

Stormwater and the Role of Flexible Geomembranes

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Stormwater has become a growing challenge for urban communities as flooding risks rise, water quality declines, and the natural water cycle becomes increasingly disrupted by widespread impervious surfaces such as roads, parking lots, and rooftops.

Stormwater refers to rainwater or snowmelt that flows over surfaces like streets, roofs, and landscaped areas. As it moves, it collects pollutants including oils, chemicals, nutrients, and debris. While some stormwater infiltrates into the ground to replenish aquifers or evaporates, most runoff flows untreated into storm drains and ultimately into rivers, lakes, wetlands, and oceans as shown in **Figure 1**. Urban stormwater can cause serious ecological, environmental and infrastructure damage.



Figure 1. Photo of urban stormwater flooding

To address these impacts, **flexible geomembranes** are increasingly being used in stormwater management systems for diversion, containment, detention, and long-term retention. Common applications include bioswales, underground storage systems, wet detention ponds, and dry retention basins. **Figure 2** shows an example of a stormwater infiltration trench.

Stormwater Containment Applications

- **Wet Stormwater Retention Ponds**
- **Dry Stormwater Detention Ponds**
- **Bioswales and Infiltration Trenches**
- **Underground Stormwater Retention & Infiltration Tanks & Chambers**

Flexible geomembranes are well suited to these applications because they can be installed in vertical trench configurations with sharp corners and can be factory-fabricated into larger custom size panels helping to reduce difficult field welding and

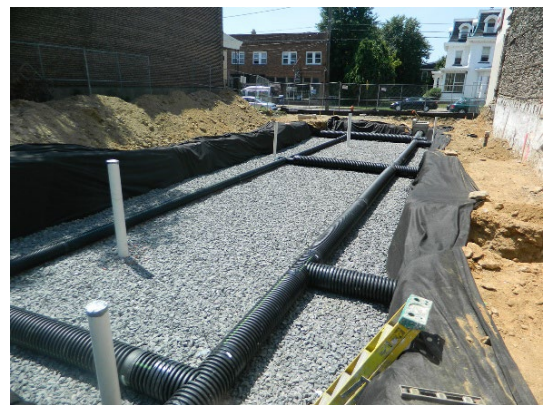


Figure 2. Philadelphia stormwater infiltration trench

reduced installation times. In some instances, a single factory-fabricated panel can line the entire stormwater management system. Heavy-weight nonwoven geotextile cushions and geocomposite products are commonly placed above and below the geomembrane to prevent puncture during construction, and service life operations. **Figure 3** shows an LLDPE geomembrane lined bioswale with a non-woven geotextile cushion fabric.

Recommended Flexible Geomembrane Materials

- PVC – Polyvinyl Chloride
- LLDPE – Linear Low Density Polyethylene
- R-LLDPE – Reinforced Linear Low Density PE
- R-PP – Reinforced Polypropylene



Figure 3. LLDPE lined Bioswale in California

Industry Collaboration and Standards Development

The **Flexible Geomembrane Institute (FGI)** recently partnered with the Philadelphia Water Department’s Office of Watersheds to form a joint stormwater regulation subcommittee. The goal of this collaboration was to develop standardized guidelines for the use of flexible geomembranes in stormwater containment systems for the greater Philadelphia region. The subcommittee worked through a range of civil, mechanical, and construction-related challenges associated with stormwater facilities. This collaborative process resulted in a new geomembrane specification and guideline for the City of Philadelphia covering geomembrane selection, installation practices, CQC and CQA of the geomembrane, and testing of the completed system. We appreciate the City of Philadelphia’s professional approach in developing a new stormwater guideline aligned with industry geosynthetic best practices. **Figure 4** and **Figure 5** below show two underground modular geosynthetic stormwater retention tank systems being installed.

Further details on flexible geomembranes products can be found on the FGI website at <https://www.thefgi.org/protected/geomembrane-guide>.



Figure 4. Underground modular stormwater tank retention system with geotextile cushion and geomembrane



Figure 5. Geomembrane lined retention tank with 30 mil LLDPE



Figure 6. Stormwater retention pond lined with a flexible PVC R-EIA Geomembrane



Figure 7. Stormwater detention pond lined with a flexible PVC geomembrane in Connecticut, USA



Figure 8. Stormwater dry detention system with a trickle channel in Colorado USA lined with flexible 30 mil R-LLDPE

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Figure 1 -Public Internet, Figure 2 - Philadelphia Water, Figure 3, 4, 5 - Layfield Geosynthetics, Figure 6 - Seaman Corp, Figure 7 - GeoStorage Corp, Figure 8 – Colorado Lining