

**alliance**  
geotechnical & environmental solutions

**Soil & Rock Mechanics | Specialty Testing**

# Strength & Mechanical

Alliance employ the best laboratory people in the commercial sector investigating Soil/Rock Strength and Stiffness behaviour, Soil Settlement and Swelling potential using the latest GDS Triaxial & Automated Oedometer machines providing the most accurate and reliable testing results.

Triaxial and Oedometer test results are used when designing foundations, excavations, embankments, tunnels, earth wall structures, settlement, drainage and slope stability analysis.

Primary parameters obtained from the tests may include the angle of shearing resistance ( $\phi'$ ), cohesion ( $c'$ ), undrained shear strength ( $S_u$ ), pore water pressure measurement ( $\mu$ ), coefficient of consolidation ( $C_v$ ), coefficient of volume compressibility ( $M_v$ ), void ratio ( $e$ ), and permeability ( $k$ ).

Talk to us about performing Australian/International test Standards, or customized specialist in-house procedures for specific projects, design or research requirements.



## Strength & Mechanical Tests

- Triaxial (UCS) - Unconfined Compression Test on Cohesive Soil
- Triaxial (UU) - Unconsolidated Undrained without pwp measurement
- Triaxial (CU) - Consolidated Undrained with pwp
- Triaxial (CD) - Consolidated Drained
- Soil Direct Shear - Peak / Residual / Constant Volume
- 1-D consolidation with optional loops/unloads/reloads/rebounds / Creep
- Free Swell, Magnitude of Swell, Swelling Pressure Index
- Collapse/Swell Strain
- Stepped Consolidation after Free Swell or Collapse Strain
- Point Load Testing
- UCS Testing

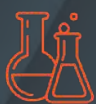


# Hydraulic Testing

At Alliance we are always continuing to develop and expand our testing capabilities to meet your needs. We are experts at delivering specialist customised testing for specific project, design or research requirements.

The hydraulic characters of materials in the geotechnical engineering are important not only because they control how liquids transport through the geo-matrix, but also affect the strength performance of the materials as the permeation of liquids affect their drainage and durability under physical and chemical erosions.

We have the latest GDS hydraulic conductivity testing equipment which provide services that measure the rate at which water moves through soil, porous rock and other porous materials. We also provide customized tests using different types permeant, eg site mine water, waste leachate, etc.



## Hydraulic Tests

- Triaxial Permeability - Constant Head
- Triaxial Permeability - Constant Flow
- Falling Head Permeability
- Emerson Class
- Pinhole Dispersion (Erodibility) Test



# Physio-Chemical Testing

Alliance incorporates the use of innovative and state of the art testing equipment and technology to assist our clients in design, mining, construction and research.

Alliance either conduct or can externally arrange soil chemical properties testing to test for aggressiveness, acidity and other chemical properties to RMS, Australian or International testing Standards.

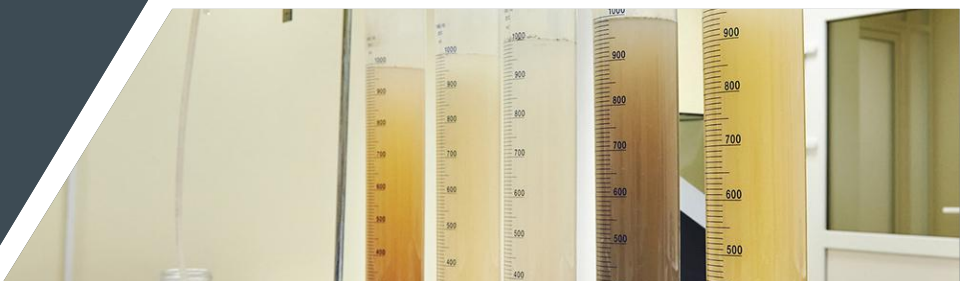
The physio-chemical properties of geotechnical materials (e.g., soils, rocks, aggregates) often control their strength and mechanical performance. A better understanding of those parameters provide engineers and designers with more knowledge and confidence in their work.

Our experienced testing team can provide a range of basic and high-tech specialist testing in the physical, classification, durability and environmental-related tests.



## Physio-Chemical Tests

- Particle Density
- Particle Size Distribution with Hydrometer
- Soluble Salt Content of Soil
- Porosity
- Slake Durability
- Petrographic Examination & Quartz content
- Rock Clay Mineralogy
- XRD (qualitative and SIROQUANT quantitative)
- SPOCAS (Acid Sulphate Soils)
- NAPP, NAG (Acid Mine Drainage)
- Asbestos



# /// Unsaturated Soil Testing

At Alliance we provide unsaturated soil mechanics testing in the specialist testing laboratory. Our soil and rock technical manager has solid knowledge and practice backgrounds in the theory, research and experiment in the unsaturated soil mechanics. With the state-of-art suction controlled triaxial equipment, we can provide unsaturated soil testing including the soil water characteristic curve (SWCC) tests, unsaturated consolidation tests and unsaturated drained triaxial tests.



## Unsaturated Consolidation Tests & Unsaturated Drained Triaxial Tests

Using the high air entry porous disk (HAEPD) and the advanced air pressure/volume controller in the triaxial setup, the consolidation characteristics and the drained shear strength of a soil at a controlled suction value (i.e., a controlled unsaturated condition) can be determined. Furthermore, if a series of unsaturated consolidation tests are conducted at different saturation stages, the equilibrium void ratio obtained at each stage can be used to analysis the soil volume change properties upon drying and wetting, which have been used in unsaturated soil mathematical models such as Barcelona Basic Model or Unsaturated Cambridge Model.



## SWCC Tests (Soil Water Characteristic Curves Test)

The SWCC of a soil describes the relationship between its moisture conditions and the suction values existing in the soil. It is the most fundamental constitutive relationship in the unsaturated soil mechanism. Scientists and engineers are able to predict some of the most commonly used unsaturated soil properties using the SWCC, e.g., the unsaturated permeability, unsaturated shear strength, etc. At Alliance we use the axis-translation technique and the filter paper method ( ASTM D5298-16) to measure matric or total suctions in the soil.



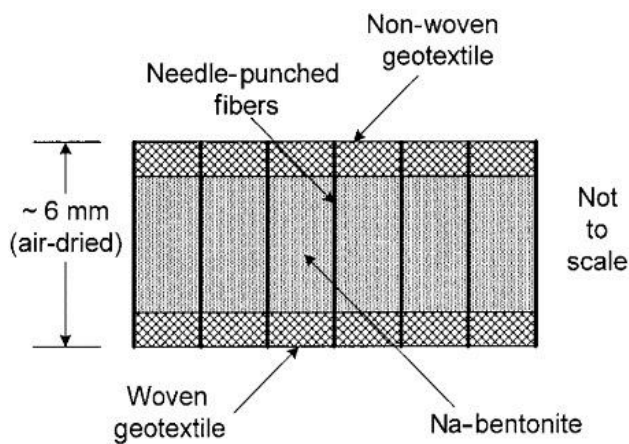
# Geosynthetics Material Tests



GCLs applied in a reservoir

At Alliance we provide the client with a suite of hydro-mechanical tests on geosynthetic materials, especially on the geosynthetic clay liners (GCLs).

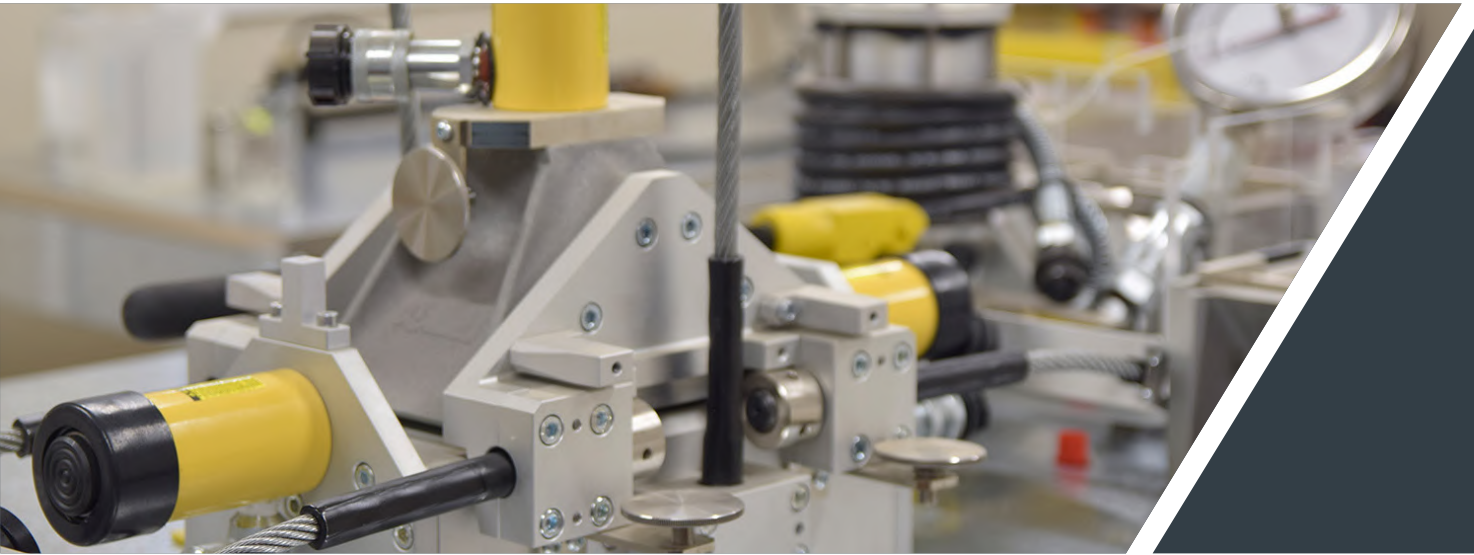
GCLs have become popular in the geotechnical and geoenvironmental engineering practices. They are used as a part of the composite liner system, working as hydraulic and chemical barriers in reservoirs, landfills, tailing dams, etc. While GCLs come with their design parameters given by the suppliers, it has been well acknowledged that these parameters may change with the site-specific stress conditions and hydro-chemical environments.



(a) A typical GCL formed in a sandwich structure



(b) A typical GCL



## Ian Goldschmidt

*Soil & Rock Mechanics Department Manager*

Ian (Goldy) Goldschmidt is the Department Manager of our specialty geomechanical testing section responsible for client management, strategic development, and innovation. Ian has been a NATA Technical Assessor in Geotechnical and Civil Construction Materials Testing since 1996 for Soil & Rock Mechanics. Ian has over thirty years of experience in the civil, geotechnical, environmental & mining industries in Australia & Internationally.



## Dr. Bowei Yu

*Soil & Rock Technical Manager*


Dr. Bowei Yu is our Technical Manager responsible for staff training, testing innovation and development. He has solid research and development backgrounds in soil mechanics, unsaturated soil mechanics, clay liners, contaminated investigations and remediations with over 7 years experience in geotechnical and geoenvironmental specialist testings. His research outcomes include 10 published technical papers and many global conference presentations.


# alliance



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