



# Specification Guidelines: Water Management

*The following specifications provide Allan Block Corporation's typical requirements and recommendations. At the engineer of record's discretion these specifications may be revised to accommodate site specific design requirements.*

## **SECTION 3: WATER MANAGEMENT**

### **PART 1: GENERAL DRAINAGE**

#### **1.1 Surface Drainage**

*Rainfall or other water sources such as irrigation activities collected by the ground surface atop the retaining wall can be defined as surface water. Retaining wall design shall take into consideration the management of this water.*

- A. At the end of each day's construction and at final completion, grade the backfill to avoid water accumulation behind the wall or in the reinforced zone.
- B. Surface water must not be allowed to pond or be trapped in the area above the wall or at the toe of the wall.
- C. Existing slopes adjacent to retaining wall or slopes created during the grading process shall include drainage details so that surface water will not be allowed to drain over the top of the slope face and/or wall. This may require a combination of berms and surface drainage ditches.
- D. Irrigation activities at the site shall be done in a controlled and reasonable manner. If an irrigation system is employed, the design engineer or irrigation manufacturer shall provide details and specification for required equipment to ensure against over irrigation which could damage the structural integrity of the retaining wall system.
- E. Surface water that cannot be diverted from the wall must be collected with surface drainage swales and drained laterally in order to disperse the water around the wall structure. Construction of a typical swale system shall be in accordance with Design Detail 5: Swales, of the AB Spec Book.

#### **1.2 Grading**

*The shaping and re-contouring of land in order to prepare it for site development is grading. Site grading shall be designed to route water around the walls.*

- A. Establish final grade with a positive gradient away from the wall structure. Concentrations of surface water runoff shall be managed by providing necessary structures, such as paved ditches, drainage swales, catch basins, etc.
- B. Grading designs must divert sources of concentrated surface flow, such as parking lots, away from the wall.

#### **1.3 Drainage System**

*The internal drainage systems of the retaining wall can be described as the means of eliminating the buildup of incidental water which infiltrates the soils behind the wall. Drainage system design will be a function of the water conditions on the site. Possible drainage facilities include Toe and Heel drainage collection pipes and blanket or chimney*

*rock drains or others. Design engineer shall determine the required drainage facilities to completely drain the retaining wall structure for each particular site condition.*

- A. All walls will be constructed with a minimum of 12 in. (300 mm) of wall rock directly behind the wall facing. The material shall meet or exceed the specification for wall rock outlined in Section 1, 2.2 Wall Rock.
- B. The drainage collection pipe, drain pipe, shall be a 4 in. (100 mm) perforated or slotted PVC, or corrugated HDPE pipe as approved by engineer of record.
- C. All walls will be constructed with a 4 in. (100 mm) diameter drain pipe placed at the lowest possible elevation within the 12 in. (300 mm) of wall rock. This drain pipe is referred to as a toe drain, Section 3, 1.4 Toe Drain.
- D. Geogrid Reinforced Walls shall be constructed with an additional 4 in. (100 mm) drain pipe at the back bottom of the reinforced soil mass. This drain pipe is referred to as a heel drain, Section 3, 1.5 Heel Drain

#### **1.4 Toe Drain**

*A toe drain pipe should be located at the back of the wall rock behind the wall as close to the bottom of the wall as allowed while still maintaining a positive gradient for drainage to daylight, or a storm water management system. Toe drains are installed for incidental water management not as a primary drainage system.*

- A. For site configurations with bottoms of the base on a level plane it is recommended that a minimum one percent gradient be maintained on the placement of the pipe with outlets on 50 ft. (15 m) centers, or 100 ft. (30 m) centers if pipe is crowned between the outlets. This would provide for a maximum height above the bottom of the base in a flat configuration of no more than 6 in. (150 mm).
- B. For rigid drain pipes with drain holes the pipes should be positioned with the holes located down. Allan Block does not require that toe drain pipes be wrapped when installed into base rock complying with the specified wall rock material.
- C. Pipes shall be routed to storm drains where appropriate or through or under the wall at low points when the job site grading and site layout allows for routing. Appropriate details shall be included to prevent pipes from being crushed, plugged, or infested with rodents.
- D. On sites where the natural drop in grade exceeds the one percent minimum, drain pipes outlets shall be on 100 foot (30 m) centers maximum. This will provide outlets in the event that excessive water flow exceeds the capacity of pipe over long stretches.
- E. Drain pipe must be raised to accommodate outlets through the wall face when daylighting below grade is not possible. Refer to the Design Detail 4: Alternate Drain, of the AB Spec Book.

#### **1.5 Heel Drain**

*The purpose of the heel drain is to pick up any water that migrates from behind the retaining wall structure at the cut and route the water away from the reinforced mass during the construction process and for incidental water for the life of the structure.*

- A. The piping used at the back of the reinforced mass shall have a one percent minimum gradient over the length, but it is not critical for it to be positioned at the very bottom of the cut. The heel drain should be vented at 100 ft (30 m) intervals along the entire length of the wall and should not be tied into the toe drain system.
- B. The pipe may be a rigid pipe with holes at the bottom with an integral sock encasing the pipe or a corrugated perforated flexible pipe with a sock to filter out fines when

required based on soil conditions. For infill soils with a high percentage of sand and/or gravel the heel drain pipe does not need to be surrounded by wall rock. When working with soils containing fine grained cohesive soils having a PI of greater than 6 and LL of 30 or greater, 1 ft<sup>3</sup>. (0.03 m<sup>3</sup>) of drainage rock is required around the pipe for each 1 ft. (30 cm) of pipe length.

## 1.6 Ground Water

*Ground water can be defined as water that occurs within the soil. It may be present because of surface infiltration or water table fluctuation. Ground water movement must not be allowed to come in contact with the retaining wall.*

- A. If water is encountered in the area of the wall during excavation or construction, a drainage system (chimney, composite or blanket) must be installed as directed by the wall design engineer.
- B. Standard retaining wall designs do not include hydrostatic forces associated with the presence of ground water. If adequate drainage is not provided the retaining wall design must consider the presence of the water.
- C. When non-free draining soils (soils with friction angles less than 30 degrees) are used in the reinforced zone, the incorporation of a chimney and blanket drain should be added to minimize the water penetration into the reinforced mass. Refer to Design Detail 6: Chimney and Blanket Drain, of the AB Spec Book.
  - a. Drain material to be consistent with wall rock material. For more information on wall rock material see Specification Guidelines: Allan Block Modular Retaining Wall Systems, section 2.1.
  - b. Manufactured chimney and blanket drains to be approved by the geotechnical and/or the local engineer of record prior to use.

## 1.7 Concentrated Water Sources

*All collection devices such as roof downspouts, storm sewers, and curb gutters are concentrated water sources. They must be designed to accommodate maximum flow rates and to vent outside of the wall area.*

- A. All roof downspouts of nearby structures shall be sized with adequate capacity to carry storm water from the roof away from the wall area. They shall be connected to a drainage system in closed pipe and routed around the retaining wall area.
- B. Site layout must take into account locations of retaining wall structures and all site drainage paths. Drainage paths should always be away from retaining wall structures.
- C. Storm sewers and catch basins shall be located away from retaining wall structures and designed so as not to introduce any incidental water into the reinforced soil mass.
- D. A path to route storm sewer overflow must be incorporated into the site layout to direct water away from the retaining wall structure.

## 1.8 Water Application

*Retaining walls constructed in conditions that allow standing or moving water to come in contact with the wall face are considered water applications. These walls require specific design and construction steps to ensure performance. Refer to Design Detail 7 and 8: Water Applications, of the AB Spec Book.*

- A. The wall rock should be placed to the limits of the geogrid lengths up to a height equal to 12 inches (30 cm) higher than the determined high water mark. If the high water mark is unknown, the entire infill zone should be constructed with wall rock.
- B. The drain pipe should be raised to the low water elevation to aid in the evacuation of water from the reinforced mass as water level fluctuates.
- C. Embankment protection fabric should be used under the infill mass and up the back of the infill mass to a height of 12 inches (30 cm) higher than the determined high water mark.
  - a. Embankment protection fabric is used to stabilize rip rap and foundation soils in water applications and to separate infill materials from the retained soils. This fabric should permit the passage of fines to preclude clogging of the material. Embankment protection fabric shall be a high strength polypropylene monofilament material designed to meet or exceed typical NTPEP specifications; stabilized against ultraviolet (UV) degradation and typically meets or exceeds the values in Table 1.

**Table 1: Embankment Protection Fabric Specifications**

Mechanical Property	Determination Method
Tensile Strength = 225 lbs. (39.4 kN/m)	ASTM D-4595
Puncture Strength = 950 lbs. (4228 N)	ASTM D-6241
Apparent Opening Size (AOS) = U.S. Sieve #70 (0.212 mm)	ASTM D-4751
Trapezoidal Tear = 100 lbs. (445 N)	ASTM D-4533
Percent Open Area = 4%	COE-02215
Permeability = 0.01 cm/sec	ASTM D-4491

- D. For walls having moving water or wave action, natural or manufactured rip-  
rap in front of the wall to protect the toe of the wall from scour effects is recommended.

**Consult the Allan Block Engineering Department for details at 800-899-5309.**

Specifications are subject to change without notice.