



AquaGate®+PAC Guidelines: Material Handling/Storage – Installation/Placement

Although each project is unique and specific site conditions must be taken into consideration, the objective of this document is to provide general guidance regarding the handling, storage and placement of AquaGate+PAC materials.

The following sections are included in this guidance:

1. On-Site Material Handling (Stockpile) Specification
2. Installation/Placement Specification
3. Quality Control, Quality Assurance and Technical Support

As a basis for these specifications, the below represents an assumed design for AquaGate+PAC placement at a generic site.

A nominal 2-inch thick dry layer of AquaGate+PAC 5% produced with an aggregate core. The dry thickness is based on an average dry bulk density of 85lb/CF which results in a placement rate of 14lb/SF (before any material handling losses);

AquaGate+PAC Material Overview

The material formulation specified is AquaGate+PAC 5%, which consists of an aggregate core with coating layer that is a blend of sodium bentonite and powdered activated carbon (PAC). The material composition is nominally 85% aggregate and 10% sodium bentonite, and 5% powdered activated carbon by weight. The base composition will have a normal manufacturing variance of +/-5% of each material by weight on average of a sample of particles. Generally, less than 5% of the aggregate volume will have less than 100% coating coverage with bentonite.

The AquaGate material will have a maximum vertical permeability of 5.0×10^{-5} cm/sec as determined by ASTM Standard D5084 using de-aired water and a differential head of 2.2 pounds per square inch (psi) in a flexible wall permeameter. The details of this specification and the test methodology to determine this measurement are incorporated herein by reference. It is anticipated that the PAC coating will 'dissolve' off the AquaGate particle after placement and become mixed with the upper sediment layer after placement. The aggregate and bentonite will remain and form a protective layer, minimizing the impacts of currents, scour or other low level energy that may otherwise transport the activated carbon from the target sediment surface. The application of AquaGate is not intended to materially impact the existing benthic community or impact elevations.

Manufacturing quality control consists of detailed batch production records that provide the quantity of raw material input and the resulting total and net weight of product produced in each batch. As noted above, during handling, transport and placement it is anticipated that some coating losses will occur in individual coated aggregate particles.

On-Site Material Handling (Stockpile) Specification

AquaGate materials may be delivered to a site in either approximately one cubic yard bulk bags (supersacks) or in bulk via dump trucks. The method of delivery will impact the methods used to protect the material, but generally, all material must be maintained in a dry state prior to installation/placement. Material packaged in bulk bags will typically not experience losses related to material handling, it is generally recommended that an approximate 3% material overage should be supplied account for potential handling losses due to transport and handling.

If transport of AquaGate materials to the stockpile/staging location takes place in bulk open trucks, then transport can only take place during dry weather. At the installation stockpile/staging area, material would be off-loaded by simply dumping the material on a prepared stockpile surface. The location where materials are to be off-loaded must be a dry surface that is elevated with a drainage layer to prevent direct contact of AquaGate material with wet or moist ground surface. It is recommended that materials are placed in large piles using a stacking conveyor or similar equipment. The piles must then be tarped/covered to prevent contact with rain water and to minimize drying or desiccation of the coating layer. If circular piles are created with a stacking conveyor, we would recommend piles or stacks of material approximately 20-feet in height with a base of 40-feet (1:1 slope angle). Each pile must be covered or tarped individually as noted above. The tarps can consist of plastic or visqueen materials and should be secured to the base material with weights or other means and be regularly maintained to insure no exposed AquaBlok from the piles is apparent. Based on the material bulk density, each pile would contain approximately 350 tons.

If transport of the AquaGate materials to the stockpile/staging location takes place in bulk bags, then transport is not limited to dry weather. The bulk bags should be considered water 'resistant' but not water proof. Therefore, they will keep the material dry during brief rain events or off-loading during rain. However, all efforts should be made to maintain tarps or cover materials over the bulk bags and minimize exposure to direct water or moisture. Inside storage is always recommended for AquaGate materials, but if outside storage of bulk bags is to take place then a dry surface that is elevated with a drainage layer to prevent direct contact of bulk bags with a wet or moist ground surface. Pallets can be utilized to provide the separation or elevation of the bags off of the ground. We only recommend stacking the bulk bags two high. Therefore, a storage area should be provided that will accommodate material based on approximately 2.4 tons per 13.3 SF. All bulk bag material must be tarped/covered to prevent contact with rain water. Care should be taken to secure the tarps and prevent pooling of water on top of the tarped material.

Installation / Placement Specification

Preparation for installation activities are generally performed by a contractor, to include mobilizing appropriate construction/installation equipment to the project area, providing access for load deliveries, preparation of the stockpile location, providing site security and safety requirements as appropriate and utilities.

Installation / Placement of AquaGate materials can be performed with a wide range of standard (available) construction equipment. Depending on the site needs or other activities to be performed, equipment can include; excavator, clam shell (drag line), front-end loader, stone slinger, TeleBelt™, or other means approved by AquaBlok in advance. For a water-based installation, it is generally recommended that a two barge operation be used to maximize the productivity of placement. One barge would be used as a base for placement equipment and a

second barge would be used to transport material to the placement barge. The goal would be to limit the movement of the placement barge and only reposition the barge when necessary for installation of the AquaGate. An installation schedule should contemplate lost time due to site-related issues, including; slower placement rates at outfalls, potential weather interruptions, weekends, potential equipment or supply issues.

AquaGate material can be moved from the on-site stockpile with front-end loaders, excavators, or other conventional construction equipment. It is recommended that a material handling sequence be established that minimizes multiple handling steps for the material. Material can be loaded onto a barge from shore using a conveyor system, chute or be placed directly on the barge by bucket or loader, if equipment can be driven onto the material transport barge.

Installation / Placement should generally proceed from the farthest point off-shore or the lowest elevation in the lake, in a direction up a slope (assumed to be in the direction of the shoreline). Placement of material should be performed in a predetermined grid area. An appropriate quantity of material can be determined, based on the grid size and bulk bags, weigh hoppers, rock boxes or other equipment can be used to provide an estimation of the appropriate quantity (volume) of AquaBlok to be placed in a given zone or grid. Immediate pre- and post-placement measurements can be taken to evaluate and insure adequate and uniform placement of material in the grid. Any observed slumping areas on slopes should be removed until the area is stable and material should be replaced with buttressing as necessary. Prior to the end of each daily shift, an uncovered 'edge' of AquaGate of between 5-10 feet in width can be maintained at the edge of the placement zone, to accommodate the start of operations the following day. It should be anticipated that an overlap of no more than 1-3 feet take place between the daily applications of AquaGate as the installation progresses.

Quality Control, Quality Assurance and Technical Support

Quality control (QC) and Quality Assurance (QA) during installation can be performed in a number of ways. Generally, it consists of a scientist/technician measuring and documenting the surface location of each prescribed lift of material within the desired grid dimension. This can be done using simple methods such as recovering buckets or trays from the placement zone, GPS 2-D locators, core samples or other methods. Specifically, pre- and post-determination of the surface elevation should be determined and remain within +/- 1 inch of the targeted layer thickness. On a prescribed grid, at regular intervals (as determined by the site engineer) the pre-placement elevation should be taken from an established site benchmark. Typically, a core samples are taken by pushing a lexan (polycarbonate) tube through the cap layer(s) to provide assurance of thickness of material placement. Other methods can include the use of a SPI (Sediment Profile Imaging) camera. If material placement is outside the tolerance level then material can be added or removed at the site engineer's discretion. Material may be added or removed with appropriate means and methods to constitute a safe working environment. If material levels are altered, then a subsequent survey should be performed to confirm thickness.

AquaBlok, Ltd. also can provide field Q.C. personnel who could also assist with other manufacturing, construction and installation QC. Other activities that may be related to installation Q.C. may include pre- and post-capping bathymetric and/or discrete-point surveys; collection of core samples; diver assistance; and other in-water activities (which may include items such as water-quality monitoring within the work area) – are not required by AquaBlok, but if performed would be by others.