Guidelines for Installation of:

Factory Fabricated Lightweight ≤0.64 mm (25 mil) Thickness Fabric-Supported Geomembranes

International Association of Geosynthetic Installers

www.iagi.org

*This installation guideline was developed in partnership with the **Fabricated Geomembrane Institute (FGI)** & the **International Association of Geosynthetic Installers (IAGI)**.*

FGI Fabricated Geomembrane Institute

www.fabricatedgeomembrane.com

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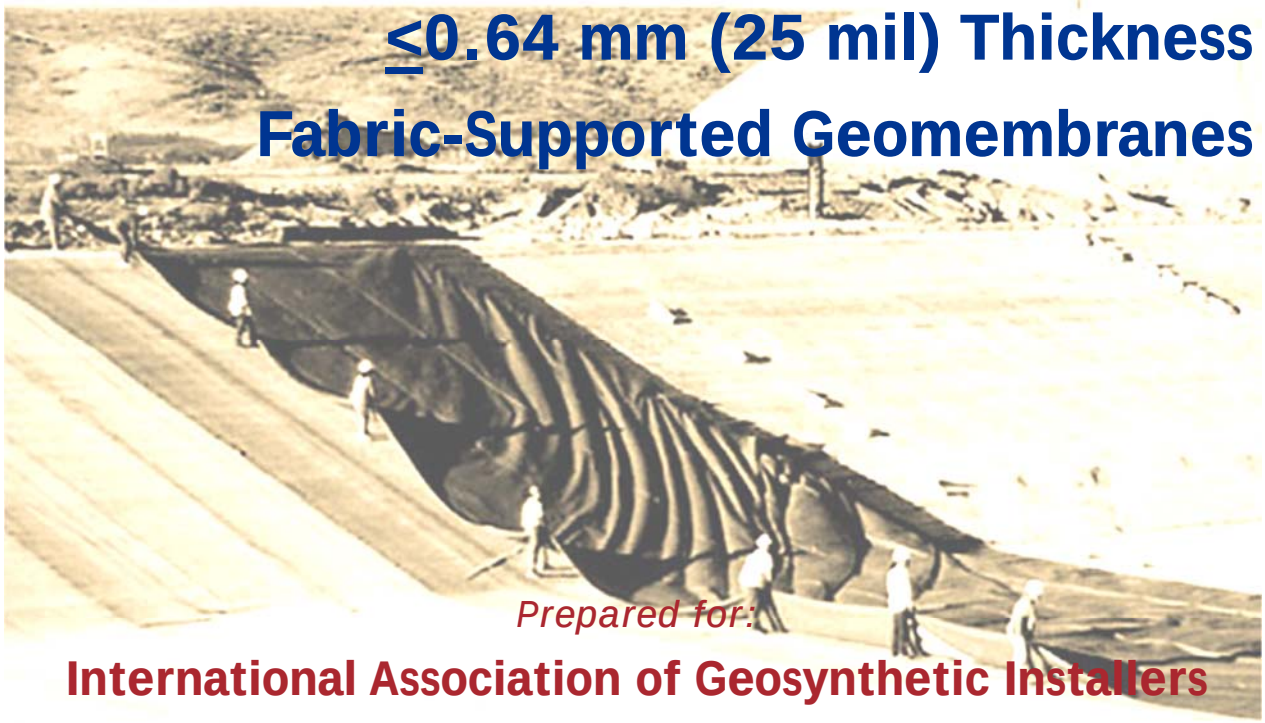

Prepared for:

International Association of Geosynthetic Installers

8457 N. Rampart Range Road, Unit 106, PMB #154

Roxborough, CO 80125 USA

Telephone: (720) 353-4977 / Fax: (612) 235-6484

Email: iagi@iagi.org

www.iagi.org

Prepared by:

Fabricated Geomembrane Institute

University of Illinois at Urbana-Champaign

Department of Civil and Environmental Engineering

205 N. Mathews Ave.

Urbana, IL 61801

www.fabricatedgeomembrane.com

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Part 1 — GENERAL

1.01 Guideline Scope

This document is an installation guideline for Factory Fabricated Fabric-Supported Lightweight Geomembranes (0.64 mm or ≤25 mil in thickness as measured by ASTM D5199, D751 or D1777). The product types are as outlined in Part 2 of this guideline. This guideline is designed to provide a minimum set of standards for site installation. However, depending on the complexity and project specific requirements, a qualified design engineering firm may be required for design and installation specifications of the geomembrane. All work shall be in accordance with the project drawings, specifications and QC requirements.

Applications

Typical applications for factory fabricated Fabric-Supported Lightweight Geomembranes that are less than 25 mil (0.64 mm) in thickness include but are not limited to:

- Irrigation and canal liners
- Moisture barriers and covers for athletic fields
- Golf course and decorative pond liners
- Soil remediation pads
- Interim and final landfill and Mine Reclamation cover systems
- Shale oil and gas development, e.g., drill pads and various liquid containment
- Oil and gas production, e.g., various secondary containment applications
- Mining leach pads and various liquid containment and transport applications
- Tailings ponds
- Water reservoirs and ponds
- Paved and unpaved roadways
- Subgrade protection
- Temporary erosion control

- Barriers, blankets, and curtains
- Rain sheets for Ore in Mining Applications
- Underslab vapor retarders

1.02 References

American Society for Testing and Materials (ASTM)

1. ASTM Standards D4437. "Standard Practice for Non-destructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes". ASTM International, West Conshohocken, PA.
2. ASTM Standards D5199. "Standard Test Method for Measuring the Nominal Thickness of Geosynthetics". ASTM International, West Conshohocken, PA.
3. ASTM Standards D751. "Standard Test Methods for Coated Fabrics". ASTM International, West Conshohocken, PA.
4. ASTM Standards D1777. "Standard Test Method for Thickness of Textile Materials". ASTM International, West Conshohocken, PA.
5. ASTM Standards D5641. "Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber". ASTM International, West Conshohocken, PA.

Other References

1. USEPA. (1991). *Inspection Techniques For The Fabrication Of Geomembrane Field Seams.* Cincinnati, Ohio 45268: U.S. Environmental Protection Agency.
2. Koerner, R. M. (2005). *Designing with Geosynthetics* (5 ed.). Upper Saddle River, NJ 07458: Pearson Education, Inc.
3. Geosynthetic Research Institute (2012). "Standard Specification for Test Methods, Required Properties and Testing Frequencies for Scrim Reinforced Polyethylene Geomembranes Used in Exposed Temporary Applications" GRI GM 22, Geosynthetic Institute, Folsom, PA.

1.03 Submittals

Documents to be included in a submittal to the owner/engineer:

1. Example material warranty and Geomembrane installation warranty.
2. Sample of Geomembrane(s) to be installed including the technical data of the product.
3. Reports of the results of examinations and testing shall be prepared and submitted to the Owner's Representative.
4. Shop drawings/panel layout for Geomembranes with panel numbers, field seam locations, corresponding to shipping labels.
5. Submit resumes or qualifications of the installation supervisor and certified welding technicians. It is recommended that the welding technicians hold an International Association of Geosynthetic Installers (IAGI) Certified Welding Technician (CWT) certification.
6. The documentation to be submitted by the Fabricator varies depending on the Owner's requirements. These may include copy of tested seams, certifications, or any other document related to the quality of the Geomembranes and their installation.
7. Fabricator and Installer QC Manuals.

Part 2 — PRODUCTS

2.01 Geomembrane Materials

Geomembranes included:

This Document is an installation guideline for Factory Fabricated Fabric Supported Light-weight Geomembranes that are less than or equal to 25 mil or 0.64 mm in thickness (as measured by ASTM D5199, D751 or D1777). The top and bottom coating material of the ge-omembranes included in this guideline may be comprised of a single or composite of the fol-lowing Polymers (in alphabetical order).

- Low density polyethylene (LDPE)
- Linear low density polyethylene (LLDPE)
- High density polyethylene (HDPE)
- Polyethylene (PE)
- Polypropylene (PP)

Geomembranes that are included in this Guideline are the following:

- **Woven Coated Fabrics**: These materials are woven flat tapes coated with a polymeric layer on both sides to create a geomembrane. The geomembrane may include one or more layers or arrangements of flat tapes and as many polymeric layers as needed to create a low hydraulic conductivity (relatively impermeable) structure. The finished sheet shall be capable of being thermally heat welded, fused or adhesively bonded to itself**.**
- **Woven Scrim Reinforced Geomembranes:** This geomembrane has an internal light-weight open weave reinforcement consisting of woven yarns in a square pattern (i.e. 9 x 9 or 10x 10 per sq. inch). The finished sheet shall be capable of being thermally heat welded, fused or adhesively bonded to itself.
- String Reinforced Geomembranes: This geomembranes have a string reinforcement that has an open weave of greater than one-quarter inch (¼" or 8 mm) between fibers. The

finished sheet shall be capable of being thermally heat welded, fused or adhesively bonded to itself. Thin gauge String Reinforced geomembrane materials <25 mils are included in this guideline if they are primarily repaired with techniques other than extrusion welding.

2.02 Quality Control

a. Manufacturer's Qualifications

The manufacturer of the specified geomembrane or similar product shall have at least five years of continuous experience in the manufacture of the geomembrane. Additionally, the Manufacturer shall have produced a minimum of 2,000,000 m^2 (21,527,820 ft^2) of the specified geomembrane or similar product during the last 5 years.

b. Fabricators Qualifications

The fabricator of the geomembrane shall have fabricated a minimum of 250,000 m^2/year (2,691,000 ft^2/year) of the specified type or similar geomembranes.

c. Installer's Qualifications

The Geomembrane Installer shall be the Fabricator, approved Fabricator's Installer, or an installer/contractor approved by the Owner's Representative. The installer shall have a minimum experience level of 50,000 m^2 (538,200 ft^2) using the specified geomembrane.
It is the responsibility of any of the aforementioned parties to select a Geomembrane Installer with the appropriate degree of experience, personnel, and equipment to accomplish the required quality standards.

2.03 Geomembrane Arrival at Project Site

a. Geomembrane Unloading

Inspect fabricated geomembrane panels prior to unloading from vehicle at project site (e.g. type of material, conditions, etc.). Make any claims for damage with the carrier prior to unloading or shortly after geomembrane unloading.

Materials delivered to site should be off-loaded (using forklift or similar equipment) in a location where minimum handling steps will be required.

While unloading or transferring the fabricated panels from one location to another, prevent damage to the wrapping and the fabricated panel itself.

Any damage during offloading and transferring should be documented by the contractor unloading the material and the installer.

b. Storage

Leave the panels packaged in UV protected wrap until the day that the panels are to be installed. If extremely hot or cold temperatures are present, keep the panels inside at a moderate temperature. This reduces the force required to unfold the panels.

Fabricated panels, when possible, should be stored on pallets off the ground. The storage area should be dry, level, and with a firm base to facilitate lifting; so the panels are not damaged, do not become dirty, and remain dry externally and internally.

Part 3 — EXECUTION

3.01 Installation

a. Subgrade Preparation

A pre-installation inspection shall be requested by the geomembrane installer and ALL interested parties before moving panels from the storage location to the placement area. If the subgrade is deemed to be inappropriate for any reason, it should be remediated prior to geomembrane movement and placement.

Subgrade surfaces should be free of loose rock fragments (>10 mm or 0.4 inches), sticks, sharp objects, or debris of any kind. The surface should provide a smooth, flat, firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or break in grade that can tear or damage the geomembrane.

No standing water, mud, vegetation, snow, frozen subgrade, or excessive moisture is allowed before geomembrane placement.

All pipes, drains, fitting, etc., which are to be installed beneath the geomembrane, should be in place, backfilled, and ready to be covered with the geomembrane before panel deployment.

An anchor trench in the shape of a “U” or “V” can be used as a perimeter termination point for the geomembrane. Installation of the geomembrane shall be started from the anchor trench.

b. Unfolding and Deploying Prefabricated Panels

The geomembrane shall be supplied as a continuous panel with factory seams in the panel to

reduce the amount of field seaming and testing.

Fabricated geomembrane panels are normally placed at a starting point on one corner of the area to be lined. The deployment markings on the packaging or label indicate which direction the panel will unfold. Note accordion-folded and rolled panels will unroll in only one principal direction while double accordion-folded panels may unfold in either principal direction.

While unrolling and/or unfolding the geomembrane, inspect the fabricated panel for proper material type and thickness, damage, and/or defects. Repair any damage found.

Provide suitable wind uplift protection with sandbags (dirt) or other ballast (such as rolls of geotextile) after the geomembrane panel is unfolded.

Only material that is to be immediately welded, i.e., during that work-day, should be deployed.

Once the geomembrane is properly placed, the material should be seamed as soon as practical.

c. Field Seaming

A large advantage of factory fabricated geomembranes is that manufactured rolls of material can be fabricated into large panels in a factory before shipment to the project site. This minimizes the amount of the field seaming and maximizes the amount of factory seaming which results in more high quality seams. In particular, the individual widths of the manufactured geomembrane rolls shall be assembled into large panels that are custom-designed for the specific project and correspond to the panel layout diagram. If factory seaming is maximized, field seaming can be reduced by 80 to 95 %. In other words, only 5 to 20% of all seams need to be made in the field depending on the unit weight of the geomembrane material. This reduc-

tion in field seaming improves seam quality, accelerates construction, minimizes or eliminates destructive field seam tests, reduces weather exposure issues, allows modular construction, and reduces project costs.

Field Cleaning of Seams

After the panels are initially placed in the proper position, remove as many wrinkles as practical. If possible, allow the panels to "relax" by allowing the panel to warm in the sun. The edges to be seamed need to be smooth and free of wrinkles to ensure good field seams and no "fish mouths."

An overlap of 0.15m (6 inches) for thermal seaming and 100 – 150 mm (4 – 6 inches) for tape seaming must be cleaned of all dust, dirt, water, and foreign debris no more than 30 minutes prior to the seaming operation. Only clean, soft rags should be used for cleaning the areas to be seamed.

The seaming operation requires a solid, dry, smooth subsurface (see section 3.01 A Subgrade Preparation).

During the cleaning operation, the Geomembrane sheets will be inspected for proper type, thickness, and defective areas which must be removed and/or repaired prior to seaming.

Field Seaming

Lightweight reinforced geomembranes are mainly used as a containment barrier for water or other liquids (see Section 1.01 C above). For this reason, seaming the geomembranes is a vital factor in the installation process.

For most projects, field seams should be run perpendicular to the slope.

Reinforced Factory Fabricated Lightweight Geomembrane Panels can be field seamed by either of the following methods:

- Field Thermal Seaming (automated hot edge or hot air welding machine)
- Field Tape Seaming

Extrusion welding is not included in the field seaming list because it is not recommended for geomembranes less than 40 mil (1.0 mm) thick.

Field Thermal Seaming (solid wedge only)

Thermal seaming is performed with an automated hot wedge or hot air welding machine, which uses a heated element to melt the geomembranes to be welded and then presses the two melted sheets together to form a fusion bond. When performed properly, wedge welders produce high quality and consistent seams.

The wedge in a hot wedge welder can be heated with hot air (hot air method), or with electric resistance heating (hot wedge method). It is common to weld fabric supported material with a hot air wedge welder. All wedge welders employ a set point controller to accurately maintain the welding temperature within the most efficient welding temperature for the material. The pressure wheels are normally adjustable to allow for good material bonding after heating.

The single (or solid) wedge arrangement produces a fully bonded weld not less than 25 mm (1 inch) in width.

Seaming with a wedge welder is to be undertaken only by persons that have been trained and qualified in the use of the equipment (see section 2.01 B above). Repairs, maintenance, adjustments, and modifications are to be performed only by trained personnel.

Temperature controllers on the thermal welding device should be set according to type of geomembrane, thickness, ambient temperature, type of heating (air v. wedge), rate of seaming, and location of thermocouple within the device.

It is necessary for the operator to keep constant visual contact with the temperature controls, as well as the completed seam exiting the welder to ensure adequate welding is occurring. It is not recommended to adjust welding parameters without the approval of a trial seam (See section 3.01.D.1 below).

Pre-heating of the geomembrane in the seaming area is optional. The amount or type of pre-heating and its timing preceding the actual seaming is at the option of the installer.

Properly functioning portable electric generators must be available within close proximity of the seaming region and with adequate extension cords to complete the entire seam. These generators should be of sufficient size or number to handle all seaming electrical requirements. The generator must have rubber tires, or be placed on a smooth plate such that it is completely stable and it does not damage the geomembrane. Fuel (gasoline or diesel) for the generator must be stored away from the geomembrane, and if accidentally spilled on the geomembrane it must be removed immediately. The areas should be inspected for damage to the geomembrane and repaired if necessary.

Field Tape Seaming

Prepared tapes include mastics, putties, asphalt, and butyl tapes can be used to seam some geomembranes. Selection of the tape depends on the material being seamed and the fluid being contained.

Immediately after creating a tape seam, it should be loaded or secured to facilitate bonding. The preferred method for securing prepared tape joints is to backfill the geomembrane with

a suitable soil cover so tensile stresses do not develop. The backfill creates a pressure seal between the geomembrane panels and tape which is usually effective.

An alternative method of creating strength in a tape seam is to sew the seam first and then use prepared tapes to waterproof the joint. Even with a sewn seam; the recommended practice is to backfill the geomembrane to prevent shifting of the seam and to help adhere or bond the tapes.

The minimum overlap of geomembrane sheets for tape seaming shall be about 0.10 m (4 inches).

Snow accumulations must be removed prior to seaming because tapes may not adhere or stick in the presence of frost or dew.

To create a tape seam, place one or two continuous lines of prepared tape between the sheet overlap. Press the sheet materials together to compress the tape using a rubber hand roller or similar tool. In areas where wrinkles cannot be removed, use tapes on all sides of the wrinkle to form a waterproof seal.

Visually inspect the completed seam to ensure intimate contact between the tapes and the upper and lower sheet surfaces. Repair discontinuities by placing a patch over the damaged area with a prepared tape seal around the perimeter. The patch must be round, oval, or contain rounded corners and extend 0.15 m (6 inches) around the defect.

Supervise the backfilling of the seam area to prevent the seam from being pulled apart. Backfill should proceed in a direction that does not tend to pull the seams apart or create a shear or tensile stress in the seam. (See section 3.01G Cover Materials below).

d. Field Seaming Test Requirements

Test Seams (Trial Seams)

Test seams shall be prepared and tested by the Geomembrane Installer to verify that the seaming parameters are adequate at the start of each welding session or at the beginning of each working day.

Test seams also may be made whenever personnel or equipment are changed and when climatic conditions reflect wide changes in geomembrane temperature or other conditions that could affect seam quality.

A minimum of one test strip per seaming apparatus shall be conducted at the start of each welding session during a day and at least every 4 hours or 3000 lineal feet of field seam per machine, whichever is more frequent.

Test seams shall be made using "scrap" material from the same lot as the geomembrane being welded in the field because the geomembrane is pre-fabricated into panels in a factory. This requirement is necessary to ensure that the installed geomembrane panels are not damaged prior to the onset of the field welding process because no destructive seam tests shall be conducted on field welded seams to preserve integrity of the fabricated panels (See section 3.01.D.2.a below).

Test seaming shall be conducted under ambient conditions and with the same equipment, geomembrane, and operator as field seaming on the fabricated panels. The test seams shall be at least 1.8 m (6 ft) long for all types of field seams.

If there is no area or equipment on site to provide for these seam requirements, seam strength can be verified for production using trial welds sent to an independent testing la-

boratory to verify quality.

If a test seam fails, an additional test seam shall be immediately completed. If the additional test seam fails, the seaming apparatus shall be rejected and not used until the deficiencies are corrected and a successful full test seam is produced.

Each test seam shall be labeled with date, geomembrane temperature, weather conditions, number of seaming unit, panel identification, seam number or test location, technician performing the test seam, and a pass or fail description.

Pre-qualification seams for tape seams shall be in accordance with ASTM D7272.

Non-Destructive Testing (NDT) of Seam Testing

All Field Seams shall be non-destructively tested by the Geomembrane Installer over the full length of the seams before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of the technician, name of QC person, and outcome of all NDT shall be recorded and submitted to the Owner's Representative.

Testing should be performed as the seaming progresses, not at the completion of all field seaming, unless agreed to in advance by the Owner's Representative. All defects found should be repaired, re-tested, and remarked to indicate acceptable completion of repair. NDT shall be performed using one or more of the following methods:

Air Lance Testing (ASTM D 4437)

The Geomembrane Installer shall provide an air compressor, air hose, and air lance wand with a pressure gauge capable of measuring air flow to the tip. The testing shall be performed by experienced technicians familiar with this testing procedure.

This non-destructive test involves placing the air lance wand 6 to 12 mm (¼ to ½ inch), but not more than 50 mm (2 inches), from the edge of a completed seam and closely monitoring the backside of the sheet for any air penetration through the seam, loose edges, riffles, and/or noise. If air penetrates the seam area, the technician will either see this visibly or hear it audibly and the area shall be marked for repair.

Mechanical Point Stress or "Pick" test (ASTM D4437)

This NDT uses a dull tool (such as a blunt screwdriver) under the top edge of a field seam. With care, an installer can detect an un-bonded area, which is easier to separate than a properly bonded area. Care should be taken to not damage the already bonded areas. This method must be used with extreme care so as not to damage the parent thin gauge geomembrane and is to be used only if other NDT methods are not available.

Identification of Defects

Seams shall be inspected by the geomembrane installer and the owner's representative before, during, and after field seaming to identify all dirty and wrinkled areas and any defects.

Evaluation of Defects

i. Each suspect location (both in geomembrane seam and non-seam areas) shall be non-destructively tested. Each location which fails non-destructive testing shall be marked, numbered, measured, and posted on the daily installation drawings and subsequently repaired.

ii. Defective seams, tears or holes shall be repaired by capping or cutting out the defective seam and re-seaming. Single seams in excess of 20% of their length requiring repair should be entirely removed and re-welded.

iii. Each patch or capping shall extend a minimum of 150 mm (6 inches) in all directions beyond the defect.

iv. All repairs shall be located, measured, non-destructively tested, and recorded.

e. Geomembrane Penetrations

Any structure or containment area built from man-made materials (metal, concrete, etc.) shall not allow protrusions, pinch points, or movement of the supporting structure that might damage the geomembrane and adversely affect the ability of the geomembrane to perform its containment function. All pipes, drains, fitting, etc., which are to be installed beneath the geomembrane, should be in place and ready to be covered with the geomembrane before geomembrane deployment. If possible, avoid cutting the geomembrane at details by using factory fabricated pipe boots that can be seamed to panels in the field. The following directions provide additional details for handling geomembrane penetrations:

i. Pipes

Whenever possible, avoid slitting geomembrane panels for piping details until a prefabricated pipe boot is ready for immediate installation. Cuts made in the geomembrane for clearance over penetrations should always be made as small as possible to minimize patch work. Generally, it is preferred to let the geomembrane straddle a relatively small protrusion (for later detail work) provided that a rag or towel is taped over the pipe to avoid damage to the geomembrane.

Factory prepared pipe boots should fit snugly but not require excessive force to pull over a pipe. If a pipe boot feels overly snug but workable, try applying either talc powder or using compressed air with a nozzle to float the boot sleeve over and along the pipe.

Pipe boots should never be used if the force required to install them stresses or weakens the boot. When properly installed, the pipe boot will lay flat against grade surrounding pipe without leaving pockets that may become stressed during or after placement of backfill.

Pipe boot aprons should be seamed to the parent geomembrane using one of the repair techniques described in the Seaming Section above (see 3.01C Field Seaming).

Proper leak proof sealing of pipe boots should be verified by non-destructive methods (see section 3.01 D). The pipe boot sleeve should be attached to the pipe using butyl tape between the pipe and boot and two stainless steel band clamps.

When cover materials are not used (see section 3.01.F below), splash pads or additional geomembrane layers shall be used for all inflow pipes to prevent long term wear and damage to the geomembrane caused by the direct impact of the inflow on the geomembrane panels. The pads should be welded on top of the geomembrane panels and tested according to sections 3.01.C and D, respectively. Common splash panel sizes are 1.2 to 1.8m (4 to 6 ft) in all directions. However, larger sizes may be required depending on the amount of inflow pipes and the height to the discharge point.

ii. Concrete

Where bonding a geomembrane to concrete (or masonry) is required, the concrete surface should be smooth, clean, dry, and free of any sharp protrusions or rock in the backfill. Geomembrane to concrete seals shall be accomplished with mechanical anchors (e.g. fasteners, termination bars). An approved sealant is placed between the geomembrane and the concrete surface to ensure sealing.

The geomembrane fixed to a concrete structure must be on firm soil subgrade that will not deform and stretch the geomembrane. Compacting of the soil subgrade around such structures must be performed with particular care so excessive differential movement between the concrete and soil subgrade does not occur.

iii. Drains

The geomembrane shall be mechanically fastened to the concrete structure at the location of water discharge. This detail requires the installation of a concrete base or structure at the location of the drain.

Where water enters or exits the geomembrane area, e.g., ponds, reservoirs, and canals, this point must have proper geomembrane termination so as not to damage the geomembrane. The area of inflow must be anchored with a trench of a depth or attached to a structure as designed by the Project Engineer or Design Professional. The geomembrane is installed and then anchored to the concrete prior to the covering with soil.

iv. Aerators

Geomembrane design in lagoons with aerators should require ballast, e.g. precast concrete slab, on the geomembrane to prevent uplift and to provide a pad to support the aerator when the water level is lowered. Many examples exist of geomembrane damage due to an aerator settling on the geomembrane or where the geomembrane was lifted into the aerator. Other aerator damage is frequently evidenced as cuts in the geomembrane along a specific elevation on the side slope where the aerators have been pulled to shore for maintenance. Geomembrane sheets are easily damaged by the sharp edges of a 6 mm (0.25 inch) thick stainless steel plate of an aerator.

f. Cover Materials

When placing cover material or initially filling the containment area, it is important to ballast the geomembrane into the perimeter anchor trench before covering or filling. The anchor trench or perimeter shelf area should be the last area covered to complete the cover process.

Under all operating conditions, protection of the geomembrane will be required. Care should be taken when covering the geomembrane to prevent any damage. At no time will construc-

tion equipment be allowed to operate or drive directly on the geomembranes.

Any damage to the geomembrane should be repaired prior to proceeding with cover material placement. Costs associated with repairs are the general contractor's responsibility.

The cover material shall be placed as soon as practical, in conjunction with or upon completion of the geomembrane installation or as the installation progresses to minimize traffic on the geomembrane and damage.

Access roads for clean soil cover should be maintained to provide 0.3 m (12 inch) minimum and for heavier equipment on haul roads a minimum of 0.45 m (18 inch) preferable between the excavation equipment and geomembrane at all times. Some geomembrane manufacturers may require a soil or a sand cover of at least 0.45 m (18 inches), so cover soil requirements should be verified before placement with the Design Professional and geomembrane fabricator.

Heavy equipment should operate on a minimum 1 m (3-foot) thick roadway where the "haul road" is established in and out of the containment area.

Cover material shall consist of 12 mm (0.5 inch) minus particles, clean rounded soils or gravels free of sharp edges, sticks, metal, rubbish, and debris or foreign materials. Site specific materials or sizes may be acceptable. It is recommended that the contractor receive prior written approval of acceptance of the cover materials from a geomembrane representative and/or Design Professional before covering the geomembrane.

Cover soils should be dumped and leveled over the geomembrane and not pushed from one

end to the other to minimize rolling and wrinkling of the geomembrane beneath the soils. Cover soil should always be placed from the bottom to the top of slopes to avoid stressing the geomembrane and slope stability problems.

Equipment should be turned in long sweeping turns and not spun quickly to eliminate the chance of tires digging down to the geomembrane thru the cover soil and wrinkling or stretching the geomembrane.

If geomembrane damage does occur during construction, cover placement, and/or filling, DO NOT COVER IT UP. Advise the foreman and CQA personnel so repair can be made and documented which will make doing the repair a lot easier than after cover soil placement or filling.

g. Field Acceptance

The Geomembrane will be accepted by the Owner's Representative when all of the following have been completed:

1. The entire installation is finished or on agreed upon subsections of the installation are finished (3.01 A through 3.01F).
2. All Installer's QC documentation is complete and submitted to the Owner.
3. Verification of the adequacy of all field seams and repairs and associated geomembrane testing is complete.

h. Site Clean Up and Demobilization

On completion of installation, the geomembrane installer shall dispose of all waste and scrap material in a location provided and approved by the owner. The installer should also remove all equipment used in connection with the work herein, and shall leave the premises in a neat and acceptable manner. No scrap material shall be left on the completed surface of the geomembrane or in the anchor trenches.

Part 4 — MEASUREMENT AND PAYMENT

4.01 Measurement & Payment

As per project specifications.

Thank you to Mr. Ronald Frobel for reviewing and commenting on this document.

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This document was prepared by graduate student Rafael Villarreal and Professor Timothy D. Stark of the University of Illinois at Urbana-Champaign.