Addendum Specifications
(Seksyen II (B))

SECTION 1 – PREFABRICATED VERTICAL DRAINS

1.1 GENERAL

Prefabricated vertical drains shall be installed in the areas shown on the drawings for the purpose of accelerating the consolidation settlement and at the same time achieving a gain in strength of the soft compressible soils beneath.

The method of construction adopted shall not damage any geotechnical instruments located at the vicinity. Any damaged installations shall be repaired or replaced and the costs of this and delays to the programme shall be borne by the Contractor.

The drain spacing and depth may be increased or decreased depending on the subsoil conditions encountered. The Contractor shall allow in his rates for any such adjustment to drain spacing and depth and no further claims for time or cost shall be allowed.

1.2 PREFABRICATED VERTICAL DRAINS

The prefabricated vertical drains shall consist of a polymer core and an external non-woven filter membrane and shall comply with the following general requirements: -

	Properties	Value
1.	Composition of drain core	Corrugated extruded continuous channel high molecular polypropylene
2.	Composition of filter jacket	Non woven spunbonded continuous filament 100% polypropylene.
3.	Chemical Resistance	Excellent
4.	Width of drain	100 ± 5 mm
5.	Thickness of drain	3.3 ± 0.2 mm
6.	Tensile Strength (ASTM D-5035)	2.0 ± 0.2 kN
7.	Elongation @ 1 kN (ASTM D-5034)	$< 10\%$
8.	Discharge capacity (straight) at $i = 0.5$, 350kPa vertical pressure tested in marine clay (ASTM D-4716)	45×10^{-6} m^3/s
9.	Discharge capacity (deformed) under 22% relative compression under 200kPa vertical pressure at $i = 0.5$ tested in marine clay (ASTM D-4716)	40×10^{-6} m^3/s
10.	Permeability of filter (ASTM D-4991)	$> 2.0 \times 10^{-4}$ m/s
11.	Trapezoidal tear strength of filter (ASTM D-4533)	80 N
12.	Grab tensile strength (MD) of filter (ASTM D-4632)	300 N
13.	Pore size O95 (AOS) of filter (ASTM D-4751)	75 microns

1.6 INSTALLATION OF DRAINS

The installation procedure shall be such as to ensure that no damage or 'kinks' will be developed in the drains. Installation of the drains shall be by the displacement method using a cable driven machine of sufficient capacity to install the drain housed within a mandrel through the replacement fill and geotextile and the underlying soft compressible layers beneath and subsequently to retract the mandrel. Installation of the drains and retraction of the mandrel shall be carried out in a single downward and single upward stroke and no alternative raising and lowering of the mandrel shall be permitted. The size and shape of the mandrel and end shoe shall be as close as possible to the size and shape of the drains in order to reduce disturbance to the soil. The length of the mandrel shall not be less than the maximum length of the drain.

Where a level platform is provided, the maximum deviation of the drains from the vertical shall be 1 horizontal in 75 vertical unless otherwise specified.

The depth and spacing of the drains shall be as shown on the Drawings and neither the depth nor the spacing shall be varied without the prior agreement of the S.O. The setting out Drawing shall be prepared by the Contractor and submitted to the S.O. one week before installation works commence.

The S.O. shall be satisfied that the drains have successfully penetrated the underlying soft compressible layer. Where an unforeseen obstruction is encountered the rig shall be stopped and if practicable a shorted drain installed and the Contractor shall inform the S.O. without delay. An alternative drain shall then be attempted at a distance of not more than 300 mm from the aborted drain. If this alternative placement fails, the Contractor shall continue with the other drains and the S.O. will decide what measures to adopt in the area of the obstructed drain.

Unless otherwise specified the Contractor shall cut prefabricated drains at not less than 150 mm above the working surface.

1.7 PREDRILLING

Where predrilling is required to enable the Contractor's placement apparatus to penetrate other than soft soils, the predrilling unit shall be capable of pre-drilling the ground for the placement apparatus so that the latter may place the drain to the specified depth without damaging it. The cost for predrilling shall be allowed for in the rates for installing vertical drains.

1.8 DISPOSAL OF ARISINGS

The Contractor shall ensure that the arisings from the placement operations cause the minimum contamination of the working surface. The Contractor shall remove the arisings.

Surface depressions around the installations shall be made good by the Contractor with the specified material before he commences the Works over the treated area.

1.9 METHOD STATEMENTS

The Contractor shall provide detailed method statement one week before commencement of work with respect to: -

- the type of prefabricated vertical drain proposed
- the size of the drain and method of construction
- a capacity statement of the firm's ability to carry out these works
- the level of supervision and staffing provided
- the number of rigs used to install drains
- steps to be taken to avoid damage to instruments

SECTION 2 – SURCHARGE OF PLATFORM

2.1 SURCHARGE PLACEMENT

Surcharge shall be placed at the locations and to the thickness shown on the Drawings. Placement of surcharge shall be concurrent with formation of the associated embankment unless otherwise directed.

Surcharge material can be suitable fill material or hard clean sand as defined in Clause 1.5 and shall be compacted to the requirement compaction.

Surcharge shall remove only after informing the Designer, and shall be carried out in accordance with the method and procedure stated in the Drawings. The Contractor shall be responsible for the provision of surcharge material and the removal and disposal of excess material on completion of consolidation or when informed by the Designer.

2.2 INSTRUMENTATION

2.2.1 General

The Contractor shall be responsible for and shall follow the instructions of the manufacturer in the installation, calibration and testing of all measuring instruments and equipment.

2.2.2 Settlement Plates And Displacement Markers

(i) Settlement Plates and rod displacement markers shall be provided and installed vertically by the Contractor in the positions determined by the Designer for the purpose of measuring settlements under the embankment and lateral displacements taking place adjacent to the embankments during and after the construction period. The Contractor shall be responsible for installation of all gauges as work proceeds. Continuation gauges shall be installed when the level of compacted embankment is 250 mm below the top of the proceeding gauges.

(ii) The Contractor shall take all necessary measures to protect rod gauges from damage by plant and vehicles and shall repair any such damage at his own expense. He shall erect substantial and readily visible barriers at a distance of 750 mm around each gauge.

(iii) The Contractor shall replace any damaged gauges within seven days, at his own expense.

(iv) The Contractor shall exercise great care in placing and compacting fill material around the gauges and shall ensure that the methods adopted will in no way damage them.

(v) Should a settlement plate be damage or should the Contractor fail to extend the gauge when required he shall stop all filling in the vicinity of the gauge until the necessary remedial works have been carried out.

2.2.3 Survey Stations

(i) The Contractor shall be responsible for establishing survey stations in locations selected by the Designer to monitor the settlement plates and displacement markers and for installing permanent survey base stations on undisturbed ground clear of the embankment. The survey stations shall be located on stable ground not affected by the Works.

(ii) The station shall comprise steel rods of 20 mm diameter, which shall be driven vertically into the undisturbed ground for a minimum distance of 1.0 m and shall project approximately 75 mm above ground surface. The rods shall be surrounded by not less than 0.03 m^3 of concrete at surface level, and their tops shall be carefully squared and center punched.

SECTION 3 - SPECIFICATION FOR NON-WOVEN GEOTEXTILES

3.1 GENERAL

3.1.1 Scope

This specification covers the technical and general requirements for the supply and installation of Non-Woven Geotextile as described herein. All materials used shall meet the requirements of this specification and all works shall be executed in accordance with the details shown on the drawings and the procedures described herein.

3.1.2 Contractor to Provide

The Contractor shall provide all necessary resources including materials, skilled workers, and plants/equipment to execute and complete the works related to supply and laying of non-woven geotextile as shown on the drawings.

3.1.3 Setting-Out

The Contractor shall be responsible for the true and proper setting-out of the areas to which the Non-Woven Geotextile is to be placed and for the correctness of the lines, widths, levels and slopes.

3.2 MATERIAL PROPERTIES

3.2.1 Products

All non-woven geotextile shall be from an approved manufacturer and shall be manufactured from polypropylene, polyester or polyethylene as shown in the Drawings. Non-Woven Geotextiles shall be durable and resistant to naturally occurring chemical, fungi and bacteria when installed in contact with the materials to be separated. Non-Woven Geotextiles shall be free of any flaws that may have an adverse effect on the physical and mechanical properties of the non-woven geotextiles.

Unless otherwise approved by the Engineer, non-woven geotextile fabrics shall be needle punched staple fiber geotextile in accordance with the Specification and shall be used as shown and described on the Drawings or as directed by the Engineer.

Non-Woven Geotextiles shall be stabilized against ultra-violet radiation to the degree that one month's exposure of the geotextile to sunlight shall not reduce its strength to less than 80% of the specified strength rating in the Specification.

The width of each roll of non-woven geotextile shall be 4m.

3.3 TESTING

3.3.1 General

Prior to the procurement of materials, the contractor shall provide a sample and the Manufacturer's Independent Test Report (ITR), showing full compliance of the proposed Non-Woven Geotextile to all the above-specified property values corresponding to their respective test methods, for the approval of the Engineer.

All tests shall be carried out in accordance with the codes of Practices and Standards as provided within this specification, unless otherwise approved by the Engineer. The independent test report and tests shall be prepared and carried out at reputable institution or laboratory such as SIRIM, IKRAM, UTM, UKM, UPM, UM or other accredited laboratories approved by the Engineer.

Routine sample testing, when requested and specified, shall be carried out at factory or at an independent laboratory witnessed by the Engineer's representative. The Contractor shall submit test report showing compliance of the specification by independent testing authority or laboratory such as listed above or an accredited laboratory approved by the Engineer.

3.3.2 Consignment Certificate

For the purpose of ascertaining that each consignment of Non-Woven Geotextile supplied to site is to the approved type and quality and are fully from the same Manufacturer and batch as indicated, the contractor must furnish with every consignment, an original Consignment Certificate from the Manufacturer giving the following information:-

- Name and Address of the Manufacturer
- Contact telephone/fax/email address of the Manufacturer
- Consignment Certificate Reference Number and Date
- Title of the Contract and Name of Project Owner
- Name and Address of the Purchaser
- Product Types and Quantities, corresponding to each consignment

3.3.3 Details of Test Certificates

The test certificate shall include the following:

- Wide Width Tensile Strength (longitudinal/transverse)
- Elongation (longitudinal/transverse)
- Trapezoidal Tear Strength
- CBR Puncture Resistance
- Apparent Pore Size (O_{95})
- Permeability

3.3.4 Routine Testing

Prior to installation and at the discretion of the Engineer samples of each 50,000m2 of non-woven geotextile fabric shall be selected for routine test at the testing laboratory located in the factory or other approved laboratories.

The properties to be tested shall comprise index properties including unit mass, mechanical properties including tensile strength, trapezoidal tear, Puncture Resistance and hydraulic properties including pore size and permeability. Where the individual samples fail to satisfy the requirements of this Specification on the geotextile fabric the roll from which the sample is obtained shall be rejected. Two additional samples shall then be selected from two other rolls of the same batch of non-woven geotextile fabric. If

3.5.5 Sewn Seams

The non-woven geotextile fabric shall be joined using an approved portable industrial sewing machine and by sewing a double chain stitch with 'J' or 'prayer' seam (minimum lap of 50mm) with high tenacity polyester thread and a minimum of 3 stitches per 25mm shall be required. The thread shall have a breaking load of not less than 200N. The expected seam strength shall be more than 70% of the original strength of separator non-woven geotextiles. Samples of such sewn seam assembly shall be tested in accordance with ASTM D4884 as deemed necessary by the Engineer.

3.5.6 Fill placement

The specified overlying fill material on the non-woven geotextile fabric, shall be placed in accordance with the requirements shown and described on the Drawings or as directed by the Engineer. These fill materials shall be deposited in layers not exceeding 500mm loose depth or at a thickness controlled by the compaction effort requirement and shall be spread simultaneously with the dumping in a manner to prevent any localized distress or failure of the ground.

3.5.7 No traffic shall travel directly on the non-woven geotextile and there shall be no sudden stops, starts or turns on the fill materials by the construction equipment or other such actions that may cause damage to the non-woven geotextile.

Method of Measurement (M.O.M)

METHOD OF MEASUREMENT AND PRICING FACTORS

SECTION 7 - GEOTECHNICAL WORKS

7.1 SOFT GROUND IMPROVEMENT

7.1.1 SOFT GROUND REPLACEMENT / STABILITY

7.1.1.1 Non-Woven Geotextile

Unit

The units of measurements for Geotextile below embankments shall be in Square Metre **(m^2).**

Measurement

The measurement for payment of this item shall be based on the plan area of the geotextile laid. Laps shall not be measured for payment.

Item Coverage

The item for the non-woven geotextile in ground treatment shall be in accordance with the Preambles to the Bill of Quantities General Directions and shall include:

a. supply and storage at site with necessary protection against exposure to direct sunlight.

b. placing the geotextile to suit the extend ground treatment required.

c. jointing.

d. wastage.

7.1.1.2 High Strength Geotextile – N/A

Unit

The units of measurements for high strength Geotextile below embankments shall be in Square Metre **(m^2).**

Measurement

The measurement for payment of this item shall be based on the plan area of the geotextile laid. Laps shall not be measured for payment.

Item Coverage

The item for the high strength geotextile geotextile in ground treatment shall be in accordance with the Preambles to the Bill of Quantities General Directions and shall include:

a. supply and storage at site with necessary protection against exposure to direct sunlight.

b. placing the geotextile to suit the extend ground treatment required.

c. jointing.

d. wastage.

g. standing and waiting time for tests to be carried out.

7.1.1.5 **Imported Fill Material – N/A**

Unit

The units of measurement for Placement and compaction of imported fill materials from contractor's own source shall be Cubic Metre (m^3)

Measurements

The measurement of placement and compaction of imported fill material for soft ground replacement shall be the volume of the void formed by the excavation to the lines and levels shown on drawing or describe in the contract.

Item Coverage

The items shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:

a. supply of approved materials of stated types from sources outside the site including royalties and other costs including for searching for and finding borrow pits, acquiring the right to occupy the sites and extract material, obtaining right of access, establishing and maintaining access.

b. excavation in whatever ground that may be met with and cost of the approved filling material.

c. loading, hauling and double handling (where necessary) to points of deposition or stockpiles including payment of royalties (if any).

d. provision of sites for stockpile and the costs arising there form including payment of royalties, if any.

e. increase in bulk of approved imported filling material.

f. depositing, spreading, leveling, trimming, shaping and compacting in accordance with the specification to required lines, levels, grades and dimension as shown on the drawings or as directed by the S.O, in whatever site condition and depth (filling placed beyond requirement shall not be measured).

g. shrinkage in compacted materials.

h. the mechanical or chemical treatment of soil required to facilitate the use of particular plant.

i. keeping earthworks free from water.

j. taking precaution to avoid damage to property, structures, sewers, drains and services.

k. Taking precaution to prevent suitable material from becoming unsuitable and replacing suitable material rendered unsuitable.

l. processing on or off site to bring material within the required moisture content limit for compaction.

e. removing the rigs and ancillary equipment off Site.

7.1.2.2 **Non-Woven Geotextile N/A**

Unit

The units of measurements for Geotextile below embankments shall be in Square Metre **(m^2).**

Measurement

The measurement for payment of this item shall be based on the plan area of the geotextile laid ; laps shall not be measured for payment.

Item Coverage

The items for non-woven geotextile in ground treatment shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:

a. supply and storage at site with necessary protection against exposure to direct sunlight.

b. placing the geotextile to suit the extend ground treatment required.

c. jointing.

d. wastage.

7.1.2.3 **..... kN/m Warp Tensile Strength N/A**

Unit

The units of measurements for Geotextile below embankments shall be in Square Metre **(m^2).**

Measurement

The measurement for payment of this item shall be based on the plan area of the geotextile laid; laps shall not be measured for payment.

Item Coverage

The items for high strength geotextile in ground treatment shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:

a. supply and storage at site with necessary protection against exposure to direct sunlight.

b. placing the geotextile to suit the extend ground treatment required.

c. jointing.

d. wastage.

f. temporary drainage to channel expelled water from the vertical drains away from the designated treatment area.

g. clear debris around drain position and taking measures to prevent contamination of fill material.

7.1.2.6 **Sand Fill Under Water N/A**

Unit

The units of measurement for Sand for backfilling under water shall be in Cubic Metre **(m^3)**

Measurement

The measurement for sand fill under embankment shall be in cubic metres of compacted layer constructed to lines and levels as shown on drawings or as directed by the S.O.

Item Coverage

The items for construction of the sand fill under water shall be in accordance with the Preambles to Bill of Quantities General Direction and shall include :-

a. supply of material for sand fill under embankment.

b. haul and place material in areas as shown on drawings or as directed by the engineer.

c. wastage.

d. trimming and shaping to required level.

7.1.3 **STONE COLUMNS/GEOPIERS/SOIL CEMENT/COLUMNS/CHEMICAL COLUMNS/SAND COLUMNS – N/A**

7.1.3.1 **Mobilization / Demobilization – N/A**

Please refer to Method Of Measurement Clause 7.1.2.1

7.1.3.2 **Non-Woven Geotextile – N/A**

Please refer to Method Of Measurement Clause 7.1.1.1

7.1.3.3 **High Strength Geotextile – N/A**

Please refer to Method Of Measurement Clause 7.1.1.2

7.1.3.4 **Stone column/soil cement columns/chemical columns/sand columns – N/A**

Unit

The units of measurement for stone column/soil cement columns/chemical columns/sand columns shall be in Metre **(m)**

7.1.3.5 **Drainage Blanket – N/A**

Please refer to Method Of Measurement Clause 7.1.2.5

7.1.4.1(ii) **Imported Fill Materials as Surcharge N/A**

Unit

The units of measurement for Imported fill materials as surcharge shall be in Cubic Metre **(m^3).**

Measurement

The measurement of approved imported fill material as surcharge shall be the nett cubic content in cubic metres of the compacted embankments constructed to the finished lines and levels as shown in the drawings and specified or as directed by the S.O. The line of the top of the embankment shall be the surcharge levels as shown on the drawings

Item Coverage

The items shall be in accordance with the Preambles to Bill of Quantities General Direction and shall include:-

a. supply of approved materials of stated types from sources outside the site including royalties and other costs including for searching for and finding borrow pits, acquiring the right to occupy the sites and extract material, obtaining right of access, establishing and maintaining access.

b. excavation in whatever ground that may be met with and cost of the approved filling material.

c. loading, hauling and double handling (where necessary) to points of deposition or stockpiles including payment of royalties (if any).

d. provision of sites for stockpile and the costs arising thereform including payment of royalties, if any.

e. increase in bulk of approved imported filling material.

f. depositing, spreading, leveling, trimming, shaping and compacting in accordance with the specification to required lines, levels, grades and dimension as shown on the drawings or as directed by the S.O, in whatever site condition and depth (filling placed beyond requirement shall not be measured).

g. shrinkage in compacted materials.

h. the mechanical or chemical treatment of soil required to facilitate the use of particular plant.

i. keeping earthworks free from water.

j. taking precaution to avoid damage to property, structures, sewers, drains and services.

k. taking precaution to prevent suitable material from becoming unsuitable and replacing suitable material rendered unsuitable.

l. processing on or off site to bring material within the required moisture content limit for compaction.

m. complying with requirements for the equalization of earth pressures or the sequence or rate of filling.

The measurement for payment of this item shall be the net cubic content in cubic metres of remove surcharge to the formation levels as shown in the drawings and specifies or as directed by the S.O.

Item Coverage

The item for removal of surplus surcharge material from site shall include :-

a. excavation of surcharge material to the depth specified or as directed by the S.O.

b. loading, hauling and double handling (where necessary) of excavated materials to sides of embankment and disposal area including payment of royalties (if any).

c. cost acquiring or use of land outside the site and disposal of excavated material not required for use in works.

d. preparing the disposal area, leveling and trimming the material in the disposal areas and providing all drainage and other erosion protection measures in and around the disposal areas.

7.1.5 PILED EMBANKMENT

7.1.5.1 300mm Diameter Spun Pile

7.1.5.1.1 Mobilization and Demobilization

Unit

The units of measurement for Mobilization and demobilization of all labour, plants, piling equipments, etc. on site for piling works shall be in Lump Sum (**sum**).

Measurement

The measurement shall be made on establishment of the required piling plants at site including setting up of piling frames at the first pile position.

Item Coverage

The items shall include furnishing all labour materials, tools, equipment and incidentals necessary to do all piling works required and the payment shall include :

a. the transport and installation of all plants necessary to complete the piling works from Contractor's own source to the site where they are to be used on the works.

b. mobilization of the Contractor's labour force necessary to complete the piling works.

c. mobilization of the Contractor's piling staff.

d. the supply, construction or rental of all items required.

e. construction of any necessary access roads.

f. set preparation including all necessary excavation, leveling of ground, temporary staging and setting out of piling positions.

The measurement shall be the length of each pile handled, pitched and driven complete in place and accepted by the S.O and shall be measured along the axis from the toe of the pile (after settlement of the pile under its own weight) to the specified cut off level. Driving of piles that fail to meet the piles acceptance criteria will not be paid for.

Item Coverage

The items for handle, pitch and drive precast reinforced concrete piles shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:-

a. setting out of pile position.

b. taking from store, handling and pitching in accordance with the specification.

c. all materials, equipment, tools and labour incidental thereto.

d. driving of piles.

e. driving trial piles to determine the pile length requirement.

f. jetting where permitted by the S.O.

g. moving plant and equipment back and redriving the risen pile.

h. lost time due to moving plant and equipment and standing time and disruption cost by the process of lengthening and overcoming of obstructions.

i. taking observations and compiling pile records and supplying two copies to the S.O.

j. wailing, ties and the like.

k. achieving tolerances.

l. redriving or further redriving of piles as directed.

m. continue driving to a driving resistance higher than twice the working load including change to the heavier hammer where necessary to achieve the set requirement as specified.

n. moving plant and equipment from one pile position to another pile position and from one piling site to another piling site including site preparation.

o. leveling and access ramp to individual pile.

7.1.5.1.5 **Handle, Pitch and Drive Raked Piles**

Please refer to Method Of Measurement Clause 7.1.5.1.4

7.1.5.1.6 **Lengthening of piles**

Unit

The units of measurement for Lengthening of piles shall be Number **(nr)**.

The units of measurement for Test load on preliminary pile shall be Number **(nr)**.

Measurement

The measurement for load tests shall be the number of completed tests on piles which have met the pile acceptance criteria.

Item Coverage

The items for load testing of precast concrete piles shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:-

a. bringing test rigs, kentledge and associated equipment to the site of the bridge, or other structure and subsequently removing them on completion of the test.

b. setting up test rigs, kentledge, cable anchorages, anchor piles and reference bench marks and dismantling on completion.

c. providing, calibrating, setting up, operating and maintaining instruments and apparatus required to complete the tests.

d. constructing temporary pile caps and subsequent stripping off.

e. applying, releasing and re-applying the test load in stages up to the maximum test load specified.

f. taking readings, measurements and observations of pile performance under test and supplying 2 copies of records of each test to the S.O as specified.

g. moving plant and equipment from one pile test location to another and from site to site including site preparation, leveling and access ramps.

h. in the case of trial pile testing all additional costs involved in bringing testing equipment and kentledge to Site and removing on completion of test.

7.1.5.1.12 **Test Load On Working Pile – N/A**

Please refer to Method Of Measurement Clause 7.1.5.1.11

7.1.5.1.13 **Carry Out PDA in accordance with specification**

Unit

The units shall be in Number **(nr).**

Measurement

It shall be the tonnage of completed load test on piles which have met the pile acceptance criteria

Item Coverage

a. setting up test rigs, kentledge, cable anchorages, anchor piles and reference bench marks and dismantling and removing them on completion;

7.1.5.2.3 Lean Concrete

Units

The units shall be Square Metre (m^2).

Measurement

The measurement shall be the plan area of the specified thickness of lean concrete laid as shown on the drawings or as directed by the S.O.

Item Coverage

The rate shall include preparing the subgrade, lean concrete, mixing and placing and provision of all necessary plant, equipment and labour.

7.1.5.2.4 Reinforced Concrete Slab

Unit

The unit shall be in Cubic Metre (**cu.m**).

Measurement

In-situ concrete shall be measured as the ***net volumes in cubic metres*** of concrete of the appropriate class placed and compacted in the structure as shown on the Drawings and as directed and accepted by the S.O.

No deductions shall be made for space occupied by reinforcement or holes or voids formed in the concrete not exceeding 0.01 square metre in cross-sectional area each, fillets, chamfers, splays and drips of 100 mm total girth or less measured on the face of the concrete.

Item Coverage

The rate shall include:-

a. Trial mixes as specified.

b. Providing materials, attendance and all cost for all sampling and testing carried out by the S.O.

c. Mixing, transporting, placing in or against any surface, compacting, surface finishing, curing and protecting the concrete from damage and staining.

d. Falls, cambers and shaped profiles.

e. Weep holes, pipe sleeves and the like not specifically measured in other items.

f. Forming construction joints, skew back, stunt ends, stepping, bonding chases, rebates, recesses, holes, sockets, scuppers, provision of water stops and the like including all necessary formwork.(whether shown on the Drawings or not)

g. Use of cement other than ordinary Portland cement and all necessary admixtures.

h. Any additional concrete required to fill overbreak or working space.

i. not exceeding 5m
ii. exceeding 5m but not exceeding 10m
iii. exceeding 5m but not exceeding 10m

Unit

The units of measurements for piezometers shall be in Number **(nr).**

Measurement

The measurement for payment of the piezometers shall be the respective numbers of each type of piezometers completely installed in accordance with the specification and accepted by the S.O.

Item Coverage

The items for piezometers shall include :-

a. transport and delivery to site.

b. all extension rods and joints required.

c. protection and costs of working around piezometers.

d. complete removal upon completion of monitoring exercise

7.2.4 **Supply and install inclinometers – N/A**

i. not exceeding 10m
ii. exceeding 10m but not exceeding 20m
iii. exceeding 20m but not exceeding 30m

Unit

The units of measurements for inclinometer shall be in Number **(nr).**

Measurement

The measurement for payment of the inclinometer shall be the respective numbers of each type of inclinometer completely installed in accordance with the specification and accepted by the S.O.

Item Coverage

The items for inclinometer shall include :-

a. transport and delivery to site.

b. all extension rods and joints required.

c. protection and costs of working around inclinometer.

d. complete removal upon completion of monitoring exercise

7.2.7 **Monitoring Report** N/A

Unit

The unit of measurement for monitoring report shall be Lump Sum (Ls).

Measurement

The measurement for payment shall be the number of reports prepared based on monitoring carried out and accepted by the S.O.

Pricing Factor

The item for preparation of the monitoring report shall be in accordance with the Preambles to Bill of Quantities General Direction including:-

a. cost associated in the preparation of a comprehensive report;

b. submission of five (3) copies of the monitoring report per trip to S.O.

7.3 SLOPE STABILISATION WORKS – N/A

7.3.1 SOIL NAILING – N/A

7.3.1.1 Drilling and Grouting Equipment N/A

Unit

The unit of measurement for providing the necessary drilling and grouting equipment and all other appliances required for the installation of soils nails shall be in Lump Sum **(Sum).**

Measurement

The measurement for payment shall be made as follows:

a. 70% on completion of mobilisation;
b. 30% on completion of demobilisation

Item Coverage

The items for moving of plant and equipment for soil nails shall be in accordance with Preambles to the Bill of Quantities General Directions include for:-

a. Mobilization and bringing all plant and equipment to the difference locations;

b. Erecting and setting up at each soil nail position including all tagging, platforms and access;

c. Dismantling equipment and staging, moving and reassembling at the next soil nail position;

d. Sequential method of stage excavation and any loss time;

e. Dismantling and removing plant and equipment from site on completion

Item Coverage

The rate shall include for:-

a. storage of all test equipment and tools on the sites between pull-out tests;

b. calibrating of load measuring device at approved laboratory;

c. setting up test beams, hydraulic jacks, dial gauges, and reference bench marks and dismantling and removing them on completion;

d. providing, setting up, operating and maintaining instruments and apparatus required to complete
e. the tests;

f. constructing temporary pile caps and subsequent stripping off (if required);
g. applying and re-applying the test load and releasing;

h. taking readings, measurement and observations of soil nail behaviour under test and recording
i. and supplying two copies of the record of each test to the S.O;

j. moving plant and equipment from one pull-out test location to another and from site to site including site preparation, levelling and access ramps.

7.3.1.4 **Proof test for soil nail – N/A**

Unit

The unit of measurement for proof test for soil nail shall be in Number **(nr)**

7.3.1.5 **Horizontal Drains– N/A**

Unit

The unit of measurement for installation of complete horizontal drain with perforated PVC pipe wrapped with non-woven geotextile shall be in Number **(nr)**

Measurement

The measurement for installation of horizontal drain shall be in number according to the length specified.

Item Coverage

The rate for horizontal or inclined drain shall include:

a. moving the machine for the installation of the drains from one drain position to another and from on designated treatment area to another

b. site preparation, access ramp, construction staging and working platforms as necessary

c. loss of mandrel and its replacement

d. overcoming obstruction and standing time

7.3.2.2 **Installation of Rock Bolt– N/A**

i. 2m long
ii. 4m long
iii. 6m long
iv. excedding 6 m long but not exceeding 9m (....m)

Unit

The unit of measurement for installation of rock bolt shall be in Number **(nr).**

7.3.2.3 **...mm Thick Sprayer Grade...Concrete – N/A**

Unit

The unit of measurement to construct specific thick sprayer concrete on unstable fractured rock face shall be in Square Metre **(m^2).**

7.3.2.4 **Pull-Out Test– N/A**

Unit

The unit of measurement for carry out pull-out test shall be in Number **(nr).**

7.3.3 **GROUND ANCHORAGE**

7.3.3.1 **Drilling and Grouting Equipment - N/A**

Unit

The unit of measurement for providing the necessary drilling and grouting equipment and all other appliances required for the installation of rock bolt shall be in Lump Sum **(Sum).**

7.3.3.2 **Ground Anchors– N/A**

Unit

The unit of measurement for installing ground anchors including anchor heads and necessary inspection shall be in Lump Sum **(Sum).**

7.3.3.3 **Anchor Test - N/A**

Unit

The unit of measurement for pull out anchor test shall be in Number **(nr).**

7.3.4 **HORIZONTAL DRAINS**

7.3.4.1 **Horizontal Drains– N/A**

i. 9m long

7.4.1.3 **Erection and Installation of .....Shaped Precast Concrete Panel in Successive Horizontal Lifts to Form Reinforced Soil Wall Components**

Unit

The unit of measurement shall be in Square Metre **(m^2).**

7.4.1.4 **350mm x 150mm Cast in Situ Mass Concrete Leveling Pad**

Unit

The unit of measurement shall be in Square Metre **(m^2).**

7.4.1.5 **Drainage Blanket**

Unit

The units of measurement for Drainage Blanket below structure shall be Square Metre **(m^2).**

Measurement

The measurement for drainage blanket shall be the plan area of the compacted layer constructed to lines and levels as shown on drawings or as directed by the S.O.

Item Coverage

The items for construction of the drainage blanket layer shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:-

a. supply of material for drainage blanket construction.

b. haul and place material in areas as shown on drawings or as directed by the engineer.

c. supply and lay geotextile as specified.

d. wastage.

e. multiple handling of excavated material.

f. trimming and shaping to required levels.

7.4.1.6 **River/mining Sand**

Unit

The units of measurement for sand fill to reinforced soil wall shall be in Cubic Metre **(m^3).**

Measurements

The measurement for sand shall be in cubic metres of compacted layer constructed to lines and levels as shown on drawings or as directed by the S.O.

Item Coverage

7.4.3.3 **Formwork – N/A**

Unit

The units shall be in Square Metre (**sq.m**).

Measurement

The measurement for formwork shall be the ***area in square metres*** of formwork of the appropriate class which is in contact with the finished concrete. No deduction shall be made for any opening of one square metre or less.

Item Coverage

Formwork to the following shall not be measured and shall be deemed to have been included in the rates:

a. to all types of joints such as shrinkage, construction and expansion joints (whether shown or not on the Drawings) skewbacks, stunts ends, stepping, bonding chases and the like;

b. to holes, ducts, pockets, sockets, mortices not exceeding 0.15 cubic metres each in volume;

c. to fillets, chamfers, splays, drips, rebates, recesses, grooves and the like of 150mm total width/girth or less;

d. to edge of blinding concrete 75 mm or less in thickness;

e. to upper surfaces of concrete except where shown to be required in the Contract.

Where concrete other than blinding concrete is placed in structural foundations, formwork shall be measured to the sides of such concrete foundations regardless of whether or not any formwork is used except where it is expressly stated in the Contract that the concrete is to be cast against the soil face.

The rates for formwork shall include for:-

a. construction of all temporary works, false work, formwork, centring and linings and removal of same on completion and taking all measures necessary to produce the required finishes to the surfaces of the concrete;

b. forming cambers and falls;

c. formwork at any inclination and location;

d. curved formwork of any radius;

e. all falsework and formwork left permanently in place;

f. cutting and fitting around projecting members, pipes, reinforcement and the like;

g. forming fillets, chamfers, splays, drips, rebates, recesses and grooves;

h. application of approved non-staining release agent;

i. allowing for any variation from the minimum period for striking, arising from prevailing weather conditions;

Unit

The units shall be in Linear Metre (**m**)

Measurement

The measurement shall be made on the actual length constructed and measured along the centre line of the pipe from the position of termiations.

Item Coverage

The item shall include :-

a. Supply of UPVC service duct;

b. Supply of UPVC series

c. Cutting of pipes to correct length including allowance for waste;

d. Building, forming and casting into structure during the concreting process;

e. Cleaning.

7.4.3.6 **..,,,,,mm Thick River Sand/mining N/A**

Unit

The units of measurement for river/mining sand as draining material shall be Square Metre (m^2).

Measurement

The measurement for drainage material shall be the plan area of the compacted layer constructed to lines and levels as shown on drawings or as directed by the S.O.

Item Coverage

The items for construction of the drainage blanket layer shall be in accordance with the Preambles to Bill of Quantities General Directions and shall include:-

a. supply of material for drainage material construction.

b. haul and place material in areas as shown on drawings or as directed by the engineer.

c. supply and lay geotextile as specified.

d. wastage.

e. multiple handling of excavated material.

f. rimming and shaping to required levels.

7.4.3.7 **PVC Waterstop – N/A**

Unit

Laps included in the reinforcing steel to suit the Contractor's method of construction will not be measured for payment.

Measurement of fabric reinforcement will be measured as the area of covered, with no allowance for cutting waste or laps in the fabric.

Item Coverage

The rate shall include:-

a. cleaning, cutting and bending.

b. binding, placing and fixing with wire or other materials.

c. supports and spacers (except for steel bar supports to reinforcement where shown in the Drawings).

d. extra fabric reinforcement at laps.

e. welding and splicing.

7.4.3.11 **Bituminous Coating – N/A**

Unit

The units shall be Square Metre (**sq.m**)

Measurement

The measurement shall be made on the nett dimension of the sprayed surface as shown on the drawings or as directed by the S.O.

Item Coverage

The rate shall include :

a. cleaning the surface to be treated

b. using hand tools to scrap and remove dirt from the surface

c. supply and application of protection coating

d. trial run

e. cost of materials, transport to site and other expenses incurred in procuring the materials

f. standby or waiting time, materials and attendance for sampling and testing carried out by the S.O.

g. trials and trials area.