I have investigated the suitability of application for 40 mil LLDPE non-reinforced geomembrane as an alternative Primary and Secondary liner in the Solaris – MYOX Modular Steel AST. I have reviewed your Modular Tank Drawing, Design Information and applicable correspondence. In consideration of the Primary lining system application (modular AST impoundment), size of the AST and depth, design details for modular tanks as well as estimated length of up to two years of service time, it is my professional opinion that a 40 mil LLDPE geomembrane will provide the requisite barrier against processed water loss. It should be noted that the 40 mil LLDPE exceeds the OCD mandate for a secondary lining system. The two proposed 40 mil LLDPE liners will function equal to or better than 45 mil String Reinforced LLDPE as a primary and as a secondary liner system. Additionally, the 40 mil LLDPE in a two-layer system as designed will provide requisite protection for the environment that is equal to or better than 30 mil PVC and 60 mil HDPE referenced in the OCD rule. The following are discussion points that will exhibit the attributes of a 40 mil LLDPE lining system:

The nature and formulation of LLDPE resin is very similar to HDPE. The major difference is that LLDPE is lower density, lower crystallinity (more flexible and less chemical resistant). However, LLDPE will resist aging and degradation and remain intact for many years in exposed conditions. The LLDPE resin is virtually the same for non-reinforced 40 mil LLDPE and string reinforced 45 mil LLDPE geomembranes and both will provide requisite containment and be equally protective for this application.

Flexibility Requirements. Non-reinforced LLDPE geomembranes are less stiff and far more flexible than string reinforced geomembranes as well as 60 mil HDPE and in this regard are preferred for installations in vertical wall tanks such as this proposed installation. LLDPE provides a very flexible sheet that enables it to be fabricated into large panels, folded for shipping and installed on vertical walls transitioned to flat bottom. Non-reinforced LLDPE sheet will conform better than a string reinforced LLDPE to the tank dimensions under hydrostatic loading and will exhibit less wrinkling and creasing during and after installation.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, either non-reinforced LLDPE or string-reinforced LLDPE will be acceptable as far as QC and thermal fusion seaming methods are concerned.

Potential for Leakage through the Primary and Secondary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media between the primary and secondary LLDPE geomembranes at the base of the AST in this application provides immediate drainage to a low point or outside the Modular AST Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the Secondary LLDPE liner .

Leakage through any Primary geomembrane is driven by size of hole and depth and will be detected by the increase of water in the drainage system and the volume being pumped out of the secondary containment. In this regard and for this variance, the Primary consists of 40 mil LLDPE geomembrane which will perform equal to or better than a single layer of string reinforced LLDPE for potential leakage. Thus, if a leak occurs through the top layer, it will be effectively contained by the second layer of 40 mil LLDPE geomembrane. If required, location of holes in the Primary can be found by Electrical Leak Location Survey (ELLS) using a towed electrode (ASTM D 7007). Holes found can then be repaired and thus water seepage into the leakage collection and drainage system will be kept to a minimum. Dependent on OCR requirements for Action Leakage Rate (ALR), the leakage volumes may only be monitored. For example, a typical ALR is < 20 gpad whereas a rapid and large leak (RLL) may be > 100 gpad. Most states specify maximum ALR values for waste and process water impoundments usually in the range of 100 to 500 gpad. However, New Mexico does not specify an ALR for waste or process water impoundments (GRI Paper No. 15).

Both non-reinforced LLDPE and string reinforced LLDPE can be prefabricated into large panels and thus both types offer the following for Containment:

- Prefabrication in factory-controlled conditions into very large panels (up to 30,000 sf) results in ease of installation, less thermal fusion field seams and less on site QC and CQA. (It should be noted that HDPE can not be prefabricated into panels and requires considerably more on-site welding and QC).

- Large prefabricated panels will provide better control of thermal fusion welding in a factory environment that will improve the liner system integrity for the long term. Ease of installation of large prefabricated custom size panels results in a greater reduction of installation time and associated installation and QC costs

- The Non-reinforced LLDPE geomembrane provides superior lay flat characteristics and conformability which allows for more intimate contact with the underlying soil, geonet, or geotextile and tank walls as well as overlying materials thus providing better flow characteristics for drainage of water. String reinforced LLDPE exhibits more wrinkling and when overlaid or in contact with a geonet drain, wrinkles tend to form pockets and dams affecting drainage of any leakage water to the exterior of the Modular AST Impoundment.

- Both types of LLDPE geomembrane are easily repaired using the same thermal fusion bonding method without the need for special surface grinding/preparation for extrusion welding as is typically used in repair of HDPE geomembranes. However, string reinforced LLDPE requires that all cut edges with exposed scrim must be encapsulated with extrusion bead. No encapsulation is required on non-reiinforced LLDPE.

In summary, it is my professional opinion that the two layers of 40 mil non-reinforced LLDPE geomembranes will provide a Primary/Secondary liner system that is equal to or better than 45 mil string reinforced LLDPE. Additionally, the two layers of 40 mil LLDPE will provide a superior installation and function better than liners such as 30 mil PVC or 60 mil HDPE as referenced in the OCD rule. The two layers of 40 mil non-reinforced LLDPE will provide the requisite protection of fresh water, public health and the environment for many years and especially for the estimated two year life of the proposed Solaris - MYOX Modular AST Impoundment.

If you have any questions on the above technical memorandum or require further information, give me a call at 720-289-0300 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

Section 19.15.34.12 OCD rule for impoundments

Geosynthetic Research Institute (GRI) Published Standards and Papers 2018

ASTM Standards 2018

Attachments:

R. K. Frobel C.V.

Liner [NMAC 19.15.11.J(4)]

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.17.11.J:

> (4) The primary (upper) liner and secondary (lower) liner shall be geomembrane liners. The geomembrane liner shall consist of 30- mil flexible PVC or 60-mil HDPE liner, or an equivalent liner material that the division's district office approves. The geomembrane liner shall have a hydraulic conductivity no greater than 1 x 10-9 cm/sec. The geomembrane liner shall be composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. Liner compatibility shall comply with EPA SW- 846 Method 9090A or subsequent relevant publication.
>
> (5) The operator shall minimize liner seams ... The operator shall ensure field seams in geosynthetic material are thermally seamed (hot wedge) with a double track weld to create an air pocket for non-destructive air channel testing. The operator shall test a seam by establishing an air pressure between 33 and 37 psi in the pocket and monitoring that the pressure does not change by more than one percent during five minute after the pressure source is shut off from the pocket…

With respect to the material of the primary liner, the applicant proposes two (2) 40-mil LLDPE liners and a secondary liner comprised of one (1) layer of 40-mil LLDPE material.

Demonstration That the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The attached letter from Mr. Ron Frobel concludes that the proposed primary liner system for the modular containments will provide equal protection of fresh water, public health and the environment as the primary liner system specified for an earthen pit (60-mil HDPE or 30-mil PVC). His letter states that the characteristics of the modular impoundment combined with the relatively short life-span of the project (less than 2 years) make the double-liner system of 40-mil LLDPE a better choice from an economic and environmental perspective than 60-mil HDPE or 30-mil PVC.

With respect to the secondary liner system, OCD has already approved 30-mil LLDPE for earthen pit storage systems – based upon data and arguments presented in previous submissions of Mr. Frobel. This variance request to use 40-mil LLDPE as the secondary liner for the modular impoundment system relies on some of the same arguments presented earlier, but also considers the nature of this secondary liner being exposed to some UV radiation and possibly some construction traffic. Again, Mr. Frobel concludes that the nature of the proposed secondary containment system and the less than 2-year lifespan of the project make the proposed secondary liner system a better choice from an economic and environmental perspective than 60-mil HDPE or 30-mil PVC.

Because of how the Pit Rule is written, Mr. Frobel has elected to compare and contrast the characteristics of 30-mil PVC with 40-mil LLDPE as a liner material the proposed modular containment structure. The data and arguments in Mr. Frobel's letter clearly demonstrate that the proposed variance provides better protection of fresh water, public health and the environment than the specified 30-mil PVC material.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Mr. Randall Hicks, PG
R.T. Hicks Consultants Ltd.
901 Rio Grande Boulevard
Suite F-142
Albuquerque, New Mexico 87104

November 18, 2014

RE: Technical Memorandum
LLDPE as Alternative Primary Liner System
Devon Energy MWFM Modular Impoundment

Dear Mr. Hicks:

At your request, I have investigated the suitability of application for 40 mil LLDPE non-reinforced geomembrane as an alternative Primary liner in the Devon Energy Modular Impoundment. I have reviewed your C-144 Supplemental Information Report, Modular Tank Drawing, Design and Siting characteristics as well as applicable correspondence. In consideration of the Primary lining system application (modular impoundment), size of the impoundment and depth, design details for modular tanks as well as estimated length of up to two years of service time, it is my professional opinion that 40 mil LLDPE geomembrane will provide the requisite barrier against processed water loss. The two 40 mil LLDPE liners will function equal to or better than 60 mil HDPE or 30 mil PVC as a primary liner system. The reader is referred to the Technical Memorandum regarding the Secondary Liner for discussion points on PVC. The following are discussion points that will exhibit the attributes of a 40 mil LLDPE lining system:

The nature and formulation of LLDPE resin is very similar to HDPE. The major difference is that LLDPE is lower density, lower crystallinity (more flexible and less chemical resistant). However LLDPE will resist aging and degradation and remain intact for many years in exposed conditions. Although the lifetime of LLDPE in covered conditions (i.e., secondary liner) will be somewhat reduced with respect to HDPE, a secondary liner of LLDPE will outlast an exposed HDPE liner. In fact, according to the Geosynthetic Research Institute (GRI) study on lifetime prediction (GRI Paper No. 6), the half life of HDPE (GRI GM 13) exposed is > 36 years and the half-life of LLDPE (GRI GM 17) exposed is approximately 36 years (the Devon Energy Modular Impoundment life span is expected to be only 1 year maximum). It is understood that in order to ensure compliance of materials, 60 mil HDPE must meet or exceed GRI GM 13. Likewise, the primary or secondary liner must meet or exceed GRI GM 17 for non-reinforced LLDPE. Adhering to the minimum requirements of the GRI Specifications, 40 mil LLDPE when used as a primary liner in the Devon Modular Impoundment will be equally as protective as a 60 mil HDPE liner.

Flexibility Requirements. LLDPE geomembranes are less stiff and far more flexible than HDPE and in this regard are preferred for installations in vertical wall tanks such as the Devon Modular Impoundment. LLDPE provides a very flexible sheet that enables it to

be fabricated into large panels, folded for shipping and installed on vertical walls transitioned to flat bottom. LLDPE will conform to the tank dimensions under hydrostatic loading.

Thermal Fusion Seaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, there should be no exception or recommended practice for seaming and QC testing in the OCD rules. This would be fully covered in comprehensive specifications for both the Primary and Secondary geomembranes that would be reviewed by OCD.

Potential for Leakage through the Primary Liners. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media provides immediate drainage to a low point or outside the Modular Impoundment and thus no hydrostatic head or driving gradient is available to push leakage water through a hole. In this regard, secondary geomembrane materials can be (and usually are) much less robust in both thickness and polymer type.

Leakage through any Primary geomembrane is driven by size of hole and depth and will be detected by the increase of waste water in the drainage system and the volume being pumped out of the secondary containment. In this regard and for this variance, the Primary consists of 2 layers of 40 mil LLDPE geomembrane which will out perform a single layer of HDPE for potential leakage. Thus, if a leak occurs through the top layer, it will be effectively contained by the second layer. If required, location of holes in the Primary can be found by Electrical Leak Location Survey (ELLS) using a towed electrode (ASTM D 7007). Holes found can then be repaired and thus water seepage into the Secondary will be kept to a minimum. Dependent on OCR requirements for Action Leakage Rate (ALR), the leakage volumes may only be monitored. For example, a typical ALR is < 20 gpad whereas a rapid and large leak (RLL) may be > 100 gpad. Most states specify maximum ALR values for waste water impoundments usually in the range of 100 to 500 gpad. However, New Mexico does not specify any ALR for waste water impoundments (GRI Paper No. 15).

HDPE can not be prefabricated into large panels and thus LLDPE offers the following for Primary Liner Containment:

- Prefabrication in factory controlled conditions into very large panels (up to 30,000 sf) results in ease of installation, less thermal fusion field seams and less on site QC and CQA.

- Large prefabricated panels of LLDPE will provide better control of thermal fusion welding in a factory environment that will improve the liner system integrity for the long term.

- The LLDPE geomembrane provides superior lay flat characteristics and conformability which allows for more intimate contact with the underlying soil, geonet or geotextile as well as overlying materials thus providing better flow characteristics for drainage of water. HDPE exhibits extreme wrinkling and when overlaid or in contact with a geonet drain, wrinkles tend to form pockets and dams affecting drainage of any leakage water to the exterior of the Modular Impoundment.

- Ease of installation of large prefabricated custom size panels results in a greater reduction of installation time and associated installation and QC costs.

- The LLDPE geomembrane is easily repaired using the same thermal fusion bonding method without the need for special surface grinding/preparation for extrusion welding used in repair of HDPE geomembranes.

In summary, it is my professional opinion that the double 40 mil LLDPE geomembranes will provide a Primary liner system that is equal to or better than a single 60 mil HDPE liner or a single 30 mil PVC liner and will provide the requisite protection of fresh water, public health and the environment for many years and especially for the estimated two year life of the Devon Energy Modular Impoundment.

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

C-144 Supplemental Information
Devon Energy Modular Impoundment
Prepared by R. T. Hicks Consultants Ltd.

Geosynthetic Research Institute (GRI) Published Standards and Papers 2013

ASTM Standards 2013

Attachments:

R. K. Frobel C. V.

R.K. FROBEL & ASSOCIATES
Consulting Engineers

Mr. Randall Hicks, PG
R.T. Hicks Consultants Ltd.
901 Rio Grande Boulevard
Suite F-142
Albuquerque, New Mexico 87104

November 18, 2014

RE: Technical Memorandum
LLDPE as Alternative Secondary Liner System
Devon Energy MWFM Modular Impoundment

Dear Mr. Hicks:

At your request, I have reviewed the suitability of application of a 40 mil LLDPE geomembrane as an alternative secondary liner for the Devon Energy Multi-Well Fluid Management (MWFM) Modular Impoundment. I have reviewed your C-144 Supplemental Information Report, Modular Tank Drawing, Design and Siting characteristics as well as applicable correspondence. In consideration of the Secondary lining system application (Modular Impoundment), size of impoundments and depth, design details for modular tanks as well as estimated length of service time of less than two years, it is my professional opinion that the 40 mil LLDPE geomembrane will provide the requisite barrier against potential processed water loss and will function far better than 30 mil PVC as a secondary liner system, especially in consideration of the secondary lining exposed conditions beyond the tank walls. The following are discussion points that will exhibit the attributes of a 40 mil LLDPE secondary lining system:

LLDPE Base Polymer. As discussed in previous technical memorandums, the LLDPE resin is similar to HDPE with the major difference noted that LLDPE exhibits lower density, lower crystallinity (more flexible and less chemical resistant) and better thermal fusion weld capability.. LLDPE resin will resist aging and degradation and remain intact for many years in exposed conditions. The Geosynthetic Research Institute (GRI) study on lifetime prediction (GRI Paper No. 6), shows that the half life of HDPE (GRI GM 13) exposed is > 36 years and the half-life of LLDPE (GRI GM 17) exposed is also approximately 36 years (the Devon Energy Modular Impoundment life span is expected to be only 2 years maximum). It is understood that in order to ensure compliance of materials, the primary geomembrane to be used in the pits must meet or exceed GRI Specification Requirements and in this case should meet or exceed GRI GM 17 for non-reinforced LLDPE. Adhering to the minimum requirements of the GRI Specifications, 40 mil LLDPE when used as an alternate secondary liner will be far superior to an exposed 30 mil PVC. It should be noted that PVC geomembranes are not addressed in GRI specifications.

PVC Base Polymer. PVC base resin is formulated with a number of components including oils, plasticizers, fillers and carbon black. The polymer structure is relatively amorphous and low in crystallinity and thus more permeable than the semi-crystalline

LLDPE structure. PVC must include plasticizers to make the sheet flexible and the plasticizers tend to leach out of the PVC polymer over time making the sheet stiff and very difficult to repair. Plasticizer migration is accelerated in exposed conditions by heat and UV/ozone attack. Thus PVC geomembranes are always designed with soil cover to protect the polymer from premature degradation. PVC geomembranes have been observed to deteriorate in exposed conditions in less than 2 years. The Devon Energy Modular Impoundment requires that the secondary liner be exposed beyond the tank walls.

Durability of Geomembranes is directily affected by exposure conditions. Buried or covered geomembranes are not affected by the same degradation mechanisms (UV, Ozone, Chemical, Stress, Temperature, etc) as are fully exposed geomembranes. In this regard, the PVC lining material is much less robust when fully exposed to the elements than LLDPE. PVC geomembranes are required to be covered by other geosynthetics or earth materials to prevent exposure to UV, heat and oxidation. In particular, PVC geomembrane materials will degrade due to the extraction of plasticizers which is accelerated by UV and heat exposure. LLDPE geomembranes do not have extractable resin components that would degrade the base polymer when subjected to fully exposed conditions.

Thermal FusionSeaming Requirements. Thermal seaming and QC seam test requirements for geomembranes are product specific and usually prescribed by the sheet manufacturer. Both dual wedge and single wedge thermal fusion welding is commonly used on LLDPE and QC testing by air channel (ASTM D 5820) or High Pressure Air Lance (ASTM D 4437) is fully acceptable and recognized as industry standards. In this regard, there should be no exception or recommended practice for seaming and QC testing in the OCD rules. This would be fully covered in comprehensive specifications for both the Primary and Secondary geomembranes that would be reviewed by OCD.

Potential for Leakage through the Primary Liner. Leakage through geomembrane liners is directly a function of the height of liquid head above any hole or imperfection. The geonet drainage media on top of the LLDPE secondary provides immediate drainage to outside the tank walls and thus no hydrostatic head or driving gradient is available to push leakage water through a hole in the secondary lining system. If required, location of holes in the Secondary due to construction can be found by Electrical Leak Location Survey (ELLS) using a water lance (ASTM D 7002). Holes found can then be repaired prior to placement of the Primary lining and thus any potential water seepage will be kept to a minimum..

Chemical Attack. Chemical attack to polymeric geomembranes is directly a function of exposure time as well as crystallinity. For short term exposure to process water of less than 2 years, the LLDPE geomembrane when used as a primary or secondary liner will provide a chemically resistant liner that can be QC tested to reduce potential defects or holes. Due to extractable components of PVC and less chemically resistant nature of the polymer (more amorphous and low crystallinity), PVC will not provide the requisite chemical resistant barrier in exposed conditions.

Geomembrane Installation. In consideration of the MWFM Modular Impoundment and associated construction and installation of liners in tanks, the following installation attributes of LLDPE should be considered:

- LLDPE is light in unit weight and thus will allow for factory pre-fabrication of large panels in excess of 30,000 sf for 40 mil material. This allows for a one panel installation in many Modular Impoundments.
- LLDPE provides a very dimensionally stable sheet in temperature extremes which results in far less field wrinkles and waves during and after installation. Non reinforced PVC is not as dimensionally stable.
- The LLDPE geomembrane is easily repaired using the same thermal fusion bonding method without the need for special surface preparation or cleaning. PVC, when oxidized and exhibiting loss of plasticizer is very difficult to repair and repair is usually by chemical fusion methods that are not as reliable as thermal fusion methods.
- Due to the semi-crystalline polymer structure and flexibility, the LLDPE geomembrane will provide superior installation and operation resistance to mechanical damage and is especially resistant to tear propagation, puncture and abrasion. 30 mil PVC does not exhibit the same strength requirements necessary when exposed to the elements and potential construction traffic on the tank exterior.
- LLDPE does not require a cover system to protect it from exposure to the elements whereas PVC geomembranes should be protected from direct exposure to the elements.
- LLDPE is available in a textured sheet which will provide greater base stability and resistance to sliding during and after construction of the Modular Impoundment

In summary, it is my professional opinion that a 40 mil LLDPE geomembrane will provide a short term (less than 2 years) secondary liner system that is superior to 30 mil PVC and will provide the requisite protection of fresh water, public health and the environment for many years and especially for the estimated one year life of the Devon Energy MWFM Modular Impoundment..

If you have any questions on the above technical memorandum or require further information, give me a call at 303-679-0285 or email geosynthetics@msn.com

Sincerely Yours,

R K Frobel

Ronald K. Frobel, MSCE, PE

References:

C-144 Supplemental Information
Devon Energy Modular Impoundment
Prepared by R. T. Hicks Consultants Ltd.

NMOCD Recycling Rule, Title 19, Chapter 15 – Produced Water, Drilling Fluids and Liquid Waste 2014 – Section 19.15

Geosynthetic Research Institute (GRI) Published Standards and Papers 2013

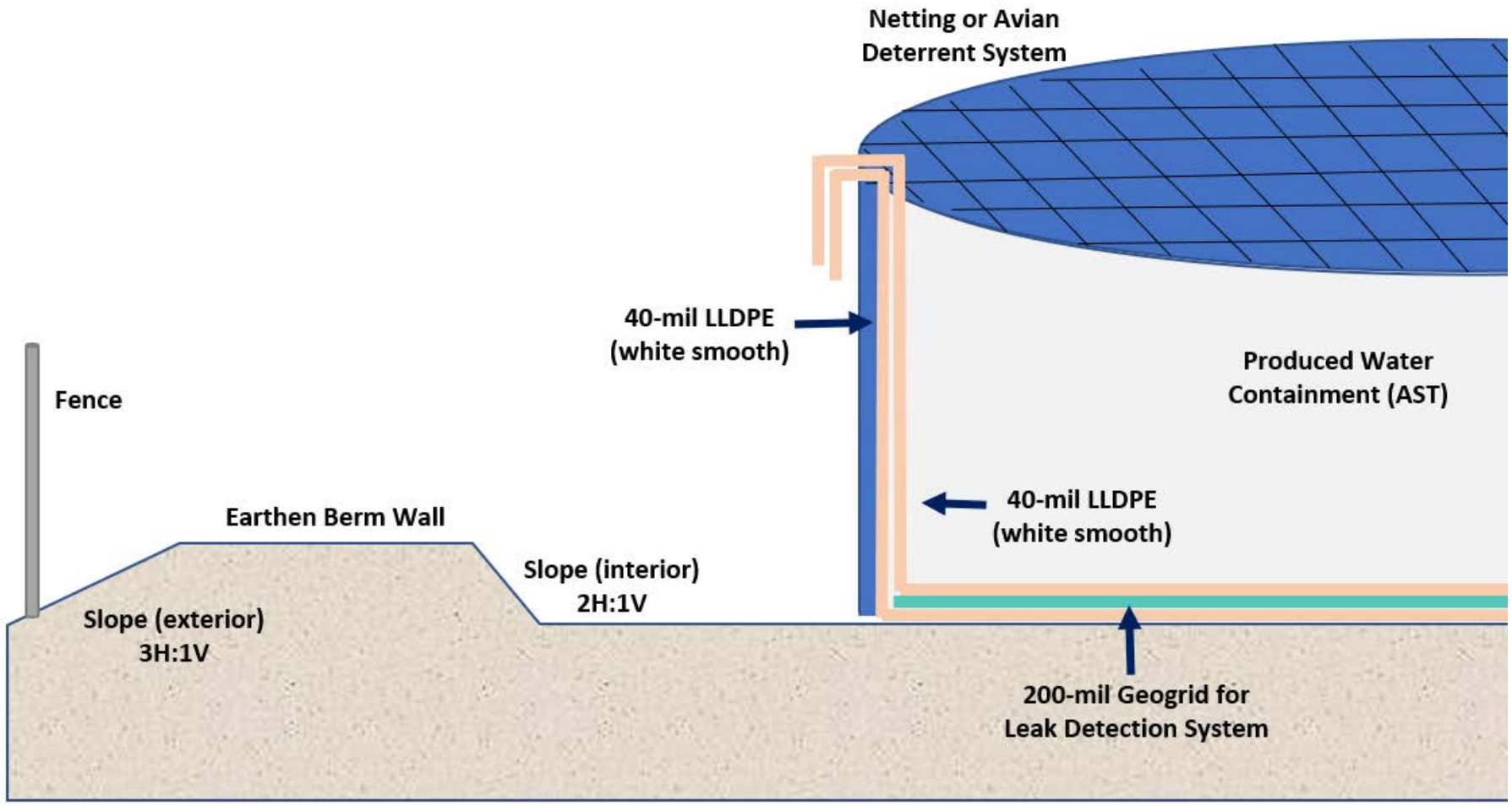
ASTM Standards 2013

Attachments:

R. K. Frobel C.V.

C-147

submitted in Volume 1

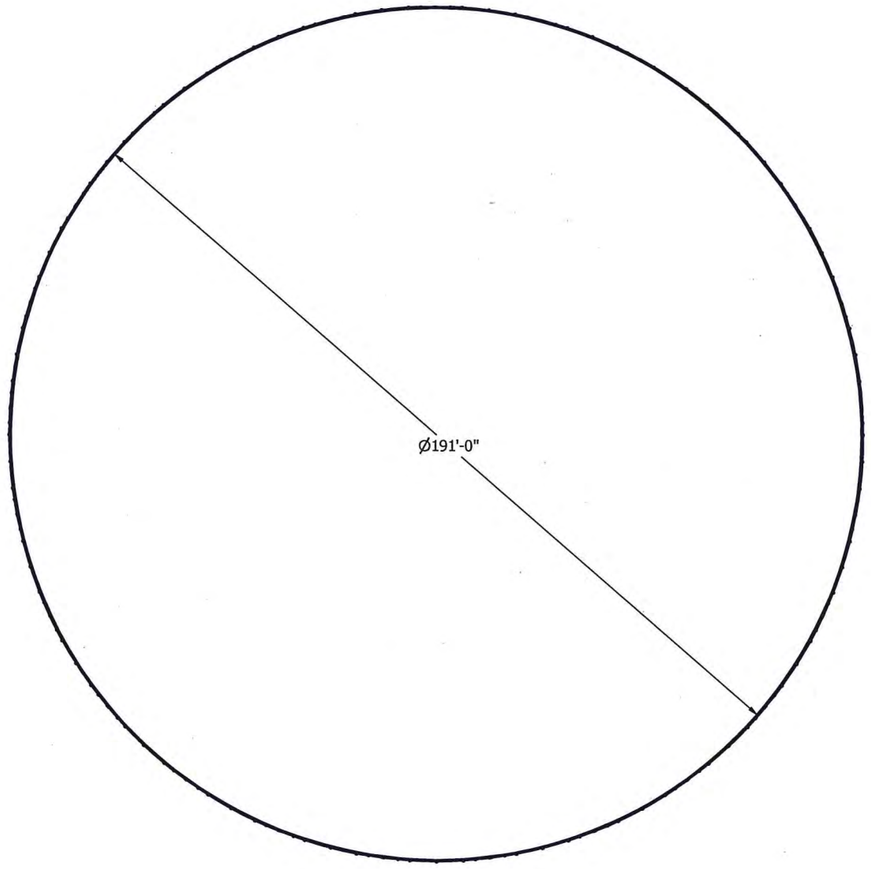


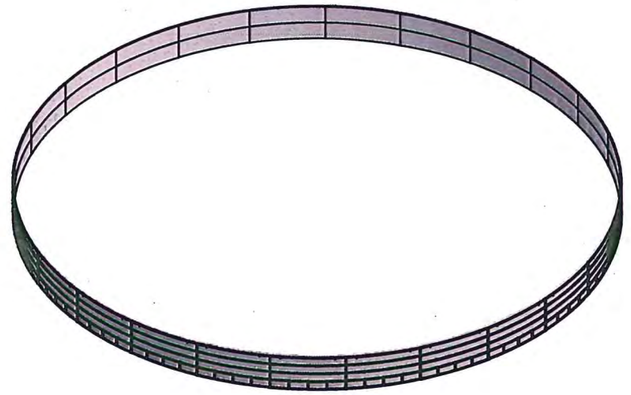
Not to Scale

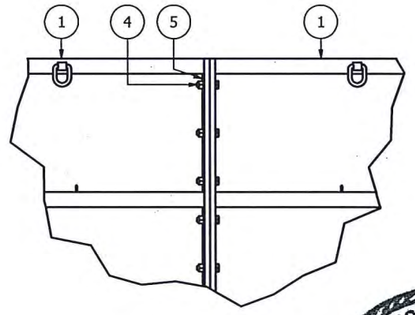
R.T. HICKS CONSULTANTS, LTD. 901 Rio Grande Blvd NW Suite F142 Albuquerque, NM 87104 O□ce Ph: 505.266.5004	AST Schematic	Plate 1
	Typical Mustant-Extreme AST	June 2019

C-147 – Box 3

Recycling Containment Design Drawings
Set Up SOP
Liner Specifications







DETAIL A
SCALE 1 / 25

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL ENGINEER
CHARLES R. GOSS
NO. 40569-E

CR Goss
18 Dec 2013

Reviewer's notes:

1. This drawing set replaces set previously sealed on 27 MAR 2013
2. Empty corral cannot withstand high winds.

ITEM	QTY	PART NUMBER	DESCRIPTION	REV
6	120	4X4X4 LUMBER	4" x 4" x 48" Lumber (NOT SHOWN)	-
5	850	WASH-200-1-1/4	1-1/4" ASTM F436 Galvanized Structural Washer	-
4	425	NUT-200-1-1/4-7	1-1/4"-7 ASTM A563 Gr DH Galvanized Hex Nut	-
7	425	BOLT-1-1/4-4333	1-1/4"-7 x 5" ASTM A490 Structural Bolt	-
3	25	ETC-106	.063" X 8" X 168" RUBBER SHEET (NOT SHOWN)	-
2	5	MWC-SA-008A	60,000 BBL Corral Shipping Support	-
1	25	MWC-SA-002a	60,000 BBL CORRAL WALL SECTION	-

PARTS LIST

NEXT ASSY | USED ON
APPLICATION
THIRD ANGLE PROJECTION

INTERPRET DIMENSIONS AND TOLERANCES IAW ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (MM)
FRACTIONAL ± 1/4(6.4)
X.XX = ±.25(6.4)
X.XXX = ±.125(3.2)
X.XXXX = ±.060(1.5)
ANGULAR ± 1°
125

MATERIAL
THICKNESS NA | WEIGHT N/A

DRAWN BY mspeciale | DATE 7/12/2012
CHECKED BY dbodenshatz | DATE 11/23/2012
APPROVED mspeciale | DATE 11/23/2012

ETC
Environmental Tank & Container
JOHNSTOWN, PA
855-382-8265
www.etctank.com

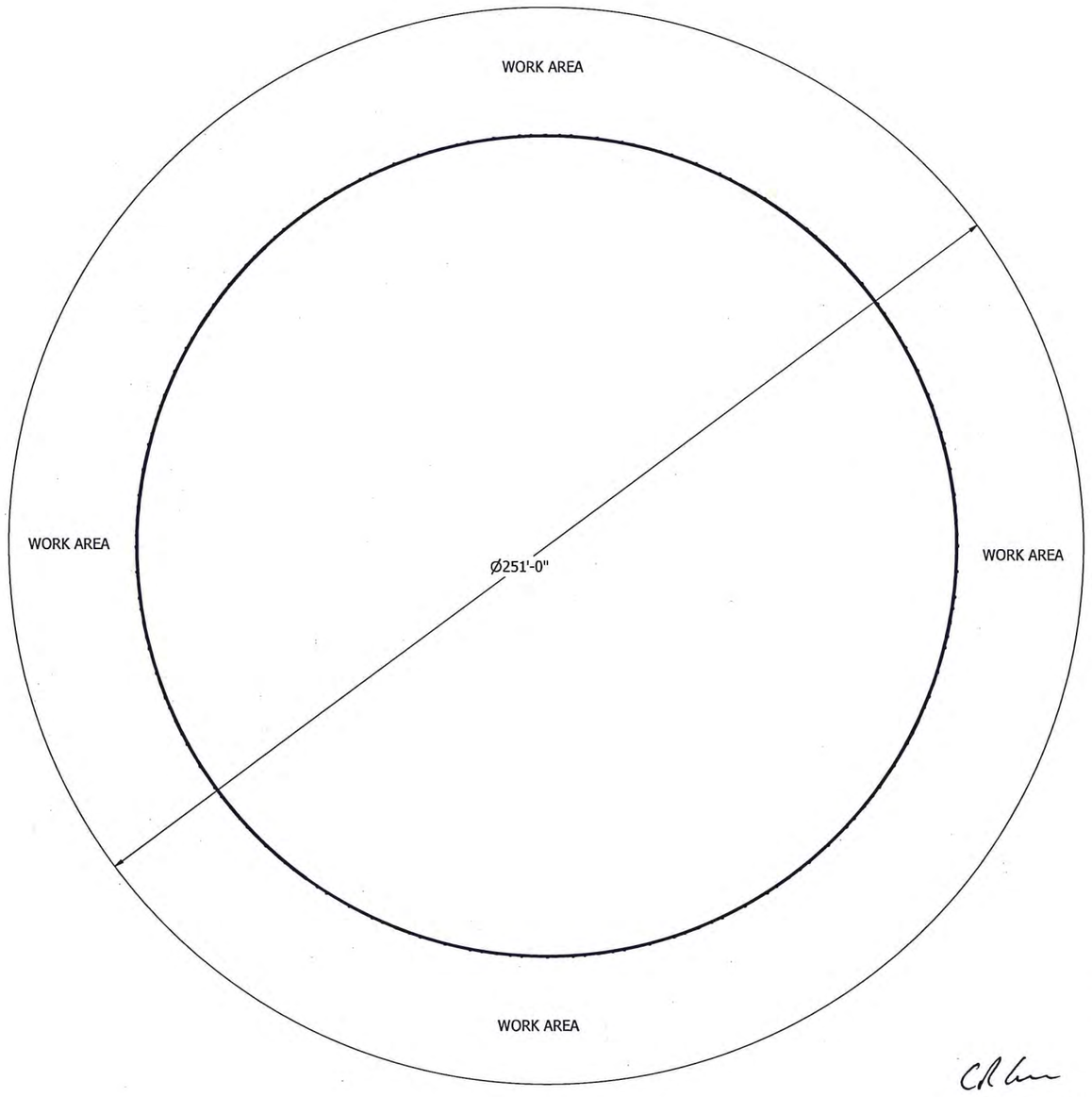
TITLE: 60,000 BBL MOBILE WATER CORRAL, BOLT-UP DESIGN

SIZE C | PRT. NO. MWC-A-002a | REV -
SCALE DO NOT SCALE | DWG. NO. MWC-A-002a | SHEET 1 OF 2

LOCATION: C:_Vault\ETCVault_Corrals\MWC-A-002a.iam

NOTES:

1. MINIMUM OF 30 FEET OF WORK AREA AROUND CORRAL
2. OVER ALL SITE MUST BE LEVEL TO +/- .50 INCH
3. RING AREA WHERE CORRAL PANELS WILL BE SETUP MUST BE LEVEL TO +/- .25 INCH
4. SOIL COMPACTION MUST MEET ASTM D-698A, 90% OR GREATER
5. BUILD A 12" X 12" SAND INSIDE CORNER RELIEF BEFORE INSTALLING LINER
6. MUST USE 1"-1/4"-7 X 4" GRADE A490 STRUCTURAL BOLTS
7. PANELS MUST HAVE ALL CONNECTING BOLTS TIGHTENED AND LINER FULLY SECURED BEFORE ADDING WATER
8. ALLOW FOR 6 INCHES OF FREEBOARD FROM TOP OF CORRAL



COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
CHARLES R. GOSS
ENGINEER
NO. 40569-E

18 Dec 2013

NEXT ASSY	USED ON
APPLICATION	
THIRD ANGLE PROJECTION	
INTERPRET DIMENSIONS AND TOLERANCES IAW ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES (MM)	FRACTIONAL ± 1/4(6.4) XXX = ±.25(6.4) XXX = ±.125(3.2) XXXX = ±.060(1.5) ANGULAR ± 1° 125
MATERIAL	
THICKNESS	NA
WEIGHT	N/A
DRAWN BY	mspeciale
DATE	7/12/2012
CHECKED BY	dbodenshatz
DATE	11/23/2012
APPROVED	mspeciale
DATE	11/23/2012

ETC
Environmental Tank & Container
JOHNSTOWN, PA
855-382-8265
www.etctank.com

TITLE: 60,000 BBL MOBILE WATER CORRAL, BOLT-UP DESIGN

SIZE	PRT. NO.	REV
C	MWC-A-002a	-

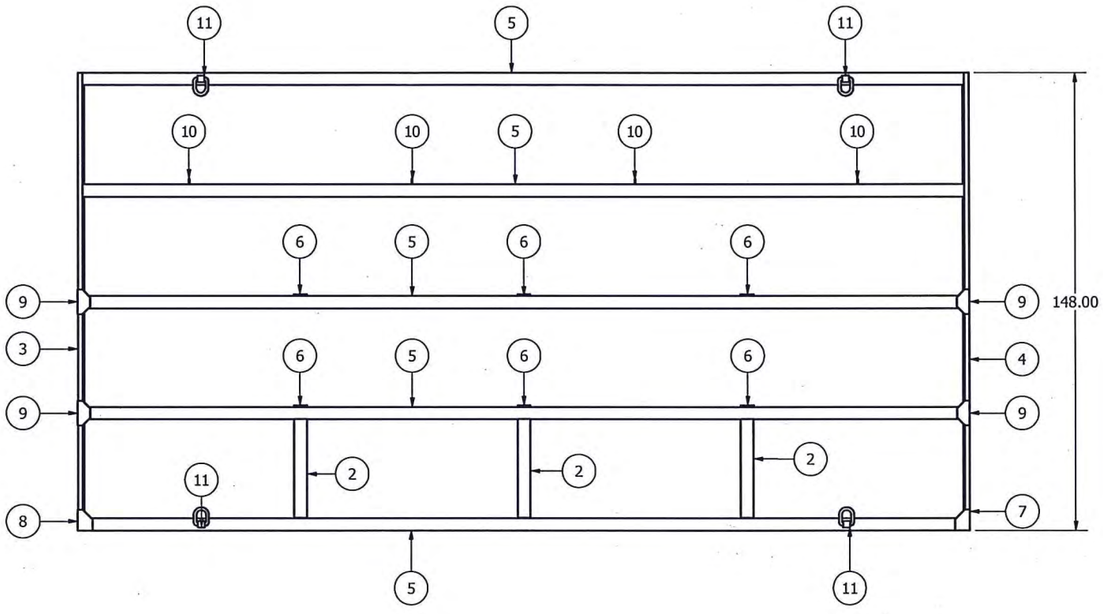
SCALE	DWG. NO.	SHEET
DO NOT SCALE	MWC-A-002a	2 OF 2

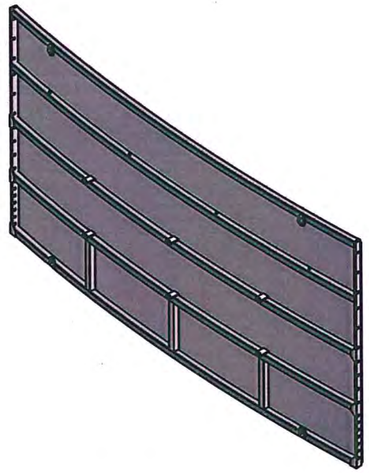
LOCATION: C:_Vault\ETCVault_Corrals\MWC-A-002a.iam

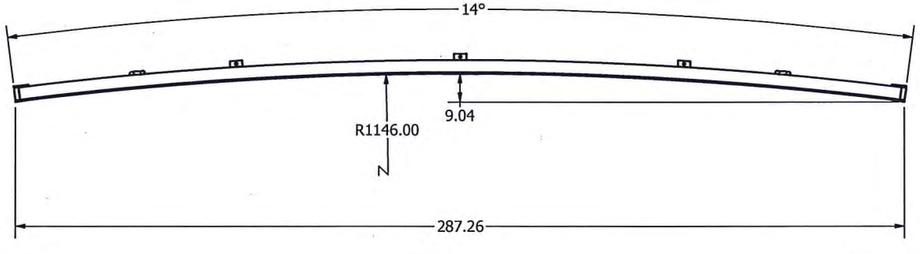
NOTES:

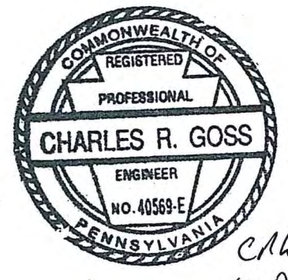
1. BLAST TO A 1 1/2 - 2 mil PROFILE
2. PAINT WITH CARBOLINE 8845, 3 - 5 mils THICK

REVISION HISTORY				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	-	INITIAL RELEASE	10/1/2012	MJS









18 Dec 2013

ITEM	QTY	PART NUMBER	DESCRIPTION	REV	STOCK NUM	UNIT QTY
12	1	ETC-109	.062" X 4" X 288" RUBBER SHEET	-	NA	NA
11	4	ETC-079	Weld-on Lifting Ring	-	NA	NA
10	4	ETC-040	D-RING	-	NA	NA
9	4	MWC-323	PLATE, 1/2"	-		1
8	1	MWC-322	PLATE, 1/2"	-		1
7	1	MWC-321	PLATE, 1/2"	-		1
6	6	MWC-019	PLATE, 1/2"	-	010558	23.43 lbs
5	5	MWC-017a	TUBE, 4" X 4" X .25"	-	030227	120 ft
4	1	MWC-211R	1.50" X 4.00" FLAT BAR	-	020172	12.33 ft
3	1	MWC-211L	1.50" X 4.00" FLAT BAR	-	020172	12.33 ft
2	3	MWC-004	TUBE, 4" X 4" X .25"	-	030068	8 ft
1	2	MWC-001a	PLATE	-	010013	5880.72 lbs

PARTS LIST

NEXT ASSY | USED ON

APPLICATION

THIRD ANGLE PROJECTION

INTERPRET DIMENSIONS AND TOLERANCES IAW ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES (MM)
FRACTIONAL ± 1/4(6.4)
X.XX = ±.25(6.4)
X.XXX = ±.125(3.2)
X.XXXX = ±.060(1.5)
ANGULAR ± 1°
125

MATERIAL: Welded Steel Mild
THICKNESS: NA | WEIGHT: N/A

DRAWN BY: mspeciale — DATE: 4/11/2012
CHECKED BY: dbodenshatz — DATE: 8/31/2012
APPROVED: mspeciale — DATE: 8/31/2012

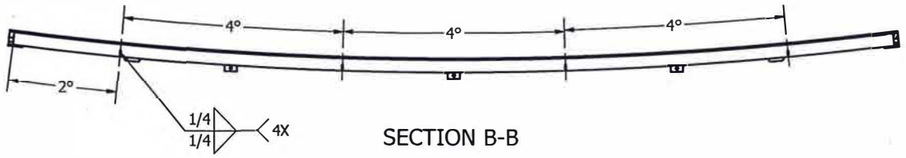
ETC
Environmental Tank & Container
JOHNSTOWN, PA
855-382-8265
www.etctank.com

TITLE: 60,000 BBL CORRAL WALL SECTION

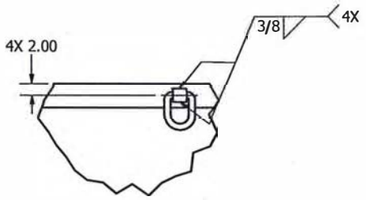
SIZE: C | PRT. NO.: MWC-SA-002a | REV: -

SCALE: DO NOT SCALE | DWG. NO.: MWC-SA-002a | SHEET 1 OF 2

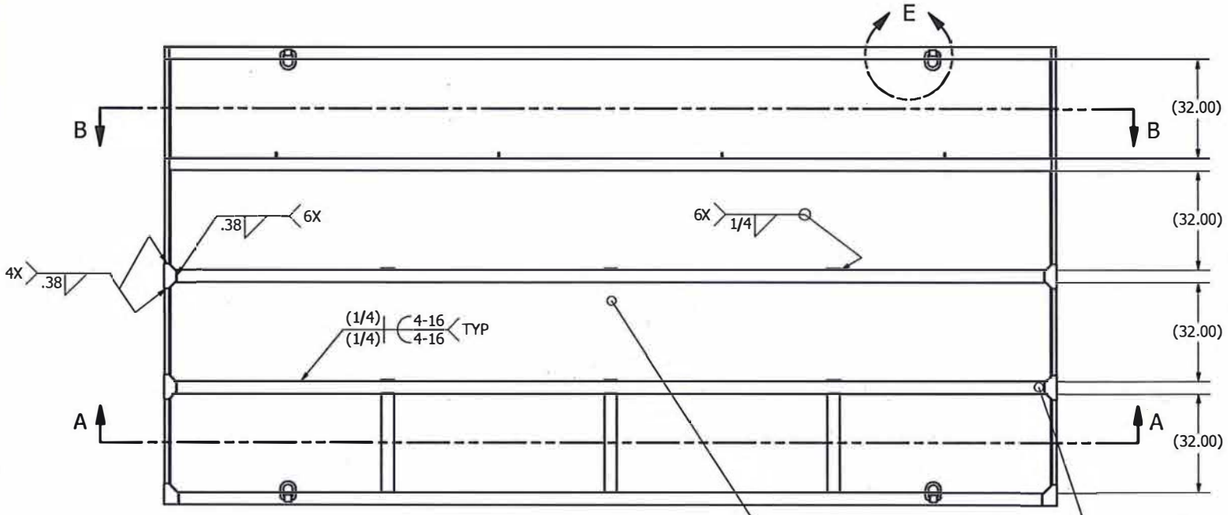
LOCATION: C:_Vault\ETCVault_Corrals\MWC-SA-002a.iam

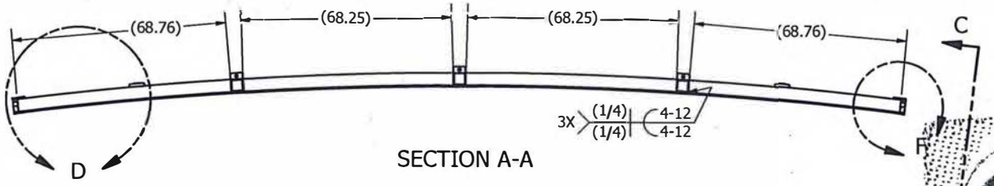


SECTION B-B

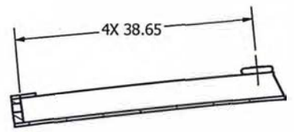


DETAIL E

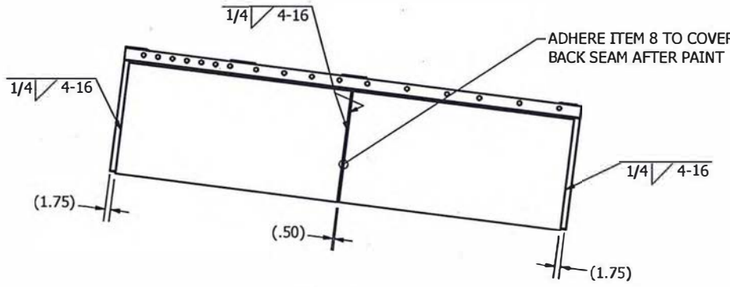




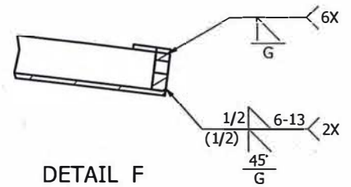
SECTION A-A



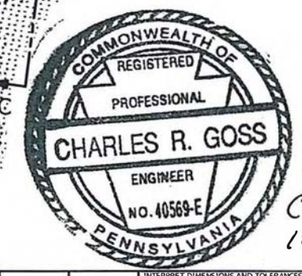
DETAIL D



VIEW C-C



DETAIL F



18 Dec 2013

NEXT ASSY	USED ON
APPLICATION	
THIRD ANGLE PROJECTION	

INTERPRET DIMENSIONS AND TOLERANCES IAW ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED
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ANGULAR ± 1°
125

MATERIAL	Welded Steel Mild
THICKNESS	NA
WEIGHT	N/A

DRAWN BY	mspeciale
DATE	4/11/2012
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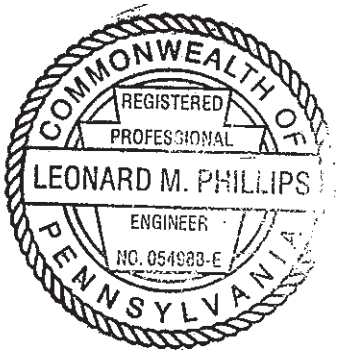
TITLE: 60,000 BBL CORRAL WALL SECTION

SIZE	PRT. NO.	REV
C	MWC-SA-002a	-

SCALE	DWG. NO.	SHEET
DO NOT SCALE	MWC-SA-002a	2 OF 2

LOCATION: C:_Vault\ETCVault_Corrals\MWC-SA-002a.iam

Date	:	3/18/2014
Document ID	:	14006H
Revision	:	0
Project	:	Evaluation of existing design
Tank #(s)	:	60,000 bbl Corral
Diameter	:	191'-0"
Shell height	:	12' - 4 "
Roof type	:	Open Top
Client	:	ETC
Location	:	Pittsburgh, Pa
PO#	:	



Standard Properties

1. Gross Tank Geometry

$D := 191 \cdot ft + 0 \cdot in$ Tank diameter

$H_s := 12 \cdot ft + 4 \cdot in$ Shell height

2. Product Variables

$DLL := 12 \cdot ft + 4 \cdot in$ Design liquid level.

$V_{nom} := \frac{\pi}{4} \cdot D^2 \cdot H_s$ $V_{nom} = 62939 \cdot bbl$ Nominal volume

$PSG := 1.2$ Maximum product specific gravity [assumed for heavy brine]

3. Design Parameters

$T_{max} := 200 \cdot F$ Maximum design temperature

$T_{min} := 5 \cdot F$ Minimum design temperature

$P_{int} := 0 \cdot psi$ Design internal pressure

$P_{ext} := 0 \cdot psi$ Design external pressure (vacuum)

4. Environmental Variables

A. Temperature Variables

$DMT := 5 \cdot F$ Design metal temperature

B. Wind Variables

$V_{wind} := 90 \cdot mph$ Design wind speed [3-second gust]

$I_{wind} := 1.0$ Wind importance factor

Exposure category (Default = C)

$K_{zt} := 1.0$ Topographic factor (1.0 minimum)

Check windbuckling in corroded condition?

Can windgirders for tanks with a diameter greater than 200 feet be designed using D = 200 ft ?

5. Shell Design

A. Shell Parameters

$JE_s := 1.00$ Shell joint efficiency

Does the client allow shell design using the variable-design-point method for tanks less than 200 feet in diameter?

$h_s := \begin{pmatrix} 6 \\ 6 \end{pmatrix} \cdot ft + \begin{pmatrix} 0 \\ 4 \end{pmatrix} \cdot in$ Height of each shell course.

$t_s := \begin{pmatrix} 0.5 \\ 0.5 \end{pmatrix} \cdot in$ Actual thickness of each shell course

$CA_s := \begin{pmatrix} 0 \\ 0 \end{pmatrix} \cdot in$ Corrosion allowance on the shell

	Shell Material 1	Shell Material 2	Shell Material 3
SR1			
SR2			
SR3			
SR4			
SR5			
SR6			
SR7			
SR8			

Shell Material Properties

Shell material	Group number	Design stress	Hydrotest stress	Appendix M factor
$SM = \begin{pmatrix} "A36" \\ "A36" \end{pmatrix}$	$GRP = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$	$SD = \begin{pmatrix} 23200 \\ 23200 \end{pmatrix} psi$	$ST = \begin{pmatrix} 24900 \\ 24900 \end{pmatrix} \cdot psi$	$RF = \begin{pmatrix} 1.000 \\ 1.000 \end{pmatrix}$

B. Shell Thickness Check (API 650)

Shell Thickness

$t_{smin} = \begin{pmatrix} 0.3168 \\ 0.3125 \end{pmatrix} \cdot in$ Minimum required steel plate thickness required by API 650

$\frac{t_{smin}}{t_s} = \blacksquare \cdot \%$

5. Shell Design

C. Shell Wind Buckling Check

Shell Buckling

$\frac{H_{tr} - h_{twg}}{H_1} = 17.02 \cdot \%$ Wind buckling check.
If value exceed 100%, intermediate windgirders are required.

D. Splice Bolt Check

$n_{bolt} := 17$ Bolts per splice connection

$d_b := 1.25 \cdot in$ Diameter of bolts

$P_{des} := 150 \cdot kip$ Design strength in tension for A490 bolt

$\Phi_{pry} := 2.0$ Increase in bolt force due to prying action [conservative estimate]

$P_{head} := \gamma_w \cdot PSG \cdot DLL = 923.82 \cdot psf$ Head pressure at base of shell

$P_{ave} := \frac{1}{2} \cdot P_{head} = 461.91 \cdot psf$ Average pressure on shell

$P_{fb} := \frac{1}{2} \cdot P_{ave} \cdot DLL \cdot D = 544.05 \cdot kip$ Force in each splice plate from circumferential hydrostatic forces

$P_b := \frac{P_{fb}}{n_{bolt}} = 32.00 \cdot kip$ Average pure tensile force in bolt

E. Panel Information

$n_{pl} := 20$ Panels per ring

$w_{tb} := 4 \cdot in$ Square tubing width

$t_{tb} := 0.25 \cdot in$ Tubing thickness

$n_{tb} := 5$ Number of tubes per panel

$F_{ytb} := 46 \cdot ksi$ Yield strength of tubing [A500 Grade B]

$FU_{tb} := 58 \cdot ksi$ Ultimate strength of tubing [A500 Grade B]

F. Safety Factor - Bolts

$$SF_{ba} := \frac{P_{des}}{\Phi_{pry} \cdot P_b} = 2.3$$

Safety factor for bolt in pure tension compared to allowable tensile strength for the bolts

G. Safety Factor - Panels

$$SF_{pa} := \frac{FA_{comp}}{\sigma_{hoop}} = 4.1$$

Safety factor for hoop stress in panel compared to composite allowable stress of plate and tubing

$$SF_{py} := \frac{FY_{comp}}{\sigma_{hoop}} = 6.5$$

Safety factor for hoop stress in panel compared to composite yield stress of plate and tubing

$$SF_{pu} := \frac{FU_{comp}}{\sigma_{hoop}} = 9.9$$

Safety factor for hoop stress in panel compared to composite ultimate stress of plate and tubing

Policy Template

APPROVALS

*All approvals are maintained and controlled By **OPERATIONS MANAGEMENT***

*Please refer to the **SOP MANUAL** for the current controlled revision and approval records.*

REVISION HISTORY

AUTHOR	*REVISED SECTION/PARAGRAPH*	*REV*	*RELEASED*
Jeff Anderson	**INITIAL RELEASE**	02	

Draft and Archived/Obsolete revisions are not to be used.

Table of Contents

1. PURPOSE

This procedure is being implemented to standardize the process for installing Epic 360 Tanks and to ensure the quality from a standardized plan.

2. SCOPE

This procedure applies to the installations of 10,000bbl, 22,000bbl, 40,000bbl, and 60,000bbl Epic Tanks

3. DEFINITIONS

- Epic 360 Tank – Above ground tank used for water containment. Permanent or temporary structure used in industrial processes where large volumes of water are needed.
- Secondary Containment – Usually a "steel wall" type of containment that surrounds the perimeter of the Epic tank and serves as safeguard if leaks were to occur.

4. RESPONSIBILITIES

- SOP process owner –On-Site Epic Supervisor designated by management
- On-site Epic Supervisor – Ensure that SOP is strictly followed as the source for correct assembly and installation of Epic Tanks and their secondary containments.
- Crew Leader – Follow direction given by the On-Site Supervisor and managing their crew in a safe and productive manner
- Crew – Labor portion of the assembly/installation process
- Safety Coordinator – Ensuring that safety standards are being followed by the On-Site Supervisor, Crew Leader, and Crew. This is attained through audits and evaluation.
- Quality Director – Performs a post-completion inspection and ensures that the tank was built to customer specifications.
- Regulatory/Document Coordinator – Compile and file appropriate inspections and quality control documentation.

5. POLICY

Procedure for installing Epic 360 Tanks.

5.1 Prepare Surface Area

- Assure ground surface is within 1" of level grade. This is checked by the On-Site Epic Supervisor.
- If level, find the center of tank location and mark ground with paint. Determine radius of tank and mark ground for footprint of the tank.
- Obtain textile and appropriate liner, as determined by customer or internal specifications.

5.2 Ground Cover Installation

- Determine whether the tank requires a secondary containment to achieve 110% containment, spill containment, or tank only installation.
- Apply textile to the entire footprint of the tank, including secondary tank if applicable. Re-mark the painted footprint on top of the textile to serve as a guide for the wall panel placement.
- Apply liner material over the textile extending it 15 feet past the edge of the tank footprint.
- Fold the liner back toward the center of the tank footprint allowing sufficient space to place the wall panels.

5.3 Tank Wall Assembly

- Panels weight 8,600 lbs. each. A 10,000--11,000 lb Telehandler or greater must be used when handling and installing these panels. Use **Extreme Caution** when performing this process.
- Wall Assembly cannot take place if winds exceed 15 mph.
- Hold a safety meeting to determine who the signal person will be. The designated signal person will be the **ONLY** person to give direction to the Telehandler operator. However, anyone can give the **STOP** signal.
- Using rate and certified lift chains, attach two (2) hooks to the top of the wall panel.
- Attach tag lines to the bottom of the wall panel to assist in guiding the panel during installation.
- Equipment operator will place the wall panel in its designated location. While still supported by chains and the telehandler, install six (6) braces on the wall panel – three (3) braces on the inside of the wall and three (3) on the outside of the wall. Once the braces are installed, the lift chains can be removed.
- Install second wall panel following the same process. Once the second wall panel is in place, bolt the panels together. Be sure to leave the braces in place until at least half of the panels are installed.
- Repeat this process until the entire circumference is complete.

5.4 Tank Liner Installation

- The On-Site Supervisor and Safety Coordinator will determine if entry into the tank would be considered “confined space entry”. If designated as such, a confined space permit will be obtained and only those designated personnel will be permitted to enter.
- Liner install cannot take place if winds are over 10-15 mph.
- Attach pull line to the edge of the liner and pull line over top of the wall panels.
- Secure liner to the top of the wall panels using the (3) clamps per panel. While clamping, inspect the liner to ensure it is not in a “stressed” condition and be sure to leave enough slack so that the liner can conform to the walls once the tank is filled with water.
- Trim any excess liner material from the outer edge of the tank wall

5.5 Final Installation

- The tank is now ready for the necessary access ladders and discharge hoses to be installed.
- Remove all excess material from the property and dispose of appropriately.

5.6 Final Inspection

- The Quality Director will inspect the completed build to ensure that it was built to the customer specifications.

6. APPLICABLE REFERENCES

- Epic Tank Supervisor

LIST OF GEOMEMBRANE ROLLS

SOLMAX

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tél.: 1-450-929-1234 • Fax.: 1-450-929-2547 • www.solmax.com

SOLMAX APPROVED Quality Assurance

Project Name : PO 3292-2 - Odessa, TX

Project Number : 3292-2

Reference Number : 111550

Packing Slip Number : 224726

Roll Number	Product Code	Resin Lot Number	Manufactured Date	Resin Melt Index 190/2.16 g/10 min D1238	Resin Density g/cc D1505	OIT Spec Result min D3895	HPOIT Spec Result min D5885	ESCR SP-NCTL Spec Roll Tested hours D5397
LLDPE 40 mils White Reflective Smooth								
5-35524	1008348-56350-1	CJB810750	23-mars-18	0.32	0.919	*100* > 120		N/A
5-35539	1008348-56350-1	CJB810750	24-mars-18	0.32	0.919	*100* > 120		N/A
5-35540	1008348-56350-1	CJB810750	24-mars-18	0.32	0.919	*100* > 120		N/A
5-35542	1008348-56350-1	CJB810500	24-mars-18	0.36	0.919	*100* > 120		N/A
5-35543	1008348-56350-1	CJB810500	24-mars-18	0.36	0.919	*100* > 120		N/A
5-35550	1008348-56350-1	CJB810500	25-mars-18	0.36	0.919	*100* > 120		N/A
5-35551	1008348-56350-1	CJB810500	25-mars-18	0.36	0.919	*100* > 120		N/A
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5-35556	1008348-56350-1	CJB810500	25-mars-18	0.36	0.919	*100* > 120		N/A
5-35557	1008348-56350-1	CJB810500	25-mars-18	0.36	0.919	*100* > 120		N/A

Quantity (rolls) : 12

Solmax is not a design professional and has not performed any design services to determine if Solmax's goods comply with any project plans or specifications, or with the application or use of Solmax's goods to any particular system, project, purpose, installation or specification.

SOLMAX

MANUFACTURING QUALITY CONTROL

Test Results - Rolls

Solmax, 2801 Boul. Marie-Victorin, Varennes, Qc, Canada, J3X 1P7
Tél.: 1-450-929-1234 • Fax.: 1-450-929-2547 • www.solmax.com

Project Name PO 3292-2 - Odessa, TX

Reference Number : 111550

Project Number : 3292-2

Packing Slip Number : 224726

SOLMAX APPROVED Quality Assurance

Product 1008348-56350-1

LLDPE 40 mils White Reflective Smooth

CE Certificate = LL-40-SS-WB

Properties		Thickness ave / min.	Geo-membrane Density	Carbon Black Content	Carbon Black Dispersion	Tensile Yield Strength	Tensile Yield Elong.	Tensile Break Strength	Tensile Break Elong.	Tear Resist.	Puncture Resist.	Dimension. Stability	Asperity Height in / out
Unit		mils	g/cc	%	Cat. 1 and 2	ppi	%	ppi	%	lbs	lbs	%	mils
Test Method		D5199	D1505/D792	D4218 / D1603	D5596	D6693				D1004	D4833	D1204	
Frequency		Each roll		1/2 ro	1/10 ro	1/2 ro				1/5 ro	1/5 ro	Certied	N/A
Specification		40.0 / 36.0	≤ 0.939	2.0 - 3.0	Cat. 1 - Cat. 2			168	800	22	62	± 2	
5-35524	MD	40.6 / 39	0.937	2.68	10 /10 Views			211	873	25.7	92.9		/
	XD							214	980	27.1			
5-35539	MD	40.1 / 39	0.937	2.25	10 /10 Views			211	864	25.6	90.4		/
	XD							197	915	26.9			
5-35540	MD	40.4 / 39	0.937	2.25	10 /10 Views			211	864	25.1	88.9		/
	XD							197	915	27.3			
5-35542	MD	40.6 / 39	0.937	2.39	10 /10 Views			210	860	25.1	88.9		/
	XD							206	939	27.3			
5-35543	MD	40.6 / 39	0.937	2.23	10 /10 Views			213	866	25.1	88.9		/
	XD							209	942	27.3			
5-35550	MD	41.4 / 40	0.936	2.59	10 /10 Views			221	913	25.9	88.6		/
	XD							217	1011	27.7			
5-35551	MD	40.7 / 39	0.936	2.68	10 /10 Views			215	878	25.9	88.6		/
	XD							222	1031	27.7			
5-35552	MD	40.9 / 39	0.936	2.68	10 /10 Views			215	878	25.9	88.6		/
	XD							222	1031	27.7			
5-35553	MD	40.8 / 39	0.937	2.83	10 /10 Views			218	894	25.0	90.9		/
	XD							220	1028	27.2			
5-35554	MD	40.9 / 40	0.937	2.83	10 /10 Views			218	894	25.0	90.9		/
	XD							220	1028	27.2			
5-35556	MD	40.6 / 39	0.937	2.59	10 /10 Views			210	855	25.0	90.9		/
	XD							216	1021	27.2			
5-35557	MD	40.8 / 40	0.937	2.51	10 /10 Views			225	926	25.0	90.9		/
	XD							216	1001	27.2			

CoA Date: 02/13/2018

Certificate of Analysis

Shipped To: SOLMAX
2801 BOUL MARIE-VICTORIN
VARENNES QC J3X 1P7
CANADA

Recipient: Marcotte
Fax:

Delivery #: 89611704
PO #: 116755-0
Weight: 188300.000 LB
Ship Date: 02/13/2018
Package: BULK
Mode: Hopper Car
Car #: CPCX815050
Seal No: 110664

Product:
MARLEX 7104 POLYETHYLENE in Bulk
Additive levels have been tested and meet minimum the specification for this lot.
As a result, Standard OIT (by ASTM D 3895) is greater than 120 minutes (nominal value, not tested on every lot).

Lot Number: CJB810500

Property	Test Method	Value	Unit
Melt Index	ASTM D1238	0.36	g/10min
Density	D1505	0.919	g/cm3

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP (CPChem).
However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

KEVIN AYRES
QUALITY ASSURANCE SUPERINTENDENT

For CoA questions contact Melissa Alexander at +-832-813-4244

CoA Date: 02/14/2018

Certificate of Analysis

Shipped To: SOLMAX
2801 BOUL MARIE-VICTORIN
VARENNES QC J3X 1P7
CANADA

Recipient: Marcotte
Fax:

Delivery #: 89612650
PO #: 116787-0
Weight: 196150.000 LB
Ship Date: 02/14/2018
Package: BULK
Mode: Hopper Car
Car #: NAHX620433
Seal No: 122023

Product:
MARLEX 7104 POLYETHYLENE in Bulk
Additive levels have been tested and meet minimum the specification for this lot.
As a result, Standard OIT (by ASTM D 3895) is greater than 120 minutes (nominal value, not tested on every lot).

Lot Number: CJB810750

Property	Test Method	Value	Unit
Melt Index	ASTM D1238	0.32	g/10min
Density	D1505	0.919	g/cm3

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP (CPChem).
However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

KEVIN AYRES
QUALITY ASSURANCE SUPERINTENDENT

For CoA questions contact Melissa Alexander at +-832-813-4244

PRODUCT DATA SHEET

GSE UltraFlex Smooth Geomembrane

GSE UltraFlex is a smooth linear low density polyethylene (LLDPE) geomembrane manufactured with the highest quality resin specifically formulated for flexible geomembranes. This product is used in applications that require increased flexibility and elongation properties where differential or localized subgrade settlements may occur such as in a landfill closure application.

[*]

AT THE CORE:

An LLDPE geomembrane that is used in applications requiring increased flexibility and elongation properties, such as landfill closures and mining applications.

Product Specifications

These product specifications meet GRI GM17

Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5199	every roll	40 36	60 54	80 72	100 90
Density, g/cm^3 (max.)	ASTM D 1505	200,000 lb	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lb	 152 800	 228 800	 304 800	 380 800
Tear Resistance, lb	ASTM D 1004	45,000 lb	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lb	56	84	112	140
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)	Note(1)	Note(1)
Oxidative Induction Time, mins	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lb	>100	>100	>100	>100
TYPICAL ROLL DIMENSIONS						
Roll Length(2), ft			870	560	430	340
Roll Width(2), ft			22.5	22.5	22.5	22.5
Roll Area, ft^2			19,575	12,600	9,675	7,650

NOTES:

- (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2)Roll lengths and widths have a tolerance of ±1 %.
- GSE UltraFlex is available in rolls weighing approximately 3,900 lb.
- All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- *Modified.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

[DURABILITY RUNS DEEP]

For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

SKAPS Industries
571 Industrial Parkway
Commerce, GA 30529 (U.S.A.)
Phone (706) 336-7000 Fax (706) 336-7007
e-mail: info@skaps.com

SKAPS TRANSNET™ (TN)
HDPE GEONET 220

SKAPS TRANSNET™ Geonet consists of SKAPS GeoNet made from HDPE resin.

Property	Test Method	Unit	Required Value	Qualifier
Geonet				
Thickness	ASTM D 5199	mil.	220±20	Range
Carbon Black	ASTM D 4218	%	2 to 3	Range
Tensile Strength	ASTM D 7179	lb/in	45	Minimum
Melt Flow	ASTM D 1238[3]	g/10 min.	1	Maximum
Density	ASTM D 1505	g/cm^3	0.94	Minimum
Transmissivity[1]	ASTM D 4716	$m^2/sec.$	$2x10^{-3}$	MARV[2]

Notes:
1. Transmissivity measured using water at 21 ± 2ºC (70 ± 4ºF) with a gradient of 0.1 and a confining pressure of 10000 psf between stainless steel plates after 15 minutes. Values may vary between individual labs.
2. MARV is statistically defined as mean minus two standard deviations and it is the value which is exceeded by 97.5% of all the test data.
3. Condition 190/2.16

C-147 – Box 4

Bonding and Financial Assurance Cost Estimate

Financial Assurance Documents will be provided in a separate submission.

C-147 BOXES 5 & 6 FENCING AND SIGNAGE
SEE DESIGN/CONSTRUCTION PLAN

C-147 BOX 7 APPROVED VARIANCES
SEE SEPARATE SUBMISSION

BOX 8 SITING CRITERIA DEMONSTRATION

BOX 9
DESIGN/CONSTRUCTION PLAN
O&M PLAN
CLOSURE PLAN

9.
Recycling Facility and/or Containment Checklist:
Instructions: Each of the following items must be attached to the application. Indicate, by a check mark in the box, that the documents are attached.

- ☒ Design Plan - based upon the appropriate requirements.
- ☒ Operating and Maintenance Plan - based upon the appropriate requirements.
- ☒ Closure Plan - based upon the appropriate requirements.
- ☒ Site Specific Groundwater Data -
- ☒ Siting Criteria Compliance Demonstrations –
- ☒ **Certify that notice of the C-147 (only) has been sent to the surface owner(s)**

General

In this plan, the portion of the Produced Water Re-use Rule that is addressed by certain text is underlined.

Examination of the engineering drawings and the SOP for set-up (Appendix Engineering Drawings, Liner Specifications, Set Up) plus the history of solid performance of these ASTs demonstrates that the AST is designed and will be assembled to ensure the confinement of produced water, to prevent releases and to prevent overtopping due to wave action or rainfall. As the AST is less than 160 feet in diameter, wave action is not a meaningful consideration.

These ASTs are constructed of 12-foot high steel panels and are netted or employ the Mega Blaster Pro avian deterrent system to prevent ingress of migratory birds. ASTs will be enclosed by a 4-strand barbed wire fence. Thus, complies with the Rule to fence or enclose a recycling containment in a manner that deters unauthorized wildlife and human access and shall maintain the fences in good repair.

The operator shall post an upright sign no less than 12 inches by 24 inches with lettering not less than two inches in height in conspicuous places surrounding the containment. The operator shall post the sign in a manner and location such that a person can easily read the legend. The sign shall provide the following infom1ation: the operator's name, the location of the site by quarter-quarter or unit letter, section, township and range, and emergency telephone numbers.

Site Preparation

Foundation for AST

Preparation of the soils on site is required to form a dependable base for the AST in accordance with the SOP. Because the location of the AST is on an existing pad, the operator has stripped and stockpiled the topsoil for use as the final cover or fill at the time of closure.

Examination of the SOP shows that the AST contractor will conform to the following mandates of the Rule:

- the AST (recycling containment) will have a properly constructed foundation and interior slopes consisting of a firm, unyielding base, smooth and free of rocks, debris, sharp edges or irregularities to prevent the liner's rupture or tear.
- Geotextile will be placed under the liner where needed to reduce localized stress-strain or protuberances that otherwise may compromise the liner's integrity.
- If the AST contractor constructs the containment in a levee, the inside grade is no steeper than two horizontal feet to one vertical foot (2H: 1 V) and the outside grade no steeper than three horizontal feet to one vertical foot (3H: IV). As the secondary liner covers the levee with the anchor trench outside of the containment, there is for inspection and maintenance of the anchor trench.

The Operator will ensure that at a point of discharge into or suction from the recycling containment, the liner is protected from excessive hydrostatic force or mechanical damage and external discharge or suction lines shall not penetrate the liner.

Liner and Leak Detection Materials

The liner and geotextile specifications show that all primary (upper) liners in a recycling containment shall be geomembrane liners composed of an impervious, synthetic material that is resistant to ultraviolet light, petroleum hydrocarbons, salts and acidic and alkaline solutions. All primary liners shall be 45-mil LLDPE string reinforced (minimum). The primary liner of the AST employs two (2) 40-mil LLDPE smooth liners, which the OCD has determined is equivalent to one (1) 45-mil LLDPEr liner.

Secondary liners shall be 30-mil LLDPE string reinforced (minimum) or equivalent with a hydraulic conductivity no greater than 1 x 10-9 cm/sec. The secondary liner is also a 40-mil LLDPE smooth liner, which the OCD has determined is equivalent to a 30-mil LLDPEr liner.

Liner compatibility shall meet or exceed the EPA SW-846 method 9090A or subsequent relevant publications.

Install Secondary Liner, Leak Detection System and Secondary Containment

All AST containments holding produced water will have a primary (upper) liner and a secondary (lower) liner with a leak detection system appropriate to the site's conditions. The edges of all secondary liners shall be anchored in the bottom of a compacted earth-filled trench. The anchor trench shall be at least 18 inches deep.

The AST Contractor (MustangExtreme) will cause the recycling containment will have a leak detection system between the upper and lower geomembrane liners that shall consist of 200-mil geonet to facilitate drainage. The leak detection system shall consist of a properly designed drainage and collection and removal system placed above the lower geomembrane liner in depressions and sloped to facilitate the earliest possible leak detection (see attached drawing).

The presence of the secondary containment levee or pre-fabricated secondary containment meets the OCD Rule mandate that a recycling containment shall design the containment to prevent run-on of surface water. The containment shall be surrounded by a berm, ditch or other diversion to prevent run-on of surface water.

AST Tank Setup

As with the secondary liner, MustangExtreme will minimize liner seams and orient them up and down, as much as possible, not across, a slope. Factory welded seams shall be used where possible. MustangExtreme will employ field seams in geosynthetic material that are thermally seamed. Prior to field seaming, MustangExtreme shall overlap liners four to six inches and minimize the number of field seams and corners and irregularly shaped areas. There shall be no horizontal seams within five feet of the AST bottom. Qualified personnel shall perform field welding and testing.

Fluid Injection/Withdrawal Flow Diverter

The injection or withdrawal of fluids from the containment shall be accomplished through a header, diverter or other hardware that prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes.

General Specifications

In this plan, the portion of the Produced Water Re-use Rule that is addressed by certain text is underlined. This plan provides additional protocols to cause the proposed recycling containments (ASTs) to conform to NMOCD Rules.

The operator will maintain and operate the recycling containments and facility in accordance with the following plan to contain liquids and maintain the integrity of the liner to prevent contamination of fresh water and protect public health and the environment.

- The operator will use the treated produced water in the containments for drilling, completion (stimulation), producing or processing oil or gas or both. If other uses are planned, the operator will notify the OCD though the submission of a modified C-147.
- For all exploration and production operations that use produced water, the operator will conduct these activities in a manner consistent with hydrogen sulfide gas provisions in 19.15.11 NMAC or NORM provisions in 19.15.35 NMAC, as applicable.
- The operator will address all releases from the recycling and re-use of produced water in accordance with 19.15.29 NMAC.
- The operator will not discharge into or store any hazardous waste in the recycling containments, but they may hold fluids such was freshwater, brackish water, recycled and treated water, water generated by oil or gas processing facilities, or other waters that are gathered for well drilling or completion. The recycling facility will not be used for the disposal of produced water. The operator will maintain the containments free of miscellaneous solid waste or debris.
- The operator will verify that no oil is on the surface of the contained fluid. If oil is observed, the oil shall be removed using an absorbent boom or other device and properly disposed at an approved facility. An absorbent boom or other device will be maintained on site.
- The operator will install and use a header and diverter described in the design/construction plan in order to prevent damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes during injection or withdrawal of liquids.
- Pursuant to an approved variance, the operator will maintain at least 2-feet of freeboard in each AST containment. For in-ground containments, the operator will maintain at least 3-feet of freeboard. Under extenuating circumstances, which will be noted on the inspection log as described below, the operator may temporarily exceed the freeboard mandate.
- If the liner develops a leak or if any penetration of the liner occurs above the liquid's surface, then the operator will repair the damage or initiate replacement of the liner within 48 hours of discovery or will seek a variance from the division district office within this time period.
- If visible inspection suggests that the liner developed a leak or if any penetration of the liner occurs below the liquid's surface, then the operator will remove all liquid above the damage or leak line within 48 hours of discovery. The operator will also notify the district division office within this same 48 hours of the discovery and repair the damage or replace the liner.
- In the event of a leak due to a hole in the liner, the following steps will be followed:

1. If the source of the fluid is uncertain, comparative field tests may need to be performed on both the water in the containment and that which may have been released (e.g. pH, conductance, and chloride).
2. If the fluid is found to be coming from the containment, determine the location from which the leak is originating.
3. Mark the point where the water is coming out of the tank.
4. Locate the puncture or hole in the liner.
5. Empty the containment to the point of damage in liner.
6. Clean area of liner that needs to be repaired.
7. Cut out piece of material (patch or tape) to overlay liner.
8. Either weld the patch to the injured area in the liner or apply tape over the rupture.
9. Make sure rupture is completely covered.
10. Monitor as needed.

- The operator will inspect and remove, as necessary, surface water run-on accumulated in the secondary containment.

Monitoring, Inspections, and Reporting

The containment will contain enough produced water to prevent any shifting of the liner. Weekly inspections shall occur when there is 1-foot depth or more of produced water in the containment. Monthly inspections shall occur when there is less than 1-foot depth of produced water in the containment, as well as when the ASTs are emptied and prior to refilling. An inspection log will be maintained by the operator and will be made available to the division upon request. Inspection may include: freeboard monitoring, leak detection, identifying potential hazards that may have developed, change in site conditions or if the contents of the containment change from the initial use. An "Inspection Form" to be filled out during these routine inspections.

The "AST Visual Inspection Checklist" form to be filled out by Solaris during periodic inspections. The form provides a list of observations that will enable early detection of uneven tank panel settlement, soil settlement, liner damage, insufficient liner slack, or leaks. The form is reproduced at the end of this section.

The form "Tank Panel Visual Inspection Check Sheet" will be used by Solaris to inspect individual containment panels and connections titled.

Monitoring and Inspection Checklist (routine weekly or monthly inspections):

- Visually inspect the liner. If a liner's integrity is compromised, or if any penetration of the liner occurs above or below the water surface, then the operator will notify the appropriate Division district office within 48 hours (phone or email).
- Inspect the system for injection or withdrawal of liquids from the ASTs and document that the design prevents damage to the liner by erosion, fluid jets or impact from installation and removal of hoses or pipes is working appropriately.
- Inspect the water surface for visible oil.
- Measure the freeboard.

- Inspect the secondary containment berm around the ASTs to check for erosion and collection of surface water run-on.
- If H2S is a documented potential issue with the containment, measure H2S concentrations on the down-wind side of the facility when produced water is present.
- Inspect the secondary containment for evidence of damage and monitor for leakage.
- Inspect the netting for damage or failure. If netting is jeopardized, repair of the netting shall occur within 48 hours.
- At least monthly, inspect netting (may not be used if Mega Blaster Pro avian deterrent is used) for dead wildlife, including migratory birds. Operator shall report the discovery of a dead animal to the appropriate wildlife agency and to the district within 30 days of discovery. Further prevention measures may be required.

If observed conditions indicate a potential tank failure is imminent, the vicinity will be immediately cleared and the AST will be drained.

Cessation of Operations

If less than 20% of the total fluid capacity is utilized every six months, beginning from the first withdraw, operation of the facility has ceased and the division district office will be notified. The division district may grant an extension not to exceed six months to determine the cessation of operations.

The operator will remove all fluids from the recycling facility within 60 days of cessation of operations. An extension, not to exceed 2 months, may be granted by the district division for the removal of fluids from the facility.

The breakdown of the containments follows the reverse order of the setup steps presented in the set up manual.

Inspection Form

Date: _____

Gamma Ridge Recycling Containments and Facility

(weekly inspection when fluids are present, monthly otherwise)

Tank ID: _____

Fluid Level: _____ Tank contents: _____

Inspection Task	Results		Remarks, Observations, and/or Remedial Actions
Visible Oil on Surface	☐ None Observed	☐ Yes, Describe Action	
	An absorbent boom or similar device is located on site to remove visible oil from surface.		
At least 2 ft of freeboard	☐ Yes	☐ No, Measure Freeboard	
Evidence of surface water run-on	☐ None Observed	☐ Yes, Describe	
	Check for excessive erosion of perimeter berms.		
Birds or wildlife in net or screen	☐ None Observed	☐ Yes, Describe	
	Within 30 days of discovery, report dead birds or wildlife to the appropriate agency (USFWS, NMDGF) and to NMOCD district division office.		
Damage to netting or screen	☐ None Observed	☐ Yes, Describe	
Rupture of Liner	☐ None Observed	☐ Yes, Describe	
	If rupture is above fluid level, repair within 48 hours. If below fluid level, remove fluid above within 48 hours, notify NMOCD district division office, and repair.		
Clips or clamps properly securing liner	☐ Yes	☐ No, Describe	
If low level, enough liner slack on panel wall	☐ Yes	☐ No, Describe	
Uneven gaps between panels	☐ None Observed	☐ Yes, Describe	
Signs of tank settlement	☐ None Observed	☐ Yes, Describe	

Erosion of soil surrounding tank (10 ft radius)	☐ None Observed	☐ Yes, Describe	
Running water on the ground	☐ None Observed	☐ Yes, Describe	
Unusual ponding of fluid inside berm	☐ None Observed	☐ Yes, Describe	
	Field test (pH, Cl-, conductance, etc.) ponded fluid and compare to fluid in tank. If tank is determined as the source, locate and repair rupture within 48 hours. Notify NMOCD district division office and repair.		
Rust or corrosion on panels, stairs, or hardware	☐ None Observed	☐ Yes, Describe	
Damage to any hardware	☐ None Observed	☐ Yes, Describe	

Additional Observations or Actions: _____

_____

_____

_____

_____

_____

_____

_____

_____

Inspected by: _____

Closure Plan

The containments are expected to contain a small volume of solids, the majority of which will be windblown sand and dust with some mineral precipitates from the water.

The operator will notify the division district (phone or email) before initiating closure of the containments and/or facility.

Excavation and Removal Closure Plan – Protocols and Procedures

1. Residual fluids in the containments will be sent to disposal at a division-approved facility.

2. The operator will remove all solid contents and transfer those materials to the following division-approved facility:
   Disposal Facility Name: R360 Permit Number NM 01-0006

3. If possible, geomembrane textiles and liners that exhibit good integrity may be recycled for use as an underliner of tank batteries or other use as approved by OCD via a variance request.

4. Disassemble the recycling containment infrastructure according to manufacturer's recommendations

5. After the disassemble of the containments and removal of the contents and liners, soils beneath the tanks will be tested as follows:
   a. Collect a five-point (minimum) composite from beneath the liner to include any obviously stained or wet soils, or any other evidence of impact from the containments for laboratory analyses for the constituents listed in Table I of 19.15.34.14 NMAC.
   b. If any concentration is higher than the parameters listed in Table I, additional delineation may be required and closure activities will not proceed without Division approval.

If all constituents' concentrations are less than or equal to the parameters listed in Table I, then the operator will backfill the facility as necessary using non-waste containing, uncontaminated, earthen material and proceed to reclaim the surface to pre-existing conditions.

Closure Documentation

Within 60 days of closure completion, the operator will submit a closure report (Form C-147) to the District Division, with necessary attachments to document all closure activities are complete, including sampling results and details regarding backfilling and capping as necessary.

In the closure report, the operator will certify that all information in the report and attachments is correct and that the operator has complied with all applicable closure requirements and conditions specified in the closure plan.

Reclamation and Re-vegetation

The operator will reclaim the surface to safe and stable pre-existing conditions that blends with the surrounding undisturbed area. "Pre-existing conditions" may include a caliche well pad that existed prior to the construction of the recycling containment and that supports active oil and gas operations.

Areas not reclaimed as described herein due to their use in production or drilling operations will be stabilized and maintained to minimize dust and erosion.

For all areas disturbed by the closure process that will not be used for production operations or future drilling, the operator will

1. Replace topsoils and subsoils to their original relative positions.
2. Grade, so as to achieve erosion control, long-term stability and preservation of surface water flow patterns.
3. Reseed in the first favorable growing season following closure.

Federal, state trust land, or tribal lands may impose alternate reclamation and re-vegetation obligations that provide equal or better protection of fresh water, human health, and the environment. Re-vegetation and reclamation plans imposed by the surface owner will be outlined in communications with the OCD.

The operator will notify the division when the site meets the surface owner's requirements or exhibits a uniform vegetative cover that reflects a life-form ratio of plus or minus fifty percent (50%) of pre-disturbance levels and a total percent plant cover of at least seventy percent (70%) of pre-disturbance levels, excluding noxious weeds.

The operator will notify the Division when reclamation and re-vegetation is complete.