CONSTRUCTION SPECIFICATION FOR WICK DRAIN INSTALLATION

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220.01 SCOPE

This specification covers the requirements for the supply and installation of wick drains, including granular blanket.

220.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 206 Grading
OPSS 501 Compacting

Ontario Provincial Standard Specifications, Material

OPSS 1010 Aggregates - Base, Subbase, Select Subgrade, and Backfill Material

Canadian General Standards Board (CGSB)

CAN/CGSB 148.1 No.10-94 Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size

ASTM International

D638-10	Standard Test Method for Tensile Properties of Plastics
D3776/D3776M-09ae2	Standard Test Methods for Mass per Unit Area (Weight) of Fabric
D4491-99a(2009)	Standard Test Methods for Water Permeability of Geotextiles by Permittivity
D4533-11	Standard Test Method for Trapezoid Tearing Strength of Geotextiles
D4632-08	Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
D4716-08	Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
D4833-07	Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
D5199-12	Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
D5261-10	Standard Test Method for Measuring Mass per Unit Area of Geotextiles

220.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Geotechnical Instrumentation means equipment used to monitor the progress of settlement, displacement, and pore water pressure measurements and includes such equipment as piezometers, settlement cells, standpipes, settlement profilers, inclinometers, and settlement rods.

Granular Blanket means a layer of free draining granular material used to provide drainage of excess pore pressures due to soil consolidation.

Recognized Specialist Subcontractor means a subcontractor retained by the Contractor that has proven satisfactory experience in work of this type and magnitude and has completed a minimum of five wick drain installation projects in the last five years.

220.04 DESIGN AND SUBMISSION REQUIREMENTS

220.04.01 Submission Requirements

220.04.01.01 Qualifications

Prior to the commencement of the Work, the qualifications of the recognized specialist subcontractor shall be submitted to the Contract Administrator.

220.04.01.02 Materials

At least 3 weeks prior to the installation of wick drains, the Contractor shall submit to the Contract Administrator the following:

a) A minimum one metre sample of the wick drain.

b) The manufacturer’s technical specifications indicating that the materials meet the requirements shown in Table 1.

c) A certificate for each production lot supplied indicating that the wick drain supplied was produced and tested according to the requirements shown in Table 1.

The Contractor shall have test results available for the aggregates to be used in the work. At the request of the Contract Administrator, the Contractor shall make available or submit quality control test results. When more than one aggregate source is used for supplying material, test data from each source shall be submitted separately.

220.04.01.03 Installation Procedures

At least 3 weeks prior to the installation of wick drains, the Contractor shall submit to the Contract Administrator the details of the sequence and method of installation outlining the following:

a) Size, type, weight, maximum pushing force, and configuration of the installation rig.

b) Dimensions of the mandrel to be used.

c) Details of wick drain anchorage.

d) Detailed description of proposed installation procedures.

e) Alternative methods for overcoming obstructions.

f) Methods for splicing wick drains.

220.05 MATERIALS

220.05.01 Wick Drains

Wick drains shall be prefabricated and shall consist of a continuous plastic drainage core wrapped in a non-woven geotextile. The geotextile, core, and composite wick drain shall meet the requirements shown in Table 1.

All wick drains shall be free of defects, rips, holes, and flaws.

220.05.02 Granular Blanket

The granular blanket shall be Granular B, Type I, Type II, or Type III, according to OPSS 1010, except that 100% shall pass the 37.5 mm sieve.

220.06 EQUIPMENT

The equipment used to install wick drains shall be of the type that minimizes the disturbance to the drainage blanket or the native subsoil during the installation operation.

Falling weight impact hammers shall not be permitted.

220.07 CONSTRUCTION

220.07.01 Operational Constraints

When a site is designated as an environmentally sensitive area, jetting techniques shall not be permitted.

Wick drains shall be installed subsequent to the construction of the granular blanket and prior to the installation of monitoring instruments and placement of any overlying material. Wick drains shall be protected by a minimum of 2 m of earth fill or 4 m of rock fill before the ground freezes. Wick drains shall not be installed in frozen ground.

Installation of the wick drains shall be coordinated with the placement of geotechnical instrumentation as specified in the Contract Documents. Wick drains shall be installed in a manner that does not disturb geotechnical instrumentation already in place. Geotechnical instrumentation damaged as a result of Contractor's activities shall be replaced by the Contractor.

220.07.02 Transportation and Storage

During transportation and storage, the wick drain materials shall be protected from damage.

The storage area shall be so that the wick drain materials are protected from sunlight, dirt, dust, mud, debris, and all other detrimental substances.

220.07.03 Granular Blanket

The granular blanket shall be placed subsequent to the excavation of unsuitable material and any backfilling specified in the Contract Documents.

The granular blanket shall be placed and compacted to the limits and grades specified in the Contract Documents.

The granular blanket shall be placed according to the earth embankment requirements of OPSS 206 and compacted to a minimum 90% of its maximum dry density measured according to OPSS 501.

When the granular blanket is placed under water, it shall be placed by end dumping.

220.07.04 Trial Wick Drains

Prior to the installation of wick drains within the areas designated in the Contract Documents, the Contractor's Engineer shall demonstrate that the proposed materials, equipment, and installation method produce a satisfactory wick drain installation in accordance with these specifications. The Contractor's Engineer shall install a minimum of 10 trial wick drains at permanent installation locations designated by the Contractor.

Provided the trial wick drains are installed to the satisfaction of the Contract Administrator, they shall be incorporated as part of the permanent installation.

The Contractor's Engineer shall monitor the wick drain installation on a full-time basis. If at any time the Contractor's Engineer considers that the method of installation does not produce a wick drain that satisfies the Contract requirements, the method or equipment or both, as necessary, shall be altered to comply with the requirements of the Contract Documents.

220.07.05 Installation

220.07.05.01 General

Wick drains shall be installed to the depths specified in the Contract Documents.

Wick drains shall be installed using a mandrel advanced through the granular blanket and the underlying soil. The mandrel shall protect the wick drain material from damage during installation and shall be withdrawn after the installation of the wick drain. The mandrel shall be provided with an anchor plate to prevent soil from entering the bottom of the mandrel during installation and to anchor the bottom of the wick drain at the required depth at the time of mandrel removal. The projected cross-sectional area of the mandrel and anchor combination shall not exceed 7,700 mm^2.

Augering or vibratory equipment may be used within the granular blanket and underlying soils to facilitate the installation of wick drains. The use of augering or vibratory equipment shall not extend more than 1 m into the soil to be consolidated.

220.07.05.02 Layout

Wick drains shall be located and staked out by the Contractor. The spacing of the wick drains shall not vary more than 150 mm from the spacing specified in the Contract Documents.

220.07.05.03 Vertical Alignment

Wick drains shall be installed vertically, within a tolerance of not more than 10 mm per 500 mm. The Contractor shall maintain a suitable method of verifying the vertical alignment of the mandrel and of determining the depth of the wick drain at all times.

220.07.05.04 Splices

Splices in the wick drain shall be made so as to ensure continuity and to prevent reduction in the wick drain discharge capacity. Splices shall be a minimum of 150 mm in length.

220.07.05.05 Cut-Off

The wick drain shall be cut at the surface of the granular blanket so that at least a 150 mm length protrudes above the top of the granular blanket at each wick drain location.

220.07.05.06 Obstructions

Where obstructions are encountered below the working surface that cannot be penetrated by the wick drain installation equipment, the Contractor shall complete the wick drain from the elevation of the obstruction to the working surface and notify the Contract Administrator. At the direction of the Contract Administrator, the Contractor shall attempt to install a new wick drain within a 500 mm radius of the obstructed wick drain. A maximum of two attempts shall be made as directed by the Contract Administrator.

220.07.06 Inspection after Wick Drain Installation

A Certificate of Conformance shall be submitted to the Contract Administrator upon completion of the wick drain installation and prior to the placement of any overlying material.

220.07.07 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

220.08 QUALITY ASSURANCE

220.08.01 Certificate

Certificates for each production lot indicating that the wick drain supplied was produced and tested according to the requirements of this specification shall be provided by the manufacturer for all wick drains delivered to the Contract.

220.08.02 Rejected Drains

Wick drains that are damaged or that do not meet the requirements of this specification shall be rejected and replaced. Replacement wick drains shall be installed within a 500 mm radius from the location of the rejected wick drain, as directed by the Contract Administrator.

220.09 MEASUREMENT FOR PAYMENT

220.09.01 Actual Measurement

220.09.01.01 Wick Drains

Measurement shall be by length in metres for all accepted wick drains, including the protruding portion up to 150 mm per installation.

Properly installed obstructed wick drains and replacement wick drains shall be measured for payment.

220.09.02 Plan Quantity Measurement

When measurement is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

220.10 BASIS OF PAYMENT

220.10.01 Wick Drains - Item

Payment at the Contract price for the above tender item shall be full compensation for all labour, Equipment, and Material to do the work.

Geotechnical instrumentation damaged as a result of the Contractor's activities shall be replaced at no additional cost to the Owner.

Payment shall not be made for rejected wick drains or delays or expenses incurred by the Contractor as a result of improper or unacceptable material or installation.

All labour, Equipment and Material required for the granular blanket shall be paid for with the appropriate road base or subbase item, Granular B Type I, Granular B Type II, Granular B Type III, as specified.

TABLE 1
Wick Drain Property Requirements

Component	Property		Test Method	Unit	Requirement
Core	Physical	Material	--	--	Polypropylene, Studded or Grooved
		Thickness	ASTM D5199	mm	≥ 2
		Mass	ASTM D3776	g/m	≥ 40
	Mechanical	Tensile Strength	ASTM D638	N	≥ 800
Geotextile	Physical	Material	--	--	Polypropylene, Non-Woven
		Mass	ASTM D5261	g/m^2	≥ 110
	Mechanical	Grab Tensile Strength	ASTM D4632	N	≥ 600
		Puncture Strength	ASTM D4833	N	≥ 200
		Trapezoidal Tear	ASTM D4533	N	≥ 250
		Filtration Opening Size (FOS)	CAN/CGSB 148.1, Method No. 10	µm	≥ 40
		Permittivity	ASTM D4491	s^{-1}	≥ 0.5
Composite Wick Drain	Physical	Width	--	mm	≥ 100
		Thickness	ASTM D5199	mm	≥ 3
	Mechanical	Discharge Capacity @ 10 kPa	ASTM D4716	m^3/s	≥ 1.2×10^{-4}
		Discharge Capacity @ 240 kPa	ASTM D4716	m^3/s	≥ 1.0×10^{-4}