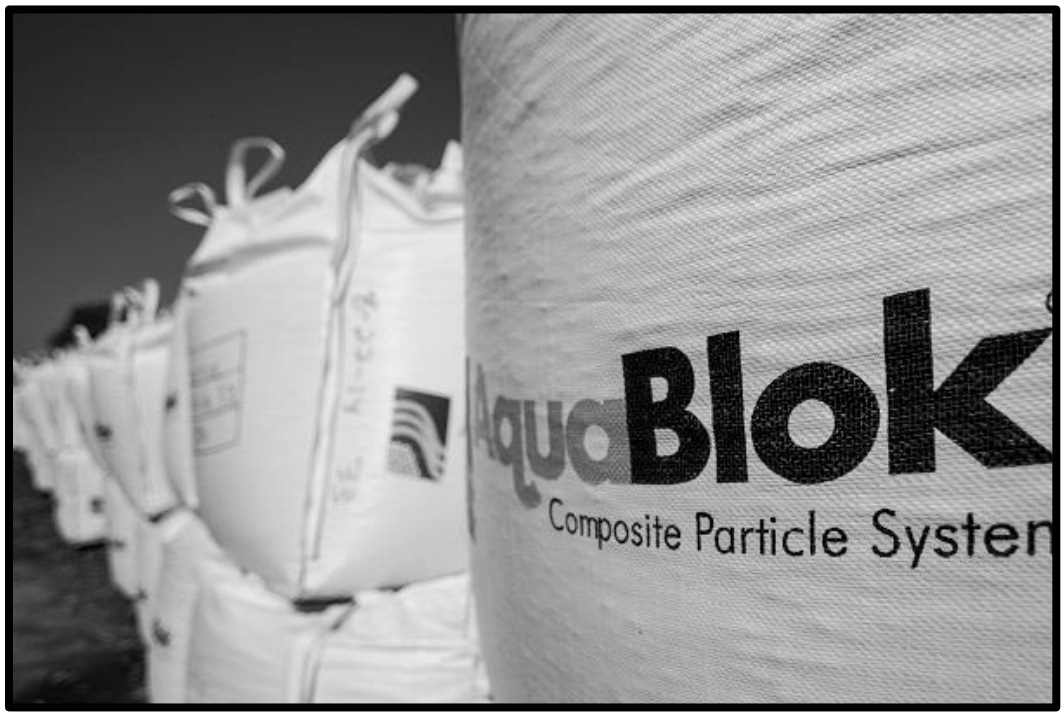


# AQUABLOK GEOTECHNICAL SEALING SOLUTIONS

# MANUFACTURER'S RECOMMENDED INSTALLATION GUIDELINES FOR

# COMPOSITE BENTONITE AGGREGATE

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**IMPORTANT: READ ALL INSTRUCTIONS CAREFULLY BEFORE INSTALLING, FAILURE TO DO SO MAY CAUSE PERSONAL INJURY OR DAMAGE TO PRODUCT AND/OR PROPERTY.**

## PRODUCT INFORMATION

AquaBlok is a Composite Bentonite Aggregate (CBA) product made of three different components:

- AASHTO No. 8 (1/4" to 3/8") aggregate (or custom-sized to meet project-specific needs)
- Natural Wyoming Sodium Bentonite, with all particles passing a 200-mesh sieve, and a minimum swell index of 25
- Non-toxic Binder

The finished CBA product may vary in proportionate blend of bentonite and other clay minerals to aggregate (by weight), depending on the product type and installation conditions:

- **AquaBlok 1585 FW**: 15% Bentonite / 85% Aggregate, designed for freshwater and brackish water applications (up to a salinity of approximately 14 ppt-equivalent chloride).
- **AquaBlok 2080 FW**: 20% Bentonite / 80% Aggregate, designed for freshwater and brackish water applications (up to a salinity of approximately 14 ppt-equivalent chloride).
- **AquaBlok 3070 FW**: 30% Bentonite / 70% Aggregate, designed for freshwater and brackish water applications (up to a salinity of approximately 14 ppt-equivalent chloride).
- **AquaBlok 3070 SW:** 30% Clay Mineral Blend / 70% Aggregate, designed for full saltwater / marine applications (salinity of approximately 35 ppt-equivalent chloride).
- **AquaBlok Blended Barrier**: made using a standard AquaBlok product blended with a prescribed volume of uncoated aggregate (per project requirements).

## PACKAGING & DELIVERY

CBA product is typically packaged in one of three standard containers for sale. These include a 50-lb paper sack (typically bundled in a 48-count pallet); a 2,400-lb. Flexible Intermediate Bulk Container FIBC "tote" or bulk bag, or a 2,700-lb. (FIBC) "tote" or bulk bag. Additionally, CBA product can be packaged in custom containers or delivered via loose bulk (unbagged) if negotiated prior to delivery.

50-lb. Sack

2,400-lb. Bulk Bag

2,700-lb. Bulk Bag

Freight capacity for CBA product is a maximum of 43,200 lbs. (21.6 tons) per truckload using a standard tractor flatbed trailer or enclosed van trailer. The maximum packaged loads of CBA product are as follows:

- 50-lb. sacks (packaged in 48-count pallets) = 864 sacks (18 pallets) per truckload
- 2,400-lb. bulk bags (on pallets) = 18 bulk bags per truckload
- 2,700-lb. bulk bags (on pallets) = 16 bulk bags per truckload

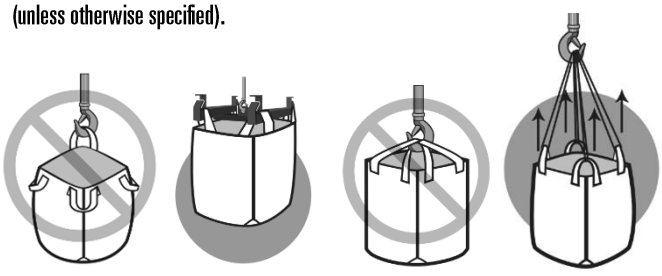
Less-than-truckload (LTL) freight can sometimes be available for certain routes. Pricing and availability can be based on the need for lift-gate capability if applicable equipment is not available for unloading. Freight charges are quoted and invoiced separately from materials for all purchases.

## HANDLING & STORAGE

When offloading delivered CBA product on pallets, ensure that the forklift is designed to handle the load. Only lift bags from below if palletized. Any damage to delivered materials should be documented (i.e., photographically) at the time of receipt and AquaBlok should be notified immediately. In extreme cases, the load may be refused if damage is excessing. During off-loading care should be taken to prevent puncturing or otherwise damaging packaged product with forks.

50-lb. sacks will be individually labeled on each package. Bulk bags will be labeled on one side, indicating the product, batch and bag number, and bag weight.

When lifting bulk bags from lifting loops, ensure that the machinery used to move the material (forklift, excavator, etc.) is designed to handle the load. Lift bags one at a time, using the four reinforced loops / straps. Ensure that the load is evenly distributed among all four lifting loops. Never suspend a bulk bag using fewer than all four lifting loops. Do not gather lifting loops to lift with one hook unless a separate sling is utilized to keep the loops in a vertical orientation. Heed all safety messaging on the bag manufacturer's labeling. Once CBA product has been emptied from the bag, the bulk bag should be discarded in a proper location. Bulk bags are rated for one-time usage (unless otherwise specified).



NO YES NO YES

CBA products are extremely sensitive to moisture. The bulk bags are moisture resistant but not waterproof. Always store the CBA product under cover (either inside a building or securely under a tarp to protect from rainfall) in original shipping package until placement/installation. Do not store bulk bags directly on the ground, store on pallets in areas that are not subject to inundation by ponding / standing water.

Avoid prolonged exposure of containers to direct sunlight and areas prone to dramatic swings in temperature and/or humidity, whenever possible. CBA product stored

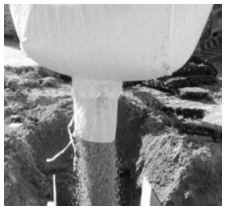
outdoors should be used within six months of delivery to the site. Bulk bag totes can be double stacked, but it is not recommended that pallets are used between stacked totes.

A Safety Data Sheet (SDS) for CBA products manufactured by AquaBlok can be provided upon written request.

## GENERAL INSTALLATION GUIDELINES

Never allow personnel to stand or place any appendage under a suspended bulk bag. Ensure that all personnel are safely clear of potential hazards when lifting, handling, or emptying a bulk bag.

A reinforced discharge spout is generally provided on the bottom of each bulk bag to facilitate unloading. Always use caution when working near elevated or suspended bulk bags. To discharge material rapidly, an opening on the bottom of the bulk bags can also be expanded with a knife cut.



To gravity-drop CBA product using this spout, first make sure that the area where the material is to be applied is clear of personnel. Then securely lift the bag using the four lifting loops, center the spout over the target location, untie the nylon ties securing the outer spout cover, and finally untie the inner spout ties. The weight of the material will allow the CBA product to flow. (BE AWARE THAT THE CBA PRODUCT OFTEN DISCHARGHES QUICKLY).

If CBA product bridges at the spout, push on the bottom corners of the bag. To cut off the flow of the CBA product (before the bag is completely empty), the spout can be temporarily pinched shut.

If a bulk bag does not include a tied spout or if there is a desire to discharge the material more quickly from the bulk bag, then a 6-8" diameter "C-shaped" cut can be made in the bottom of the bag to facilitate unloading. However, once the bag is cut open, it is important to understand that CBA product flow cannot be stopped until the bag is nearly empty.

Personnel working in close contact with CBA product should wear gloves, a dust mask and eye protection and other PPE deemed appropriate. Fine particles or dust left behind (in containers or other storage areas) should not be inhaled as they may cause respiratory sensitivity.

CBA product can generally be applied from bulk bags, or spread, broadcast, or otherwise placed in or on an area of application. CBA product can be placed directly through a water column or in other saturated areas but should not be mixed with water or other liquids prior to placement (i.e., hydraulic placement will damage the product). When using an excavator or loader bucket, bin, or wheelbarrow, care should be taken to keep surfaces as dry as possible so as not to cause premature hydration of the CBA product which can stick to various surfaces.

Once CBA product is in place, initial hydration may be desired if the product is not expected to be wetted naturally within a reasonable time. If initial hydration is desired, it is recommended that clean water is uniformly sprayed over the CBA product at a rate of 20 gallons per cubic yard (~0.75 gal. per cubic foot). It is not recommended that all water is poured onto a concentrated area of the CBA product.

Swell and self-compaction of CBA product begins immediately after the product encounters water. Material can typically be considered fully hydrated in approximately 24 hours under saturated and semi-confined conditions. CBA product should be monitored for any significant movement or sloughing during this time and may require additional material or repair to ensure performance.

## APPLICATION-SPECIFIC INSTALLATION GUIDELINES

### Trench Dam / Anti-Seep Collar Installation

When excavating any type of trench, all precautions and protective systems required by the Occupational Health and Safety Administration must be employed.

Placement of CBA product for a trench dam or anti-seep collar can be accomplished via discharge from a bulk bag spout. Alternative placement methods include the use of concrete buckets, chutes, excavators, etc.

Typically, a simple form is utilized, to provide support for the CBA product at the desired dimensions of the trench dam / anti-seep collar. CBA product is placed directly in this form over the pipe or conduit in the trench. This form can be made of metal, plywood, or other thin, rigid material capable of temporarily separating the CBA product from adjacent soils.

For trench dams / anti-seep collars less than or equal to 12 inches thick, a continuous pour (with no intermediate lifts) is acceptable. Mild tamping or rodding can be performed once CBA product is in place. For trench dams / anti-seep collars thicker than 12 inches, intermediate lifts of one foot in height are recommended, with intermediate hydration after each lift. Mild tamping shall be performed under and at the pipe haunches as the CBA product is placed to ensure that voids are minimized around the conduit or pipe. Mechanical compaction of the CBA product is not required but can be performed if desired or specified by the design engineer.

For larger installations, once all CBA product (or a lift) is placed in the trench dam / anti-seep collar, hydration is recommended by uniformly spraying water over the CBA at a rate of 20 gallons per cubic yard (~0.75 gal. per cubic foot) per lift. Do not pour water into one place within the trench dam / anti-seep collar. Repeat the CBA product lift installation, using uniformly sprayed water at the same rate until the trench dam / anti-seep collar is filled with CBA product.

NO

YES

Backfilling of the trench can be performed either during placement of lifts or once all CBA product is placed and/or hydrated, in accordance with plans and specifications.

Temporary forms should remain in place during backfill, but immediately removed thereafter.

After placement of CBA product, a geotextile fabric is recommended for placement over the trench dam / anti-seep collar when residing under areas of high loading as directed by the Engineer. The fabric shall be placed so that it extends / drapes past the horizontal limits of the Trench Dam a minimum of two (2) feet on all sides.

Cutoff Trench / Wall Installation

When excavating any type of trench, all precautions and protective systems required by the Occupational Health and Safety Administration must be employed.

Cutoff trenches should be excavated in location(s) and depth(s) depicted in plans and specifications. Often test sections are prepared to evaluate soil properties and determine if trench cuts will remain open or if soils will slough into the trench. If soil conditions dictate, a trench box or other support of trench walls may be used for placement of CBA product. Spoils should be removed and stored safely away from the trench so as not to obstruct placement of the CBA product. A modest length of trench should be excavated and backfilled using CBA product before continuing with additional excavation. No more length of trench should be excavated than can be feasibly backfilled with CBA product within a reasonable work period or day. Any partially excavated and backfilled portion of trench should be covered and protected at the end of each workday.

Placement of CBA product for a cutoff trench can be accomplished via discharge from a bulk bag spout. Alternative placement methods include the use of concrete buckets, chutes, etc. No personnel should be in or adjacent to the trench while the bulk bag is suspended over placement area.

For cutoff trenches less than or equal to 12 inches wide, a continuous pour (with no intermediate lifts) is acceptable (dependent on depth). Mild tamping may be performed once CBA product is in place. For cutoff trenches wider than 12 inches, intermediate lifts of one foot in height are recommended, with intermediate hydration after each lift. Mild tamping can be performed as the CBA product is placed to minimize voids in the trench. Mechanical compaction of the CBA product is not typically required.

For larger trenches, once all CBA product (or a lift) is placed in the cutoff trench, hydration is recommended by uniformly spraying water over the CBA product at a rate of 20 gallons per cubic yard (~0.75 gal. per cubic foot) per lift. Do not pour water into one place within the cutoff trench. Repeat the CBA product lift installation, using uniformly sprayed water at the same rate until the applicable section(s) of cutoff trench are completely backfilled. Manual hydration is not necessary for CBA product backfilled below a present groundwater level.

Any cover soil atop the CBA product in a backfilled cutoff trench should be placed per plans and specifications. Cover soil can be placed immediately following completion of CBA product backfill and hydration.

Pond, Channel, or Waterway Lining, Sealing, and/or Capping / Closure

CBA product can be placed directly through the water over the bottom of a pond, channel, or other waterway with a designed thickness to prevent seepage (or migration) through underlying (or overlying) soils. In new construction or situations where the pond or water body has been drained, CBA can be placed directly over a prepared soil surface. CBA product placement should adhere to all dimensions and depths depicted on the plans and specifications.

Optimal sealing performance is achieved through uniform placement of the CBA product. For small applications, CBA product can be discharged from a bulk bag spout and manually spread over the applicable area. Larger areas may require placement using an excavator bucket, clamshell, belt placement systems (i.e., a stone slinger or Telebelt®) or other device with greater capacity and reach. Care should be taken to distribute consistently to achieve minimum thickness of CBA product in all areas.

Use of a spreader, conveyor, excavator with clamshell or other broadcast device or machinery is recommended for large scale lining, sealing, and/or capping/closure applications. All equipment and manufacturer's recommendations and instructions should be employed, and a qualified operator should perform the broadcast application. The operator should be familiar with the application area and understand the size and weight of CBA product with respect to distance and trajectory of conveyance. Conveyor hoppers or loading bins can be filled directly from bulk bag discharge or on-site stockpiles and are used for such large-scale applications.


CBA product installed through a water column, or on otherwise saturated surfaces should utilize a grid (floating lanes and buoys) marking system (if not using GPS-enabled equipment) to ensure consistency in the application rate (i.e., lb./SF). Equipment installed with GPS controls can be used to accurately follow an uploaded coverage plan. Poles, stakes, or other markers can also be temporarily placed and moved to guide CBA product placement.

For CBA product installed over dry surfaces, initial hydration is recommended if contact with water is not immediately anticipated. Hydration is recommended by uniformly spraying water over the CBA product at a rate of 20 gallons per cubic yard (~0.75 gal. per cubic foot) per lift. Do not pour water into one place on the CBA product and avoid erosion of the CBA product when adding water.

CBA product should not be placed on slopes or banks steeper than 3H:1V without addressing stability concerns. The installation of cellular confinement (i.e., geocell) products are typically suitable to provide stability of the placed CBA product. Cellular confinement products should be installed using the manufacturer's recommended installation guidelines before placement of any CBA product within.

Once installed, CBA product may be covered with soil or rock ballasting in accordance with plans and specifications. Care should be taken to select or appropriately size the soil or rock cover material for the anticipated forces (e.g., tractive velocity, wave attack, etc.) that could potentially cause mobilization. Use of woven or non-woven geotextile fabrics, or graded riprap may be warranted within the placement sequence of cover materials to contain and mitigate the "suction" of fine aggregates within the material.

**Sinkhole, Inflow / Infiltration, Wildlife, or Other Damage Repairs**

CBA product may be used along with other materials to plug, seal, or otherwise repair holes in various infrastructure (e.g., dams, levees, shorelines, ponds, roadsides, etc.). A Professional Engineer or other qualified technical professional should be consulted to evaluate the nature of damage and impacts of repair methodology.

Sinkholes can occur naturally (in regions of Karst geology), or as the result of failed infrastructure (e.g., broken pipes, breached structures, etc.). For Karst sinkholes, large stone (rip rap), concrete, flowable fill, or other material is typically required to replace large volumes of lost soil. The sinkhole should be excavated to firm material (as determined by the engineer / professional) and backfilled with appropriately sized stone, concrete, etc. to within three feet of finished grade. The fill material should then be covered using a 4 oz. (minimum) non-woven geotextile, extending a minimum of three feet horizontally past the fill rock in all directions.

Once the structural material is placed, the CBA product can then be used as a supplemental sealing material to increase the longevity of the repair. CBA product should be installed atop the geotextile at a minimum thickness of one foot, covering all the geotextile. Once placed, hydration is recommended by uniformly spraying water over the CBA product at a rate of 20 gallons per cubic yard (~0.75 gal. per cubic foot) per lift. Do not pour water into one place on the CBA product.

Upon hydration, a two-foot layer of structural soil fill (as prescribed by the engineer / professional) should be placed and compacted as designed atop the CBA product.

Other (non-Karst sinkhole) repairs can be accomplished in similar fashion, with variations in types and thicknesses of materials as deemed appropriate by the engineer / professional.

**OBSERVATION & MAINTENANCE**

Once CBA product is installed (in any application) and hydrated, the finished area of installation should be periodically observed to ensure that performance expectations are met.

As with any earthen infrastructure improvement or repair, any visible leakage, seepage, moisture, ponding, etc. at or near the installed CBA product should be recorded. Determination of hydraulic position (i.e., upgradient or downgradient) of moisture relative to CBA product should be determined. Persistent flow may require excavation to determine the cause and areas required for repair.

Any visible mobilization, sloughing, erosion, etc. of CBA product installed on a surface should be recorded. The cause of mobilization should be determined, and additional CBA product should be placed (or replaced) in areas of concern. Steps to prevent future mobilization (e.g., surface runoff diversion, flattening of slopes, etc.) should be employed to protect CBA product.

CBA product should be observed after prolonged periods with no hydration, such as drought or manual dewatering activity. In some cases, manual hydration after installation may be required.

**CALCULATIONS / CONVERSIONS**

The following are frequently used formulas to assist in estimating the amount of CBA product* needed for standard applications:

- 1 $ft^3$ of CBA product = 85 lbs. of CBA product
- 1 $yd^3$ of CBA product = 2,295 lbs. of CBA product
- 1 $yd^3$ of CBA product = 1.15 Tons of CBA product

- 1 $yd^3$ of CBA product covers 162 $ft^2$ placed 2 inches thick

- 1 pallet of 50-lb. bags = 2,400 lbs. (1.20 Tons) of CBA product
- 1 – 2,400 lb. bulk bag = 1.20 Tons of CBA product (1.05 $yd^3$)
- 1 – 2,700 lb. bulk bag = 1.35 Tons of CBA product (1.18 $yd^3$)

- 1 truckload of CBA product = 18 – 2,400 lb. bulk bags (21.60 Tons)
- 1 truckload of CBA product = 16 – 2,700 lb. bulk bags (21.60 Tons)

* Based on properties of standard AquaBlok 2080 FW product (consult AquaBlok if utilizing other CBA products or custom blends to obtain applicable properties and data).


**CONTACT INFORMATION, CUSTOMER & TECHNICAL SUPPORT**

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