Geosynthetic Clay Liner (GCL) Technical Specifications		
Parameter Category	Technical Specification	Test Method
Physical Properties		
Material Composition	Sodium bentonite clay (≥5.0 kg/m²) encapsulated between geotextiles/polymeric membranes	ASTM D5993
Unit Weight	3.8-5.2 kg/m² (varies by thickness)	ASTM D792
Thickness	5.0-7.5 mm (under 2 kPa normal stress)	ASTM D5199
Roll Dimensions	Width: 4.0-5.8 m; Length: 30-60 m per roll	Manufacturer specs
Hydraulic Properties		
Hydraulic Conductivity	≤5×10^{-11} m/sec (after 100h hydration under 20 kPa)	ASTM D5887
Swell Index	≥24 mL/2g (free swell in distilled water)	ASTM D5890
Water Holding Capacity	≥400% (by dry weight of bentonite)	GRI-GCL3
Mechanical Properties		
Peel Strength	≥65 N/100mm (geotextile-to-geotextile)	ASTM D6496
Grab Tensile Strength	≥800 N (machine direction)	ASTM D4632
Shear Strength	≥20 kPa (internal under 100 kPa normal stress)	ASTM D6243
Puncture Resistance	≥400 N (CBR puncture)	ASTM D6241
Chemical Resistance		
pH Tolerance	2-13 (long-term chemical stability)	ASTM D6141
Cation Exchange Capacity	≥70 meq/100g (bentonite quality)	ASTM D7503
Permeability to Chemical Solutions	≤1×10^{-9} m/sec (with 0.025M $CaCl_2$ solution)	EPA 9100
Durability		
UV Resistance	≤10% strength loss after 500h UV exposure	ASTM D4355
Freeze-Thaw Stability	≤15% swell index reduction after 12 cycles	ASTM D5564
Wet-Dry Cycling	≤20% mass loss after 12 cycles	GRI-GCL8
Installation Parameters		

Overlap Requirement	Minimum 150mm side/end laps (300mm for critical applications)	IGS Guidelines
Anchorage Length	≥600mm in trenches	EPA LINER-98
Seaming Method	Bentonite paste or powder supplementation	GRI-GCL4