

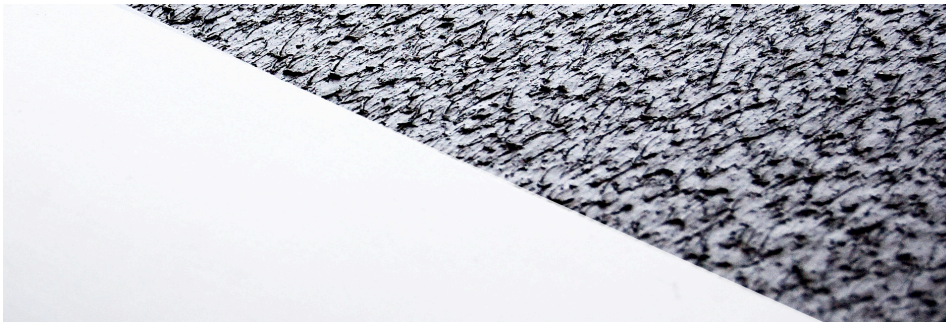
Canals

THE PROBLEM

As clean water becomes more expensive to acquire, the need for secure water containment and transport grows. Over time, concrete-lined canals may crack, resulting in a significant loss of water. Earthen canals are also subject to erosion and leakage problems.

THE SOLUTION

GSE polyethylene geomembrane provide an effective and economical solution to canal leakage and erosion problems.



[GSE Geomembranes are available in a smooth or textured surface]

COVERED OR EXPOSED

Geomembrane canal liners may be left exposed or may be protected with a covering of soil or concrete. GSE's UV-stabilized geomembranes can remain exposed for an extended length of time with no expected decline in their level of performance. However, most canal lining systems should be protected against damage from rocks, debris, equipment and vandalism. Some applications require a protective concrete covering over the geomembrane. The protective concrete layer may be cast-in-place with reinforcing steel, pumped into geotextile forms, precast in panels or spray applied.

GSE textured geomembranes can improve concrete stability during its placement on slopes by increasing the friction between the liner and the concrete and the liner and the subgrade.

HDPE & LLDPE GEOMEMBRANES

Polyethylene geomembranes are commercially available in a range of resin densities and quality. However, GSE uses only the best quality high density (HDPE) and linear low density polyethylene (LLDPE) resins. These resins exhibit exceptional flexibility, strength and durability, as well as excellent chemical resistance. HDPE geomembranes are best for high wear conditions such as exposed applications and LLDPE geomembranes offer extra flexibility.



GSE lined canal with incorporated flow control system

GSE HDPE GEOMEMBRANES EXHIBIT:

- Long-Term Durability
- Flexibility
- Puncture Resistance
- Optional Textured Surfaces
- Large Roll Widths & Lengths
- UV Stability
- Low Temperature Flexibility
- Thermally Welded Seams
- Flow Improvement
- Reduced Maintenance

REPAIR OF EXISTING CANALS

GSE geomembranes are suitable for lining over cracked concrete canal linings. Sections of the canal can be repaired at different times if the budget does not allow for a complete relining at one time.

CASE HISTORIES - RELINE USING TEXTURED GEOMEMBRANE & SHOTCRETE

For 30 years, the Putah South Canal in Vacaville, CA supplied irrigation water for the Solano Irrigation District¹. Seepage was a continuing problem which was partially mitigated by lowering the surface height of the canal water by 24 in (61 cm). A decision was finally made and funds allocated to reline the worst section of the canal - about 4,000 ft (1,500 m). Various methods were considered.

The material chosen was a polyethylene geomembrane with a textured surface manufactured and installed by GSE. Installation began at the lowest point of the canal and proceeded upwards. The geomembrane panels were installed transverse to the canal and the panels were fusion welded together. They were then mechanically attached to the existing concrete liner at the top of the canal slopes.

Shotcrete with reinforcing fibers was then spray-applied to a 2 in (5 cm) thickness. The textured membrane allowed for applying the complete shotcrete thickness at one time instead of in three applications as would have been necessary using a smooth-surfaced geomembrane. Expansion and contraction joints were added at 12 ft (3.5 m) centers. One section was completed in 1989; a second section using the same method, was completed in 1993. The lining

eliminated water loss.

NEW CANAL WITH GEOMEMBRANE AND CAST-IN-PLACE CONCRETE

The Pasto Grande Umarzo Canal Project in the mountains of Peru involved constructing 59,000 feet (18 km) of concrete-lined canal in an arid region. The canal supplies drinking and irrigation water for an agricultural community. The canal lining consists of a geotextile cushion and the textured HDPE waterproofing geomembrane. A steel-reinforced, cast-in-place concrete protective covering was later installed to minimize the cost of the surface preparation and to protect the HDPE.

Several sections of the canal, which winds down the mountains, utilized a



[GSE lined canals help prevent water loss]

concrete-lined canal. The cast-in-place concrete was poured directly on top of the geomembrane. Forms were utilized on the steep side slopes.

GSE textured geomembrane was an excellent choice for this difficult and demanding canal lining installation and was able to withstand the traffic and activity necessary to install the protective concrete layer.

ENGINEERING SUPPORT

The GSE Engineering Support Staff is comprised of multidisciplinary product professionals to support you across a range of project requirements. This includes knowledge

in geomembrane, geosynthetic clay liners, geonet, geocomposite, nonwoven geotextile and concrete protection products and application solutions. Rely on our technical staff to help you solve your project issues.

CUSTOM FABRICATION

The GSE Custom Fabrication Group builds products to your exact specifications. We have extensive experience in prefabricated polyethylene products and components. A few examples of our custom fabricated products are Aqua Tanks, Quick Containment, concrete protection liners, boots, sumps, pads, pipes, daily covers, temporary containment, containment boom and other products to fulfill your fabrication needs.

INSTALLER NETWORK

The GSE Installer Network leads the industry with the most experienced, large, and flexible crews available around the world to meet your installation requirements. Each installer is equipped with state-of-the-art welding and testing equipment to ensure a successful installation. Selecting a qualified installer with the right product knowledge is critical to your success. Let GSE connect you to the right installer to handle your installation project of any size from start to finish.

¹Refer to the Concrete Placement over Geomembranes, Alice I. Comer, Bureau of Reclamation paper, USA.

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

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

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

