651.1080 Appendix 10D-Indiana permeability (hydraulic conductivity) testing for soil liners

For soil liners on Natural Resources Conservation Service (NRCS) and/or Indiana Department of Environmental Management (IDEM) approved waste storage projects the following tests should be run:

1. **Mechanical analysis by ASTM D422** and **Atterberg Limits** by **ASTM D4318** to determine **soil classification** according to the Unified Soil Classification System (USCS) **ASTM D2487**.

2. **Standard Proctor compaction tests by ASTM D698.**

3. **Permeability (Hydraulic Conductivity) done by ASTM D5084.** ASTM D5084 is the Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter. **The method used should be Method C - Falling Head with Rising Tailwater. The sample should be saturated before the testing begins.**

The samples used for the hydraulic conductivity test should be compacted to 95% standard proctor and +3% of optimum moisture. Consult the engineering firm or NRCS representative to discuss the results and if further testing is needed. If this test value results in a predicted specific discharge rate of more than 1/16 inch/day (hydraulic conductivity is too high), then other samples may be run. Some other options to achieve the specific discharge rate would be the following:

1) Compact the sample to 98% standard proctor and +1% of optimum moisture and run the hydraulic conductivity test.

2) Add a soil amendment such as soda ash or bentonite. The amendment should be selected that is appropriate for the soil being tested. Bentonite should only be used for soils that either have less than 20 percent clay (percent finer than 2 microns) or have a Plasticity Index less than 7. Soda ash should be used for other soils. These tests using additives should be performed on samples that are compacted to 95% standard proctor and +3% of optimum moisture. ASTM D5084 should be performed to measure the coefficient of permeability with the additive. Select the

3) additive rate of application to evaluate based on NRCS Conservation Practice Standard 521C for Bentonite and 521B for soda ash.

4) Work with the engineering firm or NRCS representative to determine if increasing the earthen liner thickness will help to achieve the specific discharge rate. The minimum required thickness of an earthen liner is one (1) foot.