PREFABRICATED VERTICAL WICK DRAIN

**From Cornwall BRS 0172(6)

xx. DESCRIPTION. This work shall consist of furnishing and placing prefabricated vertical wick drain(s) (PVWD) at the location(s) indicated in the Plans and as directed by the Engineer.

xx. MATERIALS.

(a) General. The PVWD shall be of newly manufactured material. It shall be a two-part prefabricated geocomposite soil drain consisting of a formed polypropylene core covered with a non-woven polypropylene filter fabric that is not bonded to the core. The PVWD used shall be one of the following products:

Amerdrain (Type 407) (Type 417)	American Wick Drain Corp. 1209 Airport Road Monroe, NC 28110 Tel.: (800)242-9425 www.americanwick.com
Nilex Wick Drain MD-7407	Nilex Corporation 15171 East Fremont Drive Centennial, CO 80112 Tel.: (303)766-2000 www.nilex.com
ADP Drain 74	American Prefabricated Drain 6636 Ciscayne Pl. Charlotte, NC 28211 Tel.: (704)405-7764 www.americanprefabricateddrain.com

Sand Borrow shall meet the requirements of Subsection 703.03.

(b) Alternative PVWD. The Contractor may propose use of alternative "equivalent" PVWD. Acceptance of proposed alternatives will be determined solely by the Engineer. The Contractor shall submit to the Engineer for approval all manufacturer's literature and specification data as well as all pertinent test data at least 8 weeks prior to the start of PVWD installation. The submittal shall include the reasoning for proposing an alternative PVWD.

Proposed alternative PVWD shall meet the following requirements, in order of consideration:

(1) Equivalent Diameter. Equivalent diameter, d_w > 52 mm (2 inches), where equivalent diameter is defined as half the sum of the width and thickness of the PVWD.

(2) Discharge Capacity. Discharge capacity of 3.8 liters per minute (1.0 gpm) at a gradient of 1.0 while under a normal load of 241 kPa (35 psi), as determined in accordance with ASTM D 4716.

(3) Jacket Filter Characteristics. PVWD jacket shall act as a filter and prohibit the migration of fines into the core. Accordingly, the Apparent Opening Size (AOS) of the geotextile jacket shall be No. 70 (0.21 mm) standard sieve size or finer, as determined in accordance with ASTM D 4751.

(4) Material Strength. The PVWD shall be capable of withstanding all handling and installation stresses. The grab tensile strength, as determined in accordance with ASTM D 4632, and the puncture strength, as determined in accordance with ASTM D 4833, of the geotextile jacket shall be at least 356 N (80 lbs) (minimum roll value) and at least 222N (50 lbs) (minimum roll value), respectively.

xx. GENERAL REQUIREMENTS. During shipment and storage, the PVWD material shall be wrapped in a heavy-duty protective covering. The storage area shall be such that the PVWD material is protected from mud, dirt, dust, debris, and detrimental substances. PVWD material shall be stockpiled and stored in a manner that will protect the material from damage. The PVWD shall be free of defects, rips, holes, or flaws. Damaged materials shall be replaced at the Contractor's expense.

The Contractor shall demonstrate that the selected equipment, method, and materials produce a satisfactory installation in accordance with these specifications. For this purpose, the Contractor will be required to install a minimum of 5 trial PVWD at locations within the work area designated by the Engineer. Additional trial PVWD may be installed if deemed necessary by the Engineer.

xx. OBSTRUCTION REMOVAL. Obstruction removal for PVWD shall consist of the penetration of embankment fill including some boulders, riprap, and the drainage blanket. Vibratory techniques may be used to penetrate the obstruction or stiff, upper soils, but may not be used to penetrate the underlying soft materials. Other techniques such as pre-augering may be used to remove more difficult obstructions.

Obstruction removal shall only be used when directed by the Engineer.

xx. INSTALLATION. The Contractor shall excavate all unsuitable material such as muck, pavements, etc. prior to placing the drainage blanket within the area where drains are to be installed.

The Contractor shall place a drainage blanket consisting of sand borrow at the elevations and to the limits indicated on the Plans throughout the PVWD area. The drainage blanket shall be a minimum of 600 mm (2 feet) in thickness. Any common excavation necessary for the placement of drainage blanket will be done in conjunction with the placement of the blanket.

After the drainage blanket is completed, the Contractor shall stake out the proposed locations of the PVWD using a baseline and benchmark provided by the Engineer. The Contractor shall take all reasonable precautions to preserve the stakes. PVWD locations shall be numbered for reference.

The mandrel or sleeve used to install the PVWD shall be plumbed prior to installation of each PVWD and shall not deviate from vertical more than 60 mm (2.4 inches) in 3 meters (10 feet) during the installation of any PVWD.

The Contractor shall provide the Engineer with a suitable means of verifying the vertical alignment of the PVWD and the installing equipment and determining the depth of any PVWD at any time.

The PVWD shall be installed in a sequence such that equipment will not travel over previously installed drains. Any PVWD that are damaged by the Contractor's operations shall be replaced at the Contractor's expense.

The PVWD shall be installed using a continuous push by static (hydraulic pressure) method. The use of a falling weight impact hammer or vibration will not be permitted. To protect the PVWD from tears, cuts, and abrasions during installation, the PVWD shall be installed in a protective sleeve or mandrel which shall be retracted after each drain is installed. Alternate raising and lowering of the sleeve or mandrel during advancement will not be permitted. The cross-sectional area of the sleeve or mandrel shall not exceed 64.50 cm^2 (10 in^2) and shall be sufficiently stiff to prevent wobble or noticeable deflection during installation. The tip of the driving sleeve shall be capable of cleanly cutting through the geotextile fabric, without tearing, gathering, folding, or otherwise disturbing or stressing the fabric.

The mandrel or sleeve shall be provided with an anchor plate or similar arrangement at the bottom of the mandrel to prevent the soil from entering the bottom of the mandrel during drain installation. The anchor plate or similar arrangement shall anchor the drain tip at the required depth during mandrel withdrawal. The dimensions of the anchor shall conform as closely as possible to the dimensions of the mandrel so as to minimize soil disturbance. The anchorage system shall be approved by the Engineer.

The Contractor shall be responsible for penetrating any overlying material necessary for drain installation, which may involve removal of embankment riprap and pavement subbase materials.

Where obstructions or stiff soils are present that prevent the installation of PVWD, the Contractor shall make two attempts to install a PVWD within 457 mm (18 inches) of the original location. If a PVWD can still not be installed, the location shall be marked and designated for pre-augering.

If permitted by the Engineer, the Contractor may use augering, vibrating techniques, or other approved methods to loosen the soil and clear obstructions.

The obstruction removal technique shall have a minimum outside diameter equal to the largest horizontal dimension of the mandrel, shoe, or anchor, whichever is greatest. The maximum outside diameter of the obstruction removal technique shall not be more than 76 mm (3 inches) greater than the minimum outside diameter of the mandrel.

The PVWD shall be installed from the work surface to the bottom of the compressible layer, which generally consists of organic silt and/or silt and clay, or as directed the Engineer. The stratum below the compressible layers generally consists of sand and/or silty sand. The Engineer may vary the depths, spacing, number of PVWD to be installed as deemed necessary. The location of the PVWD shall not vary more than 152 mm (6 inches) from the locations identified on the Plans or as directed by the Engineer. PVWD which are more than 152 mm (6 inches) from Plan location, or are damaged or improperly installed, will be rejected and abandoned in place. No payment will be made for rejected PVWD.

Splices or connections of PVWD material shall be done so as to ensure hydraulic and structural continuity of the PVWD as approved by the Engineer. The jacket and core shall be overlapped a minimum of 152 mm (6 inches) at any splice. No PVWD shall have more than one splice along its entire length.

The PVWD shall be cut such that a minimum of 152 mm (6 inches) protrudes above the working surface at each PVWD location.

The Contractor shall provide the Engineer with suitable means of determining the quantity of PVWD installed at each location and shall provide suitable means for the Engineer to determine the depth of the PVWD at any given time during installation. The Contractor shall supply to the Engineer at the end of each working day a summary of the PVWD installed that day. The summary shall include drain type, locations, and length to the nearest 30 mm (1 inch) of PVWD installed at each location.

xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Prefabricated Vertical Wick Drain Mobilization) to be measured for payment will be on a unit basis for each PVWD equipment mobilization and demobilization to and from the project performed in the complete and accepted work.

The quantity of Special Provision (Prefabricated Vertical Wick Drain) to be measured for payment will be the number of meters (linear feet) installed in the complete and accepted work. Measurement will be from the working surface to the drain tip or as authorized by the Engineer, plus the minimum required cut-off length of 152 mm (6 inches) above the working surface.

The quantity of Special Provision (Prefabricated Vertical Wick Drain Obstruction Removal) to be measured for payment will be the number of meters (linear feet) of augered hole in the complete and accepted work, measured in place and approved by the Engineer. The length of obstruction clearance to be paid for shall be the length from the working surface at the time of installation to the depth penetrated by the auger, or to a depth 0.6 m (2 feet) into the underlying compressible layer, whichever is the lesser depth. The obstruction clearance depth is subject to verification by the Engineer.

Obstruction clearance shall not be paid for unless the use of the necessary equipment is authorized by the Engineer prior to its use, and the Engineer verifies the penetration length.

xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Prefabricated Vertical Wick Drain Mobilization) will be paid for at the Contract unit price for each. Payment will be full compensation for mobilization, remobilization, and demobilization of PVWD equipment to and from the project, including erecting and dismantling, and for furnishing all materials, labor, tools, equipment, and incidentals necessary to complete the work.

Partial payments will be made as follows:

(a) When PVWD equipment has been set up and PVWD installation operations begin, 75 percent of the Contract unit price will be allowed.

(b) The remaining 25 percent of the Contract unit price will be paid when the PVWD installation operations are complete and the equipment has been removed from the site to the satisfaction of the Engineer.

The accepted quantity of Special Provision (Prefabricated Vertical Wick Drain) will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for furnishing, transporting, storing, handling, and installing the PVWD, including the PVWD material, anchors, excavation and sand borrow for drainage blanket, equipment for checking vertical alignment, altering the equipment and methods of installation as necessary, and for the furnishing of all materials, labor, tools, equipment, and incidentals necessary to complete the work.

No payment will be made for improperly placed PVWD.

Payment for trial PVWD will be made for the number of meters (linear feet) installed and accepted by the Engineer.

The accepted quantity of Special Provision (Prefabricated Vertical Wick Drain Obstruction Removal) will be paid for at the Contract unit price per meter (linear foot). Payment will be full compensation for pre-augering or performing other acceptable methods of clearing obstructions to allow the satisfactory installation of the PVWD, including the cost of disposal of any surplus pre-augering material or construction clearance materials, permits if required, and for the furnishing of all materials, labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item	Pay Unit
900.620 Special Provision (Prefabricated Vertical Wick Drain Mobilization)	Each
900.640 Special Provision (Prefabricated Vertical Wick Drain)	Meter (Linear Foot)
900.640 Special Provision (Prefabricated Vertical Wick Drain Obstruction Removal)	Meter Linear Foot)