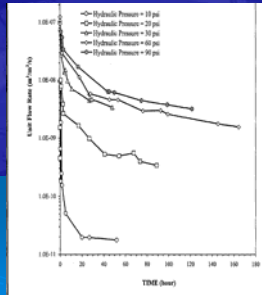


Seam box test

- Membrane backed GCL placed in hydrostatic chamber with seam and bead of granular bentonite
- flux 1×10^{-9} m³/m²/s at 20 psi head



3 ASTM GCL Standard Guides

- ASTM D5889 – Standard Guide for Manufacturing Quality Control of Geosynthetic Clay Liners
- ASTM D5888 – Storage & Handling of Geosynthetic Clay Liners
- ASTM D6102 – Installation of Geosynthetic Clay Liners



Unloading with Straps



Manual Unroll (downslope)



Use of lightweight ATVs



Anchorage

- Anchor trench or flat runout may be used
- Typically recommend a 1.5 ft. wide and 2 ft. deep anchor trench
- Crest and anchor trench edges should be rounded



Seaming

- Overlapping of GCL panels:
 - 12" side-to-side; 24" end-to-end
- Shingle end-to-end in downhill direction.
- Membrane backed GCL requires 1/4 lb. per lineal foot of granular bentonite between seams and end-to-end overlaps.



Seaming - Augmented Seam w/ Bentonite



Placement of Cover

- GCL should be covered w/ geomembrane or cover soil at the end of workday. Edge can be protected with plastic film.
- Use caution! Uncontrolled cover placement can damage the liner.
- With soil cover, avoid overlap contamination
- Push soil up from toe of slope as much as possible.



Cover Soil Application



Idaho Springs Reservoir Dam

- Located 40 miles west of Denver
- Built in early 1900s as water supply for city
- 270 acre-feet storage
- By 2000, restrictions (120 acre-feet) placed on storage due to five significant seeps found on downstream side of dam

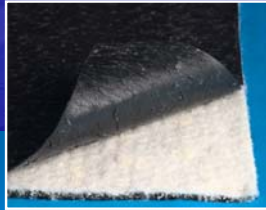


Idaho Springs Dam

- Initial feasibility study considered gunite and hot asphalt injection
- Larger than expected voids encountered
- Remote location, long haul for clay
- Short construction season at high elevation

Idaho Springs Dam

- Final design called for a membrane-backed geosynthetic clay liner
- 1 truck GCL = 20 trucks of clay
- GCL could be installed in cold conditions.



Idaho Springs Dam

- Shear box test by independent lab
- Interface between site soils and GCL
- peak interface shear strength of 45 degrees.



Idaho Springs Dam



Idaho Springs Dam

- 15-foot wide rolls anchored in anchor trench at crest
- 1-foot overlap with ¼ lb per linear foot of granular bentonite applied between seams
- GCL run out 20-25 feet past toe of slope
- Cover soil and riprap placed over GCL 3 foot total thickness

Idaho Springs Dam



- Post construction monitoring
- Downstream toe has remained dry
- Seepage greatly reduced to acceptable levels

Completed dam rehab

