



EROSION MANAGEMENT PLAN

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Project Title:

The proposed development of a 225MW solar photovoltaic (PV) facility on several portions of farms in the Hanover district, Emthanjeni local municipality, Pixley Ka Seme district municipality; Northern Cape province.

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Definitions & Acronyms

- **ECO** – Environmental Control Officer;
- **Engineer** – refers to the (Chief) Resident Engineer, that oversees the implementation of the project. In some instances, this role may also be fulfilled by a Project Manager.
- **IEA** – Independent Environmental Auditor;
- **Pollution incident** -is any incident that may or has caused contamination of soil or water, and may result in significant damage to the natural environment.
- **Sedimentation or Settlement ponds**-are ponds that retain sediment-laden water from the Works for a sufficient period for the sediment to settle. These include small scale portable devices used to remove sediment from water;
- **SEO** – Site Environmental Officer;
- **Watercourse** - means any river, stream and natural drainage channel whether carrying water or not;
- **Water body**- means a body containing any form of water and includes dams and Wetlands, whether ephemeral or permanent;
- **Wetland** -means all areas with waterlogged soils, or soils covered with a shallow layer of water (permanently or seasonally), unique types of soil formed under seasonal or permanent saturation, and distinctive plants adapted to water-saturated soils.

Table of Contents

Definitions.....	2
1. Scope	5
2. Relevant Sections of the Specification.....	Error! Bookmark not defined.
3. Management and Supervision.....	5
4. Resources, including involvement of Subcontractors.....	5
5. Technical Execution.....	6
5.1 Surface and Trench Excavations.....	6
5.2 Underground Works (pipe jacking).....	6
5.3 Working in Water bodies and Watercourses.....	6
5.4 Minor Watercourse Crossings (dongas).....	8
5.5 Groundwater	8
5.6 Management of Water	8
5.7 Quality of Water Discharged from the Works.....	9
5.8 Sedimentation Ponds (see attached drawing 2).....	9
5.9 Pipeline Testing.....	Error! Bookmark not defined.
5.10 Water Abstraction.....	10
5.11 Water Quantity.....	10
5.12 Water Quality Monitoring.....	11
5.13 Sampling Techniques	12
5.14 Monitoring and Sampling Equipment	13
5.15 Sampling by the Engineer.....	13
6. Materials	13
7. Occupational Health and Safety	13
8. Quality Management, Control and Assurance.....	Error! Bookmark not defined.
9. Communications.....	Error! Bookmark not defined.
10. General	13
11. Appendices.....	14
Appendix 1: Extraction from specification- Annexure 8/1 Effluent standard	Error! Bookmark not defined.
Appendix 2: Extraction from specification – Annexure 8/2 In situ measurement ...	Error! Bookmark not defined.
Appendix 2: Extraction from specification – Annexure 8/2 In situ measurement ...	Error! Bookmark not defined.

Appendix 3: Drawing 1.....	14
Appendix 4: Drawing 2A.....	15
Appendix 5: Drawing 2B.....	16
Appendix 6: Drawing 4.....	17
Appendix 7: Drawing 5.....	18
Appendix 8: Drawing 6.....	19
Appendix 8: Drawing 7 – method to deflect unpolluted runoff away from dirty area	20
Appendix 9: Drawing 8 – Cross section of V-drain.....	21
Appendix 10: Illustration of installing effective silt fence	21
Appendix 11: Photo record of free-draining measures implemented at the Dwars River	22
Appendix 12– General Site Daily Checklist – Dealing with Water	24

Scope

This Management Plan deals with requirements for dealing with storm water & erosion including the collection, treatment and discharge of water within and from the Works arising from all natural and artificial sources.

Except otherwise specified in this Management Plan, Soventix and / or its agents, will manage and control water, whether from major water courses (Brak River etc.), local water courses, rainwater, seepage, underground springs or any other source or cause.

Soventix will take all precautions and properly deal with and dispose of all water to ensure that:

- The works are kept sufficiently dry at all times for their proper execution;
- Storm water runoff as a result of rainfall events is controlled effectively at all borrow areas;
- The damage caused from storm water is mitigated; minimal damage is expected due to storm water runoff but will be mitigated via control measures including but not limited to silt fences and rock packing. Minimal damage can be defined as small erosion gullies, silt or debris build-up against the silt fences.
- There is compliance with all relevant legislation.

For this purpose, Soventix will construct sumps, furrows, drains, cofferdams, measuring weirs, settlement ponds, slurry trenches, cut-off trenches and any other Temporary Works as may be necessary.

Soventix will also provide, operate and maintain in sufficient quantity pumping equipment, well points and pipes as may be necessary.

Soventix will continue with these measures for the duration of the Construction & Operations and will at all times be subject to compliance with the Environmental Authorisation (EA) and Environmental Management Programme (EMPr) & its appendices, with regard to their sufficiency.

Soventix will minimize the use of water and will immediately attend to any wastage, in order to rectify the problem and introduce additional measures to prevent its recurrence.

Management and Supervision

As the work progresses the excavation / earthworks teams will deal with water as per this Management Plan; and compliance with the conditions of this Management Plan will be verified and reported on by the ECO & IEA.

Resources, including involvement of Subcontractors

The front manager will be responsible for dealing with water and where possible assisted by the environmental foreman and his team equipped with suitable plant for the task (TLB,

loader, water cart, tipper trucks, grader, and water pumps). No subcontractors are envisaged at this stage.

Technical Execution

4.1 Surface and Trench Excavations

Wherever possible Soventix will protect surface works, general and trench excavations, against the ingress of surface water, ponding of rain water and ground water and will take precautions by means of construction of inter alia earth berms (see *attached Drawing 1*), cut-off drains, channels, sumps and suitably sloping surfaces. Where possible, excavations will be self-draining, to avert the accumulation of water and concurrent destabilisation of excavation embankments (see drawing no 6).

Where excavations are not self-draining, Soventix will construct sumps and install suitable pumps. Diesel powered standby pumps will be readily available in case of breakdowns.

Excavations for pipe drains, culverts, service ducts and similar structures will be adequately protected against possible ingress of water during rainstorms and will be self-draining where possible. Where space allows protection will consist of soil berms strategically positioned to divert surface water away from the excavations. These berms will be positioned so as to divert water away from drains, culverts and similar structures and will decant into a suitable receiving environment.

Find attached drawing no 7 & 8 for a schematic representation of typical storm water management measures to be implemented on site.

4.2 Underground Works (pipe jacking)

Soventix will deal with all water in underground Works whether flowing into the Works from natural water sources (surface and sub-surface) or as a result of construction operations.

Soventix will endeavour to keep construction areas dry for the duration of its activities by means of earth berms, cut-off drains, channels, sumps and suitably sloping surfaces. Where necessary sand bag systems will be used to deflect surface runoff water.

Where water enters the underground works these construction areas will be dewatered by pumping and discharged according to the required water quality parameters.

4.3 Working in Water bodies and Watercourses

Soventix will take all precautions to prevent contaminated water from construction activities (which includes contamination with silt) to enter Water bodies and Watercourses.

Contaminated water from construction areas will be removed via pumping or self-draining and will go through the requisite sedimentation structures and / or geo-fabric silt curtains and released according to the required water quality parameters and / or

ensure all suspended solids are removed, as applicable (see *attached drawing 2*). No work in or near Watercourses will commence without the Engineer's approval and approval of the requisite method statement. When planning to work in or near a Watercourse, Soventix will take into account possible water levels during the period of construction. For that Soventix will check climate data relevant to the area. Monitoring of water quality will be undertaken as per relevant item below.

Prior to commencement of working within flowing water Soventix will ensure that downstream sedimentation is controlled by installing and maintaining (maximum of 25m downstream) geo-fabric sedimentation weirs. The design of these weirs will be rock packed gabions covered lightly with the mentioned geo-textile. The running water will filter through this textile thus retaining any arrant particles of sediment. Where the water flow may be so much that these measures cannot be maintained, Soventix will propose other measures to protect the environment for the Engineer's approval.

Soventix will plan the Works such that construction within flowing water is minimized; the only work that will take place in flowing water will be the creation of coffer dams, or installation of diversion structures. Prior to excavations commencing all diversions will be in place, water diverted away from or piped across the working area and temporary infrastructure suitably protected against erosion and flooding.

No construction equipment, including vehicles are allowed to cross a Watercourse or Water body or operate from within the Watercourse channel, unless it is essential to the execution of the Works and after approval from the Engineer. The Engineer may detail crossings to be constructed by Soventix, to mitigate damage to Watercourses, which will be removed upon completion of the Works.

A detailed method statement of all river crossings will be designed and implemented on site.

Where practical (depending on scale), temporary diversions will be lined with 250µm plastic or geo-textile fabric to control the erosive effects of the flow and prevent the migration of fines into the Watercourse. The full cross-section of the temporary diversion will be lined, and the plastic / geo-textile strips shall extend for a minimum of 2 m beyond the lip of the excavation and will be embedded into the upper lip of embankment and anchored using sandbags. Adjacent plastic / geo-textile strips shall be overlapped with the upstream section overlaying the downstream section (see attached drawing 4).

During the execution of the Works, Soventix will take appropriate measures to prevent pollution and contamination of the riverine environment e.g. including ensuring that construction equipment is well maintained and not leaking oils or fuel, placing of drip trays under pumps, installation of oil absorbent booms across the Watercourse (where necessary), re-fuelling and servicing equipment outside of the Watercourse area, provision of the requisite hydrocarbon spill kits, provision of litter bins, regular monitoring etc.

All construction roads in or adjacent to the riparian zone will be aligned and managed so as to minimize disturbance of the riparian zone and in-stream habitats.

Where earthworks are being undertaken in close proximity to any Watercourse or water body, slopes will be stabilized using one or a combination of sandbags, rock-packing and geo-textile to prevent sediment from entering the water.

The mitigation methods used will be audited during construction, and monitored for a period thereafter, until full rehabilitation is assured and stability demonstrated.

Appropriate rehabilitation and re-vegetation measures for riverbanks will be implemented timeously, in accordance with the Rehabilitation Management Plan and EMPr. In this regard, the banks will be appropriately and incrementally stabilised as soon as construction allows.

For natural Watercourses, the original geometry, topography and morphology in both cross-sectional and longitudinal profile should be reinstated to match the conditions that prevailed prior to construction, both upstream and downstream of river crossings.

In the event that an excavation with a pipe is filled with water (either through a major storm event or construction taking place in a wet area) the pipe shall be kept from floating by ensuring the end caps are perforated enabling the water to flood the pipe and create an equilibrium. Once the excavation has been pumped of water it will be the contractor's responsibility to clean and quality test the pipe before commissioning.

Minor Watercourse Crossings (dongas)

These crossings may need to be protected by gabions and / or reno-mattresses if erosion is present, especially if dispersive soils are present.

Fill materials for gabion baskets and reno-mattresses will be obtained from a source approved by the Engineer and will not be sourced from within any Watercourse.

Groundwater

Soventix will deal with all water flowing into the Works from natural water sources. Soventix will keep construction areas dry for the duration of the activities. In this regard, appropriate provisions like sumps, drains etc., will be provided to collect groundwater. Water discharged from these sumps and drains in the Works will be treated to comply with the requirements of the relevant regulations covered by the National Water Act, before being discharged into natural Watercourses.

4.4 Management of Water

Pumping

Pumps and / or generators will be placed over a drip tray in order to contain fuel spills and leaks. Soventix will take all reasonable precautions to prevent spillage during the refueling and maintenance of these pumps. Soventix will ensure that none of the water pumped during dewatering activities, is released into the environment without passing through the requisite sediment and oil traps to the Engineer's approval.

Management of Polluted Runoff

Runoff from concrete mixing & works areas shall be strictly controlled, and contaminated water shall be collected, stored and either treated or disposed of off-site, at a location approved by the Engineer. The approval of the Engineer shall be required prior to the release of treated runoff from batching areas into any Watercourse or Waterbody.

All spillage of oil on concrete surfaces and floors shall be controlled by the use of an approved absorbent material and spill kit. Used absorbent shall be disposed of appropriately.

Water that has been contaminated only with suspended solids, like soils and silt from disturbed construction areas may be only released into Watercourses or Water bodies after all suspended solids have been removed from such water by settling out these solids in sedimentation ponds (*see attached drawing 2*). The release of settled water back into the environment will be subject to the Engineer's approval. Such settled water may be used for dust suppression on haul roads.

Soventix will notify the Engineer, immediately, of any pollution incident on Site. Then a verbal report will be followed up by a written report, which will be provided within 24 hours of the incident.

Quality of Water Discharged from the Works

Natural storm water run-off not contaminated by construction activities and clean water can be discharged directly to natural Watercourses and Water bodies. This discharge will be managed in such a way as to not increase the velocity of water. Water velocity deforming features shall be constructed in areas deemed fit and should be in the form of packed rocks (Rip rap), silt fences and retention ponds. Discharge of clean water must not result in increased turbidity or suspended solid levels. These measures will be achieved by minimizing contact of discharge water with in situ soil. The location of these velocity deforming features will be visually assessed by the SEO, and monitored by the ECO.

All wastewater discharged from the Works will comply with requirements, before it is discarded into any natural Watercourses, Water body or land.

Sedimentation Ponds (*see attached drawing 2*).

Soventix will construct, operate and maintain for the duration of the project, sedimentation ponds with sufficient capacity for their purpose. Temporary sedimentation ponds are likely to be used along the Works in dewatering applications.

The contractor shall submit Method Statements and obtain Engineer's approved for all proposals in connection with sedimentation ponds prior to the construction of such ponds. The Method Statement shall specify detail on the size, location, layout and operation of the sedimentation pond / s as well as stipulating the manner and location of disposal of the accumulated silt.

Sedimentation ponds will be watertight, using a liner approved by the Engineer. Sedimentation ponds will be sub-divided to enable alternative sections to be cleaned while other sections are in operation. Temporary settlement ponds may be a combination of sections of excavated trench and silt traps above.

All clean groundwater and storm water will be prevented from flowing into sedimentation ponds, and will be diverted around the ponds to ensure that accumulated sludge is not washed into natural Watercourses and water bodies by storm water.

Sedimentation ponds must be located above the floodplain and outside of the riparian vegetation zones of Watercourses and Waterbodies.

Water Abstraction

Where authorization has been granted to abstract water from a Watercourse or Water body (in terms of the applicable legislation), Soventix will abstract this water either from a naturally occurring scour hole or from a temporary sump, as directed by the Engineer.

During water abstraction Soventix will ensure the following:

1. A vehicle abstracting water does not enter, cross nor operate from within the Watercourse. No damage occurs to the Watercourse bed or banks and that the abstraction of water does not entail stream diversion activities. The pipes used for this abstraction will be procured with the intent of being long enough to be used outside the riparian zone or 1:50m year flood line. This pipe may in some areas be 50m long. The front manager's responsibilities will be to ensure that all machines and equipment stay out of these areas and will be inducted as such. Soventix equipment, such as pumps, generators and associated equipment will be appropriately bunded and located above the 1:50 year flood level.
2. Measures to limit pollution or sedimentation of the downstream Watercourse will be implemented e.g. construction equipment is well maintained, use of drip trays, provision of bins, monitoring of personnel and activities.

Water Quantity

Water required for construction purposes and abstracted from Watercourses and Water bodies, must be metered and recorded on a daily basis and reported to the

Engineer each week in writing. Only water out of approved abstraction points will be used for water.

Water Quality Monitoring

Soventix will be responsible for monitoring, testing, record keeping and compliance with water quality requirements as follows:

Point Source Monitoring

All effluent emanating from settlement ponds, sewage treatment works, batching plants, washing areas and any other areas of effluent and water discharge, constructed for the purposes of this Contract, will be sampled and tested for the variables indicated in *the relevant regulation* and / or General Authorisation under the National Water Act, at point of source.

Sampling and testing shall occur weekly for settlement ponds and dewatering of excavations and for storage sites and refueling sites.

Monitoring points for effluents will be determined in agreement with the Engineer when the locations of specific areas and treatment works have been established in terms of the relevant method statements.

Monitoring of point source effluent disposal into a natural Watercourse or water body will take place where the final effluent discharges into the natural watercourse or water body.

Diffuse Source Monitoring

Diffuse source monitoring will be undertaken whenever there is a disturbance to any watercourse or water body caused by construction within or adjacent to the said watercourse or water body.

Sampling and monitoring will take place 50 m upstream and 50 m downstream of the area where disturbance to the Water course or water body has occurred.

Sampling will comprise of a composite water sample collected from 4 points equidistant across the Water course or water body at each location.

Samples will be tested using hand held equipment, and based on a comparison of the monitoring criteria (General Authorisation limits), the quality of the water in the Watercourse or water body downstream of the activities in the watercourse or water body may not be worse by no more than 10% when compared to the quality of the water upstream of the activities.

Sampling and testing for diffuse sources will occur daily for the duration of any such activity.

More detailed testing may be required by the Engineer to establish the source of any contamination and take measures of suitable preventative and remedial measures.

Sampling Techniques

Soventix will ensure that persons taking samples are correctly trained and standard sampling techniques are followed;

As a minimum, the water quality monitoring program will involve;

- Collection of water samples for chemical and biological analysis;
- Taking in-situ measurements of dissolved oxygen, temperature, pH and electrical conductivity;
- Visual observations;
- Recording;
- Reporting of the status quo and any deviations from expected or allowed conditions;

Samples requiring laboratory analysis are to be labeled and stored in a cool box cooled by ice packs until they are transferred to a refrigerator or directly to the laboratory;

The period of sample storage shall not exceed 24 hours;

Labeling will include the date and number of the sampling station and the name of the person taking the samples;

In-situ measurements of dissolved oxygen, temperature, electrical conductivity and pH will be carried out with handheld instruments;

Duplicate samples may be required to be taken under the direction of the Engineer and analysed as a quality assurance measure;

Soventix will arrange to take water samples, in the presence of the Engineer, in accordance with the sampling procedures of SANS 241 at each point of testing at the frequency outlined above;

Records and sign-off sheets should be kept;

Soventix will utilize sampling bottles as required by the analysing laboratory;

Samples will be delivered to the laboratory within 24 hours of being taken; and

All analysis will be carried out by a laboratory accredited according to the South African National Accreditation System (SANAS) in terms of SANS 10259.

Monitoring and Sampling Equipment

Soventix will provide all the necessary equipment to carry out water quality monitoring as required.

In this regard Soventix will be responsible for the requisite calibration of all meters and equipment, and keeping of calibration records.

For collecting water samples, the following is required.

- Plastic beaker(s).
- Plastic sampling bottles.
- Labels for sampling bottles to record sampling date, time, location and other appropriate information.
- Plastic crate(s) for the transport of sampling equipment and for carrying equipment to the watercourse or water body monitoring point.
- Preservative (if samples are to be stored for an extended period of time).
- Cool box and ice packs for keeping samples out of the sun and cool.

Sampling by the Engineer

The Engineer will, at his discretion, take samples and test the quality of water. Soventix will make his equipment available for this purpose.

Materials

250µm plastic sheeting, geo-textile, metal or wood poles, sand bags, gabion baskets.

4.5 Occupational Health and Safety

All activities must be undertaken in accordance with the Occupational Health and Safety Act.

4.6 General

Soventix employees and Subcontractors will not be permitted to use any road or track other than the established roads.

Soventix employees and subcontractors may not at any time enter any private properties along the pipeline route without the permission and co-ordination of the Engineer.

Surplus material not required, after approval by the Engineer, shall be removed to designated borrow pits during the progress of the work.

Modifications to this Management Plan may be required from time to time, following approval by the SEO.

1. Appendices

Appendix 1: Drawing 1

Drawing 1

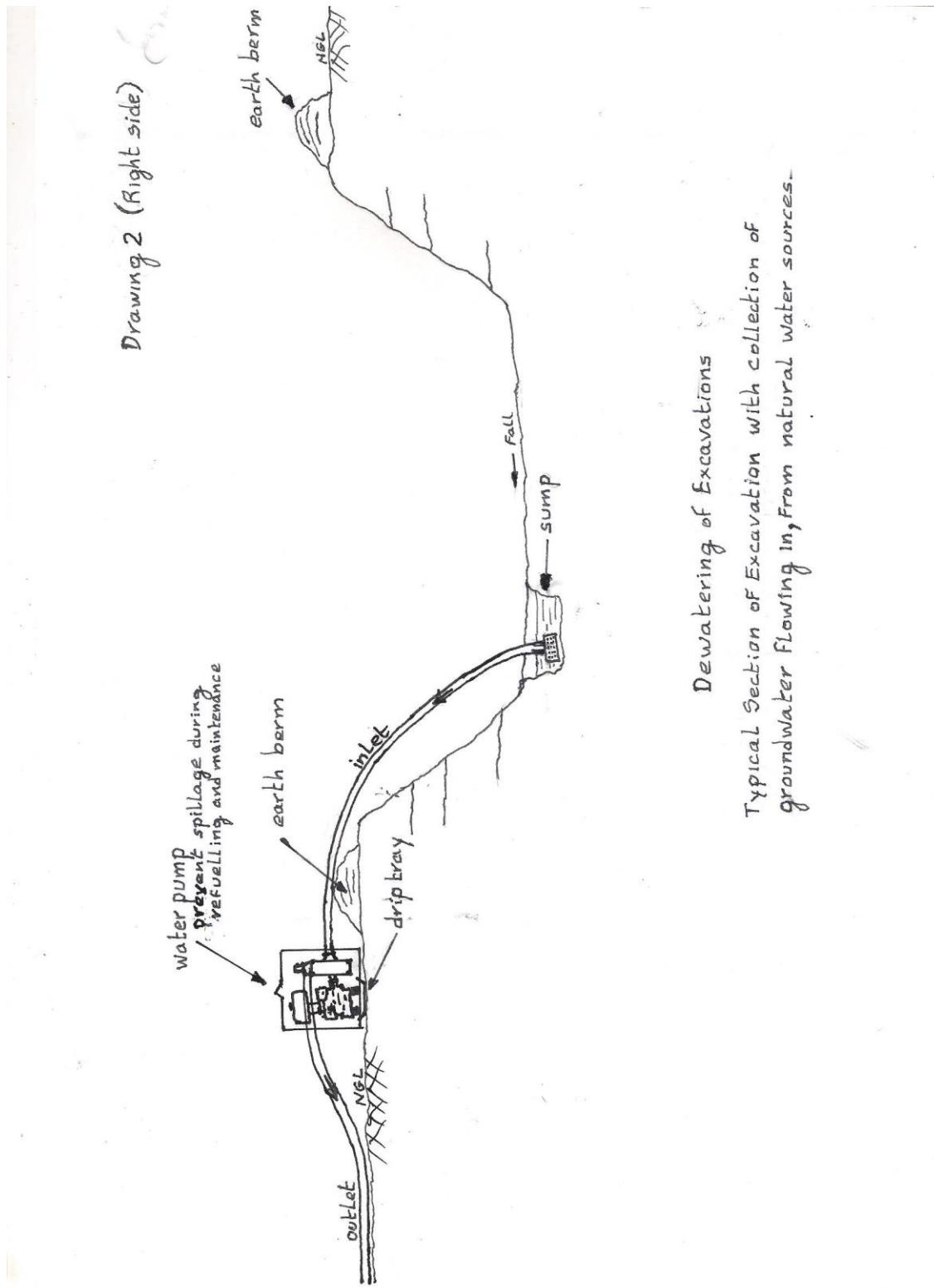
Excavated material leveled off for pipe layer work,
doubles as earth berm against the ingress of
surface water.

Subsoil/Fertile soil stockpiled,
doubles as a earth berm against
ingress of surface water.

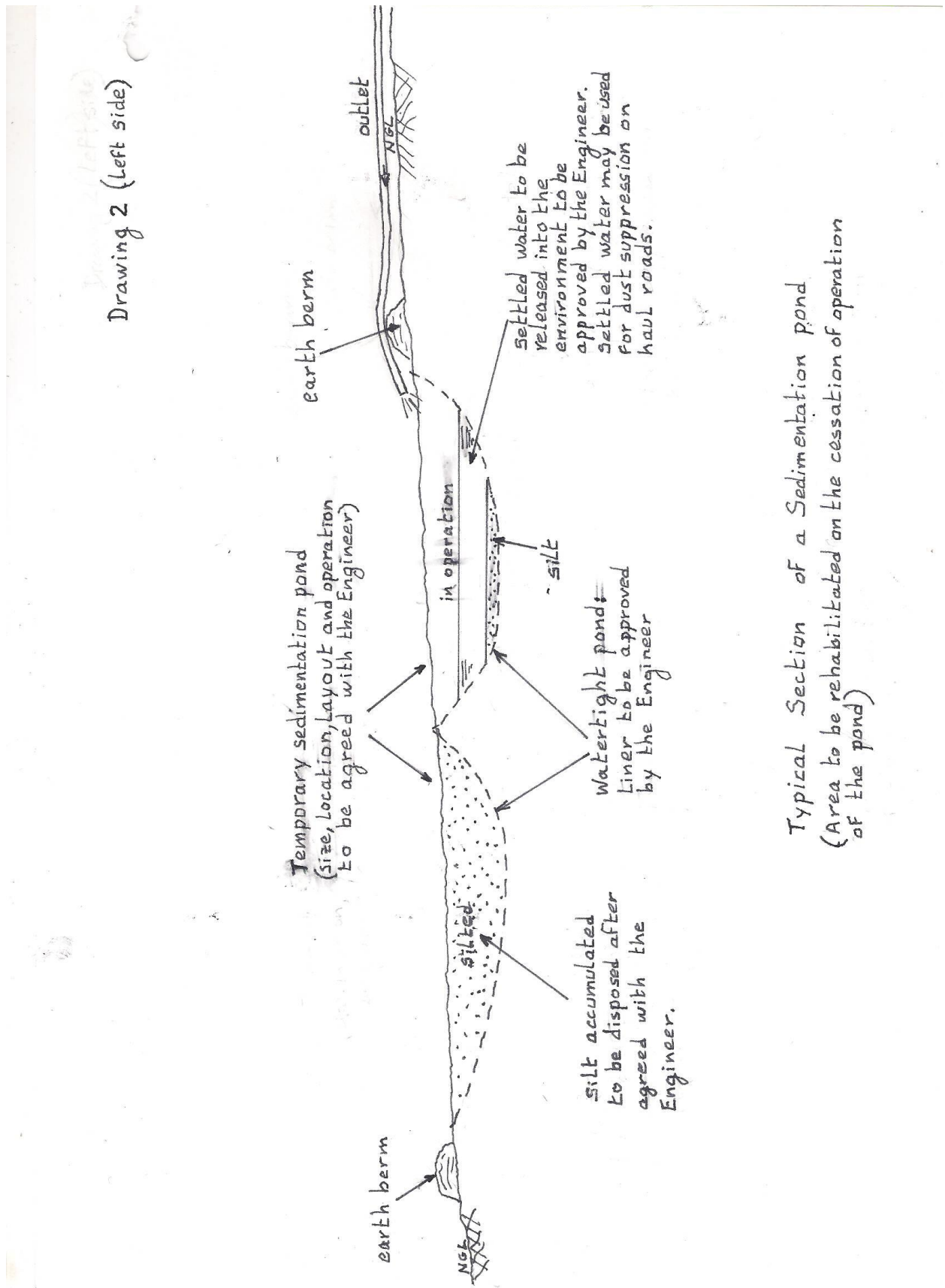


Typical Section through pipe trench excavation.
Protection against ingress of surface water.

Appendix 2: Drawing 2A



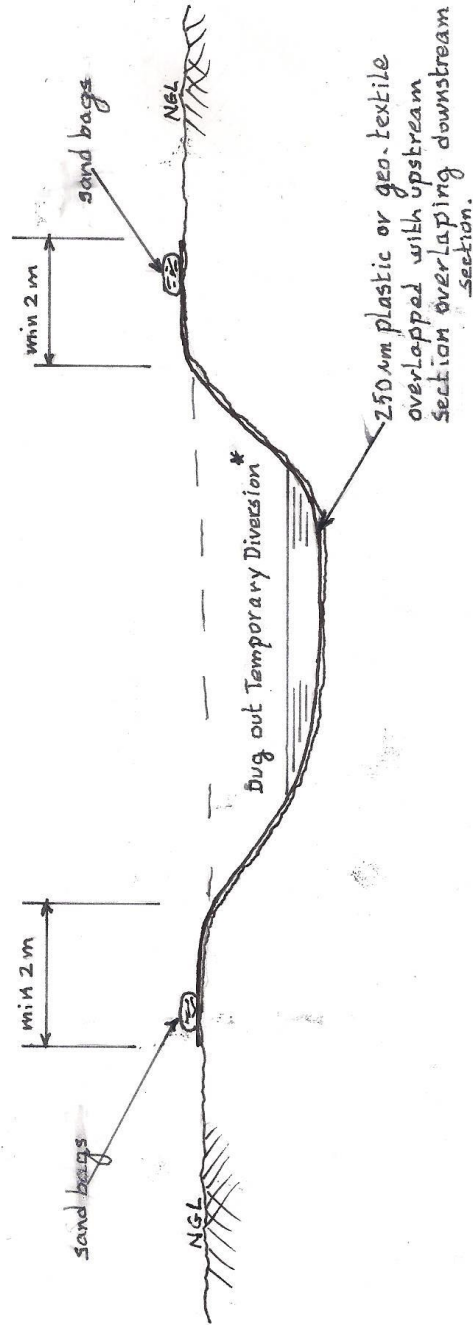
Appendix 3: Drawing 2B



Typical Section of a Sedimentation pond
(Area to be rehabilitated on the cessation of operation of the pond)

Appendix 4: Drawing 4

Drawing 4



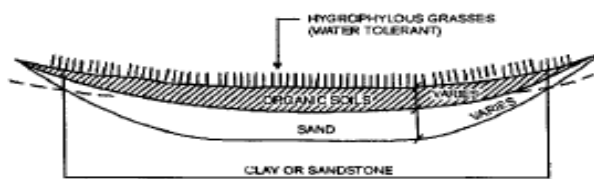
* To be reinstated after cessation of operation

Typical Cross-Section

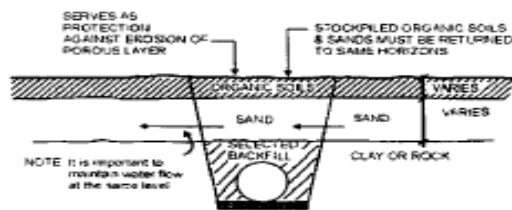
Temporary Diversion

Appendix 5: Drawing 5

Drawing 5

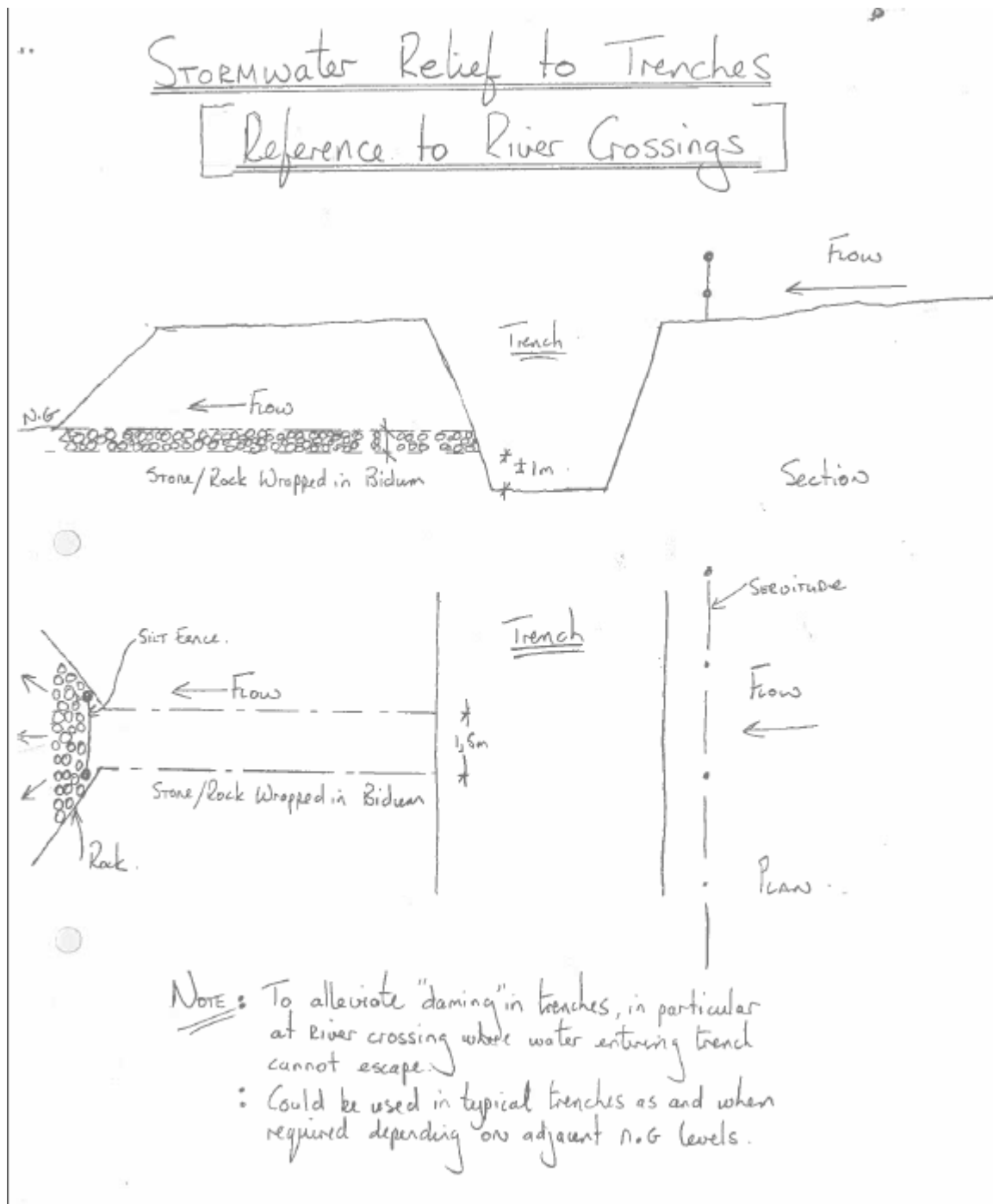


TYPICAL SECTION THROUGH WETLAND

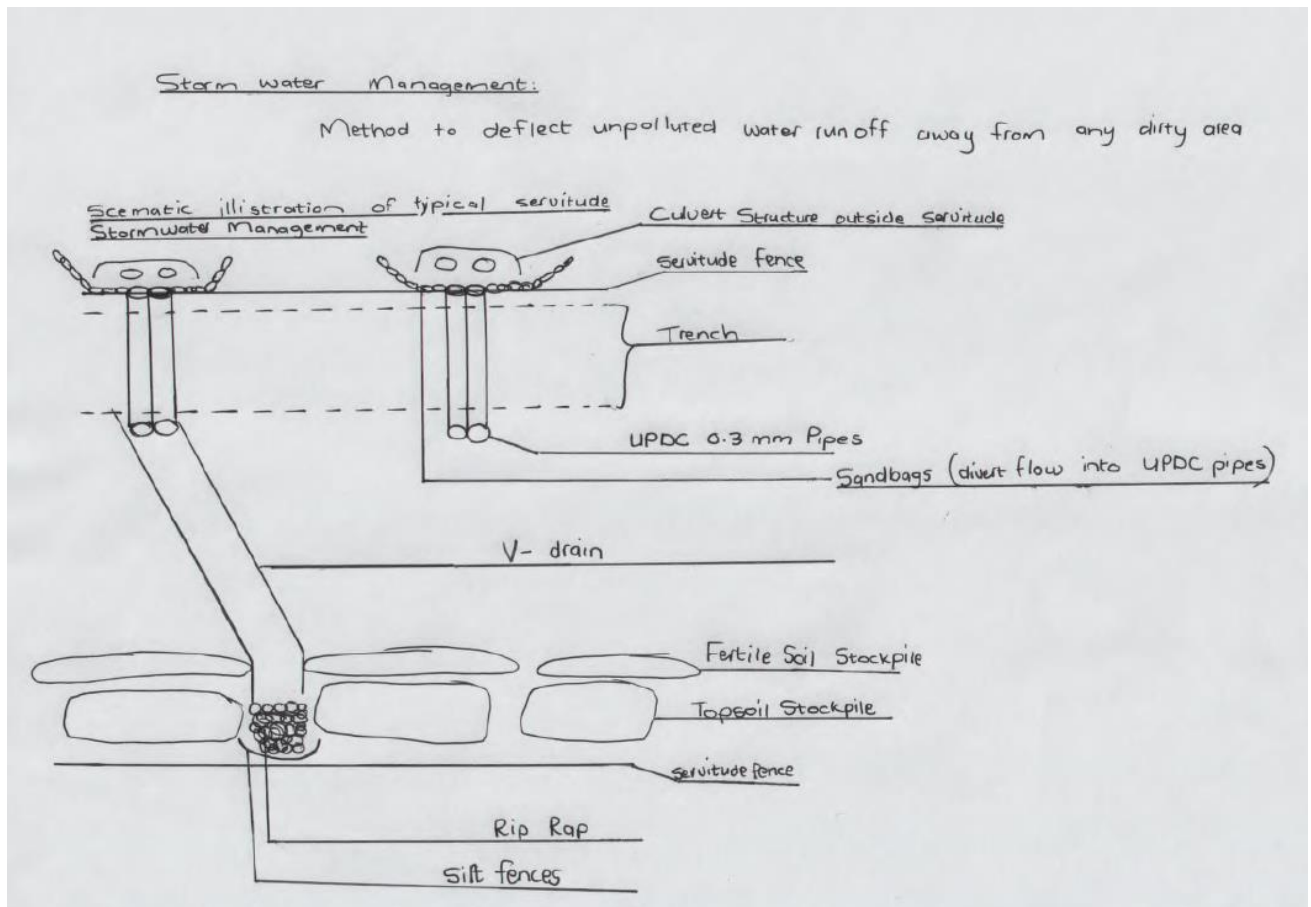


TYPICAL BACKFILL OF PIPE TRENCH THROUGH WETLAND

Appendix 6: Drawing 6

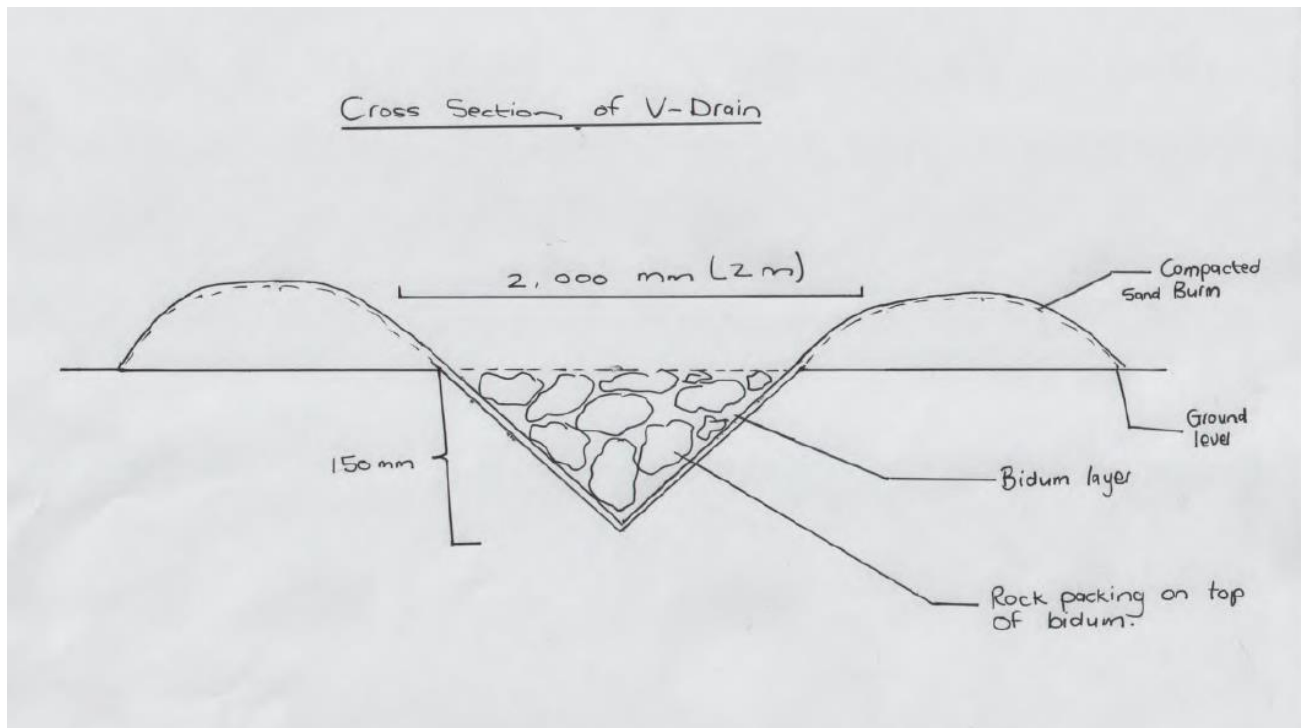


Appendix 7: Drawing 7 - method to deflect unpolluted runoff away from dirty area

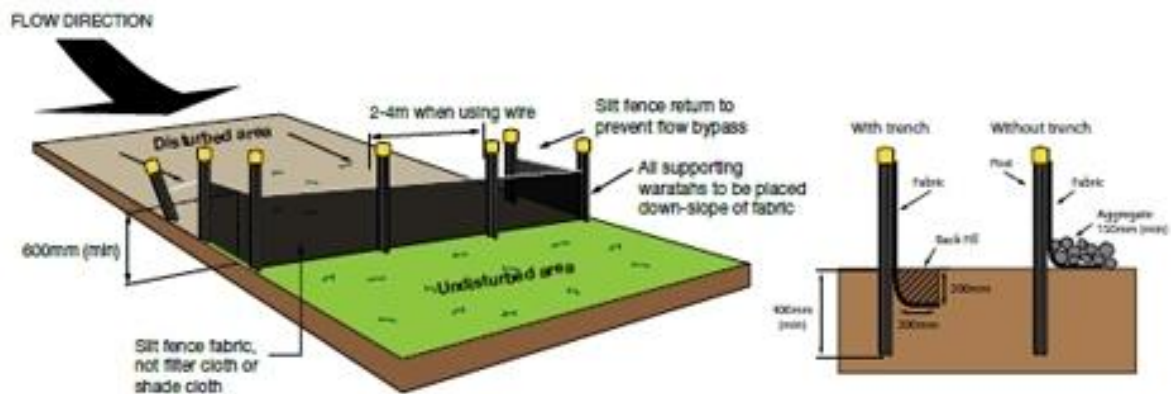


- Note that the above illustration is designed for catchment areas with a flow rate less than $0.3\text{m}^3/\text{s}$ in a 1:5 year flood line (less than $6\text{m}^3/\text{s}$ in the 1:100 year floodline) and assuming the sandbag diversion berms containment volume is at 3m^3 . The flow rate of the two UPVC pipes is calculated at $0.48\text{m}^3/\text{s}$. In areas where a higher flow rate is expected more than two UPVC pipes may be used. Catchment areas exceeding these thresholds will be dealt with accordingly as addendums to the applicable method statements.
- The sandbag diversion berms will be building in such a way to only divert the water from outside the servitude trough the pipes and over the trench into the v-drains to allow the free flow of unpolluted water. The depth and containment volume will vary as site conditions changes. The depth of the sandbag containment should not be less that 400mm.

Appendix 8: Drawing 8 – Cross section of V-drain



Appendix 10: Illustration of installing effective silt fence



Publication Source: <http://phnceto2.com/install-silt-fence/>

Appendix 10: Photo record of free-draining measures implemented at river crossings



Photo 1. Installation of silt fence at discharge point.



Photo 2. Lining of soil stockpiles prior to release of pooled storm water to ensure no loss of stockpile.



Photo 3. Silt fencing filtering sediment-laden water prior to water exiting servitude.

Appendix 12– General Site Daily Checklist – Dealing with Water

The checklist must be completed daily against every condition in the list, and made available for inspection.

Period: Monday _____ to Saturday _____.

Nr.	Condition	Mon	Tue	Wed	Thu	Fri	Sat
1	Are measures in place to reduce ingress of surface water into the trench and pooling of rainwater by means of earth berms, cut-off drains, channels and suitably sloping surfaces?						
2	As far as possible, are excavations self-draining?						
3	Are silt fences installed at all exit & discharge points from the servitude?						
4	Where water crosses the servitude are measures in place to reduce erosion and/or trap sediment within the servitude?						
5	Are underground works being kept dry and dewatered by pumping after testing for compliance with water quality parameters?						
6	Are all pumps positioned on drip trays and located outside the 1:50 floodline?						
7	Where water in the trench does not comply with water quality parameters, is the water being pumped into settlement ponds to achieve the desired parameters before discharge?						
8	Has a Method Statement been submitted and Engineer’s approved been obtained for all sedimentation ponds prior to the construction of such ponds?						
9	Are sedimentation ponds watertight, using a liner approved by the Engineer?						

10	Are sedimentation ponds sub-divided to enable alternative sections to be cleaned while other sections are in operation?						
11	Is the sediment at the bottom of the settlement pond being disposed of at an approved location?						
12	Is water used for dust suppression being recorded and logged daily?						
13	Are measures in place to avoid pollution and contamination of watercourses e.g. ensuring that construction equipment is well maintained and not leaking oils or fuel, placing of drip trays under pumps, installation of oil absorbent booms across the Watercourse (where necessary), re-fuelling and servicing equipment outside of the Watercourse area, provision of the requisite hydrocarbon spill kits, provision of litter bins etc?						
14	Are vehicles used for abstracting water being monitored so that they do not enter, cross nor operate from within the Watercourse and that the abstraction of water does not entail stream diversion activities?						
15	Is construction ensuring that no damage occurs to the Watercourse bed or banks?						
16	Has it been confirmed that no additives whatsoever are included in the water for hydrostatic testing of the pipeline?						
17	Has the quality of water been monitored and sampled, prior to its release into any Watercourse or water body?						
18	Have draining and scour operations been conducted such that water is released in a controlled manner avoiding erosion?						