Municipal Water and the Role of Flexible Geomembranes

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Municipal water systems provide important potable water and wastewater treatment services to communities. Drinking water is sourced from local surface waters, such as lakes and rivers, and from groundwater aquifers. Municipalities treat this raw water through a series of filtration, disinfection, and storage processes to ensure it is safe for everyday consumption and use.

Flexible geomembranes have been used extensively in municipal water containment applications and are increasingly relied upon to protect valuable water resources. Their ultra-low hydraulic conductivity, chemical resistance, flexibility, and long-term durability make them ideally suited for both new construction projects and the rehabilitation of aging water storage and wastewater treatment infrastructure. As municipalities seek to reduce water losses, protect groundwater resources, and extend the service life of critical assets, geomembranes have become a widely accepted containment technology.

Common geomembrane applications within municipal water systems include reservoir and pond liners, floating covers for water storage facilities, and baffle curtains used in water and wastewater treatment processes. These systems improve containment performance, enhance operational efficiency, and support the long-term sustainability of municipal water infrastructure.

Potable Water Applications

In drinking water systems, geomembranes are commonly used for:

- Reservoir liners
- Clearwell (final storage component of a treatment system) liners
- Storage pond liners
- Concrete tank rehabilitation
- Floating reservoir covers

Figure 1. 67 million gallon R-CSPE floating cover in California

Geomembranes provide an effective impervious barrier against seepage and leakage losses, helping utilities conserve treated water and maintain system integrity. Many aging concrete reservoirs and tanks experience cracking due to differential settlement, thermal cycling, structural loading, and long-term deterioration. Installation of a geomembrane lining system provides a cost-effective method of restoring watertightness and extending asset life without major structural reconstruction. **Figure 1** shows an R-CSPE (see material types below) defined-sump floating cover system for a potable water storage reservoir installed in Southern California.

Floating geomembrane covers are widely used on open-top reservoirs to protect drinking water quality from outside contaminants, wildlife, and algae growth. One of their main benefits is to eliminate evaporation losses, making them particularly beneficial in water-stressed regions. Compared to above-ground storage tanks or underground concrete reservoirs, floating covers are one of the most economical methods for storing large volumes of potable water.

Wastewater Applications

Geomembranes are also utilized throughout municipal wastewater treatment facilities, including:

- Wastewater treatment basins
- Equalization ponds
- Aeration lagoons
- Sludge storage facilities
- Effluent reservoirs
- Odor-control covers

Figure 2. PVC geomembrane lined municipal effluent pond

In these applications, geomembranes provide a containment barrier that prevents contaminated liquids from migrating into surrounding soils and groundwater while supporting regulatory compliance. In wastewater treatment, floating covers are frequently used to control odors, reduce emissions, and improve overall facility operations. **Figure 2** shows a large PVC lined municipal wastewater effluent pond under construction.

Baffle Curtains

Reinforced flexible geomembranes are also fabricated into baffle curtain systems used in both potable water and wastewater treatment facilities. Baffle curtains direct flow through a controlled serpentine pathway, increasing hydraulic retention time and improving treatment efficiency.

Figure 3. R-EIA baffle curtains for wastewater treatment

Benefits of baffle curtain systems include:

- Reduced hydraulic short-circuiting
- Elimination of dead zones
- Improved flow distribution
- Enhanced sedimentation efficiency
- Increased overall treatment performance

Geomembrane Material Selection
A variety of geomembrane materials are used in municipal water applications. Material selection should consider water chemistry, exposure conditions, design life requirements, installation methods, and long-term operational objectives. For exposed applications, adequate ultra-violet (UV) stabilization is essential to ensure long-term weathering resistance. Geomembranes must also demonstrate resistance to common water treatment chemicals, including chlorine, chloramines, ozone, and a broad range of pH conditions.

One of the most important considerations is the effect of disinfectants on geomembrane durability. Chlorine and chloramines can accelerate antioxidant depletion in certain geomembrane polymers, potentially increasing susceptibility to oxidation, environmental stress cracking, and loss of mechanical properties. These effects may be further accelerated by elevated temperatures and high solar/UV exposure.

Consequently, material selection should evaluate the combined effects of the following conditions and chemicals:

- UV exposure
- Ambient & Water temperatures
- Disinfectant concentrations
- pH conditions
- Mechanical loading and settlement
- Required design & service life

Figure 4. Installed 45 mil R-PP potable water tank liner floating cover, South Africa

Geomembrane flexibility is an important material selection criterion in municipal water containment applications. Flexible geomembranes provide high elongation and yield properties, allowing them to accommodate differential settlement and transitions between horizontal and vertical surfaces while simplifying attachment to structures and penetrations. Flexibility is also beneficial for creating large factory-fabricated geomembrane panels that reduce field seaming, accelerate installation, and lower labor construction costs. These advantages are particularly valuable in defined sump tensioned floating cover systems see **Figure 4**, underground concrete reservoirs see **Figure 5**, above ground steel or concrete tanks, projects with numerous columns, penetrations and structural supports as well as large water storage reservoirs see **Figures 6 and 7**.

For potable water applications, geomembranes should be certified for direct contact with drinking water. In North America, certification is typically provided through **ANSI/NSF 61**, while Australia and New Zealand commonly require compliance with **AS/NZS 4020**.

Common Geomembrane Materials

Figure 5. Geomembrane relining of underground concrete reservoir in Arizona

Potable Water Applications

- R-CSPE (Reinforced Chlorosulfonated Polyethylene (CSPE))
- R-EIA (Reinforced Ethylene Interpolymer Alloy (EIA) – (PVC+KEE)
- R-LLDPE (Reinforced LLDPE)
- R-PP (Reinforced Polypropylene)
- HDPE – Potable Grade
- LLDPE – Potable Grade

Figure 6. Hinkle Reservoir R-CSPE floating cover in California

Wastewater Applications

- HDPE (High Density Polyethylene)
- LLDPE (Linear Low Density Polyethylene)
- R-LLDPE (Reinforced LLDPE)
- R-EIA (Reinforced EIA)
- R-PP (Reinforced Polypropylene)

Baffle Curtains

- R-EIA (Reinforced EIA)
- R-CSPE (Reinforced CSPE)
- R-PP (Reinforced Polypropylene)

Final material selection should always be based on project-specific operating conditions, exposure environment, regulatory requirements, chemical compatibility, and desired service life.

Installation Considerations

Proper installation is critical to long-term geomembrane performance. Factory-fabricated systems can significantly reduce field welding, installation time, CQA requirements, and overall project costs. However, several key factors remain essential to successful installation:

- Thorough subgrade preparation
- Proper perimeter anchor trench
- Qualified installation personnel
- Approved seaming and welding procedures
- Proper mechanical attachment details
- Non-destructive and destructive seam testing
- Protection against construction damage
- Compliance with potable water certification

Figure 5. Installation of R-EIA geomembrane for a water reservoir in Maryland, USA

For exposed geomembrane systems, designers should also account for thermal expansion and contraction of the geomembrane, UV exposure, wind uplift forces, operational access requirements, and long-term maintenance considerations.

Summary

Flexible geomembranes have become an integral component of modern municipal water and wastewater infrastructure (see **Figures 8** and **9**). Their ability to provide reliable hydraulic containment, minimize leakage, rehabilitate aging assets, and reduce life-cycle costs has led to widespread adoption throughout the industry.

From potable water reservoirs and floating covers to wastewater lagoons, treatment basins, and baffle curtain systems, geomembranes provide durable, cost-effective containment solutions that help municipalities protect valuable water resources while meeting increasingly demanding operational, environmental, and regulatory requirements.

Further details on flexible geomembranes products can be found on the FGI website at https://www.thefgi.org.

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Figure 8. Baffle Curtains for municipal wastewater, Ontario, Canada

Figure 9. R-PP liner installed for large raw water storage pond in Colorado, USA

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