

PUB'S EARTH CONTROL MEASURE (ECM) REQUIREMENTS

Best Management Practices for Silt Control at Construction & Earthworks Sites

Introduction:

- 1 Construction industry is encouraged to adopt and implement the best management practices for the control of silty discharge from a construction or earthworks site, as outlined below, to comply with the requirements under the Sewerage and Drainage Act (Chapter 294) and Code of Practice on Surface Water Drainage.
- 2 The earth control measures (ECM) are for the containment and treatment of silty discharges due to the impact of **rainwater**. ECMs are meant to minimise silt discharge and are not meant to treat the wastewater due to construction activities (such as slurry from tunneling, pipe-jacking and bore-piling works) which shall be treated to comply with the requirements under Environmental Protection and Management Act (Chapter 94A).
- 3 For more information on ECM, please refer to the website <https://www.pub.gov.sg/drainage/earthcontrolmeasures>

(1) Water Quality Parameters to be complied with

The discharge from any construction / earthwork sites into a storm water drainage system shall not contain Total Suspended Solids (TSS) in concentrations greater than the prescribed limits under Regulation 4 (1) of the Sewerage and Drainage (Surface Water Drainage) Regulations.

(2) ECM Specifications in Tenders

Developers / owners and Qualified Persons should include the earth control measures (ECM) specifications and schematic or conceptual ECM plans in the tender documents and allow for the cost of ECM in the tenders.

(3) Permit to start earthworks

The site operator/contractor shall obtain a written permission (or a clearance certificate) from the Board and implement adequate ECM before the commencement of any earthwork.

(4) Submission of ECM proposal before commencement of works

The site operator/owner shall submit the detailed ECM proposal, endorsed by a QECP, to the Board to apply for an approval. The ECM proposals (with calculations) shall include a plan (a typical plan is as shown in Drawing No. 8 of the COP on Surface Water Drainage).

(* Note: A QECP is a Professional Engineer who has passed a professional ECM course conducted by IES and ACES. It is planned to only allow QECPs to endorse ECM plans.)

(5) Design Criteria of ECM

The ECM shall be designed to cope with at least a storm of return period of 5 years.

(6) ECM to be installed before commencement of work

The ECM shall be installed by the site operator / contractor according to the endorsed plans and the completed ECM at site shall be approved by the QECP before commencement of construction and earthworks.

(7) General Guidelines for Effective ECM

An effective ECM requires 2 components which shall include, but is not limited to, the following minimum measures in order to meet the legal requirements cited under Regulation 4(1) of the Sewerage and Drainage (Surface Water Drainage) Regulations:

(A) Erosion Control Measures

The erosion control measures shall **minimise the extent and duration** of any exposed / bare / erodible surfaces by:

a. Proper Work Sequencing

Adopting proper construction staging and work sequencing will help to ensure that no large bare / erodible surfaces are exposed for a long duration.

b. Covering up of all bare / erodible surfaces

All bare surfaces (including earth stockpiles) shall be by concrete-lining, concrete-paving, milled waste, erosion control blankets, close turving or other suitable materials. Accesses within the site and at exit / entrance as well as the surfaces where site facilities (such as office, fabrication and storage yards) shall be paved. For those work areas, they shall be covered by canvas sheets, tarpaulin sheeting or other suitable materials during rains or before work stops every day.

Minimising of the bare erodible surfaces as mentioned above will reduce the volume of silty water to be contained and treated. For areas which have been paved/ covered, the clean surface runoff could be channelled directly into the drains.

c. Progressive and timely revegetation and stabilization

All bare surfaces shall be restored immediately upon completion of work at every stage.

If a construction site has very little bare / erodible surfaces, the operator / contractor will have less difficulty in containing and treating the silty discharges as described in Para 7 (B) below. For those areas within a construction site which have been paved / covered and will not cause silty discharge, it is possible to drain these areas directly into the storm water drainage system without treatment.

(B) Sediment Control Measures

The sediment control measures shall trap, contain and treat the silty discharges from within a construction / earthworks site (including rain, runoff, water from washbay, underground water at basement, etc) by providing:

a. Perimeter Cut-off Drain

Perimeter cut-off drains shall be concrete-lined and adequate to capture all runoff from the site to prevent overflow onto adjacent properties. For sites located above slope, a boundary wall of at least 600mm high shall be provided along the entire perimeter of the site to prevent overflow onto adjacent properties.

b. Perimeter Silt Fence

Silt fences shall be erected along the perimeter cut-off drain (between the construction site and perimeter cut-off drain). The silt fence is to be embedded firmly into the ground and made from an approved geotextile filter fabric to capture the sediment from stormwater runoff. The sediment built-up behind the silt fence must be regularly removed.

c. Intermediate Silt Trap

Intermediate silt traps of suitable size shall be installed at regular intervals along the perimeter lined cut-off drain. Within the intermediate silt traps, suitable geotextile filter fabric or equivalents shall be installed across the full depth and width and / or coagulation-assistance materials shall be placed. Silt traps relying primarily on hardcore, granite chips or sands for filtration, are not acceptable.

d. Holding Pond / Sump

All silty runoff shall be collected and channelled to ground holding pond/sump for treatment to the required water quality standard before discharging the runoff into the drain. All silty water shall be treated and discharged within 10 hours after the rainstorm so as to prepare the pond/sump for the next rainfall event.

- i. No processed/used water, such as slurry water and sullage water shall be discharged to or kept in the holding pond/sump.
- ii. The holding pond/sump shall be located near the drainage outlet.
- iii. Water level markings shall be provided within the holding pond/sump to indicate the level of water in the holding pond/sump and the depth of the holding pond/sump.
- iv. The holding pond/sump shall have a storage capacity to cope with a storm of return period of 5 years.
- v. Cut-off drains could be used as part of the holding pond/sump.

- vi. The capacity of the cut-off drains available to hold the silty runoff should be clearly tabulated, taking into consideration the site terrain. The wash bay sump shall not be included in the calculation for storage.

e. Treatment System

Adequately-sized treatment system shall be installed to treat all silty surface runoff before it is discharged into the drains. The treatment system shall be sized to treat and empty the rain runoff water in the holding pond/sump within 10 hours after the rainstorm so as that to prepare the pond/sump for the next rainfall event. Any other water shall be handled separately and shall not be channelled to the holding pond/sump for treatment. The treatment system shall be calibrated regularly according to the manufacturer's specification. The quality of discharge shall be monitored continuously by a Total Suspended Solids (TSS) meter or by other means.

- i. The treatment plant treats the silty water at a prescribed flow rate and there is no holding capacity within the treatment plant. Treatment plants shall not be included as part of the total holding pond/sump capacity.
- ii. For above ground holding tank design proposal, contractor shall provide justifications that the system is able to function at all times, in particular, during heavy rain in the middle of the night. The justifications shall include detailed calculations of number of pumps and pump size, provision of redundancy to cater for maintenance and breakdown, positive suction head at the sump pit, provision of power supply for the automated system throughout the entire operation, and configuration of the automated system and the standby manpower as necessary.
- iii. The above information, schematics and technical drawings shall be clearly enclosed in the ECM plan for contractor to strictly adhere to. Contractor shall engage a QP (mechanical) to design and endorse the pumping system and monitor the performance and revise the ECM design accordingly.

f. Turbidity Curtains

For works that are within or adjacent to the water bodies, such as canals, rivers, sea or reclamation works, turbidity curtain(s) shall be installed along all the exposed slopes/riverbanks. The silt within the turbidity curtain(s) shall be removed regularly and disposed off accordingly to the relevant regulations.

g. Wheel wash

Used water from wheel wash shall not be discharged directly to the drain. The silty water within the wash bay could be channelled into the holding pond/ sump.

h. Minimal of No Discharge

Recycling of water should be practised at construction/earthwork sites. The recycled water could be used for non-potable purposes in order to minimize discharge into the drain.

(8) Inspection & Review of ECM during Contract duration

The site operator/contractor shall inspect the conditions of the ECM regularly and during/after every rain event.

The site operator/contractor shall arrange for his QECF to carry out regular audit/review for every stage of the earthworks and construction works, and also revise/amend the ECM at site according to the advice of the QECF. All inspection/audit/review reports shall be kept on site and made available to the Board upon request.

(9) Maintenance of ECM during Contract duration

The ECM implemented on site shall be checked and maintained regularly to ensure that the ECM remains effective throughout the whole duration of works. This shall include:

- i. Replacing of silt fences and erosion control blankets
- ii. Re-paving of worn-out concrete surfaces
- iii. Replacing of membrane modules
- iv. Calibration of silty water treatment plant according to the manufacturer's specification
- v. Removal of silt accumulated in the holding sump
- vi. Removal of silt accumulated at the silt fence and beside the boundary wall

(10) Monitoring of Discharge during Contract duration

The site operator/contractor shall monitor the discharge water quality as cited in Clause 6.3.1 before it enters the roadside/ outlet drain(s).

The site operator/contractor shall for this purpose, provide a continuous monitoring system which include the necessary monitoring instrument and CCTV system upon requested by the Board. The CCTV system shall be positioned at the drain so that it is able to view the discharge outlet(s) along with the upstream of the drain clearly. The CCTV image quality shall be able to distinguish the clear water and the silty water clearly.

The site operator/contractor shall keep the CCTV in operations at all times.

The site operator/contractor shall submit regular reports (including photographic and monitoring records) of the site ECM as well as those for discharge quality upon requested by the Board.

(11) Removal upon Completion

The ECM shall not be removed before the completion of work. The site operator/owner shall inform the Board prior to removal of the ECM on completion of the project.

(12) Requirements for Employment of Contractor's Full Time Earth Control Measures Officer (ECMO)

Apart from the Clause 9, the Contractor shall employ the site personnel with Earth Control Measures Officer (ECMO) qualification and stationed them full time on site upon the approval from the SO Rep.

Upon their employment, the ECMO shall be full time on site throughout the construction period including any time period where liquidated damages are imposed under the Contract, unless otherwise approved by the SO Rep.

The Earth Control Measures Officer is to link up with the Contractor's QECP, to supervise the operation and maintenance of the ECM implemented on site, as well as to conduct daily checks on site. The ECMO's roles shall include:

- a. Implement ECM Plan according to QECP's design;
- b. Devise ECM operations;
- c. Maintenance and inspection programme on site; and
- d. Assist the QECP to monitor ECM effectiveness throughout various stages of construction.

The ECMO need not to be the site personnel dedicated solely to perform the ECMO role. The ECMO role could be covered by the site project manager, project supervisor, Environmental Control Officer (ECO) or safety office, who has attained the ECMO qualification. The ECMO shall complete and pass a 1-day ECM course conducted by IES or its affiliates and be registered as a ECMO under the IES ECMO Registry.