## Blended Barrier

### General Description
AquaBlok is a patented, composite-aggregate technology resembling small stones that is typically comprised of a dense aggregate core. In this application of the technology, a powdered high-swell sodium bentonite coating is utilized (Figure 1) with an approximate 30% bentonite layer by weight.

![Figure 1. Configuration of AquaBlok-coated particle.](image1)

### Blended Barrier Technology
Blended Barrier is created when AquaBlok is mixed with similarly sized aggregate at a ratio of approximately 50% by volume. It has been established that Blended Barrier does not significantly increase the permeability as compared to an AquaBlok only Cap (Figure 2). This results in a very effective contaminated sediment cap for most applications that may be more cost effective than a standard AquaBlok only cap.

![Figure 2. Permeability of Select Blended Barrier Formulations](image2)

### Product Specifications

**AquaBlok Portion:**
- **Aggregate:** Nominal AASHTO #8 (1/4-3/8") or custom-sized to meet project-specific need.
  - Limestone or non-calcareous substitute, as deemed project-appropriate

**Bentonite:**
- Powdered – Approximate 200 Mesh
  - Bentonite Clay: High swell Wyoming Sodium Natural Mineral (Montmorillonite)
  - Light Grey Powder; Odorless
  - Manufacturers – Product Designation
  - Bentonite Performance Minerals – Barakade Standard
  - Others that are deemed to meet the manufacturer specification

**Binder:** Cellulosic polymer

**Aggregate Portion:**
- **Aggregate:** Nominal AASHTO #8 (1/4-3/8") or custom-sized to meet project-specific need.
  - Limestone or non-calcareous substitute, as deemed project-appropriate

### Laboratory Test Results for Blended Barrier Product on Back
Laboratory Test Results for Blended Barrier Product

Note: The test results provided in this table were performed on a Blended Barrier composed of #8 crushed limestone and AquaBlok 3070FW8 in a 50:50 v/v ratio. While additional testing and certification may not be necessary for small-scale projects (especially if the typical reported material characteristics significantly outperform the design requirements), large-scale projects may warrant additional testing to verify results, specifically with respect to incorporation of locally available materials in product manufacturing. Manufacturing tolerances will vary based on source materials and required performance designs.

<table>
<thead>
<tr>
<th>Test</th>
<th>Method</th>
<th>Blended Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Classification - Practice for Description and Identification of Soils</td>
<td>ASTM D2488</td>
<td>Gray poorly graded gravel, with and without bentonite coating (GP)</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>ASTM D2216, AASHTO T265</td>
<td>5-15%</td>
</tr>
<tr>
<td>Dry Bulk Density</td>
<td>ASTM C29</td>
<td>85-95 pcf</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>ASTM D854, AASHTO T100</td>
<td>2.64</td>
</tr>
<tr>
<td>Permeability - Flexible Wall Permeameter</td>
<td>ASTM D5084</td>
<td>1x10⁻⁷ to 1x10⁻⁹ cm/s</td>
</tr>
<tr>
<td>Shear Strength - Direct Shear</td>
<td>ASTM D3080, AASHTO T236</td>
<td>459 psf, 33.9°</td>
</tr>
<tr>
<td>Shear Strength - Triaxial Unconsolidated-Undrained (Q or UU)</td>
<td>ASTM D2850, AASHTO T296</td>
<td>2544 psf, 0.0° * 17</td>
</tr>
<tr>
<td>Shear Strength - Triaxial Consolidated-Undrained (R or CU)</td>
<td>ASTM D4767, AASHTO T297</td>
<td>512 psf, 21.6° (total) 0 psf, 39.9° (effective)</td>
</tr>
<tr>
<td>Compaction - Standard Proctor</td>
<td>ASTM D698, AASHTO T99</td>
<td>Optimum Moisture Content 16.3% Maximum Dry Density 105.1 pcf</td>
</tr>
<tr>
<td>Compaction - Modified Proctor</td>
<td>ASTM D1557, AASHTO T180</td>
<td>Optimum Moisture Content 10.5% Maximum Dry Density 122.9 pcf</td>
</tr>
<tr>
<td>Compaction - 15-Blow</td>
<td>U.S. Army Corps of Engineers EM 1110-2-1906</td>
<td>Optimum Moisture Content 18.4% Maximum Dry Density 101.8 pcf</td>
</tr>
</tbody>
</table>

1. Results are based on laboratory tests for specific blends. Variability may be experienced due to manufacturing tolerances, screening, distribution of grain sizes quality control, etc.
2. Tests were completed according to AASHTO standards when determined to be equivalent to those set by the U.S. Army Corps of Engineers.
4. Blended Barrier comprises a blend of AquaBlok 3070FW8 particles with nominal AASHTO #8 aggregate. Some variability may be expected with the use of different aggregate sizes.
6. Moisture content values are for dry material.
7. Calculated using a weighted average of the specific gravities for the material that was retained and that passed the #4 sieve. Material retained was assumed to be nominal AASHTO #8 aggregate and have a specific gravity of 2.62. Material passed was tested according to ASTM D854 to determine its specific gravity.
13. Permeability values are for freshwater scenarios. Results will vary with other permeants and the use of other material blends may be appropriate to maintain the desired permeability.
17. Triaxial unconsolidated-undrained test was performed according to ASTM D4767, saturated.