STATE OF UTAH
DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF WATER QUALITY
WATER QUALITY BOARD
P.O. BOX 144870
SALT LAKE CITY, UTAH 84114-4870

Ground Water Discharge Permit
Permit No. UGW010016

In compliance with the provisions of the Utah Water Quality Act, Title 19, Chapter 5, Utah Code Annotated 1953, as amended, the Act,

Smithfield Hog Production
P.O Box 100
Milford UT 84751

Hereafter referred to as the Permittee, is granted a Ground Water Discharge Permit the operation of the Pinnacles Finisher Sites hog production facilities at 52 farm sites north of Milford, Utah. The farm sites are located in Salt Lake Base & Meridian:

Section	Township	Range	County
29,30,31,32,33	25S	9W	Millard
7,17,18,19,20,30,31	26S	9W	Beaver
13,15,23,26,27,33,34,35	26S	10W	Beaver
5	27S	9W	Beaver
3	27S	10W	Beaver

Centralized Lat Lon: North Area: 38.57167 -112.9069 South Area: 38.5167 -112.9405

This permit is based on representation made by the Permittee and other information contained in the administrative record. It is the responsibility of the Permittee to read and understand all provisions of this permit.

The facility shall be constructed and operated in accordance with conditions set forth in the permit and the Utah Administrative Rules for Ground Water Quality Protection (UAC R317-6).

This permit shall become effective on June 1, 2017

This permit and authorization to operate shall expire at midnight May 31st, 2022

Signed this 31st day of May, 2017.

Kim Shelley
Acting Director

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APPENDIX A Summary of Construction Details for Primary and Secondary Lagoons

Applicable Smithfield Operations Documents for this permit include but are not limited to:

Smithfield Sampling and Analysis Plan

Anaerobic Lagoon Systems Operation and Maintenance Manual

Spill Prevention and Response Manual

Sludge Disposal and Farm Closure Plan

PART I CONSTRUCTION PERMIT ISSUANCE

A. AUTHORIZED CONSTRUCTION

As part of this ground water discharge permit, a construction permit is hereby issued to Pinnacle Finisher Farms as summarized below and detailed in Appendix A. Construction for this project will consist of 52 farm sites with 4 barns for a total of 208 barns. Each Farm Site will have two Waste Containment Basins, one deeper Primary Containment Basin and one Shallow Evaporation Basin. Application Addendum #1 also requested that there be an option of installing Digester Technology with an Evaporation Basin rather than the deeper Primary Containment Basin. Since the Digester Technology has not yet been determined, a new Addendum to the Construction Permit will need to be submitted and approved by DWQ. At a minimum, all Digesters and Basins will be required at have the same groundwater protection measures such as 60 mil HDPE liner, compacted soil subliner, and monitoring wells. A truck wash facility for the Pinnacle Finisher Farms will be built.

B. DESIGN AND CONSTRUCTION

Under authority of the Utah Water Quality Act, Section 19-5-108(1) Utah Code Ann. 1953, as amended and Utah Administrative Code R317-1, the authorized facilities will be constructed in accordance with the engineering design plans and specifications attached as Appendix A.

The following is a summary of the proposed major construction projects:

Construction of 52 Finisher Farm Sites each with the following:

- 4 Finisher Barns, each barn can contain up to 4800 hogs sized from 60 to 250 lbs.
- 2 Wastewater Containment Basins – One deeper Primary Containment Basin (17.5 million gallons, 53.7 ac-ft) and one shallow Secondary Evaporation Basin (4.8 million gallons, 14.7 ac-ft). The Digester Technology may replace the deeper Primary Containment Basin.

Construction of a Truck Washing Facility with a 1.3 million gallon pond (3.99 af-ft).

The plans and specifications, as submitted, comply with the Utah Water Quality Rules, (R317, Utah Administrative Code) and the following conditions:

1. Construction activities that disturb one acre or more are required to obtain coverage under the Utah Pollutant Discharge Elimination System (UPDES) Storm Water General Permit for Construction Activities. The permit requires the development of a storm water pollution prevention plan (SWPPP) to be implemented and updated from the commencement of any soil disturbing activities at the site until final stabilization of the project. For more information, or to obtain permit coverage on-line, please go to: http://www. waterquality. utah.gov/UPDES/stormwater.

2. Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof.

3. A written operations and maintenance manual, containing a description of the functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.

4. The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, issued a ground water discharge permit for the facility, and provided written authorization to place the constructed facilities in service.

The plans and specifications for this project have been stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes running down the pond side slopes, and fastened to posts at the top of the dikes should be available to allow anyone trapped in the ponds to escape.

Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements:

Soil Subgrade

- Proctor Curves,
- Soil Classification,
- Field Compaction Testing, and
- Subgrade Acceptance Certification.

Concrete

- Concrete Mix Verification;
- Concrete reinforcement;
- Waterstop placement;
- Concrete ASTM Testing Method, Frequency, and Results;
- Concrete Testing Pass/Fail Criteria, and
- Crack Inspection and Repair.

Flexible Membrane Liner

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.

PART II SPECIFIC PERMIT CONDITIONS

A. GROUND WATER CLASSIFICATION

Ground water in the Escalante Valley near the Pinnacle Finisher Farm sites is classified as Class II and Class III Drinking Water Quality. This interim determination may be changed when subsequent compliance monitoring determines the ground water quality at the multi-farm sites.

B. BACKGROUND GROUND WATER QUALITY

Based on regional Utah Geological Survey ground water quality report submitted with the application, total dissolved solids (TDS) concentrations in the general area range from 226 to 4,600 milligrams per liter (mg/l) and no parameters are above Utah Ground Water Quality Standards.

Table 1: Range of Background Ground Water Quality of shallow aquifer in the Escalante Valley Milford area, UT*

Parameter	(mg/l)
pH (units)	7.2
Total Dissolved Solids	226 – 4,600
Chloride	111 - 268
Nitrate as N	<1 – 5
Alkalinity total	238 – 515
Sulfate	67 – 274
Calcium	57 – 207
Magnesium	20 – 52
Potassium	3 – 6.5
Sodium	26 – 67

*Utah Geological Survey Cooperative Investigations Report No. 56

C. GROUND WATER PROTECTION LEVELS

Table 2 provides interim ground water protection levels for containment basin compliance monitoring wells. After completion of the accelerated background monitoring program in accordance with Part II.I.1 of this permit, ground water protection levels will be established for the site utilizing the provisions outlined in UAC R317-6-4 for the parameters listed in Table 2. The interim protection levels of Table 2 will be modified if necessary.

Table 2: Interim Ground Water Protection Levels

Parameter	Protection Level (mg/l)
pH (units) [(a)]	6.5 - 8.5
Total Dissolved Solids	1500
Chloride[(c)]	250
Bicarbonate	250
Nitrate + Nitrite as N[(b)]	2.5

(a) Equals Ground Water Quality Standard
(b) Equals 0.25 x Ground Water Quality Standard.
(c) EPA Secondary Drinking Water Standard is 250 mg/l

D. BEST AVAILABLE TECHNOLOGY (BAT) STANDARD

The administration of this permit is founded on the use of Best Available Technology (BAT), in accordance with the requirements of UAC R317-6-1.3. The construction permit (PART I) issued with this discharge permit describes construction standards for the wastewater containment basins. Compliance with the requirements for use of BAT will be demonstrated by construction, operation and maintenance of the containment basins according to the construction permit.

Achievement of these performance standards will be demonstrated by:

1) Only hog wastes may be disposed of in the containment basins.

The hog waste is drained into a primary anaerobic digestion basin for treatment and storage. These farm sites each have at least one primary basin and one containment basin for evaporation. The primary basins are sized to accept up to 1.8 cubic feet of volume per pound of live animal weight (LAW) in the digestion basin and provide enough surface area for evaporation of water in the evaporative basin. The containment basins are lined with 60-mil flexible membrane liner (FML). The liners are designed to yield a liner hydraulic permeability coefficient no greater than 1×10^{-7} cm/sec. The liner type, dimensions, maximum operating depth, free board, liquid contact area, and operating volume of each primary and containment basin for each farm site are presented in the construction permits and construction permit applications covering those units. This information is summarized in Appendix A.

Manure Drying Pads – Smithfield Hog Production has 52 farm sites in operation for this permit, and each site has a primary anaerobic basin where manure solids are collected. It is necessary to remove accumulated solids from the bottom of each primary digestion basin at the farm sites. Circle Four Farm has implemented a program to remove the solids from the digestion basins and dry the manure on a drying pad constructed near the digestion basin. The manure is a nutrient source and the drying of the manure will allow the nutrients to be sold and applied to local cropland at agronomic rates.

Manure drying pads at any of the facilities covered by this permit may not be performed on any parcel of land without first notifying and receiving the approval of the Director. Pad construction must be performed in accordance with the most recently revised and approved version of the Manure Drying Program Plan.

2. Performance Standard for Best Available Technology
Compliance with the requirements for use of best available technology (BAT) will be demonstrated by construction, maintenance and operation of the digestion basin and evaporation basins according to the construction permit (Part I).

a. *Liner* - Performance of FML liner will be evaluated for compliance with the requirements of this permit. Liner integrity will be evaluated prior to operation with the approved construction quality assurance/quality control (QA/QC) plans contained in the application for this permit.

The liner integrity must be maintained. Deterioration of materials or any other situation which prevents the liner from functioning according to the approved design

shall constitute non-compliance with this permit. After completion of construction, synthetic liners must remain in contact with the prepared soil base of the containment basins, as provided by liner slack and ballast when necessary to minimize billowing caused by the wind. Adequate slack and ballast when necessary will also be provided to minimize stresses and suspensions of the liner at the toe of the dikes due to variations in ambient temperature and incident solar radiation. Any large suspensions or billowing of synthetic liner is considered a failure of this performance standard. The formation of bulges or whales in the liner when the basins contain water is an indication of a leak in the liner. When whales form in the liner, the liner must be repaired in an expeditious manner. Impact to the underlying soils must be assessed in conformance with the provisions detailed in the most recently revised and approved version of the Spill Prevention and Response Plan.

b. *Digestion basins* - The performance standard for anaerobic digestion basin operation is based on operating and maintaining the digestion basins in a manner consistent with the design criteria detailed in the construction permits. The design of the primary lagoons is based on a total volumetric capacity of approximately 1.80 cubic feet per pound of LAW, consisting of 1.2 cubic foot for treatment and 0.6 cubic foot for 20-year sludge accumulation for finisher hogs. The evaporation basins are designed to have a normal operating depth with additional surface area needed to maintain a constant depth, at the same time of each year and evaporate the excess wastewater during each annual cycle. Construction dimensions for each primary and secondary at each farm site are summarized in Appendix A.

The anaerobic digestion basin system must be operated and maintained in accordance with the most recently revised and approved Smithfield Anaerobic Lagoon Systems Operation and Maintenance Manual. Performance of the anaerobic digestion basins will be demonstrated by the monitoring specified in Part II.F.2.b.

Smithfield may also choose to install a digester with an evaporation basin. The exact design of this system is not finalized yet, but construction drawings will be submitted and approved prior to construction. The design of the system will meet all of the minimum design criteria as stated above to protect groundwater quality.

3) No ground water degradation beyond permit limits established in Table 2 as measured by compliance monitoring wells.

4) Compliance Monitoring Wells - The Permittee will monitor one upgradient and two downgradient compliance monitoring wells at each of the containment basin systems.

5) Protection of Monitoring Wells - All compliance monitoring wells must be protected from damage due to surface vehicular traffic or contamination due to surface spills, and shall be maintained in full operational condition for the life of this permit. Any compliance monitoring well that becomes damaged beyond repair or is rendered unusable for any reason will be replaced by the Permittee within 90 days or as directed by the Director.

E. BEST MANAGEMENT PRACTICES

1) The Permittee shall operate the facility such that the ground water quality standards (UAC R317-6-2) and ground water protection levels in Table 2 that were developed

for this permit are not exceeded in the unconfined aquifer underlying the site, or other aquifers that may be impacted by facility operations. Utah ground water regulations also contain standards for contaminants such as metals, pesticides and volatile organic compounds. Accordingly, the Permittee must not discharge these or any other contaminants that could impair beneficial uses of the ground water.

2) Permittee shall ensure proper handling of plant wastewater, prompt cleanup of any releases, and an ongoing operation, inspection, and maintenance program for ancillary facilities associated with this permit.

3) Closure Plan - Any digestion basin system closure must be undertaken in compliance with the most recently revised and approved version of the Sludge Disposal and Farm Closure Plan that has been prepared by the permittee.

Prior to closure of any containment basin system, the permittee shall submit to the Director a site-specific closure plan for disposition of the liquids, solids and liner material of the basin(s) to be closed. A plan for land application of the liquids and solids at appropriate agronomic rates, on-site at manure drying pads, or other disposal methods, will be submitted for approval by the Director. The containment basin liner material will be tested according to an approved testing plan to determine an appropriate means of disposal, which will not lead to ground water contamination. The monitoring wells will continue to be sampled for a post closure monitoring period as determined by the Director.

F. COMPLIANCE MONITORING REQUIREMENTS

The permittee is required to monitor ground water quality and source activities that could potentially impact the ground water quality. Monitoring shall be performed according to the provisions of this permit.

The network of monitoring wells shall provide the ability to detect contamination in the uppermost groundwater aquifer, which could result from excess containment basin seepage. Under the provisions of this permit, ground water contamination in the shallow aquifer under the containment basin sites would be a reason for the permittee to take remedial action before further degradation occurs.

1. Compliance Monitoring Wells - The network of monitoring wells shall provide the ability to detect contamination in the uppermost groundwater aquifer, which could result from excess containment basin seepage. Under the provisions of this permit, ground water contamination in the shallow aquifer under the containment basin sites would be a reason for the permittee to take remedial action before further degradation occurs.

a) Location of Monitoring Wells - The permittee has installed a monitoring well system at each existing farm site to establish the ground water gradient underlying each containment basin system and to monitor ground water quality in both the upgradient and downgradient wells. The permittee will be required to drill additional wells if the ground water flow directions are different than expected as revealed when the wells are drilled. The locations of any new wells installed for the farm sites covered under this permit shall be submitted in this format: latitude and longitude relative to NAD83.

b) Damage to Monitoring Wells - If a monitoring well is damaged or is otherwise rendered inadequate for its intended purpose or if a previous hydraulic gradient between two monitor wells is reversed, the Director shall be notified in writing within five days of the permittee becoming aware of the condition.

c) Future Modification of Monitoring Well Network - If at any time the Director determines the monitoring well network to be inadequate due to a change in gradient or for any other reason, the permittee shall submit within 30 days of receipt of notification a plan and compliance schedule to modify the monitoring well network.

2. Monitoring Details

a) Semi-annual Ground Water Quality Compliance Monitoring - Semi-annual ground water compliance monitoring shall be conducted by the permittee under the provisions of this permit. The monitoring requirements listed below apply to all upgradient and downgradient wells. The protection levels for indicator parameters are calculated using the Ground Water Quality Protection Regulations (UAC R317-6-4), background water quality data, and historical well data.

Sample collection, handling and analysis shall be conducted in accordance with the most recently revised and approved version of the Smithfield Sampling and Analysis Plan.

Unless revised by the Smithfield Sampling and Analysis Plan, the field parameters to be measured during the semi-annual monitoring shall be: temperature, specific conductance, pH, and ground water elevation. Ground water elevations shall be determined according to Part II.F.2.e.

Unless revised by the Smithfield Sampling and Analysis Plan, the laboratory parameters to be measured during the semi-annual monitoring shall be: Nitrate plus Nitrite as Nitrogen, Bicarbonate, Chloride, and Total Dissolved Solids (TDS).

The results of the compliance monitoring shall be submitted to the Division of Water Quality along with supporting field data in the Semi-annual Ground Water Quality Monitoring Report.

b) Annual Monitoring - Annual compliance monitoring shall be conducted by the permittee under the provisions of this permit according to the most recently revised and approved version of the Circle Four Sampling and Analysis Plan, the Circle Four Anaerobic Lagoon Systems Operation and Maintenance Manual, and the Circle Four Sludge Disposal and Farm Closure Plan as indicated below.

The waste water from a representative operating primary manure digestive basin shall be analyzed annually for the following parameters: temperature, specific conductance, pH, nitrate plus nitrite as nitrogen, ammonia, total Kjeldahl nitrogen (TKN), sulfate, bromide, chloride, total dissolved solids, sodium, potassium, calcium, magnesium, bicarbonate, carbonate, phosphorus, arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc.

Sample collection, handling, and analysis shall be conducted in accordance with the most recently revised and approved version of the Smithfield Sampling and Analysis Plan. Samples shall be taken in the late summer when parameter concentrations should be at their yearly maximum. Analyses for nitrogen species shall be conducted at the same laboratory. Results of the wastewater monitoring accompanied by any supporting raw data shall be submitted to the Division of Water Quality with the next Semi-annual Ground Water Quality Monitoring Report.

Lagoon performance monitoring shall be conducted according to the most recently revised and approved version of the Anaerobic Lagoon Systems Operation and Maintenance Manual. Results of the lagoon performance monitoring accompanied by any supporting raw data shall be submitted to the Division of Water Quality.

Sludge profiling of all primary lagoons shall be conducted according to the most recently revised and approved version of the Sludge Disposal and Farm Closure Plan. The results of this profiling accompanied by any supporting raw data shall be submitted to the Division of Water Quality.

c) Background Ground Water Quality Monitoring - Background ground water quality will be established in the upgradient monitoring wells for all the farm sites covered by this permit for the purpose of establishing protection levels. The samples will be analyzed for the following parameters: temperature, specific conductance, pH, nitrate plus nitrite as nitrogen, ammonia, bicarbonate, chloride, total dissolved solids (TDS), sodium, potassium, magnesium, calcium, carbonate, and sulfate. At least one sample from each downgradient monitor well was also analyzed for all these parameters. If any additional upgradient or downgradient wells are installed, the permittee shall collect quarterly samples at equal time intervals over a two-year period from each upgradient well and each downgradient well. The samples shall be analyzed for the parameters listed above. Sample collection, handling, and analysis shall be conducted in accordance with the most recently revised and approved version of the Smithfield Sampling and Analysis Plan. The results accompanied by any supporting data shall be submitted to the Division of Water Quality with the next Semi-annual Ground Water Quality Monitoring Report.

d) Depth to Ground Water and Ground Water Elevation - Depth to ground water shall be measured to the nearest 0.01 foot, below the reference point at the top of the well casing. For each monitoring well, the permittee shall submit a report to the Division of Water Quality accompanied by a surveyors report indicating the elevation, in feet above mean sea level to the nearest 0.01 foot, of the reference point at the top of the well casing from which all ground water depths are measured.

Ground water elevations shall be measured semi-annually at all active monitoring wells at the farm sites covered by this permit. Ground water elevations shall be calculated by subtracting the depth to ground water measurement from the elevation of the reference point at the top of the well casing and reported in feet above mean sea level to the nearest 0.01 foot. Ground water elevation

calculations for each semi-annual ground water sampling event shall be submitted with the Semi-annual Ground Water Quality Monitoring Report.

Ground water potentiometric contour maps shall be constructed from these data once annually and submitted to the Division of Water Quality with the next Semi-annual Ground Water Quality Monitoring Report.

e) Laboratory Approval - All water analyses shall be performed by a laboratory certified by the State of Utah in accordance with the most recently revised and approved version of the Smithfield Sampling and Analysis Plan and the provisions of UAC R317-6-6.3.

f) Future Modification of Monitoring Plan - If the Director or permittee determine that hydrogeologic conditions at any farm site do not allow a direct comparison of upgradient and downgradient ground water quality, protection levels and compliance limits shall be established based on ground water quality in the down gradient well. In this event, the Director shall direct the permittee to begin collection of background water quality data in the down gradient well according to Part II.F.2.c. Alternatively, the permittee may propose another method of compliance monitoring within 90 days of the determination that upgradient-downgradient comparison is not possible.

3. BAT Performance Monitoring Program

Permittee shall conduct a containment basin inspection and maintenance program. Documentation of compliance with this program shall be maintained on site for review by representatives of the Division.

G. NON-COMPLIANCE STATUS

1. Probable Out-of-Compliance Status - The permittee shall evaluate results of each ground water sampling event to determine any exceedence of the Ground Water Protection Levels found in Table 2. Upon determination that a Ground Water Protection Level has been exceeded in the ground water, the permittee shall:

a. Immediately re-sample the monitoring well found to be in probable out-of-compliance status for laboratory analysis of the exceeded protection level parameter(s). Submit the analytical results thereof, and notify the Director of the probable out-of-compliance status within 30 days of the initial detection.

b. Upon exceedence of any one parameter listed in Table 2 for two consecutive sampling events, immediately implement an accelerated schedule of quarterly sampling analysis, consistent with the requirements of this permit. This quarterly sampling will continue for at least two quarters or until the compliance status can be determined by the Director. Reports of the results of this sampling will be submitted to the Director as soon as they are available, but not later than 30 days from each date of sampling.

c. Exceedance in Upgradient Well - If the protection levels referenced in Table 2 are exceeded in any upgradient well, the permittee shall note the exceedance in the next semi-annual monitoring report. If ground water elevations indicate that the well is no longer upgradient of the lagoon, or if ground water mounding has developed, the exceedance shall be treated as a non-compliance event according to the provisions of Part II.G. As part of the resolution of the non-compliance situation, the permittee may be required to propose changes to the monitoring plan for the site sufficient to demonstrate that ground water is not being polluted in violation of UAC R317-6.

2. Out-of-Compliance Status Based on Confirmed Exceedance of Permit Ground Water Protection Levels

a. Out of Compliance Status shall be defined as follows:

For parameters that have been defined as detectable in the background and for which protection levels have been established, out-of-compliance shall be defined as two consecutive samples exceeding the protection level. Out of compliance status for exceedance of bicarbonate occurs only when the respective compliance limit is exceeded and the compliance limit for total dissolved solids is also exceeded.

b. Notification and Accelerated Monitoring - upon determination by the permittee or the Director, in accordance with UAC R317-6-6.17, that an out-of-compliance status exists, the permittee shall:

1) Verbally notify the Director of the out-of-compliance within 24 hours, and provide written notice within 5 days of the detection, and

A written submission shall also be provided to the Director within five days of the time that the permittee becomes aware of the noncompliance. The written submission shall contain:

i) A description of the noncompliance and its cause;

ii) The period of noncompliance, including exact dates and times;

iii) The estimated time noncompliance is expected to continue if it has not been corrected; and,

iv) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

2) The permittee shall verbally report any noncompliance, which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of the circumstances. The report shall be made to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (8:00 am - 5:00 pm Mountain Time Monday through Friday).

3) Continue an accelerated schedule of quarterly ground water monitoring for at least two quarters and continue quarterly monitoring until the facility is brought into compliance as determined by the Director.

c. Source and Contamination Assessment Study Plan - within 30 days after the written notice to the Director required in Part II.G.2.b.1 above, the permittee shall submit an assessment study plan and compliance schedule for:

i) Assessment of the source or cause of the contamination, and determination of steps necessary to correct the source.

ii) Assessment of the extent of the ground water contamination and any potential dispersion.

iii) Evaluation of potential remedial actions to restore and maintain ground water quality, and ensure that the ground water standards will not be exceeded at the compliance monitoring locations.

3. Out-of-Compliance Status Based Upon Failure To Maintain Best Available Technology - In the event that BAT monitoring indicates a violation of any of the technology or performance management standards outlined in Part II .D and E of this permit, the permittee shall submit to the Director a notification and description of the violation in accordance with Part II.G of this permit.

4. Failure to Maintain Best Available Technology Required by Permit

A facility will be determined to be in an out-of-compliance status if best available technology has failed or cannot be maintained according to the provisions required by this permit, unless:

a. The Permittee has notified according to Part II.G.2, and

b. The failure was not intentional or was not caused by the Permittee's negligence, either in action or failure to act, and

c. The Permittee has taken adequate remedial measures in a timely manner or has developed an approvable remedial action plan and implementation schedule for restoration of best available control technology, an equivalent control technology, or closure of the facility (implementation of an equivalent technology will require permit modification and re-issuance), and

d. The Permittee has demonstrated that any discharge of a pollutant from the facility is not in violation of the provisions of UCA 19-5-107.

5. Additional Notification - In the event of out-of-compliance status due to either an exceedance of ground water compliance limits, a spill, or a failure of Best Available Technology, the permittee shall notify the Millard or Beaver County Commission and the Southwest Utah District Health Department within 24 hours or the first working day following a spill. The report shall also be made to the

Utah Department of Environmental Quality 24 hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).

6. Contingency Plan - If, after review of ground water monitoring data and other relevant information, the Director determines that use of any lagoon has caused an exceedance of ground water compliance limits at any compliance monitoring point, the permittee shall conduct a Contamination Investigation to determine the extent and severity of contamination caused by the lagoon and submit it for review by the Division of Water Quality within 45 days of determination of out-of-compliance status. After review of this report the Director may require the permittee to develop a Corrective Action Plan to remediate the contamination. Actions taken under the plan may include emptying liquids and sludge from the leaking lagoon into one of the other lagoons in the permittees farm complex, repairing or reconstructing the lagoon liner as needed, constructing temporary holding ponds lined with flexible membrane liners, and developing wells for the purpose of extracting the contaminated ground water. Contaminated ground water may be stored in the lagoons or land applied according to the most recently revised and approved Nutrient Management Plan for Land Application, if necessary and feasible.

   Significant hog waste spills from the waste handling system must be addressed in compliance with the most recently revised and approved version of the Spill Prevention and Response Manual that has been prepared by the permittee. Minor spill events shall be reported with the next Semi-annual Ground Water Quality Monitoring Report.

H. REPORTING REQUIREMENTS

1. Water Monitoring - monitoring required in Part II.F above shall be reported according to the schedule in Table 3 below, unless modified by the Director:

Table 3: Compliance Monitoring Report Schedule

Monitoring Period	Report Due Date
January through June	August 1
July thru December	February 1

2. Ground Water Quality Sampling - reporting will include:

   a. Field Data Sheets - or copies thereof including the field measurements, required in Part II.F.a above, or as listed in the most recently revised and approved Smithfield Sampling and Analysis Plan; well name/number, date and time, names of sampling crew, type of sampling pump or bail, volume of water purged before sampling, and any pertinent comments relating to sampling conditions.

   b. Water Level Measurements - water level measurements from ground water monitoring wells will be reported as measured depth to ground water from the surveyed casing measuring point, and ground water elevations as converted by casing measuring point elevations.

c. Laboratory Analytical Results - including date sampled, date received; and the results of analysis for each parameter, including: value or concentration, units of measurement, reporting limit (minimum detection limit for the examination), analytical method, and the date of the analysis. The analytical methods and the method detection limits for every parameter must conform to those specified in the most recently revised and approved version of the Smithfield Sampling and Analysis Plan.

4. Annual Sludge Profile Monitoring Report - The report of the annual sludge profile monitoring shall be submitted within 30 days of completion of all sampling, monitoring, and analysis.

5. Annual Lagoon Performance Monitoring Report - The report of the annual lagoon performance monitoring shall be submitted within 30 days of completion of all sampling, monitoring, and analysis.

6. Noncompliance or Probable Noncompliance - Reporting requirements for noncompliance or probable noncompliance status shall be according to the provisions of Part I.F.

7. Electronic Filing Requirements - The permittee will submit the required ground water monitoring data in the electronic format specified by the Director. The data may be submitted by electronic transfer, e-mail, PDF, compact disc, or other approved transmittal mechanism. In addition, a submittal of the hard copy data may be made if the Permittee prefers.

8. Monitoring Well As-Built Report - For each new well constructed the permittee shall submit diagrams and descriptions of the final completion of the monitoring wells. The report is due following the completion of drilling activities. The report shall include:

   a. Casing: depth, diameter, and type of material.

   b. Screen: length, depth interval, diameter, material type, slot size.

   c. Sand Pack: depth interval, material type and grain size.

   d. Annular Seals: depth interval, material type.

   e. Surface Casing and Cap: depth, diameter, material type, protection measures constructed.

   f. Elevation and Location: ground surface elevation, elevation of water level measuring point, latitude and longitude in degrees, minutes and seconds.

   g. Well construction description, well completion description, results of well pump tests or slug tests.

I. COMPLIANCE SCHEDULE

1. Permit Compliance Schedule Item #1 The Permittee shall install ground water monitoring wells completed in the shallow aquifer at each containment basin site. One upgradient and two downgradient wells will serve as one compliance

mechanism for monitoring any containment basin discharge. The wells shall be sampled at least once prior to placing the containment basins into service. Following well installation, each well shall be sampled quarterly until 8 samples have been collected to determine background ground water quality. Compliance sampling will then change to semi-annual frequency.

2. Permit Compliance Schedule Item #3 Final Closure Plan. In the event that the permittee decides to discontinue its operations at the facility the permittee shall notify the Director of such a decision and submit a Final Closure Plan. The Final Closure Plan shall be submitted no later than 180 days prior to the closure of the facility. The permittee shall resubmit Final Closure Plans within 60 days of receipt of written notice of deficiencies therein. Any material changes made to this plan shall require final approval of the Director.

PART III MONITORING, RECORDING AND REPORTING REQUIREMENTS

A. REPRESENTATIVE SAMPLING

Samples taken in compliance with the monitoring requirements established under Part II shall be representative of the monitored activity.

B. ANALYTICAL PROCEDURES

Water sample analysis must be conducted according to test procedures specified under UAC R317-6-6.3.L, unless other test procedures have been specified in this permit.

C. PENALTIES FOR TAMPERING

The Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

D. REPORTING OF MONITORING RESULTS

Monitoring results obtained during each reporting period specified in the permit, shall be submitted to the Director, Utah Division of Water Quality at the following address no later than the 15th day of the month following the completed reporting period:

State of Utah
Division of Water Quality
P.O. Box 144870
Salt Lake City, Utah 84114-4870
Attention: Ground Water Protection Section

Electronic document submission:
http://deq.utah.gov/ProgramsServices/services/submissions/

E. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any Compliance Schedule of this permit shall be submitted no later than 14 days following each schedule date.

F. ADDITIONAL MONITORING BY THE PERMITTEE

If the permittee monitors any pollutant more frequently than required by this permit, using approved test procedures as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted. Such increased frequency shall also be indicated.

G. RECORDS CONTENTS

Records of monitoring information shall include:

1. The date, exact place, and time of sampling or measurements:
2. The individual(s) who performed the sampling or measurements;
3. The date(s) and time(s) analyses were performed;
4. The individual(s) who performed the analyses;
5. The analytical techniques or methods used; and,
6. The results of such analyses.

H. RETENTION OF RECORDS

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

I. TWENTY-FOUR HOUR NOTICE OF NONCOMPLIANCE REPORTING

1. The permittee shall verbally report any noncompliance which may endanger public health or the environment as soon as possible, but no later than 24 hours from the time the permittee first became aware of the circumstances. The report shall be made to the Utah Department of Environmental Quality 24 hour number, (801) 536-4123, or to the Division of Water Quality, Ground Water Protection Section at (801) 536-4300, during normal business hours (Monday through Friday 8:00 am - 5:00 pm Mountain Time).

2. A written submission shall also be provided to the Director within five days of the time that the permittee becomes aware of the circumstances. The written submission shall contain:
   a. A description of the noncompliance and its cause;
   b. The period of noncompliance, including exact dates and times;
   c. The estimated time noncompliance is expected to continue if it has not been corrected; and,
   d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

3. Reports shall be submitted to the addresses in Part III.D, Reporting of Monitoring Results.

J. OTHER NONCOMPLIANCE REPORTING

Instances of noncompliance not required to be reported within 24 hours, shall be reported at the time that monitoring reports for Part II.H are submitted.

K. INSPECTION AND ENTRY

The permittee shall allow the Director, or an authorized representative, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of the permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

4. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by the Act, any substances or parameters.

PART IV COMPLIANCE RESPONSIBILITIES

A. DUTY TO COMPLY

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

B. PENALTIES FOR VIOLATIONS OF PERMIT CONDITIONS

The Act provides that any person who violates a permit condition implementing provisions of the Act is subject to a civil penalty not to exceed $10,000 per day of such violation. Any person who willfully or negligently violates permit conditions is subject to a fine not exceeding $25,000 per day of violation. Any person convicted under Section 19-5-115(2) of the Act a second time shall be punished by a fine not exceeding $50,000 per day. Nothing in this permit shall be construed to relieve the permittee of the civil or criminal penalties for noncompliance.

C. NEED TO HALT OR REDUCE ACTIVITY NOT A DEFENSE

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

D. DUTY TO MITIGATE

The permittee shall take all reasonable steps to minimize or prevent any discharge in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

E. PROPER OPERATION AND MAINTENANCE

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

PART V GENERAL REQUIREMENTS

A. PLANNED CHANGES

The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is required when the alteration or addition could significantly change the nature of the facility or increase the quantity of pollutants discharged.

B. ANTICIPATED NONCOMPLIANCE

The permittee shall give advance notice of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

C. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

D. DUTY TO REAPPLY

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and obtain a permit renewal or extension. The application should be submitted at least 180 days before the expiration date of this permit.

E. DUTY TO PROVIDE INFORMATION

The permittee shall furnish to the Director, within a reasonable time, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The permittee shall also furnish to the Director, upon request, copies of records required to be kept by this permit.

F. OTHER INFORMATION

When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Director, it shall promptly submit such facts or information.

G. SIGNATORY REQUIREMENTS

All applications, reports or information submitted to the Director shall be signed and certified.

1. All permit applications shall be signed as follows:

   a. For a corporation: by a responsible corporate officer;

   b. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively.

   c. For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official.

2. All reports required by the permit and other information requested by the Director shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:

   a. The authorization is made in writing by a person described above and submitted to the Director, and,

   b. The authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)

3. Changes to Authorization. If an authorization under Part V.G.2 is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of Part V.G.2 must be submitted to the Director prior to or together with any reports, information, or applications to be signed by an authorized representative.

4. Certification. Any person signing a document under this section shall make the following certification:

   "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

H. PENALTIES FOR FALSIFICATION OF REPORTS

The Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance shall, upon conviction be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than six months per violation, or by both.

I. AVAILABILITY OF REPORTS

Except for data determined to be confidential by the permittee, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director. As required by the Act, permit applications, permits, effluent data, and ground water quality data shall not be considered confidential.

J. PROPERTY RIGHTS

The issuance of this permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

K. SEVERABILITY

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

L. TRANSFERS

This permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date;

2. The notice includes a written agreement between the existing and new permittee containing a specific date for transfer of permit responsibility, coverage, and liability between them; and,

3. The Director does not notify the existing permittee and the proposed new permittee of his or her intent to modify, or revoke and reissue the permit. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in paragraph 2 above.

M. STATE LAWS

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, penalties established pursuant to any applicable state law or regulation under authority preserved by Section 19-5-117 of the Act.

N. REOPENER PROVISION

This permit may be reopened and modified (following proper administrative procedures) to include the appropriate limitations and compliance schedule, if necessary, if one or more of the following events occurs:

1. If new ground water standards are adopted by the Board, the permit may be reopened and modified to extend the terms of the permit or to include pollutants covered by new standards. The permittee may apply for a variance under the conditions outlined in R317-6-6.4.D.

2. If alternative compliance mechanisms are required.

3. If subsequent ground water monitoring data reveals the background water quality values in Part II Table 1 are not accurate.

APPENDIX A
CONSTRUCTION PERMIT
PLANS AND SPECIFICATIONS

Jim Webb
Director of EHS and Public Affairs
Pinnacle Finisher Sites
P.O. Box 100
Milford, UT 84751

Dear Mr. Webb:

Subject: **Construction Permit** for a Truck Washing Facility and 52 Finisher Farm Sites each with two Barns (4 Buildings) and two Waste Containment Basins.

On January 12, 2017, the Division of Water Quality (DWQ) received the Groundwater Discharge Permit Application which also included the engineering plans and specifications for the construction of 33 Finisher Farm Sites.

Addendum #1 was received by DWQ on February 28, 2017. Addendum #1 requested that the number of farm sites be increased from 33 sites to 52 sites. Each Farm Site will have two Finisher Barns (4 main buildings) and two Waste Containment Basins. Each Finisher Barn has two main buildings that house the animals and a hallway that connects the two buildings (this configuration looks like an H). The Waste Containment basins will have one Deep Primary Containment Basin and one Shallow Evaporation Basin. Each Finisher Barn can hold up to 4,800 hogs (9600 total at each Farm Site). Addendum #1 also requested that there be an option of installing Digester Technology. With the Digester Technology the deeper Primary Containment Basin is eliminated and the Evaporation Basin is much larger. Since the Digester Technology has not yet been determined, a new Addendum to the Construction Permit will need to be submitted and approved by DWQ. At a minimum, all Digesters and Basins will be required at have the same groundwater protection measures; for example 60 mil HDPE liner, compacted soil subliner, monitoring wells, etc.

Addendum #2 was received by DWQ on April 10, 2017. This Addendum requested that each farm site will be built to contain 9200 hogs instead of the 9600 hogs submitted in the original design. The size of the Containment Basins has also been adjusted accordingly.

These documents were prepared by GEM Engineering, Inc. and stamped by Joel A. Myers, P.E. Various sections of the UGDP have been reviewed and copied and are designated to be the Construction Permit. These include construction drawings, plans, and specifications.

The following is a summary of the proposed major construction projects:

Construction of 52 Finisher Farm Sites each with the following:

- 2 Finisher Barns (4 Buildings), each barn can contain up to 4600 hogs (9200 total) sized from 14 lbs to 250 lbs with the average weight being 135 lbs;
- 2 Wastewater Containment Basins – One deeper Primary Containment Basin (17.0 million gallons, 52.2 ac-ft) and one shallow Secondary Evaporation Basin (4.8 million gallons, 14.7 ac-ft). The Digester Technology may replace the deeper Primary Containment Basin and the Secondary Evaporation Basin would then be larger (8.4 million gallons, 25.8 ac-ft);
- One Truck Washing Facility with a Containment Basin (1.3 million gallons, 3.99 ac-ft).

The plans and specifications, as submitted, comply with *the Utah Water Quality Rules, (R317, Utah Administrative Code).* A **Construction Permit** is hereby issued as constituted by this letter, subject to the following conditions:

1. *Construction activities that disturb one acre or more are required to obtain coverage under the Utah Pollutant Discharge Elimination System (UPDES) Storm Water General Permit for Construction Activities. The permit requires the development of a storm water pollution prevention plan (SWPPP) to be implemented and updated from the commencement of any soil disturbing activities at the site until final stabilization of the project. For more information, or to obtain permit coverage on-line, please go to: http://www. waterquality. utah.gov/UPDES/stormwater.*
2. *Any revisions or modifications to the approved plans and specifications must be submitted to DWQ for review and approval, before construction or implementation thereof. Please submit any changes for review and approval directly to Woodrow Campbell, P.E., of the DWQ Ground Water Protection Section.*
3. *A written operations and maintenance manual, containing a description of the functioning of the facilities, an outline of routine maintenance procedures, and all checklists and maintenance logs needed for proper operation of the system, must be submitted and approved before the final inspection and operation of the system.*
4. *The approved facilities must not be placed in service unless DWQ has conducted a final inspection, reviewed and approved the As-Built Construction Certification Report, issued a ground water discharge permit for the facility, and provided written authorization to place the constructed facilities in service.*

The plans and specifications for this project have been stamped and signed by a Professional Engineer currently licensed to practice in the state of Utah. The construction design, inspection supervision, and written construction certification of all work associated with this Construction Permit must be performed by a Professional Engineer licensed to practice in the state of Utah.

This Construction Permit will expire one year from the date of its issuance, as evidenced by the date of this letter, unless substantial progress is made in constructing the approved facilities or the plans and specifications have been resubmitted and the construction permit is reissued. This permit does not relieve you, in any way, of your obligations to comply with other applicable local requirements. You may contact Southwest Public Health Department at 435.986.2582 or Paul Wright, Southwest District Engineer, at 435.986.2590 for further assistance regarding local matters.

Because of the inherent hazard potential at lagoons and ponds, warning signs should be posted at these facilities to state the dangers of drowning and asphyxiation. Safety ropes running down the pond side slopes, and fastened to posts at the top of the dikes should be available to allow anyone trapped in the ponds to escape.

Please contact Mr. Campbell at the beginning of construction to allow periodic inspections to be scheduled. Upon completion of the project, a final inspection and approval of the As-Built Construction Certification Report is required before the approval to operate the completed facilities can be issued. Please remain in contact with Mr. Campbell to schedule the final inspection. The Construction Certification Report with final as-built drawings must include test results for the following construction quality assurance and quality control (CQA/QC) elements:

Soil Subgrade

- Proctor Curves,
- Soil Classification,
- Field Compaction Testing, and
- Subgrade Acceptance Certification.

Concrete

- Concrete Mix Verification;
- Concrete reinforcement;
- Waterstop placement;
- Concrete ASTM Testing Method, Frequency, and Results;
- Concrete Testing Pass/Fail Criteria, and
- Crack Inspection and Repair.
-

Flexible Membrane Liner

- Panel Placement Log,
- Trial Seam Test Log,
- Seaming Record,
- Seam Test Record,
- Repair Log,
- As-Built Drawing,
- Manufactures Certification including QA/QC Testing of the Rolls, and
- Professional Engineer Certification.

If we can be of further assistance, please contact Mr. Woodrow Campbell at wwcampbell@utah.gov or (801) 536-4353.

Sincerely,

Kim Shelley
Acting Director

WLB/WWC/DJH:smm

cc: Paul Wright Southwest District Engineer (via email w/o attachment)
Southwest Public Health Department (via email w/o attachment)
Joel A. Myers Gem Engineering, Inc. (via email w/o attachment to joel@gemengineeringinc.com)

DWQ-2017-001105

Attachments:

DWQ-2017-000351 177 pages

Ground Water Discharge Permit Application

Application and Construction Diagrams For Pinnacle Finisher Farms and Truck Wash

Water Quality Sampling, Handling, and Analysis Plan for Pinnacle Finisher Sites

APPENDIX A TABLE 4 FARM LOCATION COORDINATES

FARM SITE	LATITUDE			LONGITUDE		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Truck Wash	38	28	26	112	57	11
1	38	28	26	112	58	14
2	38	28	14	112	56	20
3	38	28	52	112	56	21
4	38	29	4	112	57	25
5	38	29	5	112	58	14
6	38	30	0	112	58	30
7	38	30	1	112	57	26
8	38	30	7	112	56	22
9	38	30	43	112	58	32
10	38	30	43	112	57	26
11	38	30	55	112	56	25
12	38	31	37	112	58	14
13	38	31	30	112	57	24
14	38	30	27	112	54	54
15	38	30	28	112	54	4
16	38	31	4	112	54	21
17	38	31	7	112	53	31
18	38	31	31	112	54	22
19	38	31	38	112	53	31
20	38	31	56	112	54	56
21	38	32	9	112	54	8
22	38	32	43	112	54	56
23	38	32	40	112	53	31
24	38	33	26	112	54	57
25	38	33	23	112	54	22
26	38	33	24	112	53	32
27	38	36	53	112	54	52
28	38	35	37	112	54	13
29	38	35	21	112	53	36
30	38	35	22	112	52	56
31	38	35	47	112	51	49
32	38	36	3	112	53	47
33	38	35	57	112	52	55
34	38	36	5	112	51	50
35	38	36	30	112	54	50
36	38	36	44	112	53	52
37	38	36	30	112	52	56
38	38	36	57	112	53	47
39	38	36	54	112	52	54
40	38	29	6	112	53	30

FARM SITE	LATITUDE			LONGITUDE		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
41	38	29	27	112	53	47
42	38	39	51	112	53	49
43	38	29	51	112	53	29
44	38	31	40	112	56	29
45	38	32	15	112	55	49
46	38	32	31	112	56	28
47	38	32	41	112	57	17
48	38	32	58	112	56	28
49	38	33	27	112	57	43
50	38	33	18	112	56	2
51	38	34	2	112	54	22
52	38	34	41	112	54	4

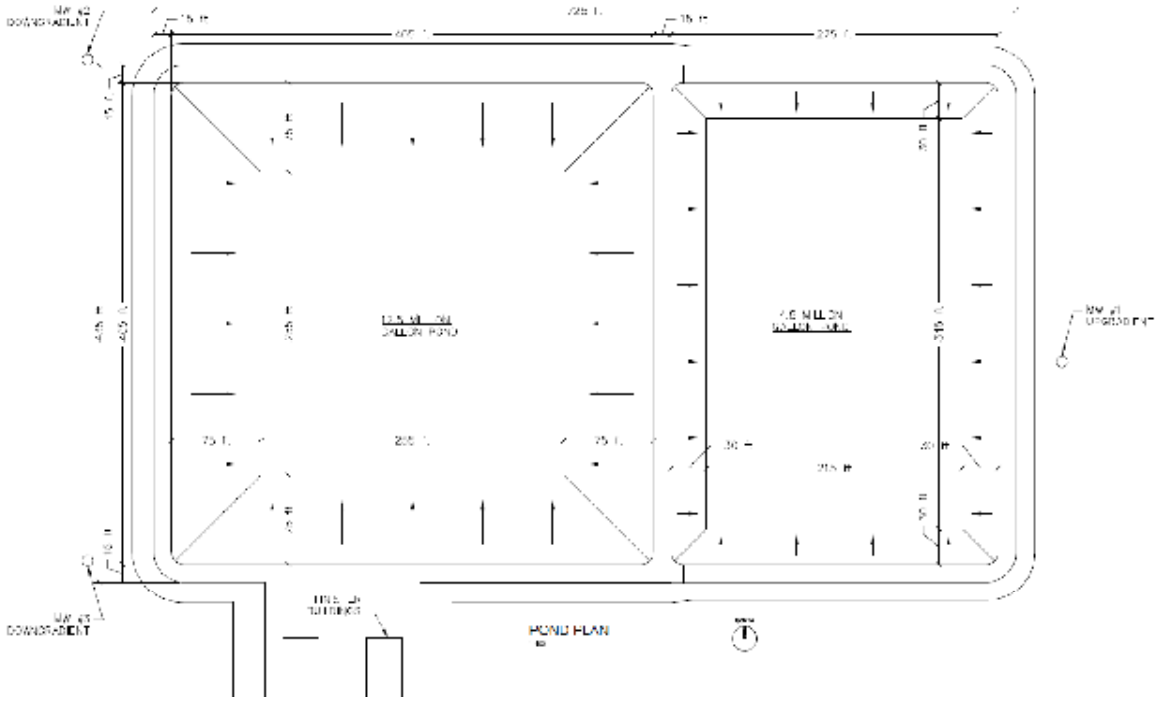


Figure 4-3 Containment Basin Detail and Monitoring Well Location

4.1.4 Waste Conveyance System

Waste shall be conveyed from the farm sites to the containment basin through either HDPE SDR 35 or PVC Schedule 40 sewer pipe, as shown in the Composite

Location & Plot Map included in **Attachment A**. The waste will gravity flow from the barns to the waste containment basins. The containment basin will be lined with a 60 mil Flexible Membrane Liner (FML).

4.1.5 Containment Basin Management Plan

As previously described, the waste flows from the barn to containment basin and then is digested aerobically. Should problems be encountered either in the liner or piping, the flow of sewage from the individual farm sites can be shut off and the contents of the basin(s) can be pumped to other containment basin so that repairs can be made and the containment basin be put back into use.

SECTION 5: COMPLIANCE MONITORING PLAN

5.1 Groundwater Monitoring

Three monitoring wells, one upgradient and two downgradient, will be drilled for compliance monitoring of the containment basin site at the facility site. A Water Quality Sampling, Handling and Analysis Plan is included as **Attachment G**. All water samples taken from the monitoring wells will be processed according to the guidelines set forth in this plan. The installation guidelines and an outline of the proposed groundwater monitoring plan are as follows:

1.) Upgradient and downgradient monitor wells will be constructed. The proposed locations of these wells are shown in **Figure 4-3** (Wells are also shown on a more detailed plot in **Attachment D**). The monitor wells will have a total depth of 10' below the first encountered water table and will be constructed and developed as per requirements of the State of Utah, Department of Environmental Quality. The monitor wells will typically be constructed as shown in **Figure 5-1**. The upgradient wells will provide background data for the downgradient monitoring wells. These wells will be constructed at locations shown in **Figure 4-3** and in **Attachment D** each of the farm sites.

2.) The static water level in each well and the elevation of the water level will be determined at least 8 days after the well has been completed. The water levels at each well will be compared with existing data to confirm the direction of groundwater movement.

3.) Monitoring wells will be sampled and tested according to the procedures outlined in the Water Quality Handling and Analysis Plan (**Attachment G**). It is anticipated that the monitoring wells will be 20 to 30 feet in depth below the ground surface at these farm site locations.

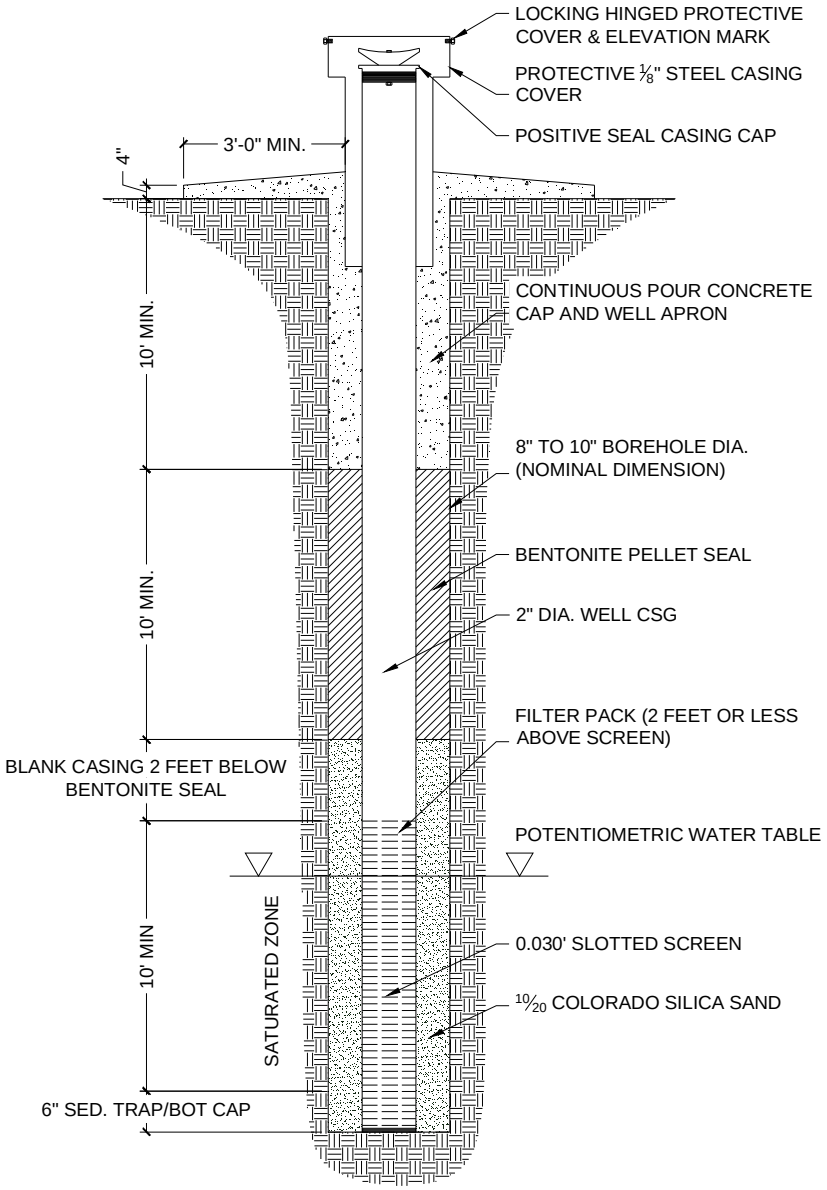


Figure 5-1 Typical Monitor Well Detail

5.1.1 Upgradient Groundwater Monitoring

The upgradient monitor well will be constructed and sampled prior to waste introduction to the Containment Basin at the site. The water in the upgradient well will be sampled and analyzed at least 8 days after the well is completed in order to determine the groundwater class protection levels and begin to establish background mean concentration levels. The groundwater protection levels of the upgradient well will be

determined according to UAC R317-6-4 from the analysis of eight independent samples taken at equal intervals during a period of one year. The accelerated background constituents that will be analyzed in a laboratory include: total dissolved solids, sulfate, calcium, magnesium, potassium, sodium, carbonate, bicarbonate, total phosphorous, chloride, nitrate-N/nitrite-N, and ammonia-N. The parameters that will be determined at the monitor well include: static water level, pH, temperature, and specific conductance.

The background mean concentration levels will be determined by averaging the upgradient monitor wells accelerated background data, then adding 2 standard deviations. The following parameters will constitute the quarterly monitoring from the upgradient well after all eight background analysis: static water level, pH, temperature and specific conductance. Also, the following constituents will be monitored quarterly: nitrate-N/nitrite-N, ammonia-N, total dissolved solids, bicarbonate, and chloride. After the groundwater properties have been well established the analysis frequency may be decreased to semi-annually.

5.1.2 Downgradient Groundwater Monitoring

If data from upgradient monitor wells indicate differing movement of groundwater than what is shown in this application, the locations for the downgradient monitor wells will be changed, sent to the DEQ for approval, and drilled at a different location than proposed in this application.

A first sample will be taken from the downgradient well at least eight days after it's construction and prior to waste flow to the digester system. Only the first sample from the downgradient well will be analyzed for the background parameters described in Section 5.1.1. After the first analysis, the well will be analyzed on a quarterly basis for the following constituents: nitrate-N/nitrite-N, ammonia-N, total dissolved solids, bicarbonate and chloride. The following field parameters will also be analyzed: static water level, pH, temperature, and specific conductance. After the groundwater properties have been well established the analysis frequency may be decreased to semi-annually.

5.1.3 Alternative & Additional Monitoring

In the event that the chemical quality proves that a common source comparison does not exist between the upgradient and downgradient well, a different background monitoring schedule may be proposed to the Department of Environmental Quality's Executive Secretary.

Additional Monitoring: Identification of the contaminants in the wastewater will be analyzed once a year. The analysis will identify the parameters required under the accelerated background monitoring at upgradient wells and also, the metals listed in Table 1 of the Groundwater Regulations, R317-6-6.3, (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver and zinc).

SECTION 6: CONTAINMENT BASIN SYSTEM LOCATION AND DESIGN

6.1 Containment Basin Description

A containment basin will be used at each finisher site to store the swine manure produced at the finisher sites. Effluent will be collected from the production building in an anaerobic Containment Basin where the effluent will be allowed to evaporate. The anaerobic Containment Basin will be lined. The liners will consist of a Flexible Membrane Liner (FML).

6.2 Containment Basin Site Soils Investigation

A soil and water table investigation was performed near the proposed Containment Basin locations. The soil investigations consisted of 2 backhoe trenches approximately 12 feet in depth near the proposed farm sites. The groundwater underlying the Containment Basin is at least 8 feet below the existing ground level. In order to meet DEQ criteria for Containment Basin construction, the seasonal high water table elevation must be at least 2 feet below the floor of the Containment Basin in hydrogeologically stable soil strata. At the proposed farm site the seasonal high water table was more than 2 feet below the bottom of the proposed Containment Basin. Also, the soil strata underlying the Containment Basins appear to be hydrogeologically stable. It is proposed that containment basin be placed approximately 5 feet below the ground surface at these farm site locations.

6.3 Containment Basin Design

The containment basins will be constructed with 60 mil HDPE liners as described in section 7 of this report and in accordance with the State of Utah Department of Environmental Quality regulations. A plan view and cross section of the containment basin can be found in Attachment D.

Similar sites have shown that the treatment volume required for finisher pigs is 1.20 cubic feet per pound of live animal weight (LAW) at the site's maximum expected population. An additional 0.60 cubic feet of volume per found of LAW is then added for sludge accumulation.

The containment basin is designed to provide a surface area that will provide sufficient evaporative potential to evaporate inflow in the system on a continuous basis. The containment

basin will have 2.5 feet of freeboard and an additional 6 inches of depth to accommodate the incident rainfall from a 25 year-24 hour storm.

Table 1-5

Anaerobic Lagoon Design Criteria

	Evaporation System Design Criteria for finisher pigs (ft^3/lb LAW)	Design Depth Constraints (feet)
Waste Treatment	1.20	-
20 Year Sludge Accumulation	0.60	-
Waste Storage	-	-
Waste Storage Evap. System*	Varies with facility water use*	-
25 year 24 hour Storm, plus direct precip. minus evaporation	-	0.50’
Freeboard	-	2.50’
Total	1.80*	3.00’

* Evaporative systems are designed based on surface area, not accumulated volume. However, sufficient capacity to allow some accumulation of liquid during times of low evaporations is necessary. The entire treatment system provides sufficient capacity to evaporate inflow into the system on a continuous basis.

Based on the LAW as defined in Table 1-2 and the design criteria defined in Table 1-5, containment basin dimensions were developed for the finishing farm sites. For the anaerobic lagoon system the treatment and sludge volumes were included along with the 25-yr, 24-hr storm and freeboard allowances. A schematic diagram of the waste storage system is shown in Attachment D project documents.

Table 1-6

Containment Basin Dimensions

Farm Type	Finisher
Live Animal Weight (pounds animal/site)	1,296,000
Treatment & Sludge Volume (ft^3)	2,332,800
Liquid Depth (ft)	22.5’
Freeboard (ft)	2.5’
Total Depth (ft)	25’
Bottom Dimensions (ft x ft)	225’ x 225’
Liquid Level Dimensions (ft x ft)	405’ x 405’
Top Inside Berm Dimensions (ft x ft)	435’ x 435’

6.4 Waste Transfer System

Waste from the barns is transferred to the containment basin through either 8” SDR 32.5 HDPE or 8” SDR 35 PVC sewer pipe, installed at a 0.5% minimum slope. The effluent pipe and Containment Basin elevations allow the waste to gravity flow from the pits to the Containment Basin. The waste will then digest aerobically in the containment basin.

6.5 Containment Basin Safety System Considerations

Access to the Containment Basins by humans and animals will be controlled by fencing. The fences will help to prevent damage to the Flexible Membrane Liners (FMLs) in the instances where they are used. Only authorized personnel will have access to the Containment Basin areas to prevent damage to the FMLs. Additionally, safety-warning signs will be posted near the Containment Basins.

6.6 Containment Basin Management Plan

The Containment Basin is designed to contain all of the waste produced by the hogs for 20 years. When the sludge accumulation is near the design life of the basin the sludge will be pumped and dried then applied to local fields at agronomic rates. The prevailing climatological conditions result in more evaporation than precipitation. In wet years and when the sludge accumulation of

sludge reaches the design life excess waste water will flow into the evaporative basin and evaporate. If should be noted that evaporation exceeds precipitation in this area. Waste flow will not exceed the capacity of the primary and secondary basins.

SECTION 7: LAGOON AND CONTAINMENT BASIN CONSTRUCTION

7.1 Containment Basin Construction

Construction of the Barns and Containment Basin shall be done in accordance with design drawings and specifications. Earthwork and liner construction shall be tested and inspected by qualified independent geotechnical and/or engineering firms. At the completion of construction, and prior to operation of the facility, an independent performance certification document will be completed by a qualified professional engineer licensed in the State of Utah containing test information and certification that basin and liner construction meets requirements of the project design documents and the requirements contained within this report.

7.1.1 General Earthwork Construction

Earthwork and dike construction for excavation of digesters and equalization basins shall be done as follows:

A. The area scheduled for construction of basins and building pads shall be cleared and grubbed to remove topsoil and surface vegetation from the digester/basin areas.

B. Soil shall be excavated from the basin area and be used to construct building pads or dikes.

C. Basin dikes shall be constructed in 6-inch compacted lifts to obtain proper compaction. For building pad and digester dike construction, the soil shall be moistened and compacted to 90% of maximum dry density, as defined by AASHTO T-99**.** Moisture will be added to the soil during compaction to target 2% above the optimum moisture.

D. The dikes will be constructed of relatively impermeable compacted native material.

E. A qualified inspector will perform the moisture content and dry density testing per every two feet of lift at random locations once every 400 feet along the Containment Basin dikes.

7.2 Flexible Membrane Liner

Specifications for manufacture, delivery, subgrade preparation, installation, and testing for FML liner installation are included in **Attachment E**. The QA/QC plan is also included in this

attachment. The specifications were adapted from requirements set forth in previous projects and permit applications. Moreover, an industry standard known as the GRI standard GM13 which covers smooth and textured geosynthetics has been developed with the intent of forming an industry standard for manufacture and testing of geosynthetic liner material. This standard was developed by the Geosynthetic Research Institute at Drexel University, Philadelphia, PA. As stated in the specifications, the requirements of latest revision of the GRI standard will be applicable.

If the basins are to remain empty for an extended period of time they shall be properly ballasted using ultraviolet ray resistant sand bags with nylon ties. The minimum specification for ballasting liner is 30-lb. sand bags spaced 5-feet apart along the entire toe of dike in containment basins. Sand-filled HDPE tube or pipe may also be used as long as an equivalent amount of ballasting per lineal foot (6 lbs./ln.-ft.) is maintained.

On occasion, repairs may have to be made to liners if damage occurs out of the norm, or modifications need to be made. All repairs made to liner seams, or incident holes found in the liner shall be vacuum/bubble tested, documented and sent to the State DEQ for informational purposes and approval of the repairs. Unless significant modifications to the liner are made, such repairs shall be made without any requirements for approval from the State DEQ.

7.2.1 Flexible Membrane Liner Installation

The Containment Basins at the finishing farms may be lined with a Flexible Membrane Liner (FML) constructed of a High Density Polyethylene (HPDE). The subgrade will conform to the FML specifications of the Manufacture and the previously stated most resent GRI standards. The installation of the FML will also comply with the Quality Assurance/Quality Control (QA/QC) found in Attachment E. In Addition to the FML specifications and QA/QC, detailed drawings of typical liner anchoring methods, pipe penetrations, air vents and water level markings of liners are found in attachment E. The following procedures will be used for installation of liners for the Containment Basins at the farm sites.

The Subgrade will be constructed according to the specifications as detailed below:

1. The subgrade material will come from either on-site material or approved stockpiles.
2. The earthwork for the anaerobic Containment Basins will be free of any foreign material such as stones greater than 3/8 inch in diameter, vegetation, brush, roots or similar material which could damage the FML.
3. The subgrade material shall be classified as either CH, CL, CL-ML, ML, SM, SC, SW or SP by the USCS Classification System.
4. A Moisture density curve will be developed for the subgrade material.
5. The minimum compacted thickness of the subgrade layer shall be 8 inches.
6. The subgrade will be compacted and graded to meet the FML contractor's specifications so as to avoid any ruts, irregularities or soft areas. The subgrade will be thoroughly compacted to provide support for the FML.
7. The subgrade will be compacted to a minimum of 90% maximum dry density as defined by AASHTO T-99. For proper compaction, moisture will be added to the soil during compaction to target 2% above the optimum moisture.
8. Installed density shall be confirmed by field test methods at a frequency of one test per 100'x100' grid square at the surface of the subgrade.

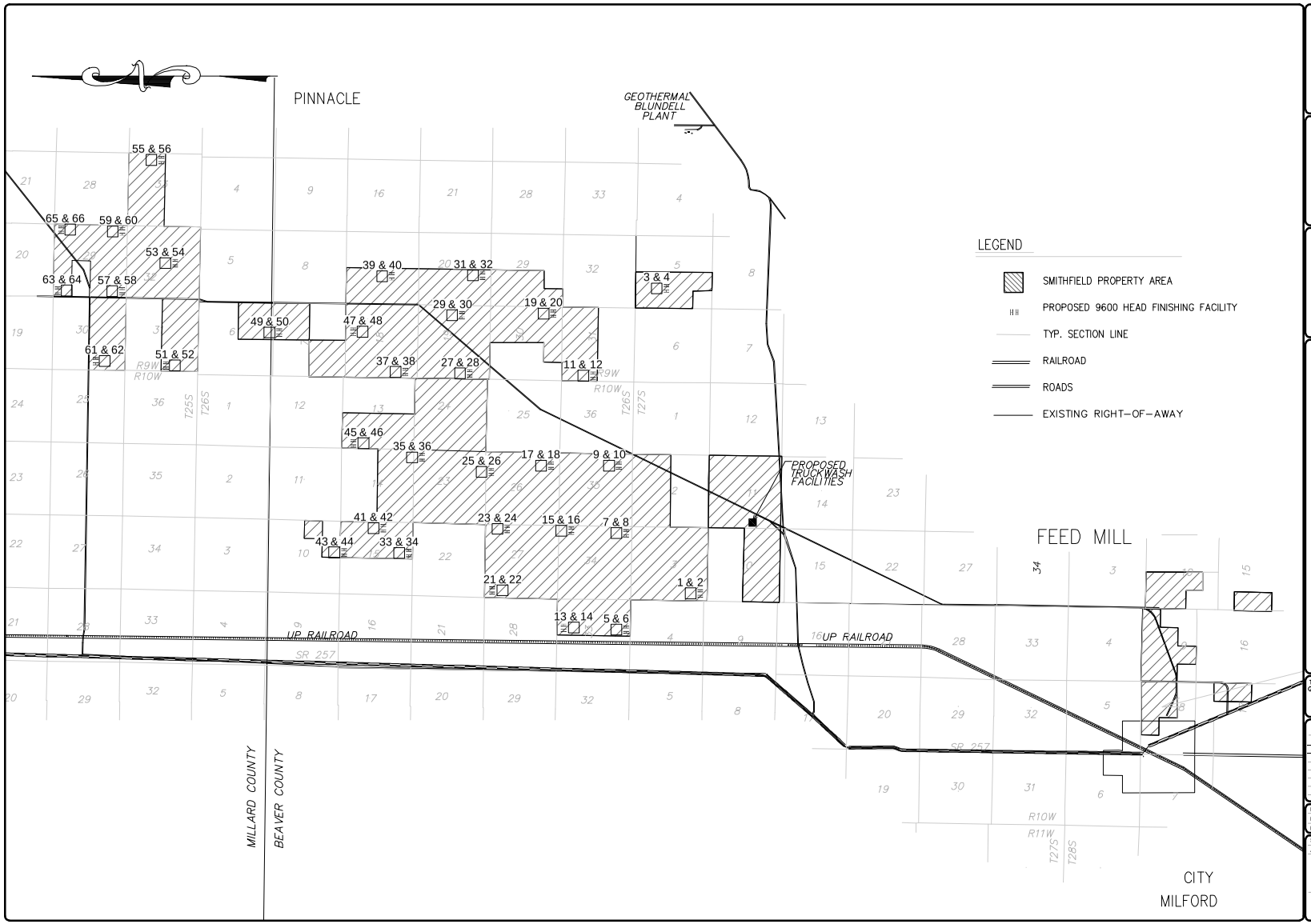
A 60-mil HDPE will be installed over the compacted subgrade. The HDPE material will meet the specifications indicated in the most resent GRI standard and in the QA/QC references in Attachment E. The drawings in Attachment E show typical liner anchoring methods and pipe penetrations of the liner material.

The HDPE liner will be installed according to the following procedure:

1. The earthwork for the anaerobic Containment Basins will be constructed so the subgrade will be free of any foreign material such as stones greater than 3/8 inch in diameter, vegetation, brush, roots or other similar materials which could damage the FML.

2. The earthwork will be compacted and graded to meet the FML contractor's specifications so as to avoid any ruts, irregularities or soft areas. The subgrade will be thoroughly compacted to provide support for the FML.
3. An anchor trench will be constructed along the crest of the berms for the purpose of securing the FML.
4. The FML will be assembled, seamed, tested and installed by the methods specified by a liner material recognized by the NSF (National Sanitation Foundation, Standard 54).
5. The FML will be certified as "holiday free" by electrical potentiometric means (spark tested) during manufacture.
6. Adequate slack will be maintained in the liner material during assembly and installation to minimize stresses due to variations in ambient temperature and incident radiation.
7. Heavily creased or otherwise defective liner material must be rejected.
8. Testing of coupons (strips of material) before seaming, stress cracks and all seams must be done in accordance with the manufacture's requirements.
9. Installation of the FML will ideally take place in temperatures ranging from 40 degrees Fahrenheit to 110 degrees Fahrenheit. In the event that the FML is installed during colder conditions (between 20 degrees Fahrenheit and 40 degrees Fahrenheit) the cold weather seaming procedures detailed in FML QA/QC, Attachment E, shall be followed.
10. Air Vents will be installed on all four sides of the Containment Basin as detailed in Attachment E and Compaction of the anchor trench backfill will provide a firm unyielding surface to secure the FML along the berms.

Attachment A – Composite Location & Plot Map



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Phone (435) 867-6478
Fax (435) 867-4372
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LOCATION:
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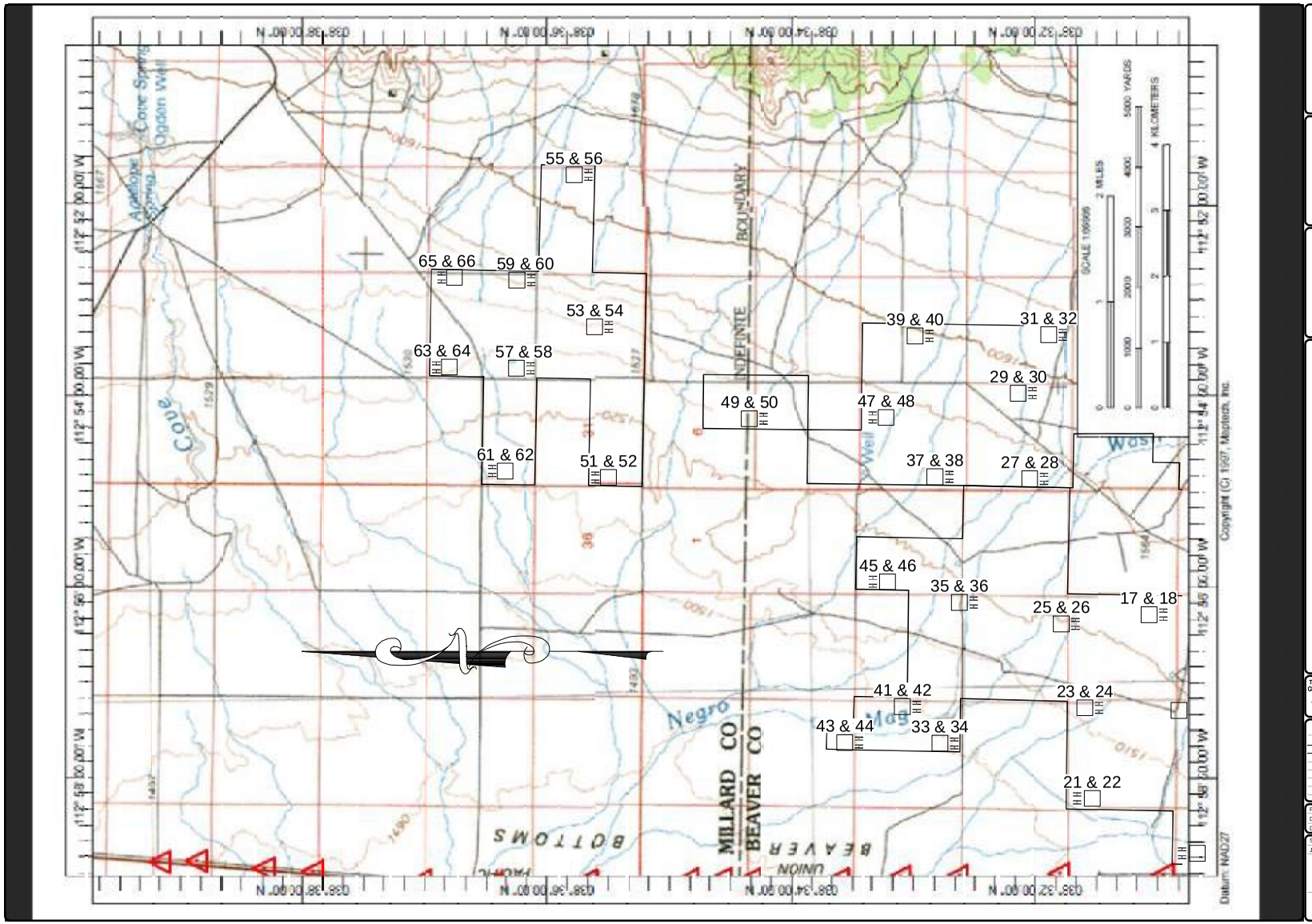
DESIGNER: RWC
DRAWN BY: RWC
SCALE: REFER TO PLAN
JOB NO.:
DRAWING TITLE: SITE PLAN
SHEET NO.: G-001

Attachment B – Topographic Map



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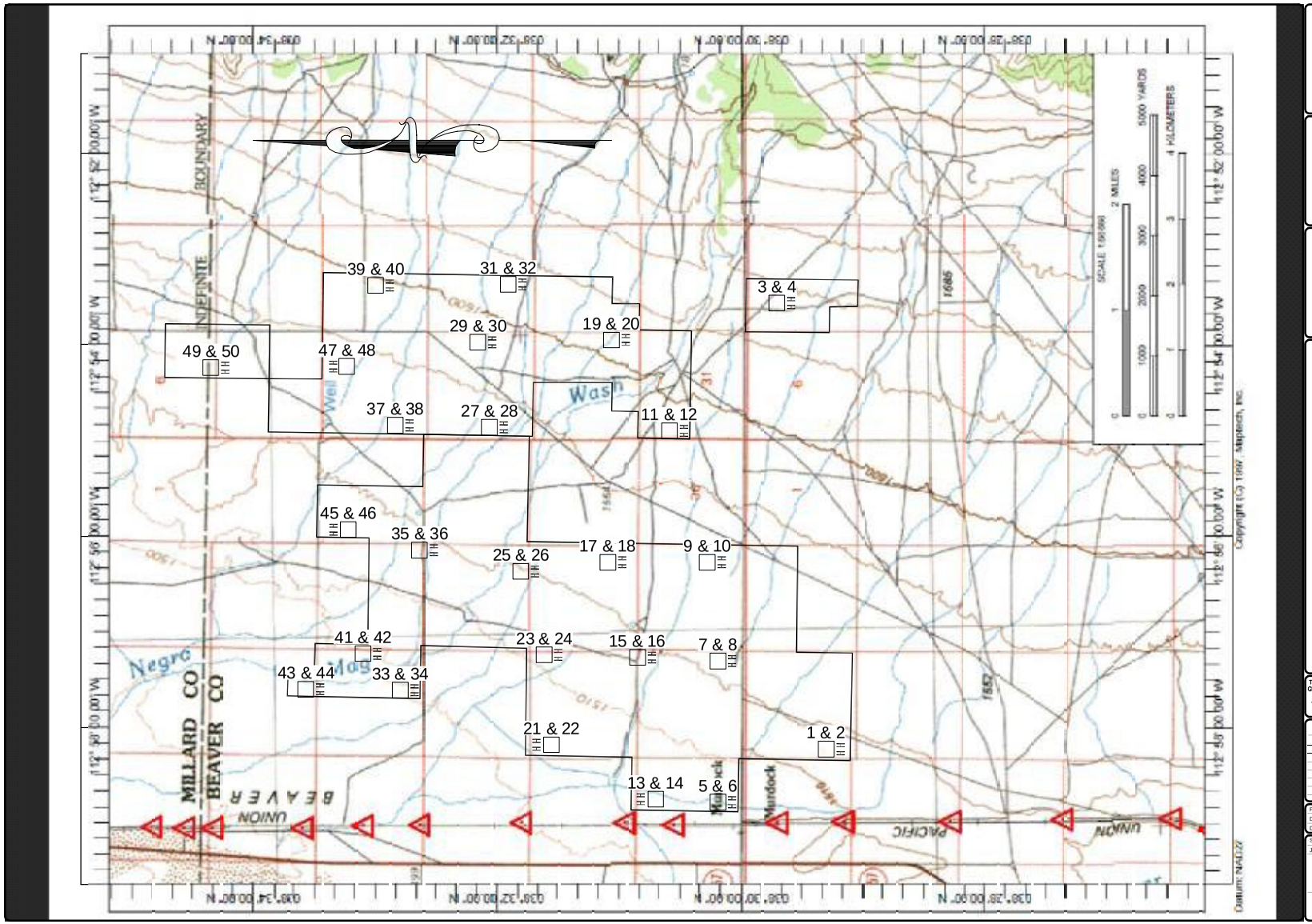
DRAWING TITLE:
TOPOGRAPHIC SITE PLAN

SHEET NO.
G-002A



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Phone (435) 867-6478
Fax (435) 867-4372
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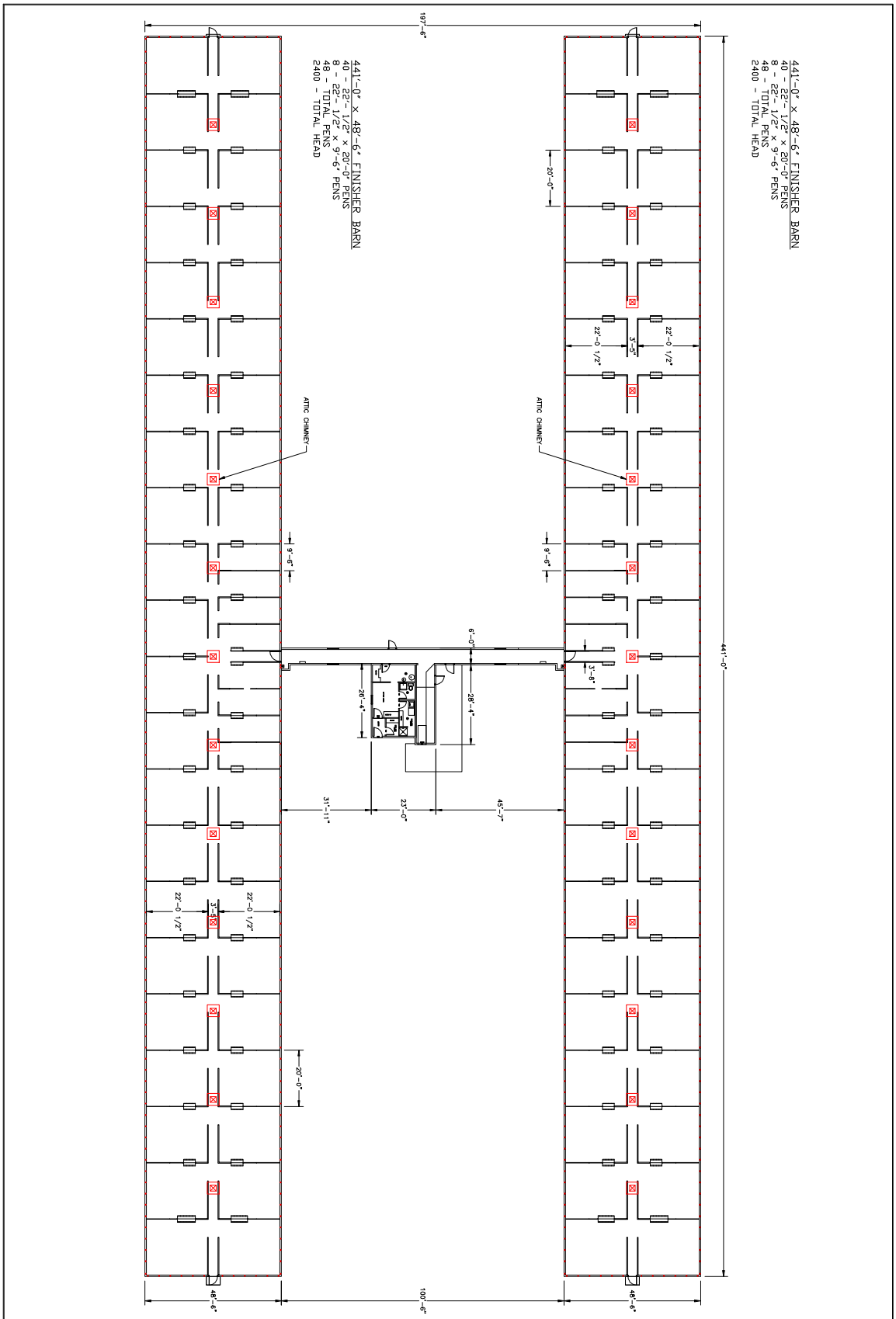
JOB NO.:

DRAWING TITLE
TOPOGRAPHIC SITE PLAN

SHEET NO.
G-002B

Attachment D – Project Documents



DATE: 3/15/16	SMITHFIELD FARMS 4800HD	CCS THE PROFESSIONALS Central Confinement Service Ltd.	REV:	BY:	DATE:	DESCRIPTION OF CHANGES
JOB #	FINISHER BARN					
DRAWN BY: N.HOFBAUER						
SALESMAN: LENNIE K.						
SHEET: P-1	BUILDING LAYOUT					

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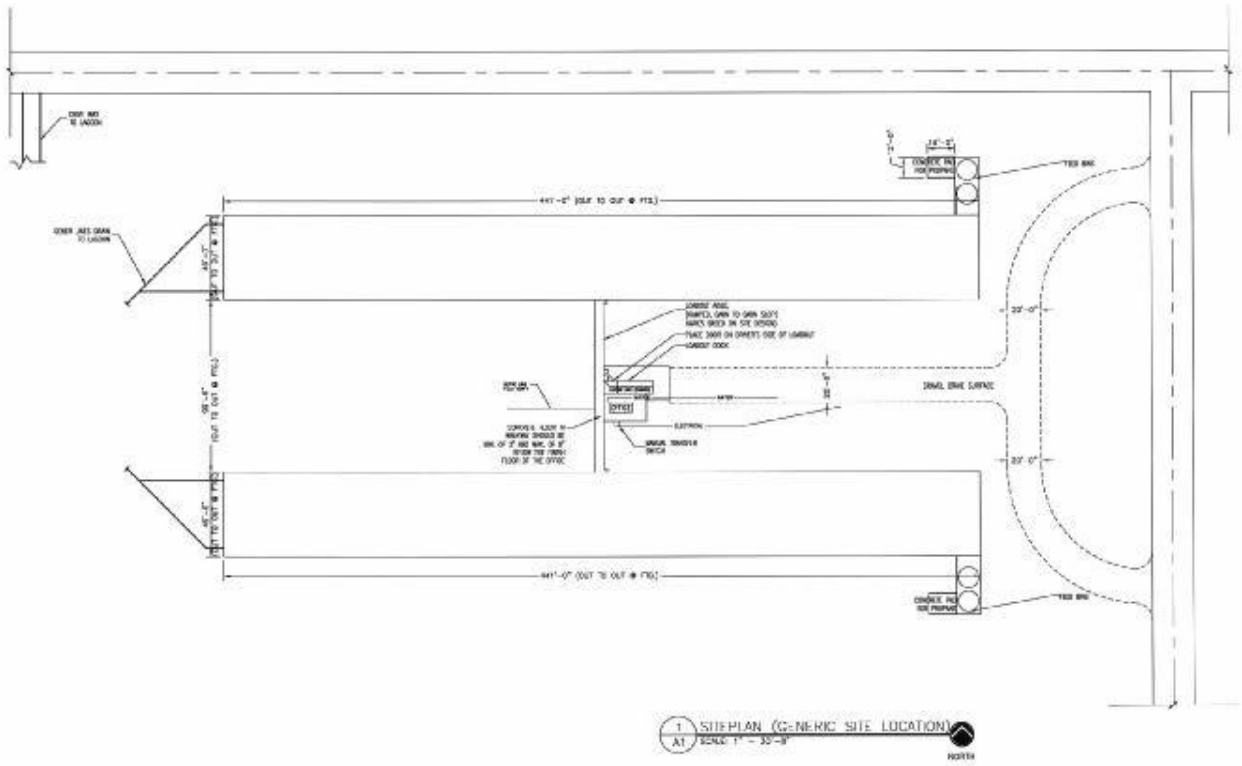
DO NOT SCALE DRAWING



1 / A1 SITE PLAN (GENERIC SITE LOCATION)
SCALE: 1" = 30'-0"

SMITHFIELD FOODS

SMITHFIELD FOODS
341 S MAIN
MILFORD UTAH 84751

NO.	REVISION DESCRIPTION	BY	DATE	CHK	DATE

2016 4800 STANDARD H – BARN

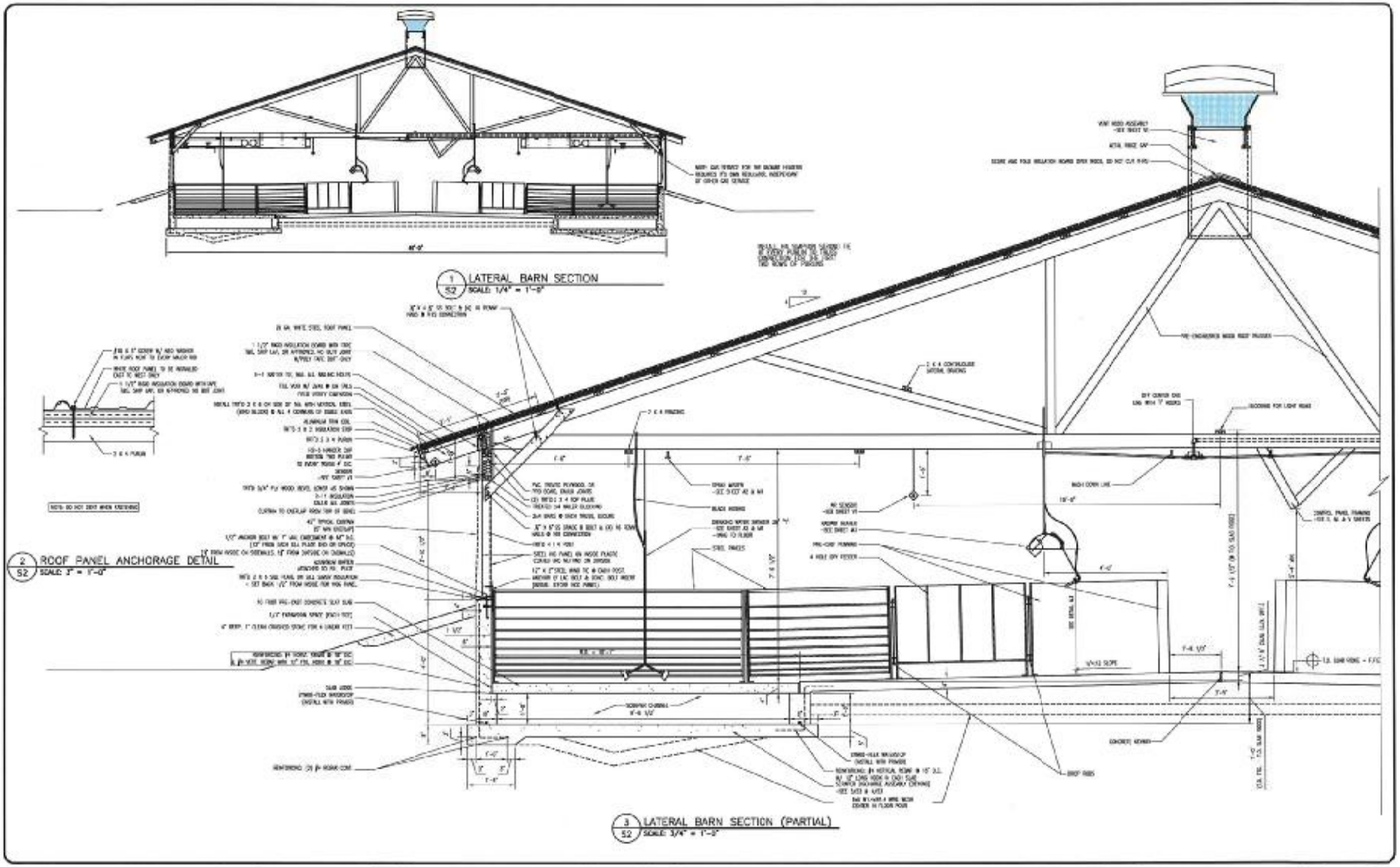
SITE PLAN

DRAWING NO.: 2851

DESIGN BY: —

DATE: 02.01.16

SHEET NO.: A1



SMITHFIELD FOODS

SMITHFIELD FOODS
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MILFORD UTAH 84751

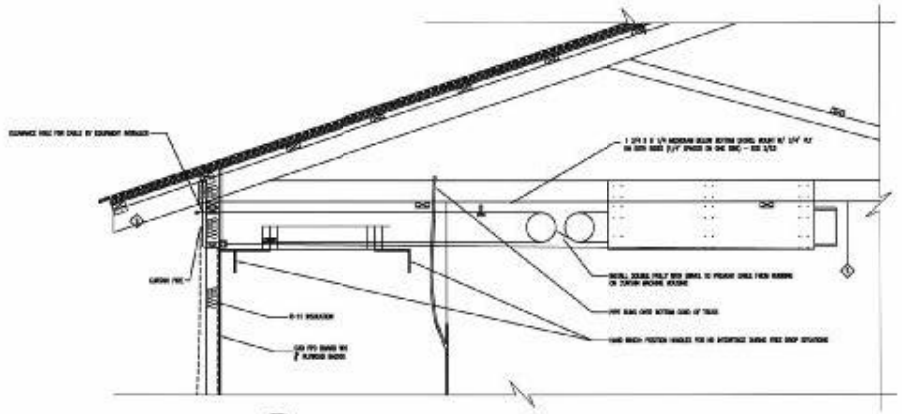
2016 4800 STANDARD H – BARN

LATERAL SECTIONS & DETAILS

2651

02.02.16

S2



1 S3 CURTAIN MACHINE MOUNT
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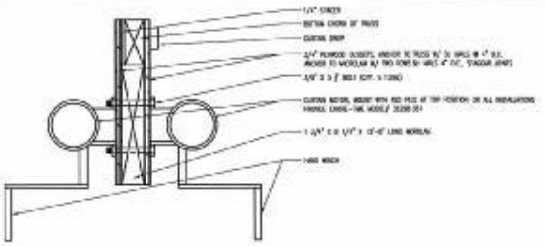

2 S3 CURTAIN MACHINE MOUNT (END VIEW)
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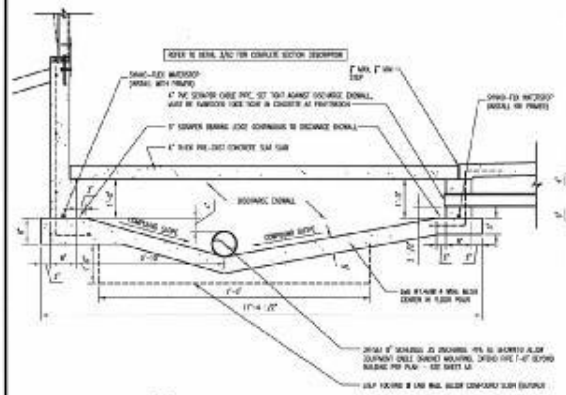

3 S3 DISCHARGE ENDWALL SECTION
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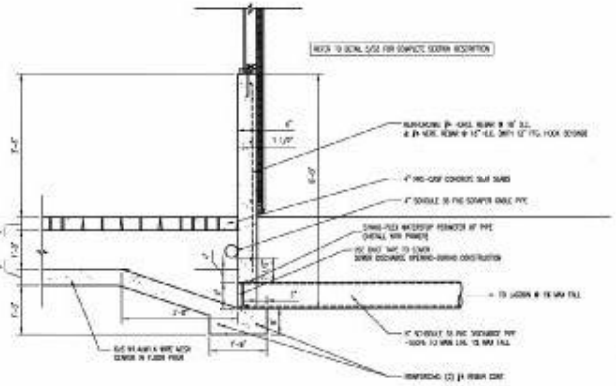

4 S3 DISCHARGE ENDWALL SECTION
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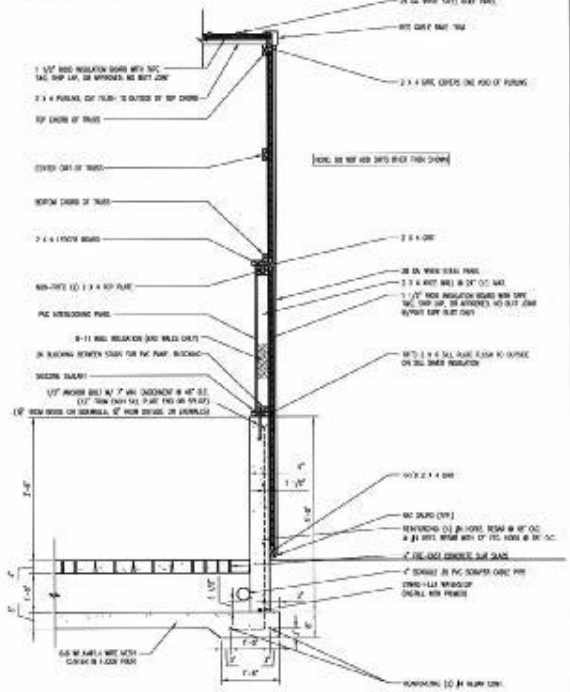


5 S3 ENDWALL SECTION
SCALE: 3/4" = 1'-0"

SMITHFIELDS FOODS	SMITHFIELD FOODS 341 S. MAIN MILFORD UTAH 84751

NO.	REVISION DESCRIPTION	BY	DATE	CHK	DATE

2016 4800 STANDARD H – BARN

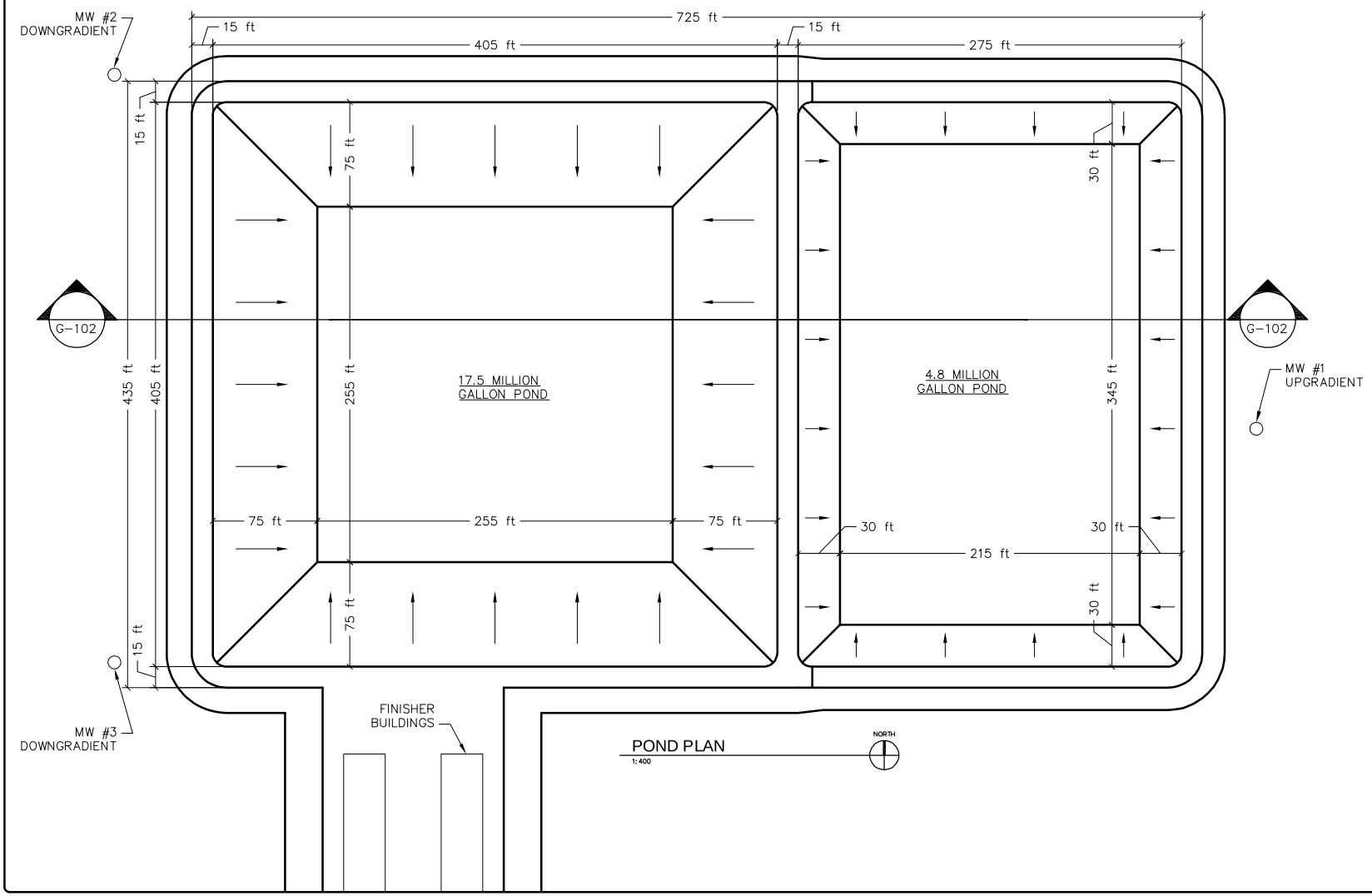
SECTION DETAILS

DRAWING NO.: 2651

CHECKED BY:

DATE: 02.01.16

SHEET NO.: S3



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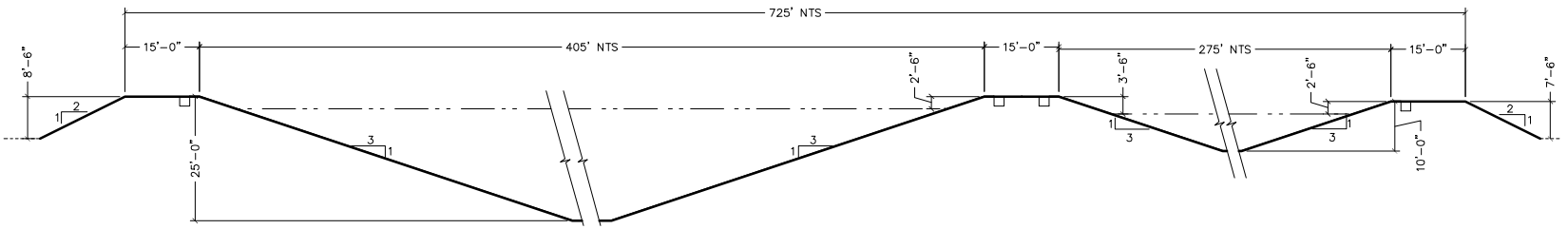
POND PLAN AND
MONITORING WELLS

SHEET NO.
G-101



POND SECTION

NO SCALE

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DRAWING TITLE:
POND CROSS SECTION

SHEET NO.
G-102

Attachment E – Specifications and QA / QC for HDPE Liners

Specifications and QA / QC for HDPE Liners

1.0 SCOPE

1.1 These specifications describe High Density Polyethylene (HDPE) Lining Membranes. The supply and installation of these materials shall be in strict accordance with the Engineer's specifications and engineering drawings and be subject to the terms and conditions of the contract. The subgrade and the HDPE material will meet the specifications contained herein and in the GRI Test Method GM13.

2.0 MATERIAL

2.1 Physical Properties:

A. The HDPE liner material used in this project shall be a minimum of 60 mil in thickness and have the properties as called out in Table 1(a) of GRI Test Method GM13 (Attachment G).

B. Raw material shall be first quality polyethylene resin containing no more than 2% clean recycled polymer by weight.

C. Melt Index (ASTM D1238 Condition 190/2.16): <= 1.0 g / 10 min.

D. Dimensional stability in each direction at +/- 2% max (ASTM D 1204 – 100^{o}C 1 hr).

E. Environmental stress crack resistance of 1500 hrs min (ASTM D 1693 Condition B).

F. The new membrane liner shall comprise HDPE material manufactured of new, first-quality products designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.

G. The lining material shall be manufactured a minimum of 22.5 feet seamless widths. Labels on the roll shall identify the thickness, length and manufacturer's roll number. There shall be no factory seams.

H. The liner material shall be so produced as to be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter. Any such defect shall be repaired using the extrusion fusion welding technique in accordance with the manufacturer's recommendations.

I. The contractor shall, at the time of bidding, submit a certification from the manufacturer of the sheeting, stating that the sheeting meets physical property requirements for the intended application. FML rolls will not be installed, if any tested property is below the National Sanitation Foundation (NSF 54) minimum standard.

2.2 Handling:

A. Delivery: Transportation of the geomembrane shall be performed by the geomembrane manufacturer through an independent trucking firm or other party as agreed by the owner.

B. Offloading: Geomembrane, when off-loaded, shall be placed on a smooth well drained surface, free of rocks or any other protrusions which may damage the material. No special covering is necessary for geomembrane The following should be verified prior to off-loading the geomembrane:

1. Handling equipment used on the site is adequate and does not pose any risk of damage to the geomembrane.

2. Personnel informed of proper handling techniques and will do so with care.

C. Any welding rod delivered to the site prior to the geomembrane installation contractor's arrival should be kept covered and dry or placed in a storage facility.

D. Upon arrival at the site the geomembrane installation contractor shall conduct a surface observation of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects are found or suspected. The geomembrane installation contractor shall indicate any damage to the Project Manager / Owner.

E. Storage: The Project Manager / Owner shall provide storage space in a location(s) such that on-site transportation and handling are minimized. Storage space should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined.

3.0 MANUFACTURER

3.1 Experience: The manufacturer of the lining material specified in the previous section shall have previously demonstrated the ability to produce this membrane by having successfully manufactured a minimum of ten million square feet of similar liner material for hydraulic lining installations. The liner material provided by the manufacturer must be listed by the NSF (National Sanitation Foundation) Standard 54.

3.2 Factory Quality Assurance and Control

A. Quality Assurance testing shall be carried out by the geomembrane manufacturer to demonstrate that the product meets this specification.

B. Raw Material: All compound ingredients of the HDPE materials shall be randomly sampled on delivery to the HDPE manufacturing plant to ensure compliance with specifications. Tests to be carried out shall include Density ASTM D1505 and Melt Index ASTM D1238, Condition E.

C. Manufactured Roll Goods: Samples of the production run shall be taken and tested according to ASTM D638 to ensure that tensile strength at yield and break, elongation at yield and break meet the minimum specifications. A quality control certificate shall be issued with the material.

D. All welding material shall be of a type supplied by the manufacturer.

E. All FML material shall be certified as "holiday free" by electrical potentiometric means (spark tested) or other equivalent approved means, during manufacture.

3.3 Submittals: The geomembrane manufacturer shall submit the following information to the Project Manager / Owner:

A. The origin (resin supplier's name, resin production plant), identification (brand name, number) and production date of resin.

B. A copy of the quality control certificates issued by the resin supplier noting results of density and melt index.

C. Reports on the tests conducted by the geomembrane manufacturer to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the considered facility (these tests should include specific gravity [ASTM D792 Method A or ASTM 1505 and melt index ASTM D1238 Condition 1902.16]).

D. Reports on these tests conducted by the geomembrane manufacturer to verify the quality of the sheet.

E. A properties sheet including, at a minimum, all specified properties, measured using test methods indicated in the specifications or equivalent.

F. After receipt of material, the geomembrane manufacturer shall provide the Project Manager / Owner with one quality control certificate for every roll of FML provided. The quality control certificate shall be signed by a responsible party. The quality control certificate shall include: roll numbers, identification and results of quality control tests. As a minimum, the quality control certificates shall include the results of the geomembrane properties tested by the method and at the frequency shown in the table below.

Property	**Test Method**	**Frequency**
Thickness	ASTM D 751	Every Roll
Density	ASTM D 792/1505	Every 5th Roll
Tensile Yield Strength	ASTM D 638	Every Roll
Yield Elongation	ASTM D 638	Every Roll
Tensile Break Strength	ASTM D 638	Every Roll
Break Elongation	ASTM D 638	Every Roll
Dimensional Stability	ASTM 1204	Every Roll
Tear Resistance	ASTM D 1004	Every Roll
Puncture Resistance	FRMS 101C-2065	Every Roll
Environmental Stress Crack Resistance	ASTM D 1693B	Every Roll
Carbon Black Content	ASTM D-1603	Every 5th Roll
Carbon Black Dispersion	ASTM D-3015	Every Resin Lot

4.0 INSTALLATION

4.1 Area Subgrade Preparation: The earthwork contractor shall be responsible for preparing the subgrade according to the basin's design and in accordance with the following specifications. If there is a discrepancy between the project design drawings and the following specifications the more stringent requirements shall apply.

A. The earthwork shall be smooth and free of all rocks, stones, sticks roots, sharp objects, or debris of any kind. No stones or other hard objects that will not pass through a 3/8" screen shall be present in the top 1" of the surfaces to be covered. No vegetation, brush roots or other foreign material shall be present on the surfaces to be lined.

B. The surface should be compacted so as to provide a firm, unyielding foundation for the membrane with no sudden, sharp or abrupt changes or break in grade. No ruts, irregularities or soft areas will be present on the surfaces to be lined. The subgrade shall be thoroughly compacted.

C. No standing water or excessive moisture shall be allowed.

D. An anchor trench shall be constructed in a square in accordance with detail DF3 / C.DF3 to secure the FML along the berm of the containment structure to be covered. See attached drawings at end of this specification for anchor and cover details.

E. The installation contractor shall certify in writing that the surface on which the membrane is to be installed is acceptable before commencing work. The FML will be assembled, seamed, tested and installed by the methods specified by a manufacturer recognized by the National Sanitation Foundation, Standard 54.

F. The subgrade shall be constructed so as to meet the following:

1. The subgrade material will come from either on-site or from approved stockpiles.

2. The earthwork for the anaerobic digesters and the equalization basins will be constructed so the subgrade will be free of any foreign material such as stones greater than 3/8 inch in diameter, vegetation, brush, roots or similar material which could damage the FML.

3. The subgrade material will be classified as CH, CL, CL-ML, ML, SM, SC, SW or SP by the USCS Classification System.

4. A moisture/density curve will be developed for the subgrade material.

5. The minimum compacted thickness of the subgrade layer shall be 8".

6. The subgrade will be compacted and graded to meet the installation contractor's specifications so as to avoid any ruts, irregularities and soft areas. The subgrade will be thoroughly compacted to provide support for the FML.

7. The subgrade will be compacted to a minimum of 90% dry density. For proper compaction, moisture will be added to the soil in quantities comparable to the OMC.

8. Installed density shall be confirmed by field test methods at a frequency of one test per 200’ x 200’ grid square.

9. A written statement by an independent professional engineer regarding the subgrade’s structural integrity, along with supporting data will be submitted with the liner certification packet.

4.2 Dike Construction: The earthwork contractor shall be responsible for constructing dikes according to the following specifications:

A. The dike will be constructed of relatively impermeable material.

B. Each lift shall not exceed 6 inches in depth.

C. A geotechnical inspector will conduct compaction testing for each two vertical foot intervals at a frequency of 1 per every 400 linear feet.

D. A written statement by an independent professional engineer regarding the dike’s structural integrity, along with supporting data will be submitted with the liner certification packet.

4.3 Anchor Trench:

A. The attached schematic detail DF3 / C.DF3 at the end of this specification indicates the anchor trench installation. Deviations from this design must be approved by the design engineer prior to use.

B. Compaction of the anchor trench backfilling will be done promptly after installation of the FML.

C. Compaction of the trench backfill shall include moisture added to the top 6 inches, with compaction done by a vibratory roller or tamper to firm unyielding surface.

D. Final grading will be implemented to produce a smooth uniform finish that slopes away from the digester and basins.

E. A client approved quality control technician shall inspect the anchor trench upon completion. Any portion of the anchor trench inadequately constructed will be re-dug and repaired in accordance with the specifications above.

4.4 Geomembrane Placement:

A. The installation of the HDPE must be done by the manufacturer, or a manufacturer’s authorized distributor, using the manufacturer’s extrusion or hot wedge welding equipment and installation methods. All supervisors overseeing the liner installation must

have five million square feet of supervisory liner experience. All field technicians must have one million square feet of seaming experience.

B. Field Panel identification: A field panel is the unit area of polyethylene which is to be seamed in the field, i.e., a field panel may be a complete roll or partial roll cut in the field. Smaller units used in the lining systems such as repairs, tabs, extensions, etc. need not be documented in the same manner as a field panel.

1. The installer will be responsible for marking each panel with the identification number and the appropriate manufacturer's roll number. It is suggested that the panel number be marked on each end of the panel, after each panel is placed, for ease of reference.

C. Field Panel Placement:

1. Placement Plan: Panel placement should take into account: site drainage (including sump or low point considerations), prevailing wind direction, subgrade construction, access to the site and the production schedule of the project. Adequate slack will be maintained in the liner material during assembly and after installation to minimize stress due to variations in ambient temperature and incident radiation.

2. Installation Sequence: Field deployed panels should be seamed as soon as possible after deployment to minimize the risk of wind or water damage.

3. Weather Conditions: Geomembrane panel deployment shall not proceed when ambient air temperature or adverse weather conditions exist which will jeopardize the integrity of the liner installation. Typically, installation shall not proceed when the ambient temperature is below 20^{o}F or above 110^{o}F. Special low temperature welding techniques may be required in conditions of ambient temperatures between 20^{o}F and 40^{o}F.

4. Geomembrane panel deployment shall not proceed if subgrade conditions have deteriorated due to moisture, or in the presence of high winds which might cause damage to the liner material. Deployed panels should be adequately ballasted at all times to limit the risk of wind damage.

5. Method of Deployment: The FML installation contractor shall proceed with deployment provided the following conditions are met. If the conditions below are not met the FML installation contractor shall cease deployment and resolve the problems with the Project Manager / Owner.

   - Any equipment used does not damage the subgrade.
   - The subgrade conditions have not deteriorated.
   - The subgrade is free of loose rocks, debris, ruts, etc.
   - The personnel who are in contact with the liner do not smoke wear damaging shoes or engage in other activities which risk damage to the liner.

- Adequate sandbags are present to weight the edges of the liner to avoid wind uplifting.
- Excessive traffic across the liner is avoided.

6. Damage: The FML installation manager and quality assurance technical shall visually inspect each panel, as soon as possible after deployment, for damage or areas needing repair. Appropriate marks indicating a need for repairs shall be done during the inspection. Heavily creased or otherwise defective material shall be rejected.

4.5 Field Seaming & Layout:

A. Individual panels of liner material shall be laid out and overlapped by a maximum of four inches (101 millimeters) for extrusion weld prior to welding or five inches (127 millimeters) for hot wedge weld prior to welding. Extreme care shall be taken by the installer in the preparation of the areas to be welded.

All sheeting shall be welded together by means of integration of the extrudate bead with the lining material. The composition of the extrudate shall be identical to the lining material, or all sheeting shall be welded together using the hot wedge welding system.

B. Seam Layout: In general, seams shall be oriented parallel to the plane of maximum slope, i.e., oriented along, not across the slope. In corners and odd shaped geometric locations the number of seams should be minimized. No horizontal seams should occur on a panel less than 5 lineal feet from the top of the slope. On slopes of less than 10% (6:1) this rule shall not apply. Seams will be installed at least four feet into the anchor trench.

1. A seam is considered a separate entity if it joins two panels. Repairs are not considered seams in this context.

2. A seam numbering system can be used to identify the seams. It is suggested that a simple numerical system be used or adjacent panel numbers can be utilized to identify the seam.

3. Seams will be welded to at least four feet into the anchor trench.

C. Seaming Equipment and Products: Approved processes for field seaming and repairing are extrusion welding and fusion welding. All welding equipment should have accurate temperature monitoring devices installed and working to ensure proper measurement of the fusion welding wedge temperature or the extrusion barrel temperature.

D. Extrusion Welding Process: This process shall be used primarily for repairs, patching and special detail fabrication and can also be used for seaming.

1. The extrusion welding apparatus (Handwelder) shall be equipped with gauges or other temperature monitoring devices to indicate temperature of the extrudate (resin) as well as the applicable pre-heat settings.

2. The FML installation contractor shall verify the following:

a. Equipment in use is functioning properly.

b. Welding personnel are purging the machine of heat-degraded extrudate prior to actual use.

c. All work by the personnel is performed on clean surfaces and done in a professional manner.

d. No seaming is done in adverse weather conditions.

E. Fusion Welding Process: This process shall be used for seaming panels together and is not generally used for patching or detail work.

1. The apparatus may be of a hot wedge type and shall be equipped with a "split wedge", used for pressure type seam testing.

2. Fusion welding equipment shall be self-propelled devices and shall be equipped with functioning speed controllers and monitors to assure proper control by the welding technician. The welding equipment used shall be capable of continuously monitoring and controlling the temperatures in the zone of contact where the machine is actually fusing the lining material so as to ensure that changes in environmental conditions will not affect the integrity of the weld.

3. The FML installation contractor shall verify the following:

a. Equipment in use is functioning properly.

b. Welding personnel are performing seaming in a professional manner and are attentive to their duties.

4. **Figure F-1** below is a schematic detail which indicates acceptable fusion weld. Deviations from these must be approved by the design engineer prior to use.

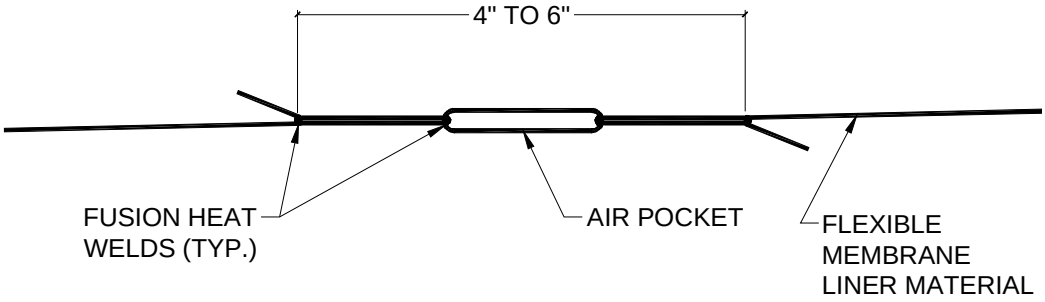

Figure F-1 – Typical Fusion Weld

F. Seam Preparation: The area to be welded shall be cleaned and prepared in accordance with this specification and the recommendations of the material manufacturer. The welding technician shall verify the following:

1. Prior to seaming the seam area shall be free of moisture, dust, dirt, sand or debris of any nature.

2. Seam is overlapped for fusion welding.

3. Seem is overlapped or extended beyond damaged areas at least 4" when extrusion welding.

4. Seam is properly heat tacked and abraded when the extrusion welding is done.

5. Seams are performed with the fewest number of unmatched wrinkles or "fish mouths".

G. Fish Mouths: No "fish mouths" shall be allowed within the seam area. Where "fish mouths" occur the material shall be cut, overlapped and an overlap extrusion weld shall be applied.

H. Slack: Adequate slack will be maintained in the liner during assembly and after installation to minimize stresses due to variations in ambient temperature and incident radiation.

I. Defective Material: Heavily creased or otherwise defective liner material will be rejected.

J. Weather Conditions for Seaming: No seaming shall be performed in ambient air temperatures or adverse weather conditions which will jeopardize the integrity of the liner installation. Ambient air temperatures shall not exceed 110^{o}F nor be below 20^{o}F during seaming. Additionally, seaming shall not proceed in conditions in which the liner is subject to dew or other condensation, rain, snow, frost or frozen subgrade.

K. Low Temperature Welding Procedures: The most important criteria for performing welding when the ambient temperature is between 20^{o}F to 40^{o}F is the condition of the trial weld. All trial welds should be made in conditions duplicating the actual welding environment. The following procedures should be used to maintain the quality of the weld in low temperature ambient conditions (20^{o}F to 40^{o}F).

1. Conduct additional trial welds when a welding machine has been shut off, or after a major change in ambient conditions. A major change in ambient conditions would include but is not limited to the following:

   a. Change in temperature of more than 20^{o}F

   b. Change in wind speed of more than 10 mph.

   c. Change in the amount of sunshine on the liner.

2. The geomembrane and extrudate material must be dry and free from frost, dew, condensation or other moisture.

3. Hot wedge set temperatures may be increased up to 700^{o}F in 10^{o}F increments as necessary.

4. The hot wedge rate of travel should be slowed as necessary.

5. Length of trial weld seams should be increased to 5 ft for extrusion welds and 24 ft for fusion welds.

6. Clean the seam area immediately in front of the welding apparatus with a clean dry cloth.

7. Destructively test one specimen, no greater than 6" from the end of each seam to confirm the quality of the seam.

8. Increase handwelder (extrusion welder) pre-heat temperature up to 600^{o}F in 20^{o}F increments as necessary.

9. Increase handwelder extrudate temperature up to 530^{o}F in 10^{o}F increments as necessary.

10. If additional measures are needed to produce acceptable welds the following additional measures may be implemented:

    a. Install an insulating material such as a geotextile cushion beneath the seam being welded.

    b. Use hot air pre-heat (additional pre-heat for extrusion welding) 6" to 12" in front of the welding apparatus (both fusion and extrusion welders). Verify weld quality be means of a trial weld.

11. If trial welds still indicate that a quality weld cannot be produced be the above steps, a wind shield or an enclosure may be placed over the area to be welded. In the case of an enclosure, the enclosed area shall be heated by forced air or radiant means to an air temperature at or above 40^{o}F.

12. All trial welds will be documented with samples (failures and approved) recorded, retained with samples attached to completion submittal records.

L. Temporary Bonding: The FML installation contractor shall verify that no solvents or adhesives are used in the seaming area. Tape or heat tacking is permissible for temporarily holding patches but is not a substitute for welding.

M. Trial seams / Welds: Trial seams / welds shall be made on appropriate sized pieces of geomembrane material to verify that seaming conditions are adequate.

1. Trial seams / welds shall be performed for each welder to be used and by each operator of extrusion welders, and by the primary operator of the fusion welder.

2. A passing trial seam / weld shall be made prior to seaming each day. If the apparatus is cooled down after use and additional trial seam may be required.

3. Fusion welded trial seams shall be approximately 5 foot long by 1 foot wide with the seam centered lengthwise. For extrusion welding the trial seam sample size shall be approximately 3 feet long by 1 foot wide with the seam centered lengthwise.

4. Test welds shall be marked with date, ambient temperature and welding machine number. All test weld samples will be retained and submitted with approved inspection reports.

5. Samples of weld ¼" to ½" wide shall be cut from the test weld and pulled by hand in peel. The weld should not peel.

6. Refer to Quality Assurance and Quality Control Section 5.2.B for testing requirements.

7. The geomembrane installation contractor shall assign each trial seam / weld sample a number and record the test results in the appropriate log.

8. Upon passing, unless otherwise specified, all trial seam / weld specimens must be retained and submitted with approval inspection reports.

4.6 Defects and Repairs

A. Once defective or areas requiring repair are identified as called out in Section 5.3. Each area shall be repaired in accordance with this section and non-destructively tested.

B. Repair Procedures: Any portion of the polyethylene lining system exhibiting a defect which has been marked for repair shall be repaired with one or more of the following appropriate procedures:

1. Repair Methods:

- Patching: Used to repair holes, tears, un-dispersed raw materials in the sheet.
- Grind and Re-Weld: Used to repair small section of extruded seams.
- Spot Welding: Used to repair small, minor, localized flaws.
- Flap Welding: Used to extrusion weld the flap of fusion weld in lieu of a full cap.
- Capping: Used to repair failed seams.
- Topping: Application of extrudate bead directly to existing seams.

2. The following conditions shall apply to all of the above methods:

   a. Surfaces of the polyethylene which are to be repaired shall be abraded.

b. All surfaces must be clean and dry at the time of the repair.

c. All seaming equipment and personnel used in repairing procedures shall be qualified and documented by the client's third party inspector.

d. All patches and caps shall extend at least 4" beyond the edge of the defect and all patches shall have rounded corners.

C. Large Wrinkles: Large wrinkles that remain in the sheet as a result of temperature expansion or uneven surface preparation may need removal in consideration of applied dead loads on the wrinkle, etc. Should the wrinkle need removing, the lower down slope edge of the wrinkle shall be cut, overlapped and repaired as described above. Both ends of the wrinkle repair shall be patched. Caution must be taken in removing any wrinkles. Wrinkles are needed to allow for future contraction of the geomembrane, especially in cold weather.

4.7 Liner Vents

A. The attached schematic detail DF4A / C.DF4 depicts a typical vent. Vents shall be installed in accordance with manufacturer's recommendations as well as requirements and recommendations indicated on project design drawings.

4.8 Pipe Penetrations

A. The attached schematic detail DF4B / C.DF4 depicts a pipe penetration. Pipe penetrations shall be installed in accordance with manufacturer's recommendations as well as requirements and recommendations indicated on project design drawings.

4.9 Final Earthwork, Backfilling and Equipment

A. Backfilling of Anchor Trench: Promptly after installation of the FML, the anchor trench shall be backfilled by the earthwork contractor or the installer, as specified in the contract. Backfilling should occur when the geomembrane is in its most contracted (taut) state. Care must be taken when backfilling to avoid damage to the FML.

B. Construction Equipment: Construction equipment or vehicles with steel tracks shall not be permitted directly on the geomembrane liner. Vehicles with rubber tires, without a tugged tread and with a loading of less than 6.0 lbs / in^2 weight are allowed, provided proper care is taken when operating the vehicle to avoid stressing the geomembrane. Other equipment such as portable generators shall be permitted if the support apparatus for the equipment protects the liner from being damaged.

5.0 QUALITY ASSURANCE AND QUALITY CONTROL

5.1 Materials:

A. The FML installation contractor or quality control technician shall verify that the property values certified by the geomembrane manufacturer meet all of the specifications; that the measurements of properties by the geomembrane manufacturer are properly documented; and that the test methods used are acceptable.

5.2 Field Seam Testing / Quality Control

A. The end user company, or their designated representative, reserves the right of access for inspection of any or all phases of this installation at their expense.

B. Qualifications of personnel: All personnel performing seaming operations shall be qualified by experience. At least one welder (Master Welder) shall be on site at all times during the seal welding process and have experience seaming a minimum of 5,000,000 ft^2 of geomembrane. The "Master Welder" shall provide supervision of the less experienced welding technicians during seaming, patching and testing operations.

C. Testing of coupons (strips of material) before seaming, stress cracks and all seams must be done in accordance with the FML manufacture's requirements.

D. Trial Welds / Seams:

1. Four specimens, each 1" wide and 6" apart from each other shall be cut from the trial seam. Two of the specimens shall be tested in shear and two specimens tested in peel. Both shear and peel tests shall be conducted to the yield point of the geomembrane. When testing a fusion welded seam the outside (top) weld of a split-wedge weld should be considered the primary weld and shall be the weld tested in peel. The specimen must exhibit the following properties to pass:

    a. Shear Test: Both specimens must meet or exceed the bonded seam strength values in shear of both specimens shall exhibit a bonded seam strength in shear that is greater than 90% of the minimum yield tensile strength of the parent material.

    b. Peel Test: Both specimens must exhibit failure of the parent material or meet or exceed the bonded seam strength values in peel, or strength values shall be greater than 70% of the minimum yield tensile strength of the parent material.

2. General seaming operations may proceed prior to the test being complete. Should a trial seam fail, a sample shall be removed 3 lineal feet from the start of the seaming operations and tested per the above. This procedure will be repeated and followed until a passing sample is located. All work preceding the passing sample shall be repaired.

E. Non-Destructive Seam Continuity Testing

1. Concept: The FML installation contractor shall non-destructively test and document all field seams over their full length using an air pressure test or vacuum test. The purpose of non-destructive tests is to check the continuity of the seams.

2. The FML installation contractor shall:

   a. Schedule all non-destructive testing operations.

   b. Instruct the testing personnel regarding marking of repairs needed, leaks and sign-off marks on seams and repairs.

   c. Monitor the operations of testing personnel to ensure that procedures for testing are followed.

3. On seams that cannot be non-destructively tested by vacuum or air-pressure methods due to physical constraints, (i.e. a boot detail) the seam shall be tested using other approved methods.

4. Vacuum Testing:

   a. Equipment:

      · Vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft gasketing material attached to the bottom, a valve assembly and a certified vacuum gauge.
      · Vacuum pumping device. Including back-up device
      · Foaming agent in solution.
      · Equipment suitable for applying the foaming agent.

   b. Procedure:

      · Wet the section of the seam with foaming agent.
      · Place the vacuum box over the wetted area.
      · Energize the pumping apparatus.
      · Obtain a minimum pressure of -5.0 psi.
      · For a period of approximately 10 seconds, observe, through the viewing window, for the presence of soap bubbles.
      · If no bubbles are observed, reposition the box on the next area for testing.
      · If bubbles are detected, mark and document location of the leak so repairs can be made.

5. Air Pressure Testing: The following procedures are applicable for seams produced by a double-fusion welding apparatus.

a. Equipment:

- Air pump or air tank equipped with pressure gage and capable of producing pressures between 25 to 30 psi.
- Sharp hollow needle to insert the air into the air chamber of the seam.

b. Testing Procedure:

- Installer will provide for approval a detailed seam testing map prior to the starting of seal tests.
- Seal both ends of the air channel in the seam to be tested.
- Insert the hollow needle into the air chamber at either end of the seam to be tested.
- Energize the air pump to a pressure between 25 and 30 psi and read pressure inserted into the chamber. Allow the pressure to stabilize and if necessary, re-pressurize to between 25 and 30 psi. Then record the pressure.
- Wait for a minimum of 5 minutes and then record the air pressure again.
- If the difference between the initial and the final pressure is greater than 4 psi the seam failed. Documentation required on all failed tests.
- Upon completion of all readings, open the opposite end of the seam with a needle. The escaping air will confirm that the entire length of the seam was pressurized and therefore tested.
- Upon passing the air pressure test, the seam shall be marked and documented.
- All Seam tests shall be witnessed by client or clients inspector.

c. Procedure for Air Pressure Test Failure:

- While the seam air-channel is under pressure, traverse the length of the seam and listen for the leak. Once the area of the leak has been narrowed down, apply a soapy solution to the seam edge (do not trim excess material from edge of seam) and observe for bubbles formed by escaping air.
- As an alternative to the step above the seam may be re-tested in progressively smaller increments, until the area of leakage is identified.
- Repair the identified leaking area by extrusion welding the excess material at the edge of the seam and then vacuum test.
- In areas where the air channel is closed and the integrity of the weld is not suspect, vacuum testing is acceptable.

F. Destructive Seam Testing

1. Concept: Destructive seam tests shall be performed at locations selected by client's inspectors. The purpose of these tests is to evaluate bonded seam strength. Seam strength testing shall be performed and documented as work progresses.

2. Location and Frequency: The minimum frequency of sample removal shall be one sample per 750 ft of seam. The location of the test sample will be taken no greater than 6" from the end of the seam. Additional test samples removal as requested by the client or client's inspector.

3. Size of Samples: The size of the sample for independent testing shall be 12” by minimal length with the seam centered lengthwise. The sample shall be cut into the following segments and distributed as follows:

    a. The first segment cut shall be 12” x 12” marked with the appropriate D/S number and given to the AQ technician for testing.

    b. The second segment, 12” x requested length (18” max) shall be marked with the appropriate D/S number and transmitted at the contractors cost to the independent testing laboratory or the quality assurance technician personnel for their dispersal.

4. Field Testing: The segments given to the quality assurance technician shall be tested in peel and in sheer using the following criteria:

    a. Ten specimens of 1” width shall be cut from the segment.

    b. Five of the specimens shall be tested in a peel configuration. The outside (top) weld of a split wedge weld shall be considered the primary weld and shall be the weld tested in peel.

    c. Five of the specimens shall be tested in a shear configuration.

    d. The geomembrane manufacturer shall supply a field tensiometer equipped with a drive / pull apparatus adjusted to a pull rate of 2”/min to 20”/ min and a means of measuring the strength of the sample.

    e. Pass Fail Criteria: The installers sample will pass when:

        - The peel specimens exhibit failure of the parent material.
        - The bonded strength peel values shall be greater than or equal to 70% of the minimum yield tensile strength of the parent material.
        - The shear specimens display parent material failure.
        - If the bonded seam strength in shear values is not listed, the shear values shall be greater than or equal to 90% of the minimum yield tensile strength of the parent material.

            Note: Locus of break determinations is to be in accordance with ANSI/NSF 54
        - Four out of five specimens meeting the above criteria constitute a passing test.

    f. Procedure for Failing Tests:

        - Two samples of the same size shall be removed from the failed seam. The first sample shall be removed 10 lineal feet in front of the failed sample and the second shall be removed from behind the failed sample.
        - Label the samples A and B and test in accordance with procedures listed above.

- If both samples A and B pass, seam between the location of samples A and B shall have the flap extrusion welded or be capped and non-destructively tested accordingly.
- If either sample A or B fails, additional samples shall be taken a minimum distance of 10 feet away from the failed test location. Testing shall continue as outlined above until the area of incorrect seam is isolated.
- In lieu of taking an excessive number of samples, the installer may opt at their cost to extrusion weld the flap or cap for the entire length of the seam then non-destructively test the seam.
- All failing tests shall be documented and forwarded to the client or client's representative within 24 hours, along with recommendation of correction

5.3 Defects and Repairs

A. Identification: All seams and non-seam areas of the polyethylene lining system shall be examined for defects in the seam or sheet.

B. Identification of the defect may be made by marking on the sheet/seam with paint or other marks. The following procedure shall be followed:

1. For any defect in the seam or sheet that is an actual breach (hole) larger than ¼" in the liner system, the installer personnel shall circle the defect and mark the letter "P" inside the circle. The letter "P" indicates that a patch is required.

2. For any defect in the seam or sheet that is less than a ¼" hole, the installer personnel shall only circle the defect indicating that the repair method may be only an extruded bead and a patch may not necessarily be required. Repair methods will be at the sole discretion of the client and the client's qualified inspection representative.

C. Unless otherwise specified, only the geomembrane installation contractor or quality assurance technician shall be permitted to mark on the liner system. The quality assurance technician shall use markings that are distinguishable from the geomembrane installation contractor markings.

D. Verification of Repairs: Each repair shall be non-destructively tested in accordance with requirements of these specifications and manufacturer's recommendations. Once passing tests are achieved a marking shall be placed on the repair, indicting the test is complete and the area has passed the test. If defects remain, appropriate markings shall be made to clearly indicate that additional repairs are required.

5.4 Final Approval

A. A final inspection of the completed liner will be conducted by the FML installation contractor, quality assurance technician and project manager / owner. This careful evaluation will occur before the Division of Water Quality is asked to approve the use of the lined lagoon. The purpose of the inspections is to verify the following:

1. All repairs have been appropriately performed.

2. All test results are positive.

3. Area is free of scrap, trash and debris.

4. Anchor trench has been properly backfilled.

5. Liner has been installed according to the requirements of these specifications, the project documents and the manufacturer's recommendations.

6. Four (4) copies in three ring binders of all installation record documents will be required prior to final acceptance.

B. Each liner material test, construction inspection checklist, data sheet, or narrative report will be preserved for inspection by the Division of Water Quality. Waste shall not be discharged into the digesters or equalization basins prior to the approval of the Division of Water Quality.

6.0 Warranty and Guarantee

6.1 The manufacture / Installer shall provide a written warranty in accordance with the requirements specified by the owner and / or design engineer.