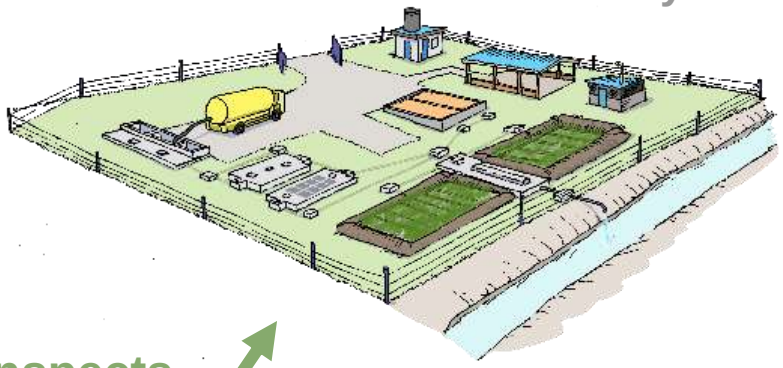
DTF implementation
Roles and responsibilities

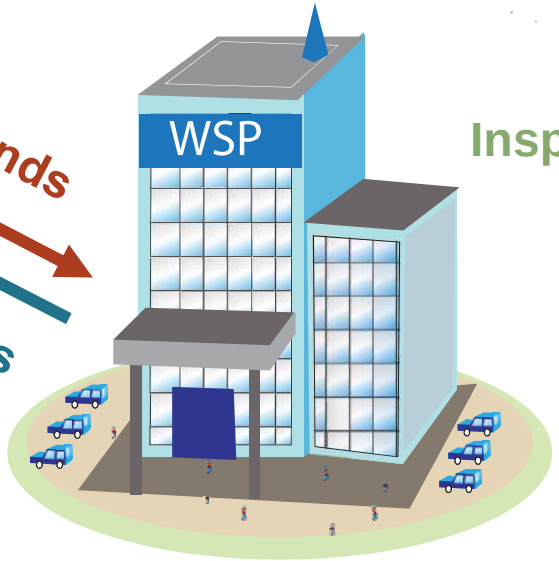
Decentralised Treatment Facility



Water Services Trust Fund

Funds

Reports



Water Services Provider

Inspects

Constructs

Reports

Contracts and supervises

Contractor

WSTF side

Programme Manager and officer	CRM	Technical Advisor
• Is in charge of the overall UBSUP implementation • Approvals and official communication with the WSP	• Is the communication link between the WSP and the WSTF • Continuous consultations with the WSP • Support the WSP in implementing the DTF • Progress report	• Support the WSP technically (on demand) in implementing the DTF • Quality checks

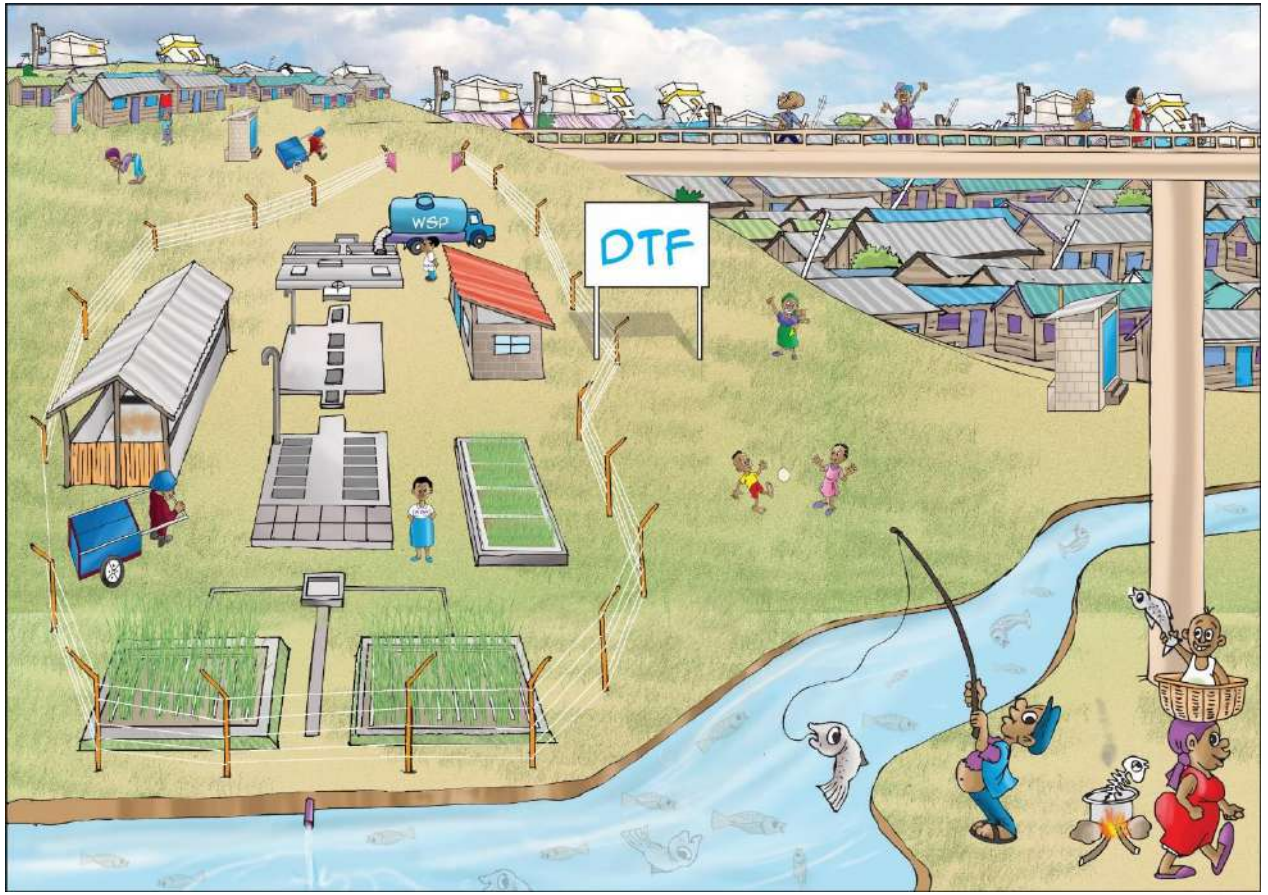
Contractor side

Contractor	Site agent
• Overall responsibility for **planning**, **coordinating** and **supervising** the construction project • Is in charge of preparing a **work schedule**, **procuring material**, and hire **specialised staff** to carry out the project • Must ensure that the project adheres to **local regulation**, including safety and building codes • Is responsible for responding to **emergencies**, **incidental problems** and **delays**	• **Works alongside the contractor** to make sure the project is carried out on schedule • Is responsible for all **on-site activities** • Must regularly **test materials and machinery** to ensure they are working efficiently • Must keep accurate **records of work progress** for daily report to the client (WSP)

WSP side

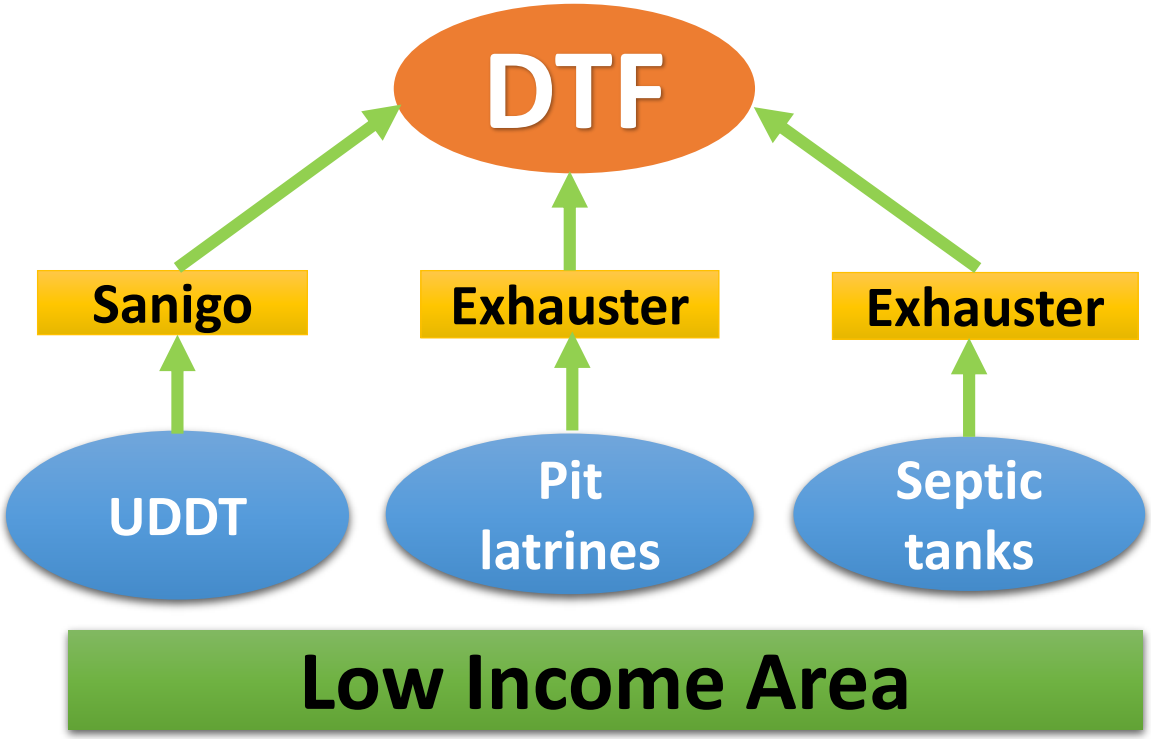
Managing Director	Resident Engineer (Project Manager)	Inspector of Work
• Is responsible of the successful implementation of the DTF	• In charge of the DTF implementation • Supervises the work of the contractor: issue instructions • Communicate any change of scope • Reports to the WSTF	• Inspects the work of the contractor on a daily basis • Plays a key role in quality control • Reports to the Project Manager

THE DTF CONCEPT



What is a DTF?

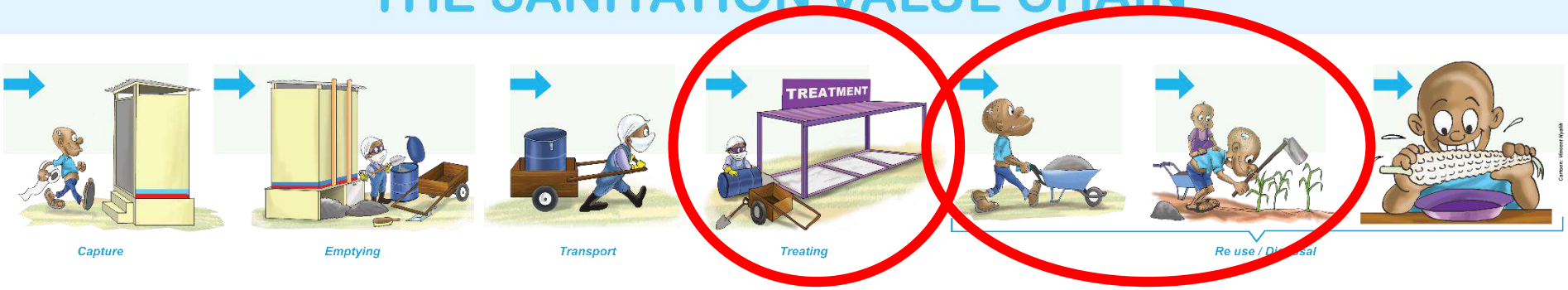
Decentralised Treatment Facility: small scale decentralized plant to treat faecal sludge from dry and wet toilets through mechanical and biological treatment



Objective
Treat faecal sludge for safe release of the effluent into the environment

PURPOSE OF A DTF

THE SANITATION VALUE CHAIN



1 Treatment

Mechanical and biological treatment

2 Safe disposal

Safe release of the treated effluent into the environment (water body). Quality of the effluent compliant with national standards

3 Reuse

Recycling of

- **the dry sludge into fertiliser**
- **The treated effluent as water for irrigation**

WHAT CAN BE TREATED OR NOT?

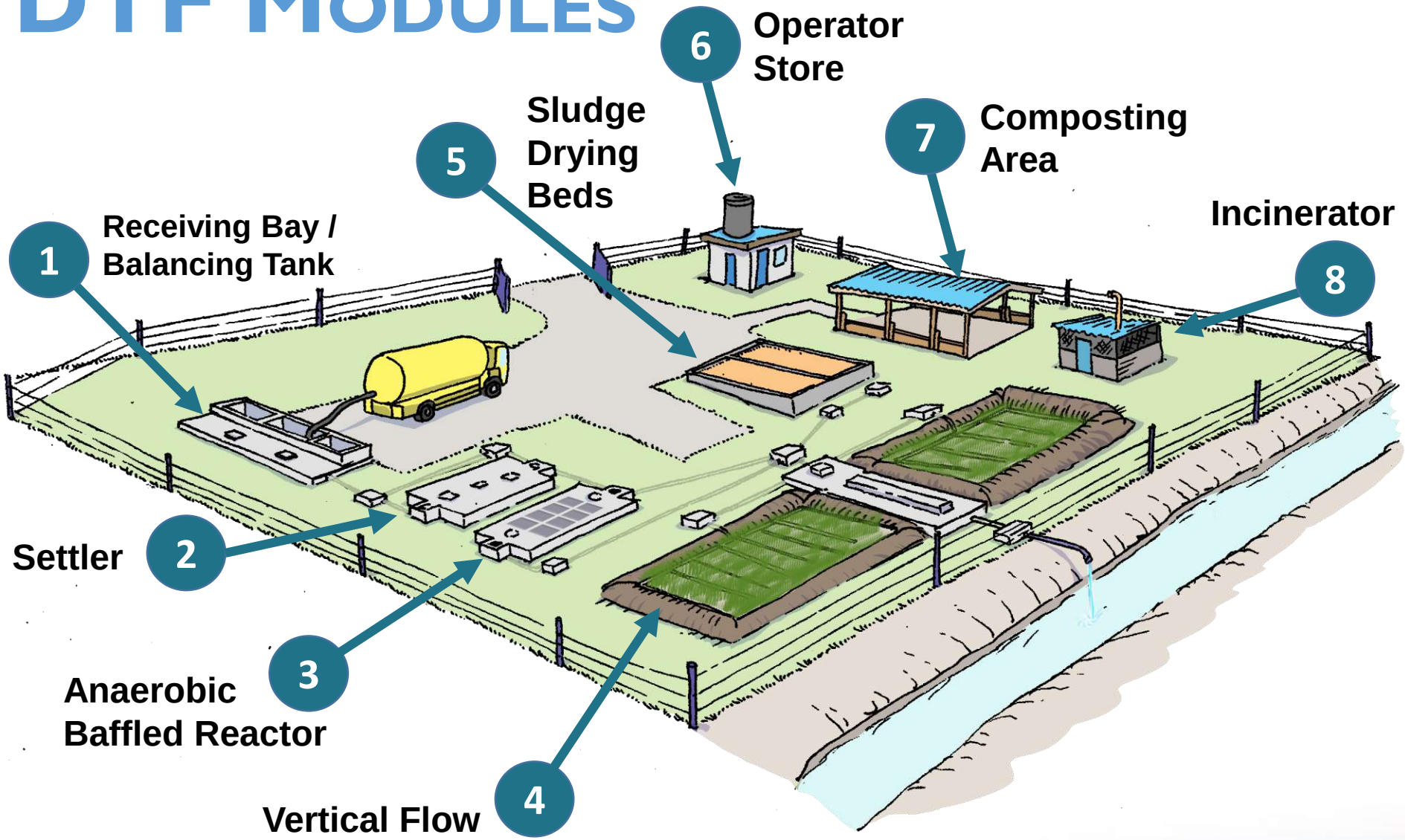
TREATED

- **Faecal sludge (septage)** emptied and transported by exhauster trucks from septic tanks or latrines
- **(partly) dried faecal matter** from UDDTs emptied and transported by Sanigo
- **Waste water** generated in flush toilets and conveyed through a sewer network

NOT TREATED

- **Grey water** (from laundry, shower, kitchen) due to low organic loads that would negatively affect the treatment performance of the DTF and saturate the capacity of the DTF too quickly
- **Storm water** for the same reason as grey water

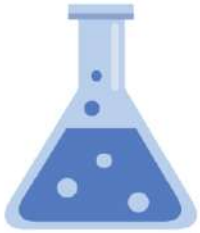
DTF Modules

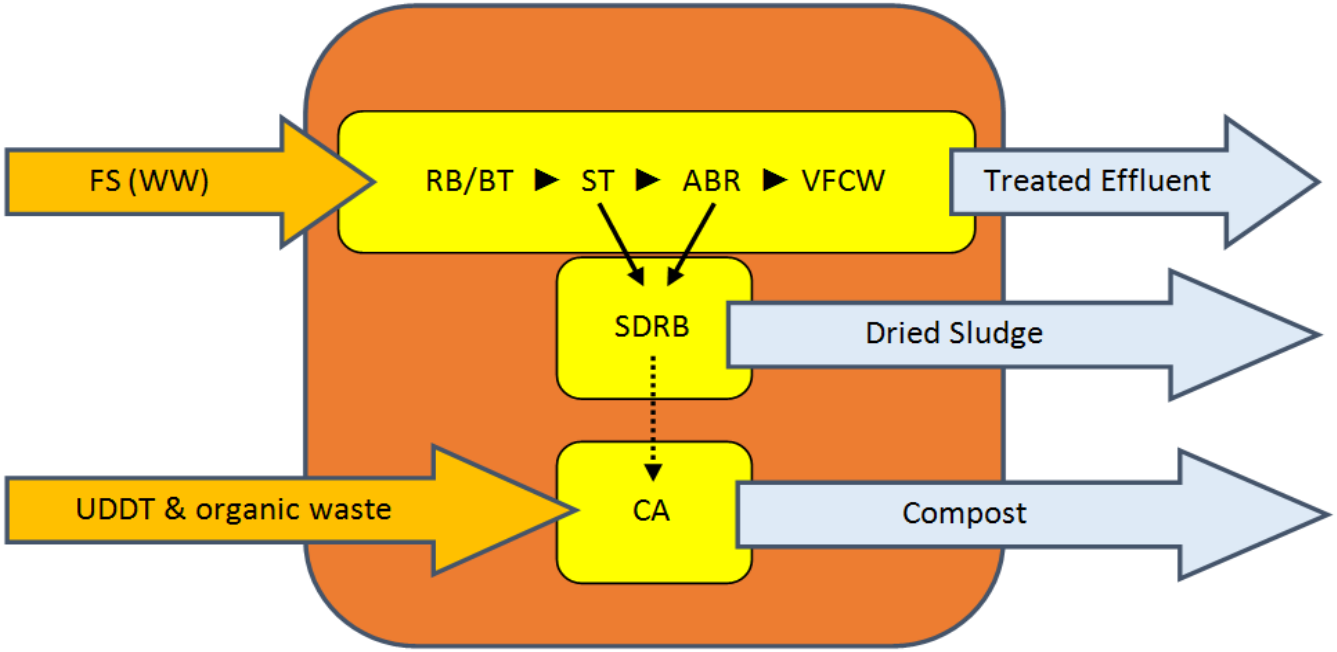

6
Operator Store
5
Sludge Drying Beds
7
Composting Area
Incinerator
1
Receiving Bay / Balancing Tank
8
Settler
2
3
Anaerobic Baffled Reactor
4
Vertical Flow Constructed Wetland

DTF TREATEMENT

NO CHEMICALS !!

→ Mechanical and biological treatment





NO ELECTRICITY !!

→ DTF runs by gravity

In Details

Operator Store

- Operator's office (equipped with toilet, sink and shower)
- Entrance registration desk
- Storage room for equipment

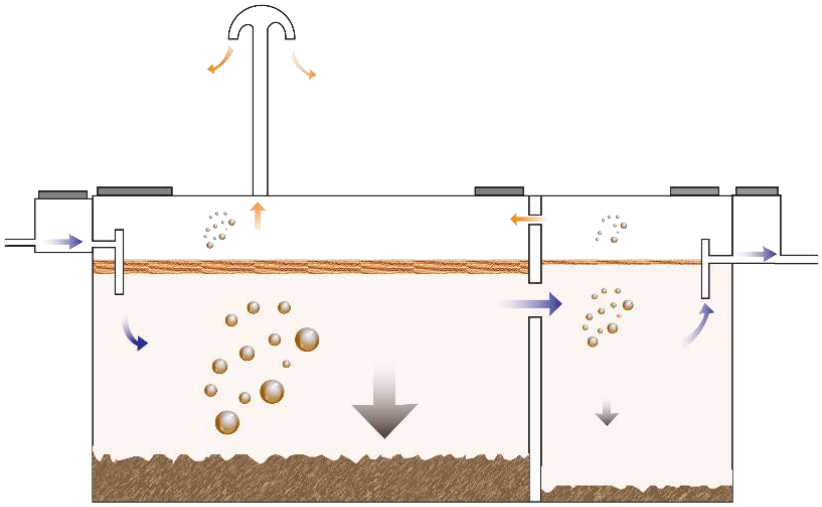
In Details

Receiving Bay / Balancing Tank

- Screening of the coarse material
- Storage of the effluent
- Flow control to provide constant inflow to the DTF

In Details

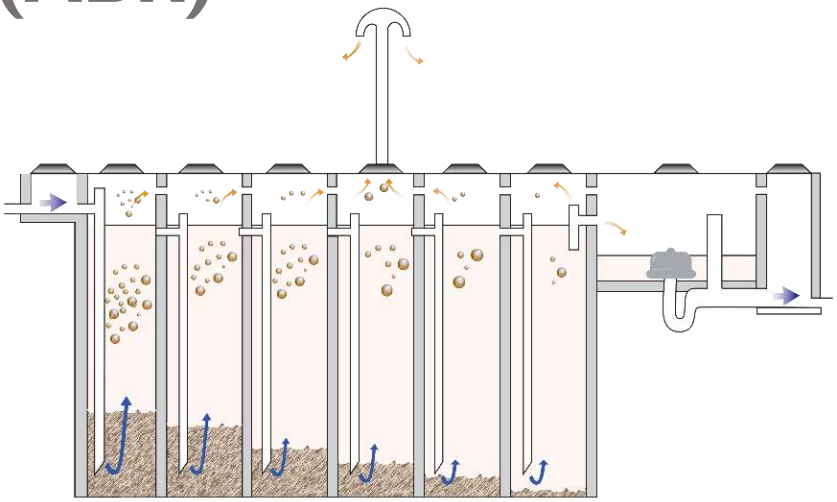
Settler



- 2 consecutive chambers separated with a baffle wall
- Sedimentation of settable solid
- Flotation of fat and oil

In Details

Anaerobic Baffled Reactor (ABR)

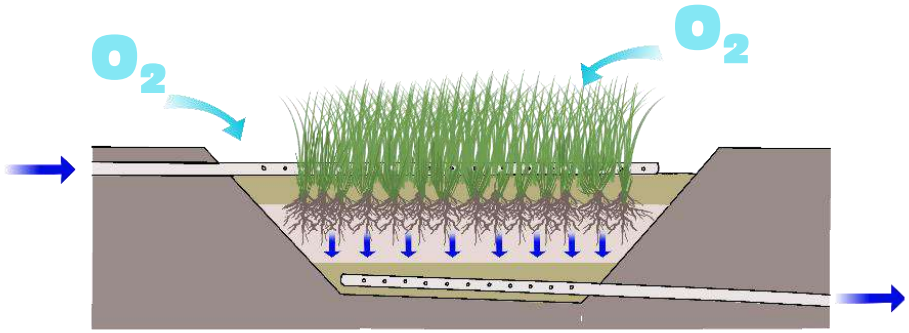


- 2 rows of 6 consecutive chambers with down pipes → anaerobic treatment through the settled sludge
- 1 siphon chamber → to release intermittent flow

In Details

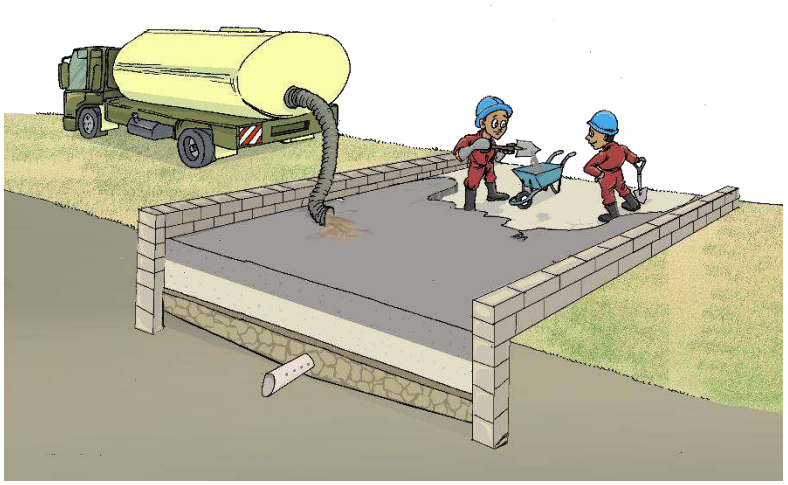
Vertical Flow Constructed Wetland (VFCW)

- 2 basins filled with successive gravel and sand layers planted with aquatic plants
- Perforated pipes on top (to feed) and at the bottom (to receive)
- Intermittent feed to enable intake of oxygen
- Filtration and sedimentation
- Anaerobic and anaerobic treatment



In Details

Sludge Drying Beds (SDB)



- 2 non planted beds filled with successive gravel and sand layers
- 1 underdrain pipe at the bottom draining the leachate to the next treatment module
- Filtration and dehydration (evaporation)

In Details

Composting Area

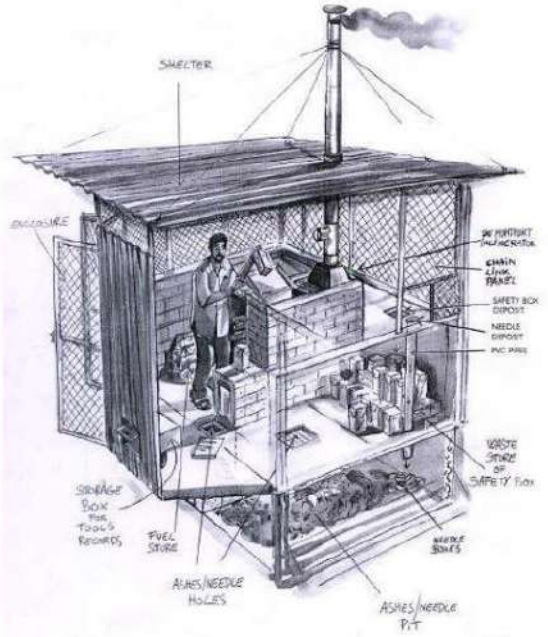
- Composting shed with partly translucent roofing
- Mix dry sludge and organic waste to produce compost
- After 12 weeks of appropriate mixing, turning and watering

→ mature and safe compost

In Details

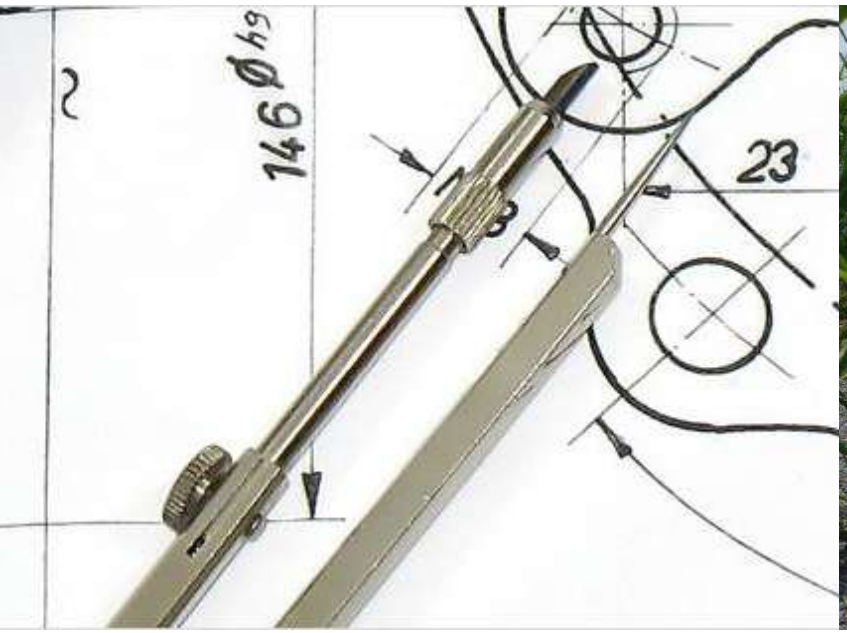
Waste Disposal Unit

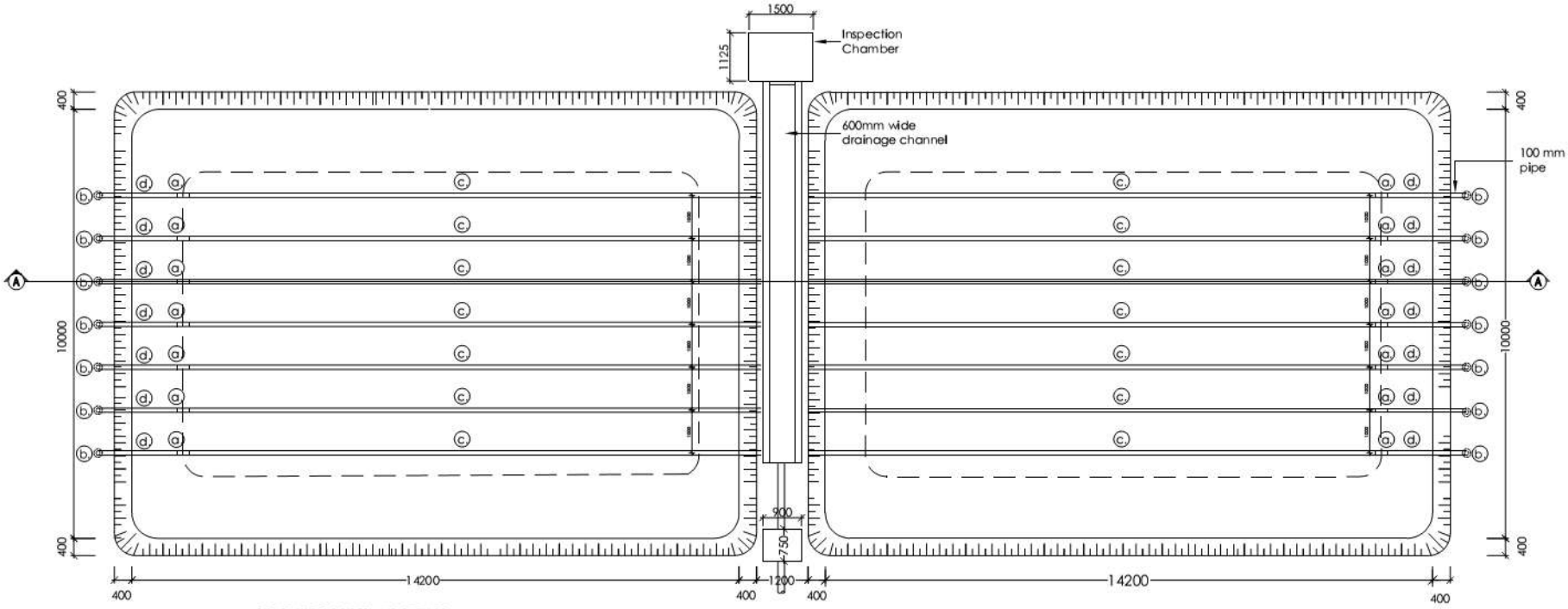
- Comprises of an incinerator, a 4m high chimney, a waste store and a shelter for protection against the rain
- Solid waste screened in the Receiving Bay is incinerated at a temperature of 600°C



VERTICAL FLOW CONSTRUCTED WETLAND

TECHNICAL SPECIFICATION AND REQUIREMENTS





SCHEDULE OF PIPES AND FITTINGS

	Description	Length	Qty
(a)	100mm Dia. uPVC 45° Bends	-	14
(b)	100mm Dia. uPVC Vent Cowls	-	14
(c)	100mm Dia. uPVC Pipe	13.5m	14
(d)	100mm Dia. uPVC Pipe	1.7m	14

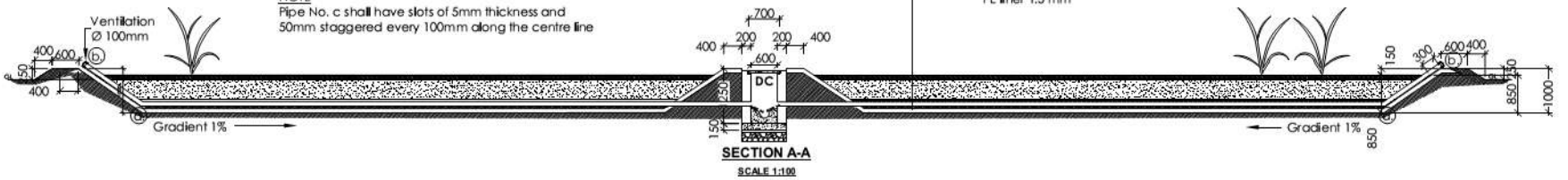
PLAN - UNDERDRAINAGE PIPEWORK

SCALE 1:100

NOTE
Pipe No. c shall have slots of 5mm thickness and 50mm staggered every 100mm along the centre line

KEY

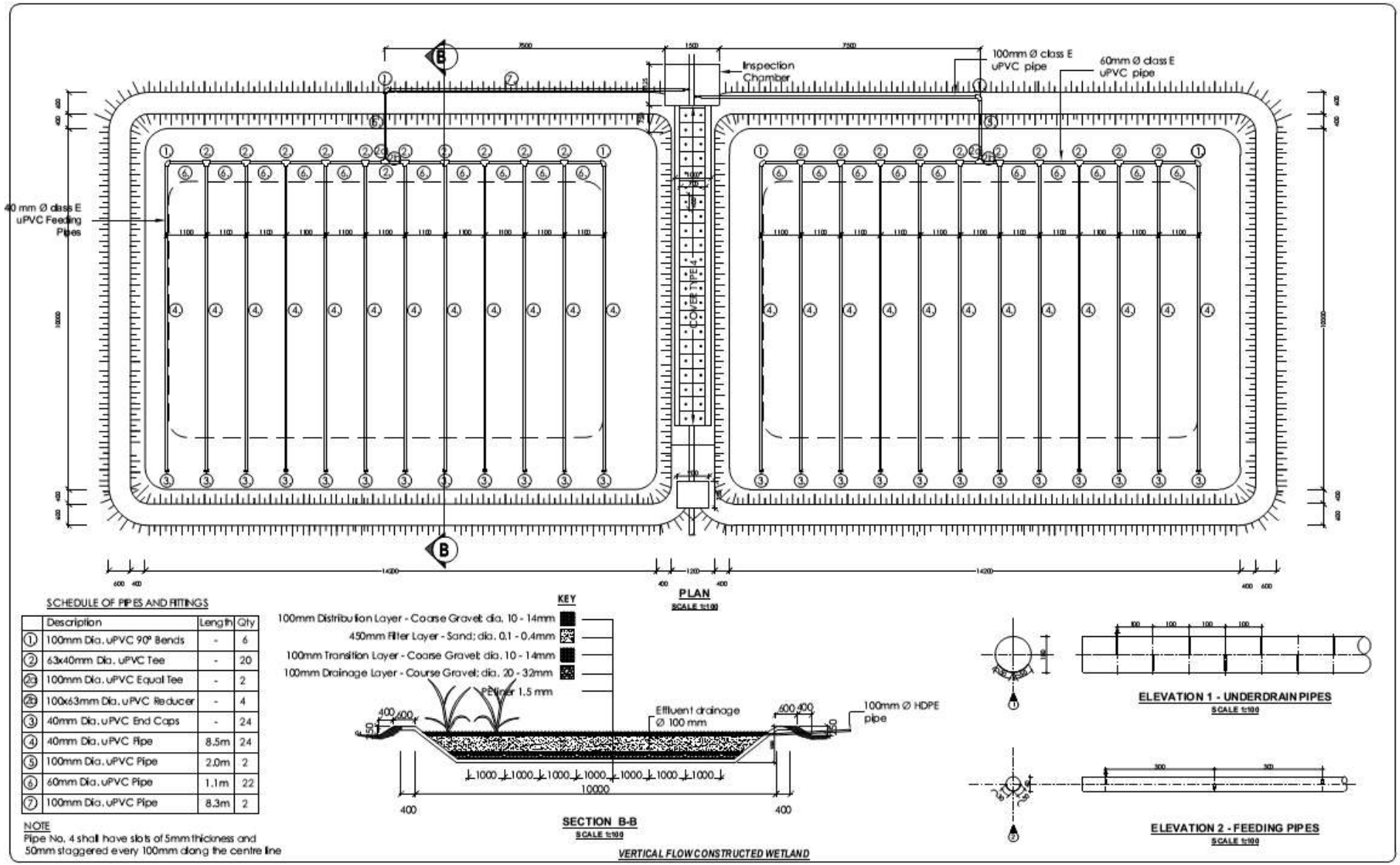
- 100mm Distribution Layer - Coarse Gravel; dia. 10 - 14mm
- 450mm Filter Layer - Sand; dia. 0.1 - 0.4mm
- 100mm Transition Layer - Coarse Gravel; dia. 10 - 14mm
- 100mm Drainage Layer - Course Gravel; dia. 20 - 32mm
- PE liner 1.5 mm



SECTION A-A

SCALE 1:100

VERTICAL FLOW CONSTRUCTED WETLAND



SCHEDULE OF PIPES AND FITTINGS

	Description	Length	Qty
①	100mm Dia. uPVC 90° Bends	-	6
②	63x40mm Dia. uPVC Tee	-	20
②a	100mm Dia. uPVC Equal Tee	-	2
②b	100x63mm Dia. uPVC Reducer	-	4
③	40mm Dia. uPVC End Caps	-	24
④	40mm Dia. uPVC Pipe	8.5m	24
⑤	100mm Dia. uPVC Pipe	2.0m	2
⑥	60mm Dia. uPVC Pipe	1.1m	22
⑦	100mm Dia. uPVC Pipe	8.3m	2

NOTE
Pipe No. 4 shall have slots of 5mm thickness and 50mm staggered every 100mm along the centre line

KEY
100mm Distribution Layer - Coarse Gravel; dia. 10 - 14mm
450mm Filter Layer - Sand; dia. 0.1 - 0.4mm
100mm Transition Layer - Coarse Gravel; dia. 10 - 14mm
100mm Drainage Layer - Course Gravel; dia. 20 - 32mm
Effluent drainage Ø 100 mm
100mm Ø HDPE pipe

SECTION B-B
SCALE 1:100

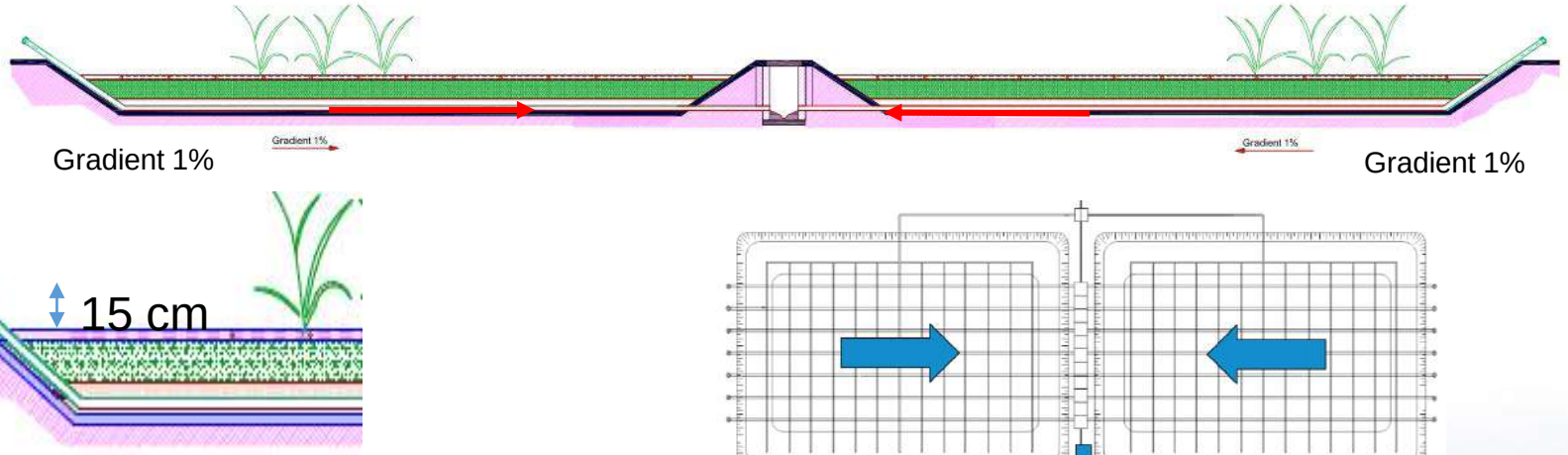
ELEVATION 1 - UNDERDRAIN PIPES
SCALE 1:100

ELEVATION 2 - FEEDING PIPES
SCALE 1:100

VERTICAL FLOW CONSTRUCTED WETLAND

SUBSURFACE

- Compact the subgrade (below the filter media) uniformly
- A slope of 1% toward the drainage channel is recommended for proper drainage
- 15 cm freeboard for water accumulation
- The surface must be flat and horizontal to prevent unequal distribution and surface run-off

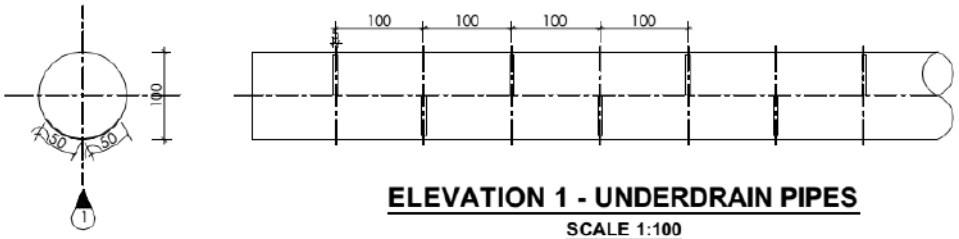


LINING MATERIAL

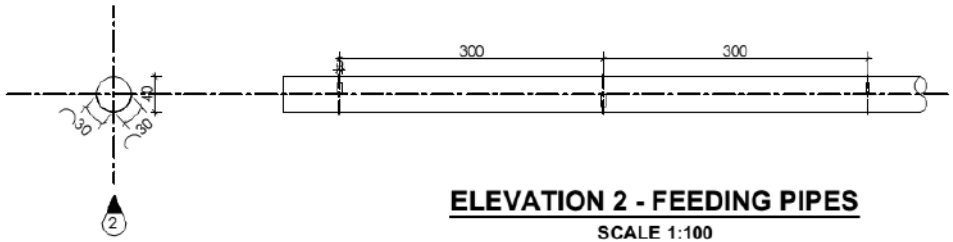
A clay layer + Plastic liner to seal the filter bed at the base

- Clay layer of 100 mm thickness, if no clay available, the soil can be mixed with cement (8kg/m2)
- Preparation of the subgrade is crucial for successful liner installation: well compacted, free from materials that might puncture the liner
- PE liner 1 mm thick
- Overlapping 5 to 10 cm welded with wedge / hot air welding machine
- Before filling with gravel, water tightness test of the filter beds

PERFORATION OF PIPES



ELEVATION 1 - UNDERDRAIN PIPES
SCALE 1:100



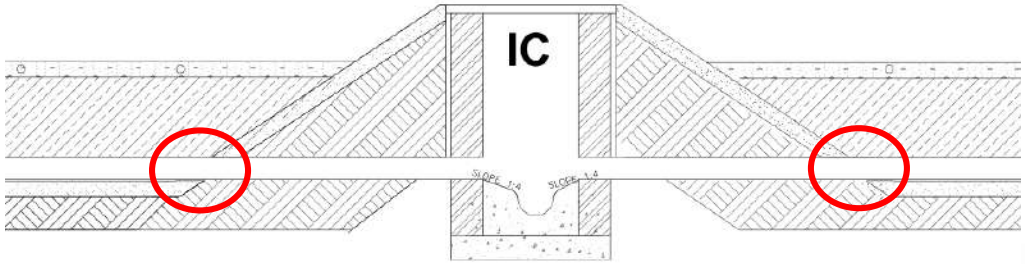
ELEVATION 2 - FEEDING PIPES
SCALE 1:100

- Feeding pipes: uPVC class E (100, 60 and 40 mm dia.)
- Underdrain pipes: uPVC class 41 (100 mm dia)

Watertight Installation of Underdrain Pipes

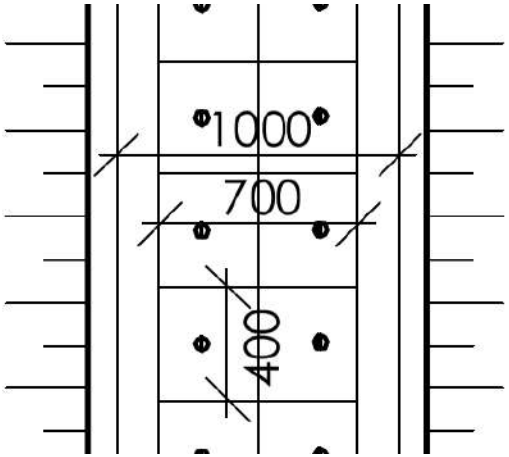
To prevent leakages at the joint between the drainage pipes and the PE liner:

- Welding/glueing and fix with brackets
- Bitumen sealant



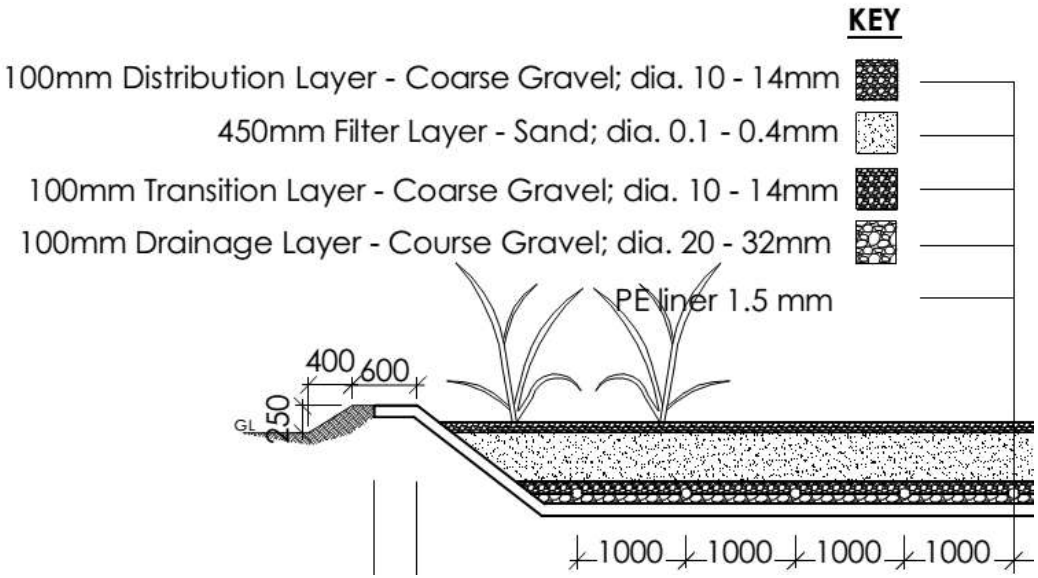
Central Drainage Channel

- PCC (with steel frame) or iron cast cover with two handles per cover. Dimension: 700 x 400mm
- Edge of the channel with recess



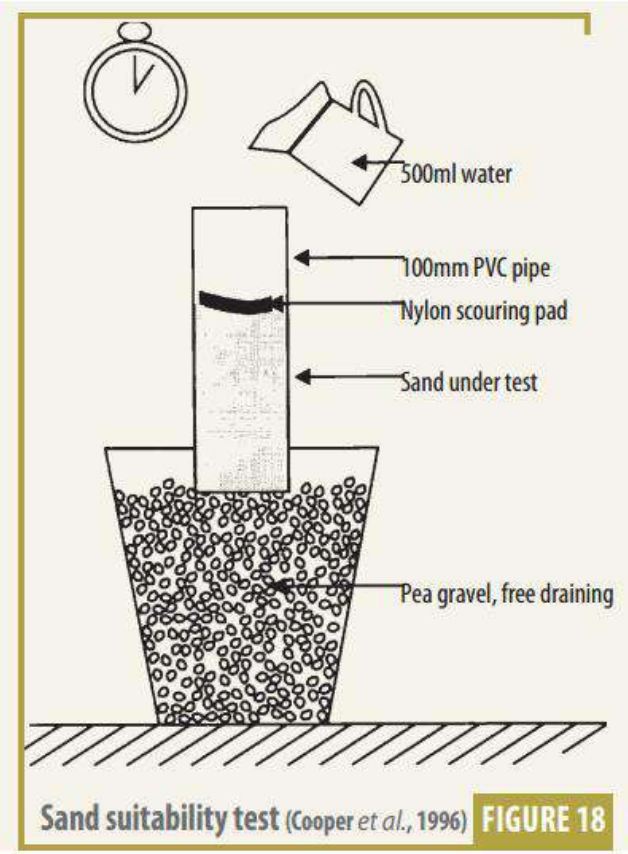
FILTER MEDIA

- The gravel layers do not contribute to filtering process.
- The middle sand layer is the actual filter bed.
- Sand should be of uniform grain size: d10 between 0.1 and 0.4 mm



- The sand filter bed should not contain loam, silt nor other fine material that could block the void
- The gravel at the base should not have sharp edges
- The layers of different size of substrate to be filled should be properly marked inside the basin

SAND SUITABILITY TEST



Sand suitability test (Cooper *et al.*, 1996) FIGURE 18

Place a 300 mm long length of 110 mm dia. PVC pipe on a bed of gravel for free draining

Fill it with 200 mm of the sand to be tested

Place a piece of scouring pad on top to reduce disturbance by the water

Pour 500 ml of water into the tube several time until the sand is completely damp (not saturated). The time for the water to drain from top to bottom should level off.

Sands that drain in 50 – 150 seconds for 500 ml (once saturated) are satisfactory.

PLANTS

- The plant chosen should follow the following criteria:
  - Indigenous (can be found locally)
  - Deep root penetration, strong rhizomes and massive fibrous root
  - Maximum surface area coverage (high biomass and stem density)

- Overview of some possible plants:
  - *Phragmis australis or Phragmites karka* (Common Reed)
  - *Typha latifolia or Typha angustifolia* (Cattail)
  - *Pennisetum purpureum* (Elephant grass)
  - *Cyperus papyrus* (Papyrus sedge)

Common Reed

Cattail

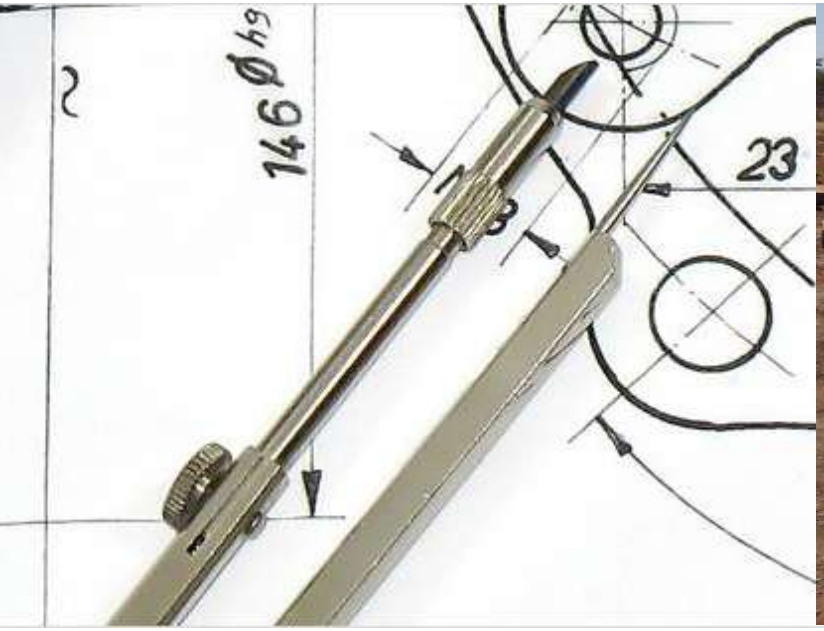
Papyrus sedge

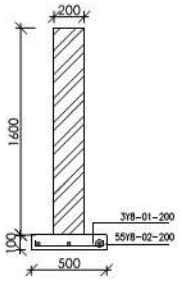
Root and rhizome system of reed

Elephant Grass

SLUDGE DRYING BEDS

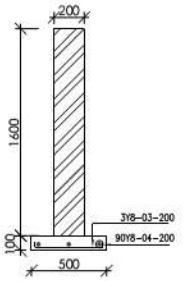
TECHNICAL SPECIFICATION AND REQUIREMENTS





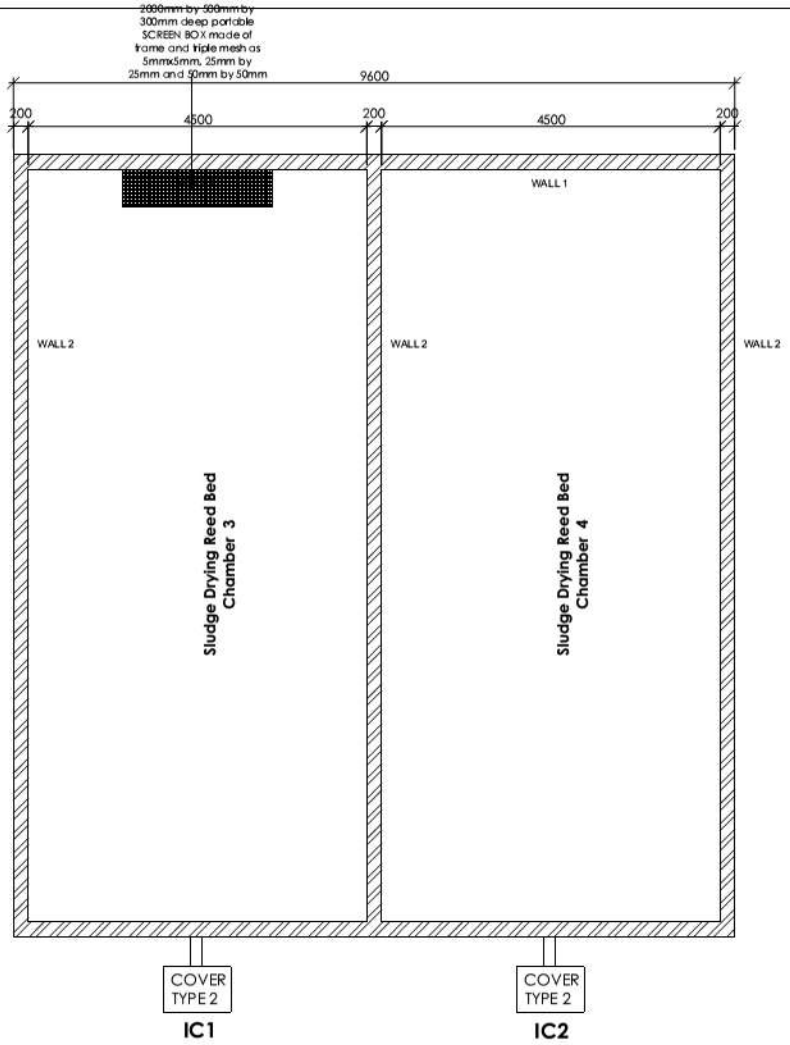
FOUNDATION - WALL 1

SCALE 1:50



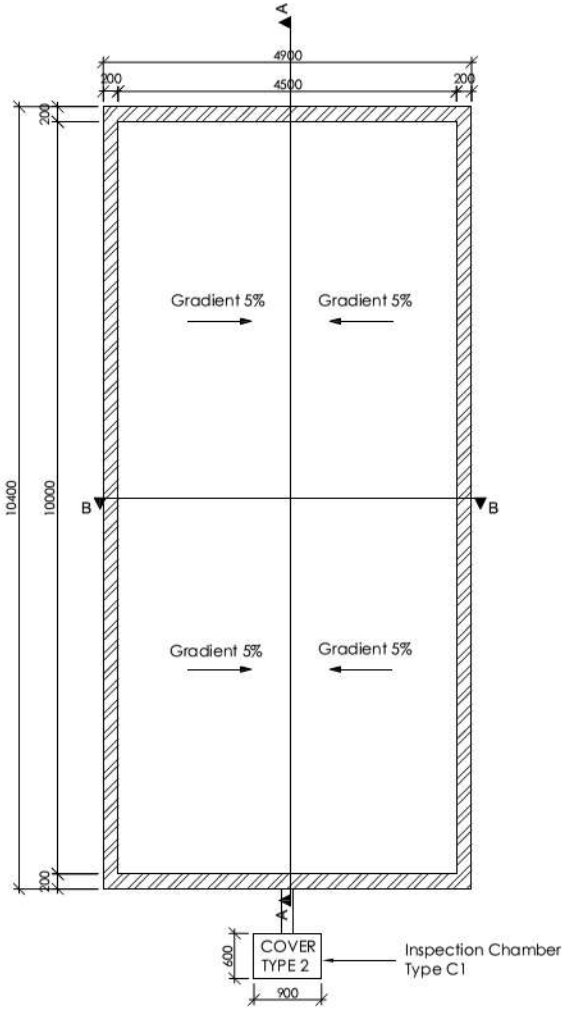
FOUNDATION - WALL 2

SCALE 1:25



SDRB LAYOUT PLAN - 2NR UNITS

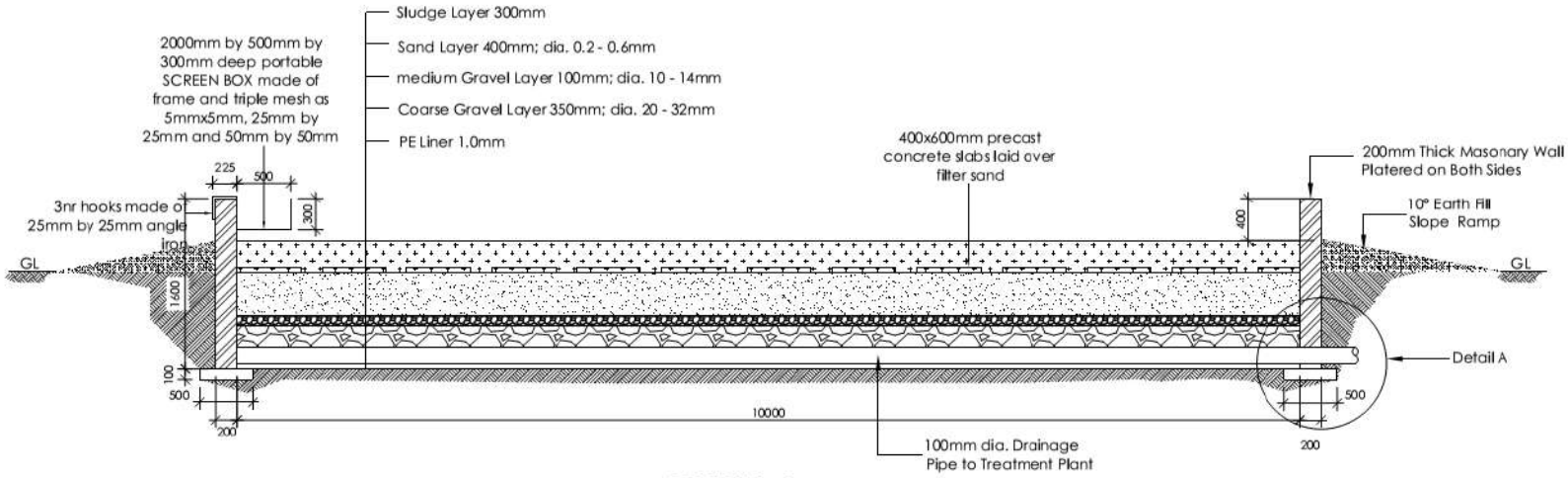
SCALE 1:50



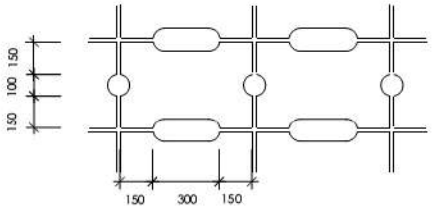
SINGLE UNIT LAYOUT PLAN

SCALE 1:50

SLUDGE DRYING BED



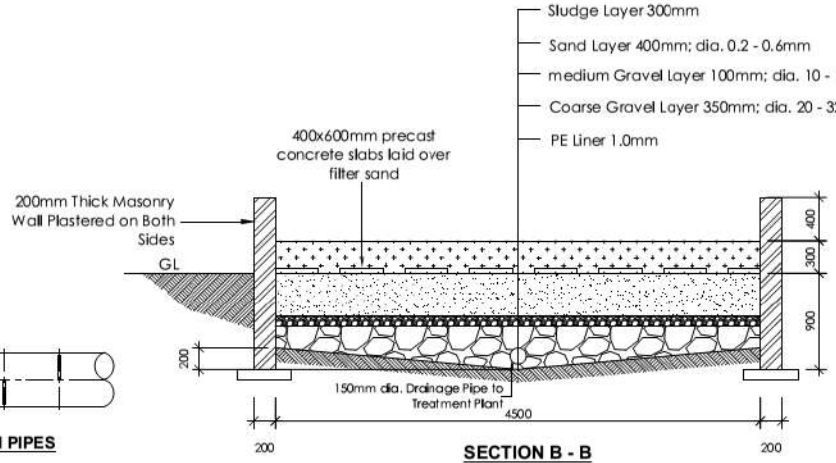
SECTION A - A
SCALE 1:50



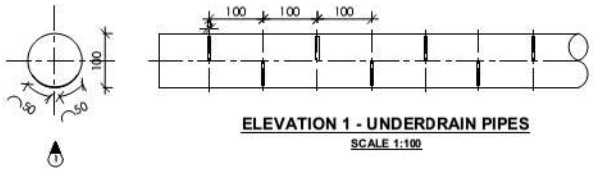
400mm x 600mm x 50mm THICK PRECAST CONCRETE SLABS LAID ON SURFACE OF MEDIA
N.T.S

KEY

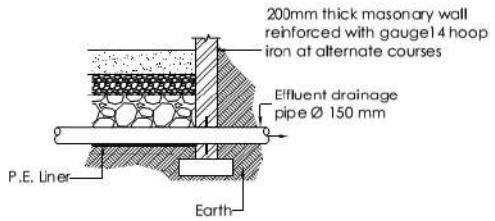
- Fecal Sludge Layer
- Sand Layer; dia. 0.2 - 0.6mm
- Medium Gravel Layer; dia. 10 - 14mm
- Coarse Gravel Layer; dia. 20 - 32mm



SECTION B - B
SCALE 1:50



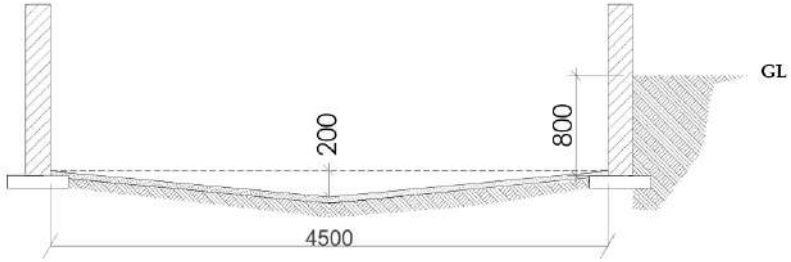
ELEVATION 1 - UNDERDRAIN PIPES
SCALE 1:100



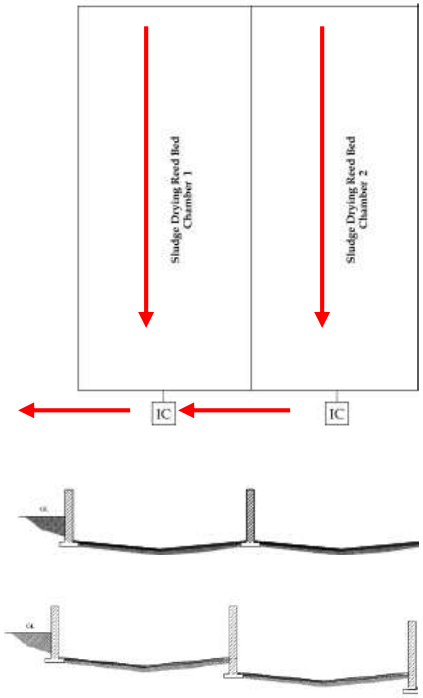
COUPLING DETAIL A
SCALE 1:50

SLUDGE DRYING BED

SUBSURFACE



- Compact the subgrade (below the filter media) uniformly
- Create a 2 sides slope towards the centre of each bed to enable drainage
- The beds are placed 80 cm (1 m at the centre) below the ground level

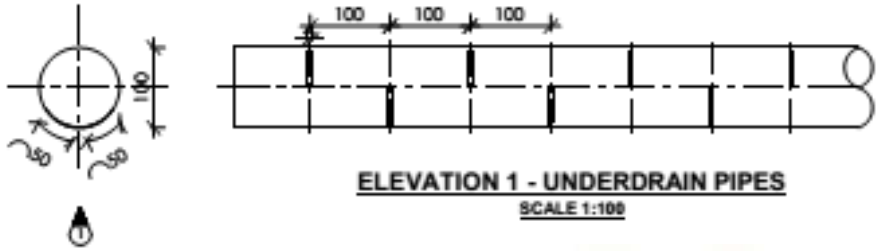


- For each bed create a 1% slope towards the inspection chamber to enable drainage
- In case of a sloppy area, the 4 beds can be laid separately at different levels

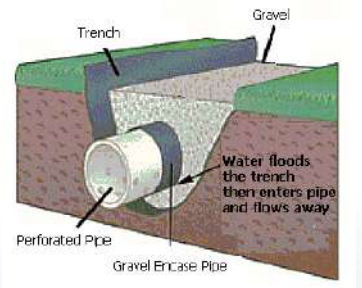
Lining Material and Underdrain Pipe

Lining material should be the same as for the Vertical Flow Constructed Wetland

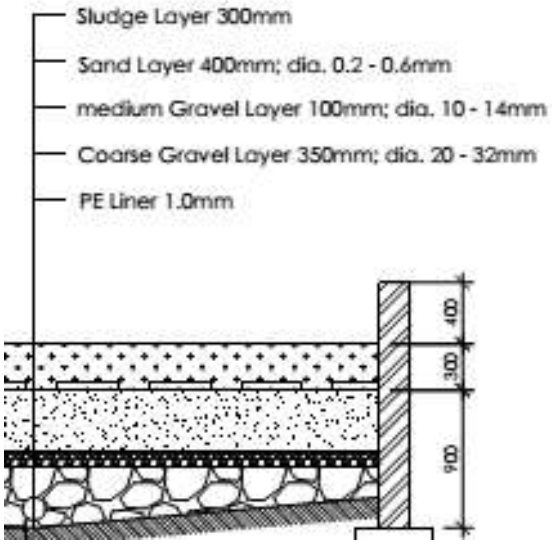
- A clay layer (50mm thick) + PE liner (1 mm thick)
- Well compacted subgrade, PE liner overlap of 5 to 10 cm, water tightness test before filling with filter media



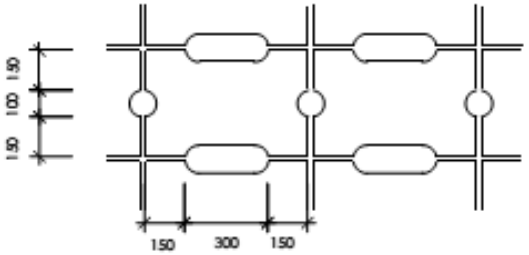
- Underdrain pipes: uPVC class 41 (100 mm dia.)



Filter Media and Slab



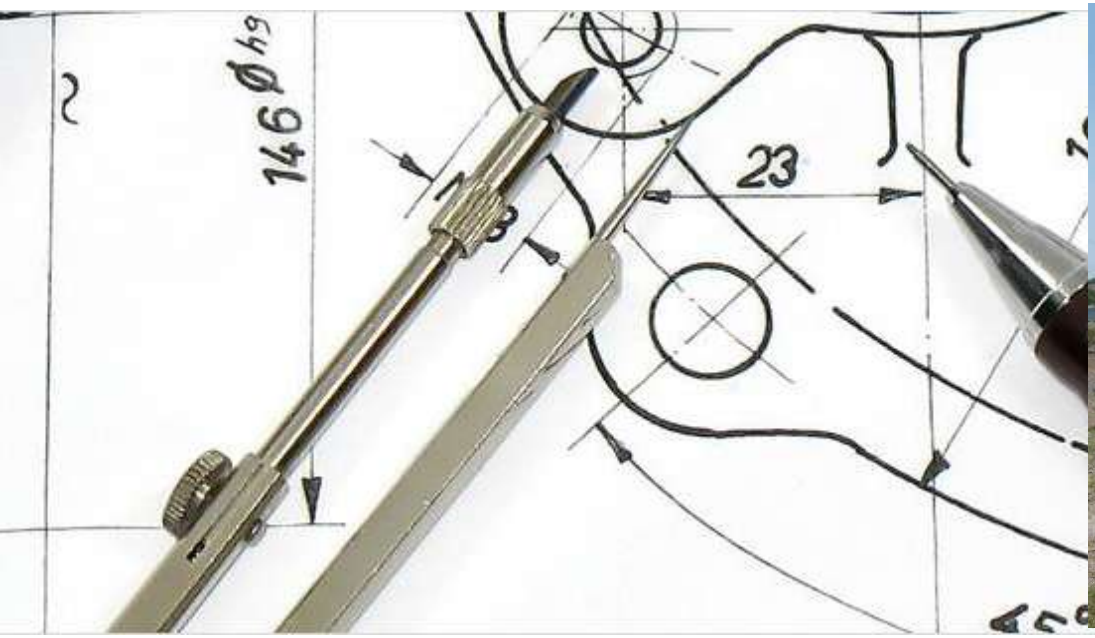
Same requirements as for VFCW: sand free of loam and silt, no sharp edges at the bottom, etc.

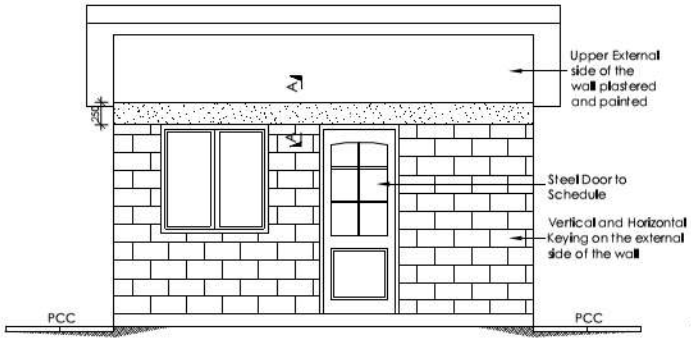


Precast Concrete Slab laid on top of sand layer with following dimension: 400 x 600 x 50mm thick

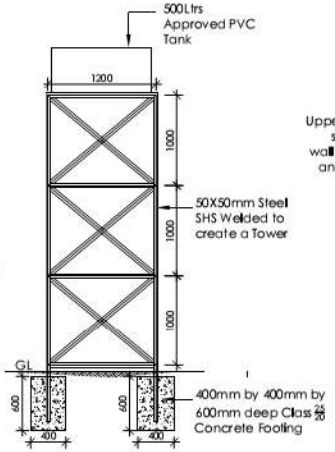
OPERATOR STORE

TECHNICAL SPECIFICATION AND REQUIREMENTS

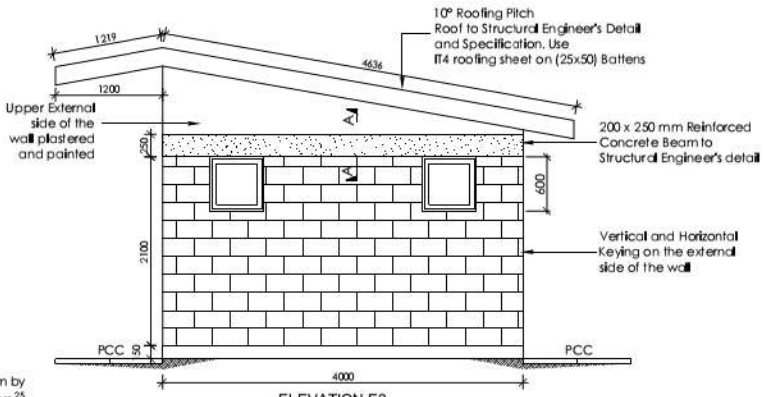




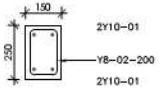
ELEVATION E1
SCALE 1:50



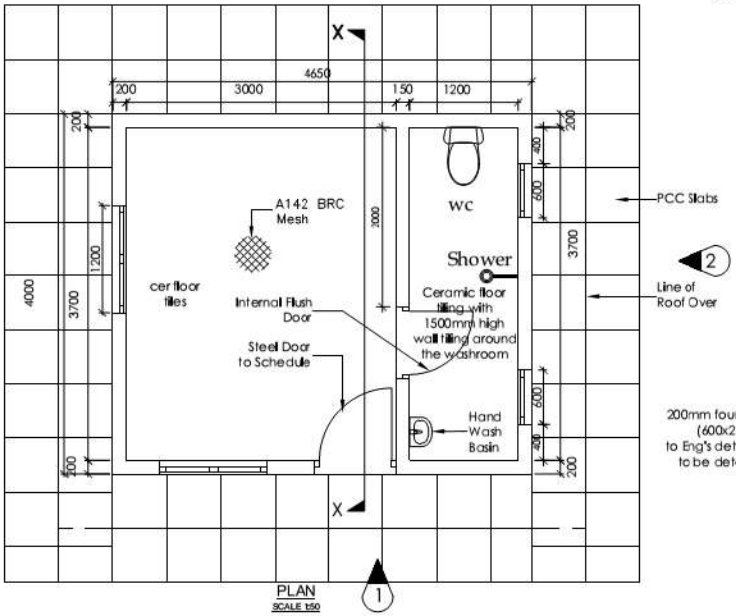
PVC TANK ELEVATED ON A STEEL TOWER
SCALE 1:50



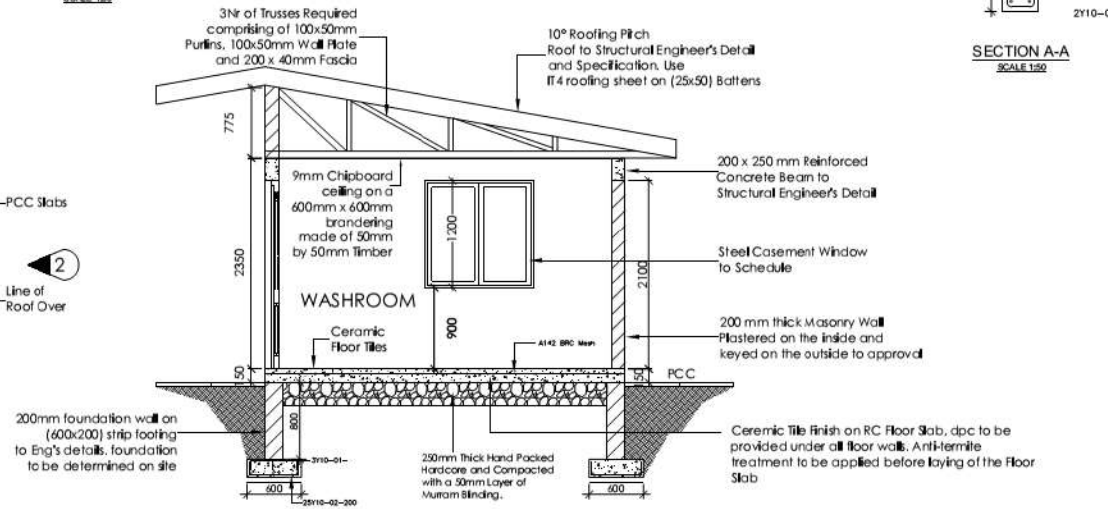
ELEVATION E2
SCALE 1:50



SECTION A-A
SCALE 1:50



PLAN
SCALE 1:50



SECTION X - X
SCALE 1:50

Doors and Windows Schedule		
Type	Width	Height
Door D1	900	2100
Window W1	1200	1200
Window W2	600	600

OPERATORS OFFICE

Water Supply

Water for sink and toilet:

- Connect water supply to the site including the installation of a 500L water tank elevated on a steel tower

ELECTRICITY SUPPLY

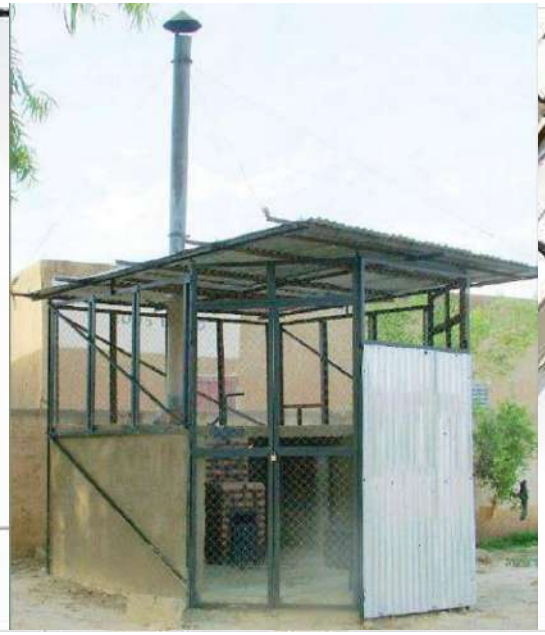
Electricity for office and bathroom: 2 bulbs, 2 switch buttons, 3 double electrical sockets:

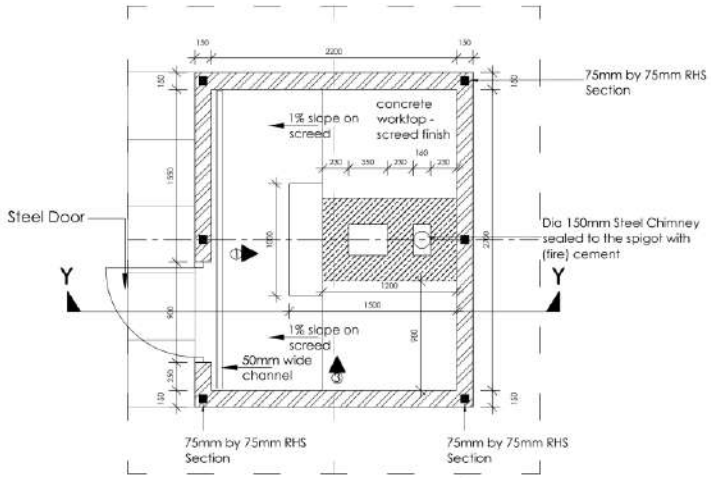
- electrical connection including complete meter connection with meter box (KPLC), compact switch board, or
- 50W Solar Panel with 10A solar charge controller, 12V battery and inverter

Kenya Power

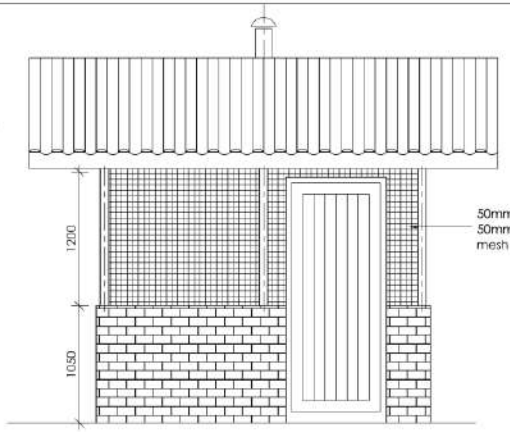
WASTE DISPOSAL UNIT

TECHNICAL SPECIFICATION AND REQUIREMENTS

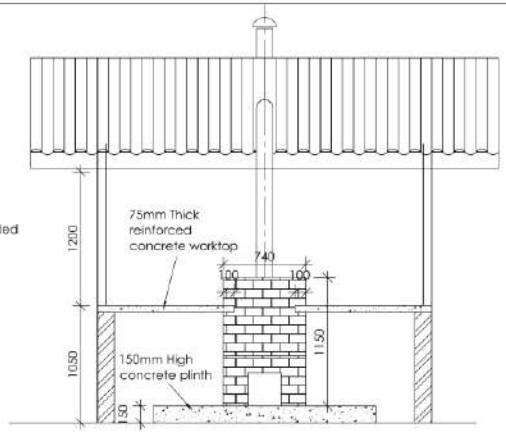




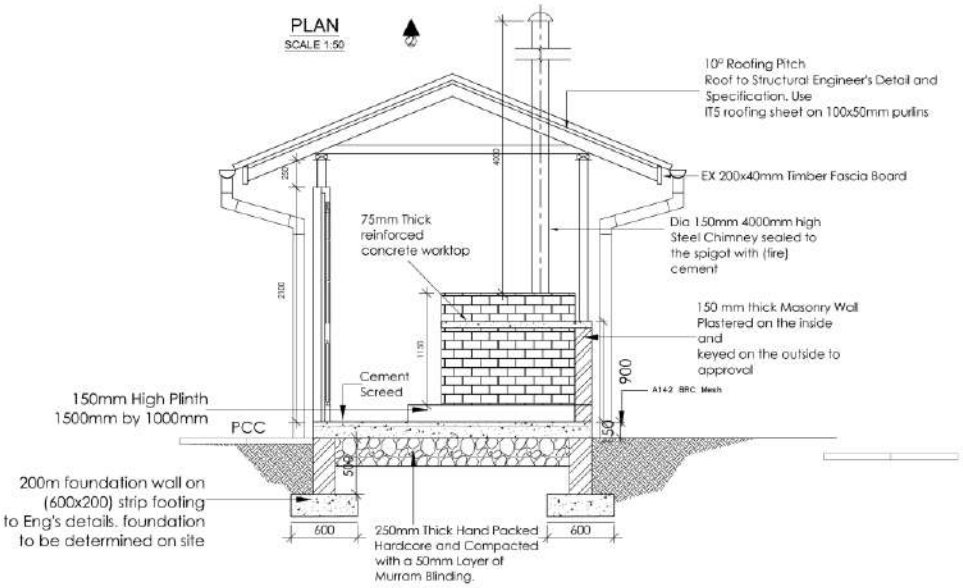
PLAN
SCALE 1:50



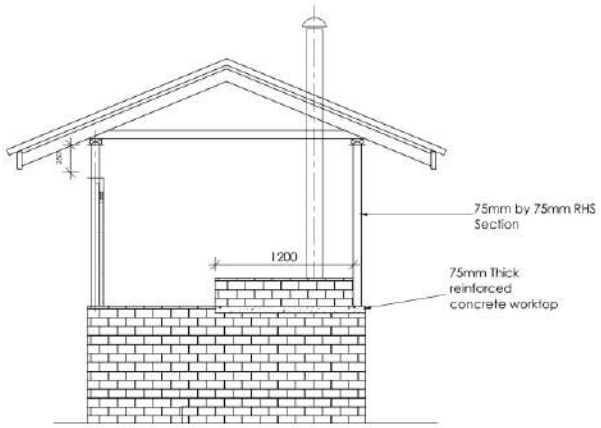
FRONT ELEVATION
SCALE 1:50



ELEVATION 1
SCALE 1:50

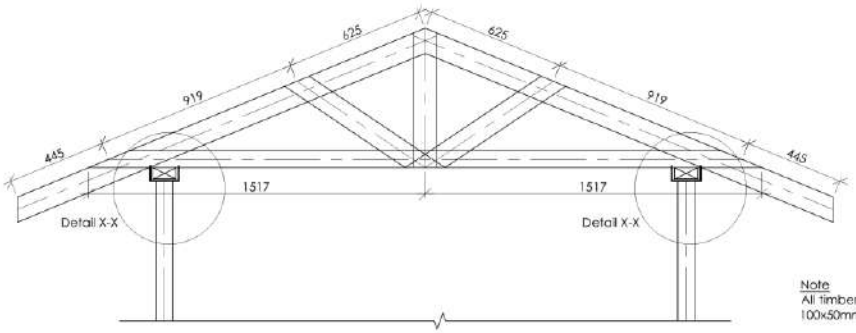


SECTION Y-Y
SCALE 1:50



ELEVATION 2
SCALE 1:50

INCINERATOR SHED

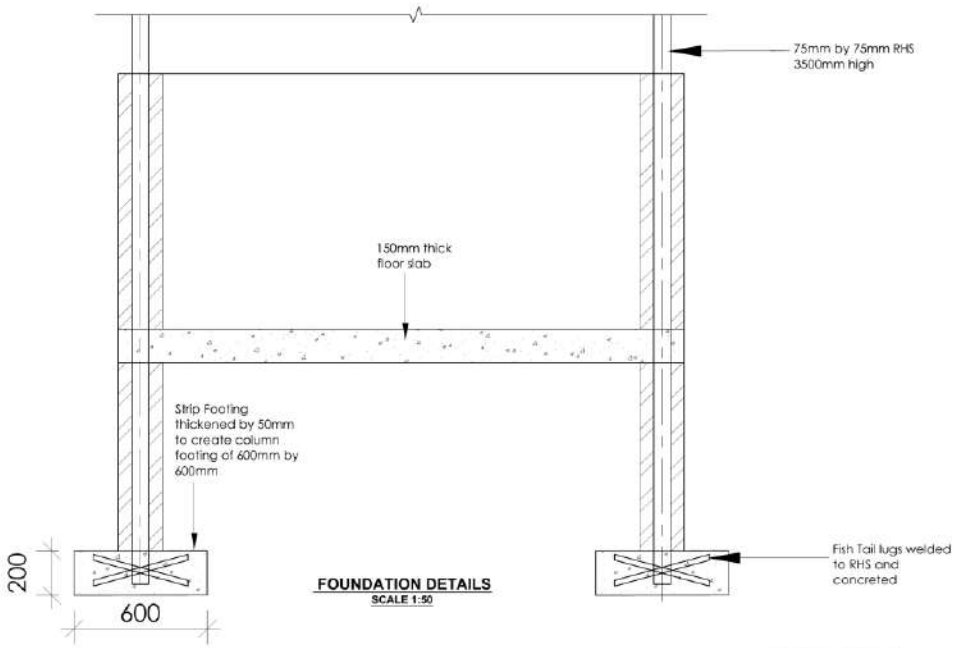


Note
All timber members are 100x50mm

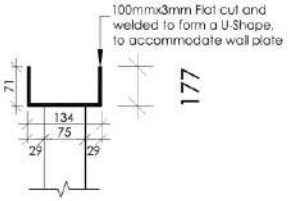
TRUSS DETAILS - 3 NR REQUIRED
SCALE 1:50

LIST OF MATERIALS FOR THE INCINERATOR UNIT

Item	Dimensions	Quantity
Fire Bricks	230mm by 115mm by 80mm	200 approx
Sand		200Kg
Fire Cement (High Alumina)	50Kg bag	2 bags
Steel Angle	30mm by 30mm by 3mm	12m
Steel Channel	100mm by 40mm by 5mm	4m
Flat sheet for loading door	600mm by 750mm by 3mm	1 sheet
Flat sheet for ash door	250mm by 250mm by 3mm	1 sheet
Flat sheet for chimney spigot support	250mm by 150mm by 3mm	1 sheet
Steel pipe	150mm Dia by 3mm thickness	4m long
Hinges for Ash Door		
Pipe for loading door hinge	1 inch	1nr
Rod for loading door hinge	3/4 inch	1nr
Masonry plugs	no 10	16nr
Steel cable	no 10	40m



FOUNDATION DETAILS
SCALE 1:50

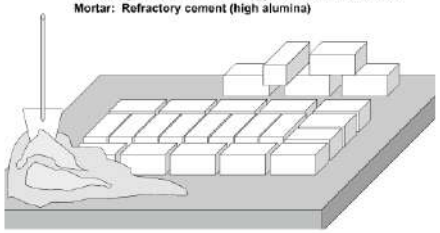


DETAIL X-X
SCALE 1:10

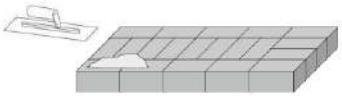
INCINERATOR SHED

FOUNDATION

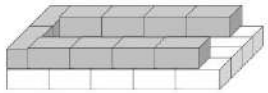
Concrete foundation: L x W x H = 2m x 2m x 0.15m
Refractory bricks: L x W x H = approx. 230 x 110 x 65 mm
Mortar: Refractory cement (high alumina)



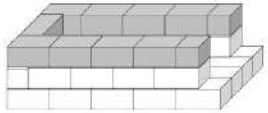
LAYER 1



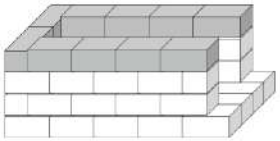
LAYER 2



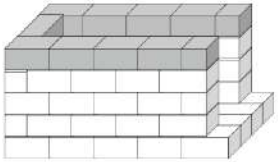
LAYER 3



LAYER 4

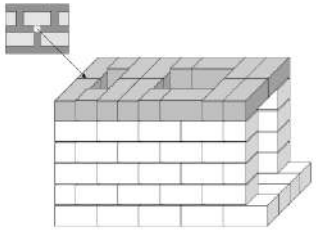


LAYER 5

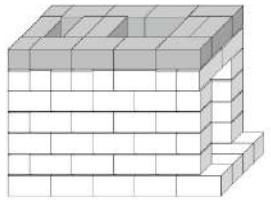


LAYER 6

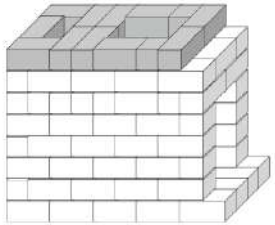
Make a viewing hole by creating a gap in the cement between layer 6 & 7. Insert a piece of wood that can be removed.



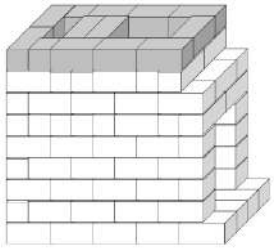
LAYER 7



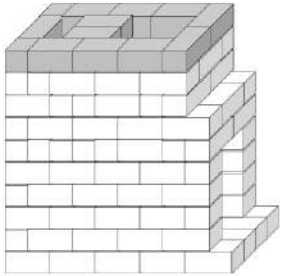
LAYER 8



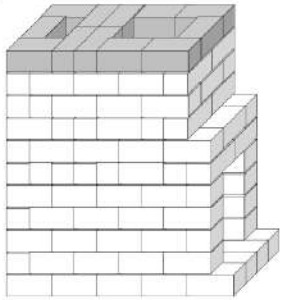
LAYER 9

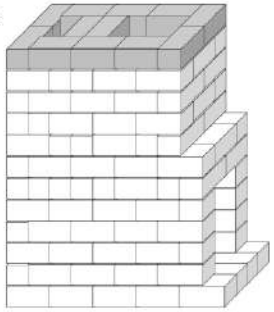


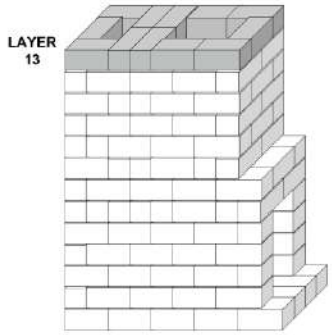
LAYER 10

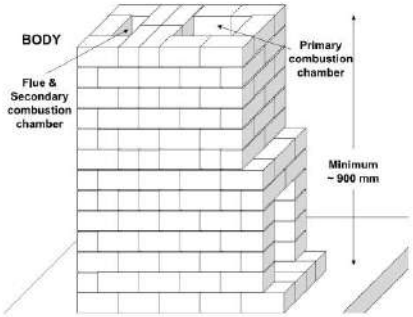


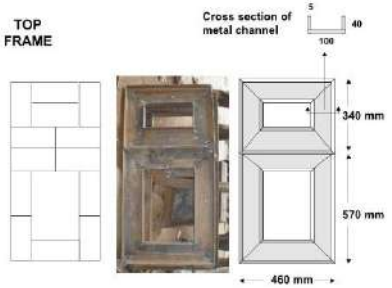
LAYER 11



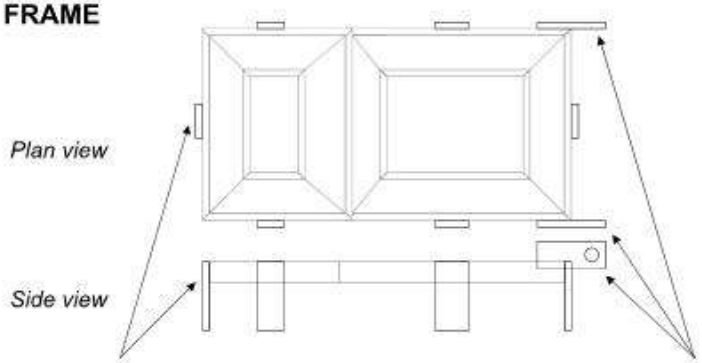








TOP FRAME



LOCATORS: Pieces of metal channel are welded to the top frame as locators

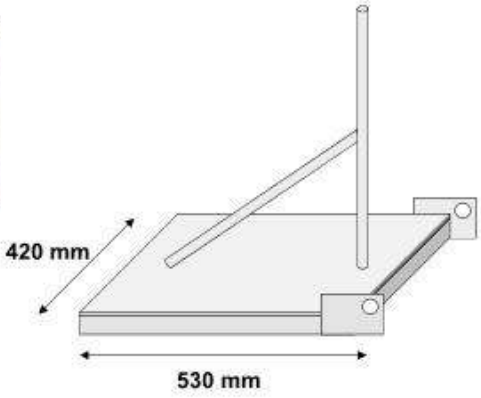
HINGES: 3mm metal plate is used for the loading door hinges

LOADING DOOR

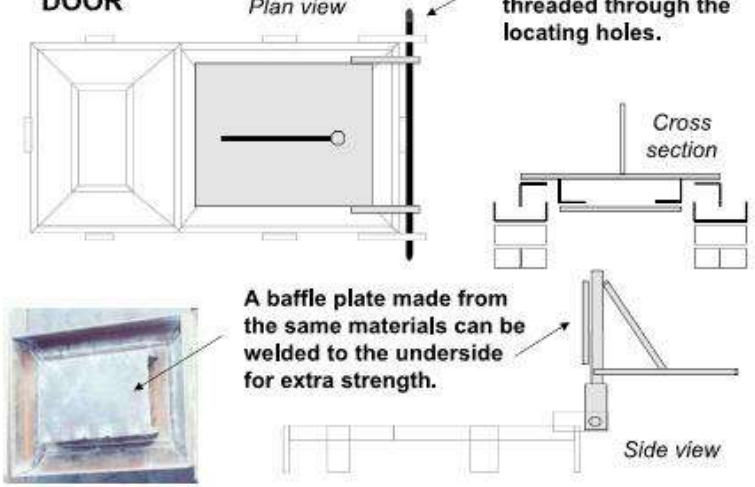
The loading door is made from a frame of metal angle (30 x 30 x 3) with a plate of 3mm steel welded on top.

Underside

Metal Angle



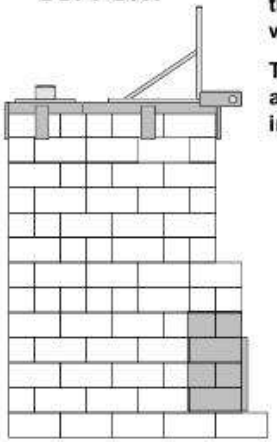
LOADING DOOR



FITTING THE TOP FRAME TO THE INCINERATOR BODY

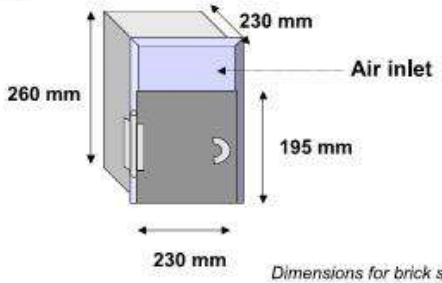
Seal with refractory cement

ASH DOOR & SUPPORT



The brick arch at the front is supported by a steel tunnel (3mm thickness). Steel angle (30x30x3) welded around the front edge of the tunnel forms the support for the ash door, which is hinged.

The ash door (3mm thickness) covers _ of the area of the arch. The remainder forms the air inlet.

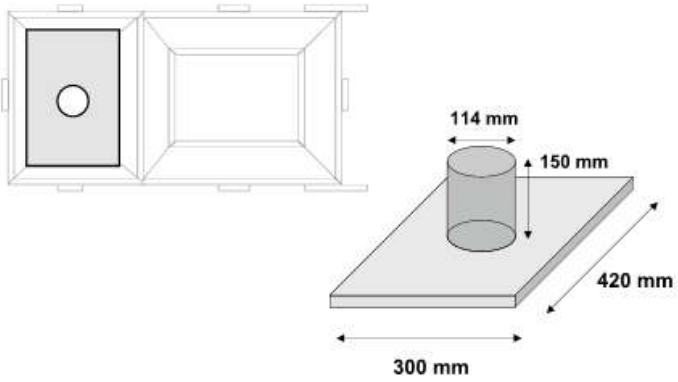


Dimensions for brick size (230 x 100 x 65), may need to be adjusted

BODY OF INCINERATOR WITH ASH DOOR AND TOP FRAME

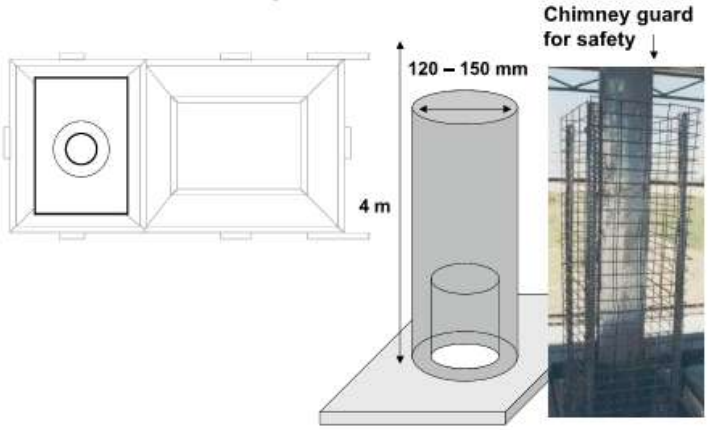
CHIMNEY SPIGOT

The chimney spigot is made from a frame of metal angle (30 x 30 x 3) with a plate of 5mm steel welded on top and a piece of steel pipe (3mm thickness)



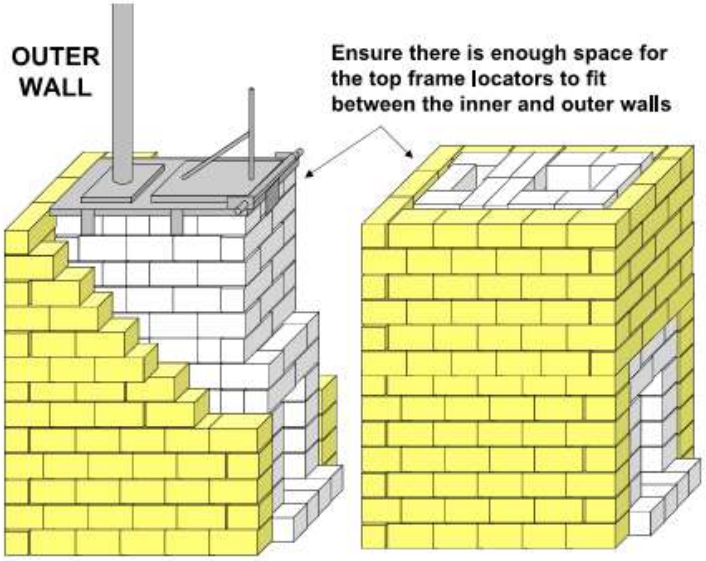
CHIMNEY

The chimney is made from a steel pipe (3mm thickness). It is sealed to the spigot with fire cement.



OUTER WALL

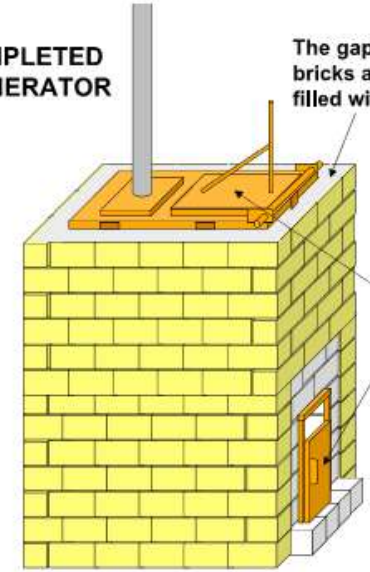
Ensure there is enough space for the top frame locators to fit between the inner and outer walls



COMPLETED INCINERATOR

The gaps between the refractory bricks and outer wall can be filled with refractory cement

Paint to inhibit corrosion



SHELTER

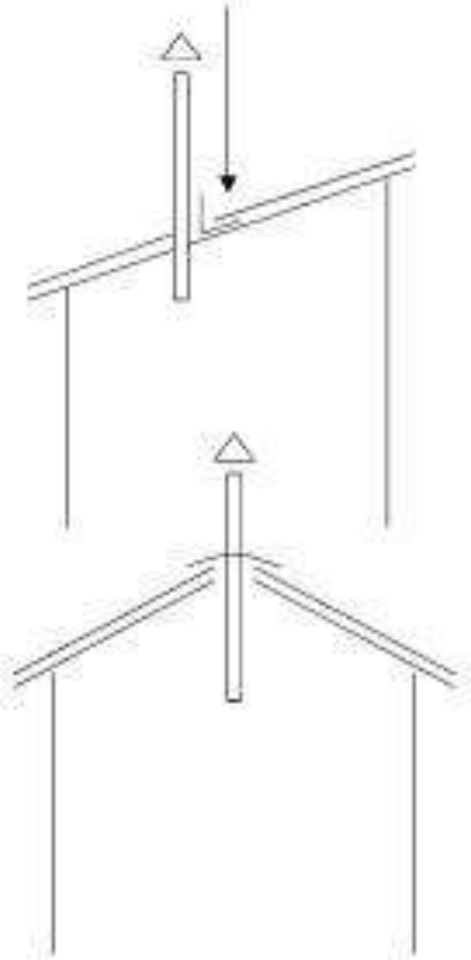
Channel to divert rain way from chimney

Ensure good seal

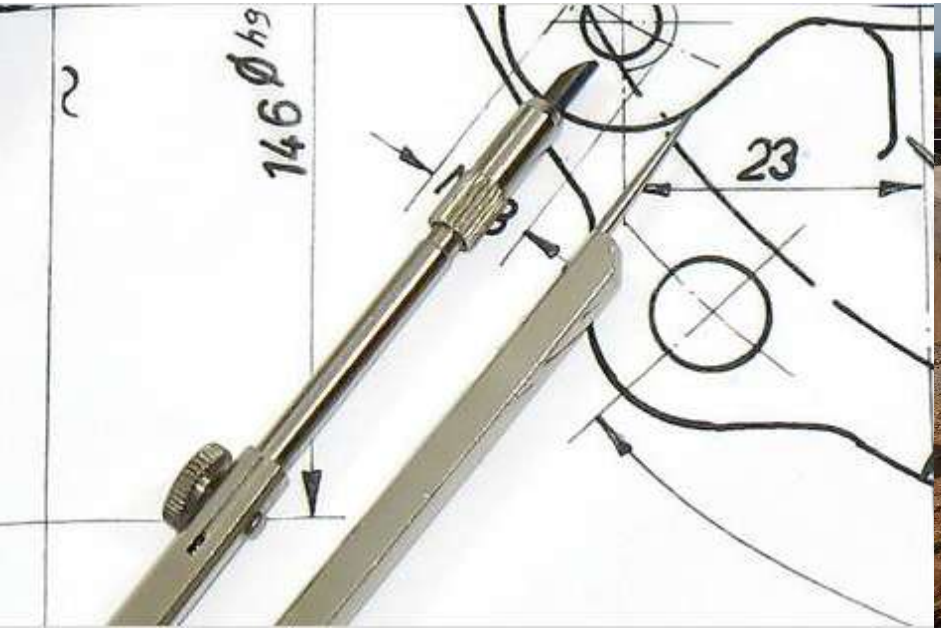
Rain cap for chimney

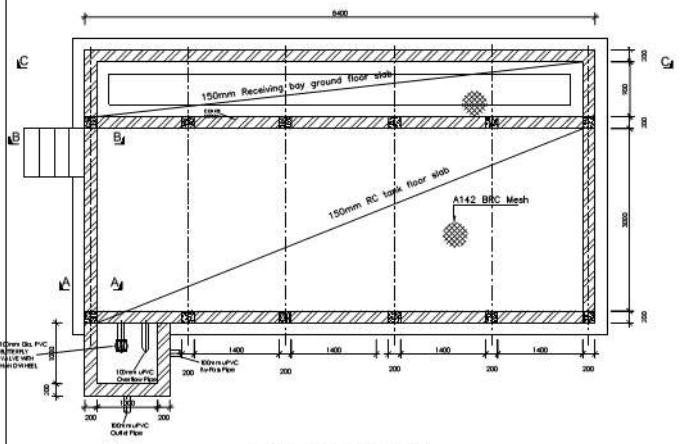
Sloping roof, made from steel sheet

Concrete foundation

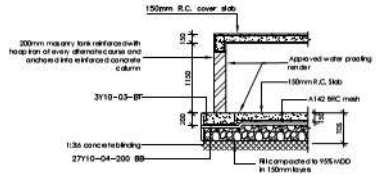


RECEIVING BAY
BALANCING TANKS
TECHNICAL SPECIFICATION AND REQUIREMENTS

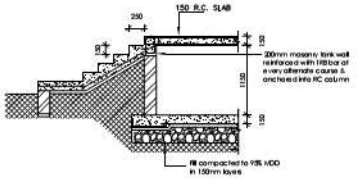




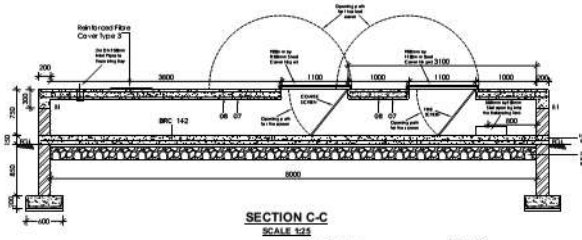
FOUNDATION LAYOUT PLAN
SCALE 1:75



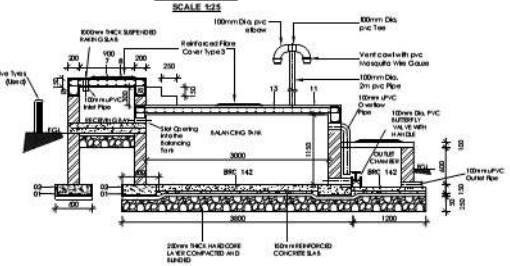
SECTION A - A
SCALE 1:50



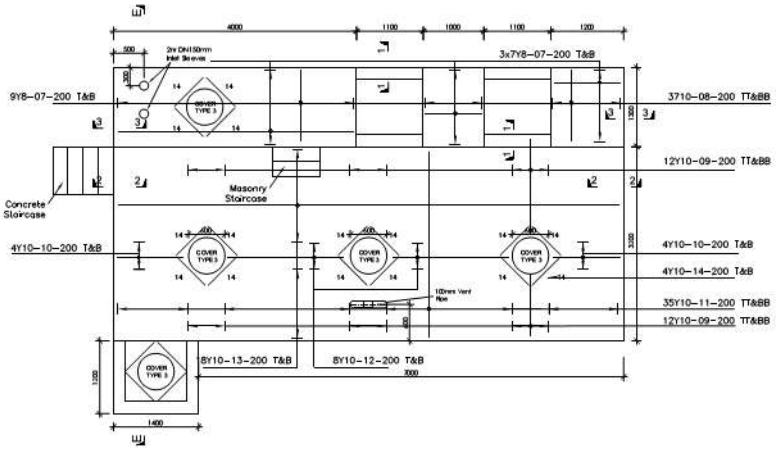
SECTION B - B
SCALE 1:50



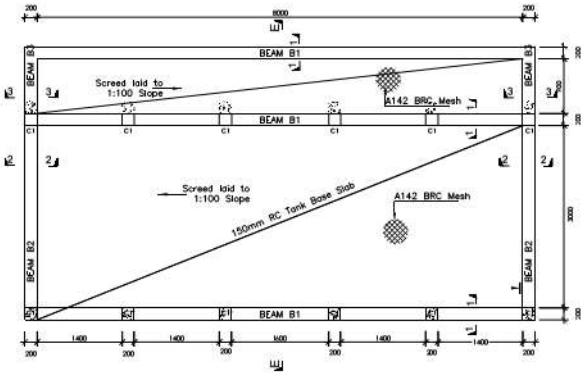
SECTION C-C
SCALE 1:25



SECTION E-E
SCALE 1:25



ROOF SLAB PLAN
STRUCTURAL DETAILS
SCALE 1:25



BASE SLAB PLAN
STRUCTURAL DETAILS
SCALE 1:25

NOTES

1 CONCRETE:
- (a) CEMENT TO BE ORDINARY PORTLAND CEMENT TO B.S. 12
- (b) CONCRETE AGGREGATE TO COMPLY WITH B.S. 882
- (c) WATER IN CONCRETE MIXES TO B.S. 3148
- (d) CONCRETE CLASSES TO BE AS FOLLOWS:—
  MASS CONCRETE FILL AND BLINDING MIX. CLASS 15/40
  REINFORCED CONCRETE. CLASS 25/20
- (e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm UNLESS AS SPECIFIED BELOW FOR BUILDINGS:
  MEMBERS OF BUILDINGS:
  - SLABS - 20 mm
  - BEAMS - 25 mm
  - COLUMNS - 40 mm
  - FOUNDATIONS & FOOTINGS - 50 mm
- (f) WALLS/COLUMNS SHOULD BE POURED, IF POSSIBLE, IN A FULL HEIGHT POUR AS SOON AS POSSIBLE AFTER THE BASE HAS BEEN CONCRETED (2 TO 3 DAYS)

2 REINFORCEMENT:
- (a) REINFORCEMENT TO BE HIGH YIELD SQUARE TWISTED BARS TO B.S. 4461
- (b) BENDING DIMENSIONS TO B.S. 4466
- (c) THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL SPACER BLOCKS, CHAIRS AND TYING WIRE
- (e) EXAMPLE. 16 T12 – 07 – 150 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 07 AT 150mm CENTRE TO CENTRE SPACING

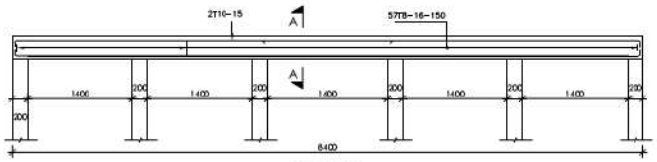
3 JOINTS:
- (a) THE POSITION AND NUMBER OF INTERMEDIATE JOINTS TO BE AS DIRECTED BY THE ENGINEER OR AS SHOWN IN THE DRAWINGS.
  BEFORE PLACING FRESH CONCRETE THE OLD SURFACE SHALL BE ROUGHENED AND ALL LAITANCE AND LOOSE MATERIAL REMOVED.
  THE SURFACE SHALL BE THOROUGHLY WETTED BUT EXCESS WATER SHOULD BE REMOVED SO THAT THE CONSTRUCTION JOINTS ARE IN A SATURATED BUT SURFACE DRY CONDITION.
- (b) ALL WALL TO SLAB BASE CONNECTIONS SHOULD HAVE 100mm KICKER UNLESS OTHERWISE SPECIFIED
- (c) THE uPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
- (d) JOINT FILLER TO B.S. 5292 AND TO BE APPROVED BY THE ENGINEER

4 ABBREVIATIONS:

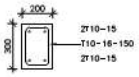
T - TOP	B - BOTTOM
N.F. - NEAR FACE	F.F. - FAR FACE
E.F. - EACH FACE	E.W. - EACH WAY

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. RBBT/01

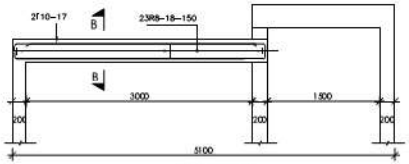
RECEIVING BAY AND BALANCING TANK



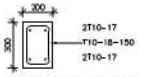
BEAM B1
SCALE 1:100



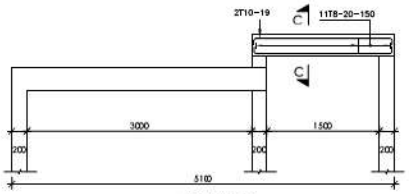
BEAM B1 SECTION A-A
SCALE 1:50



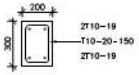
BEAM B2
SCALE 1:100



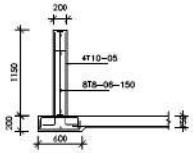
BEAM B2 SECTION B-B
SCALE 1:50



BEAM B3
SCALE 1:100



BEAM B3 SECTION C-C
SCALE 1:50



COLUMN C1
SCALE 1:50

NOTES

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- (b) CONCRETE AGGREGATE TO COMPLY WITH B.S. 882
- (c) WATER IN CONCRETE MIXES TO B.S. 3148
- (d) CONCRETE CLASSES TO BE AS FOLLOWS:-
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  REINFORCED CONCRETE, CLASS 25/20
- (e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm UNLESS AS SPECIFIED BELOW FOR BUILDINGS:
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2 REINFORCEMENT:
- (a) REINFORCEMENT TO BE HIGH YIELD SQUARE TWISTED BARS TO B.S. 4461
- (b) BENDING DIMENSIONS TO B.S. 4466
- (c) THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL SPACER BLOCKS, CHAIRS AND TYING WIRE
- (d) EXAMPLE: 16 T12 – 07 – 150 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 07 AT 150mm CENTRE TO CENTRE SPACING

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- (c) THE uPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
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4 ABBREVIATIONS:

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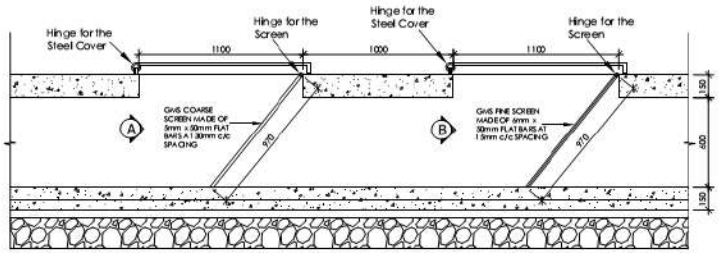
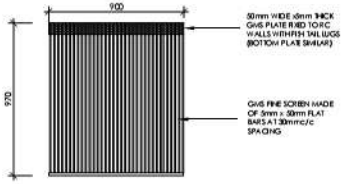
5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. RBBT/01

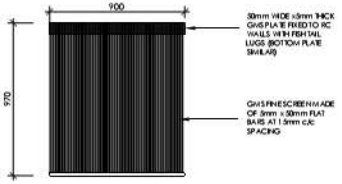
SCREEN DETAILS



SECTION 2-2
COARSE AND FINE SCREEN
SCALE 1:25



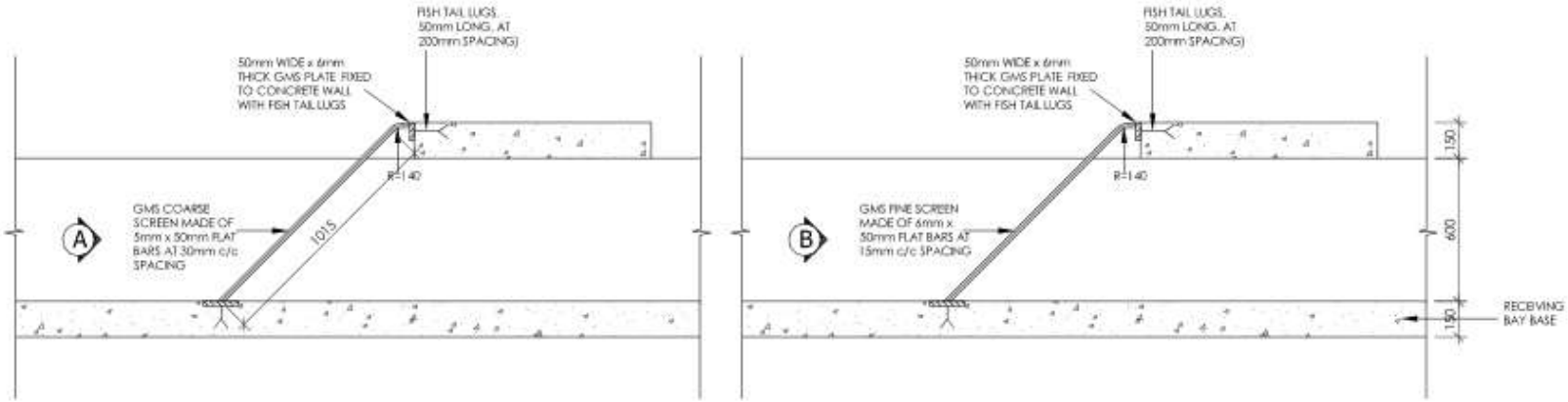
ELEVATION A
COARSE SCREEN DETAILS
SCALE 1:25



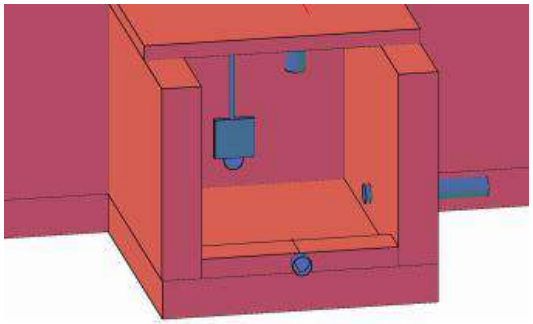
ELEVATION B
FINE SCREEN DETAILS
SCALE 1:25

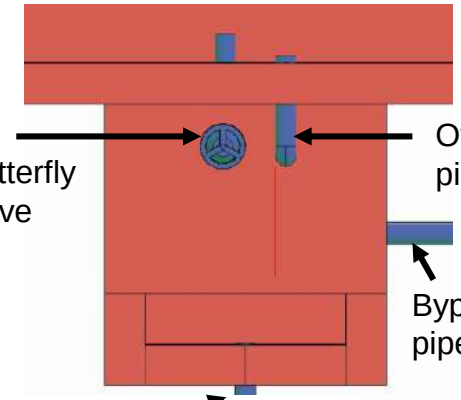
RECEIVING BAY AND BALANCING TANK

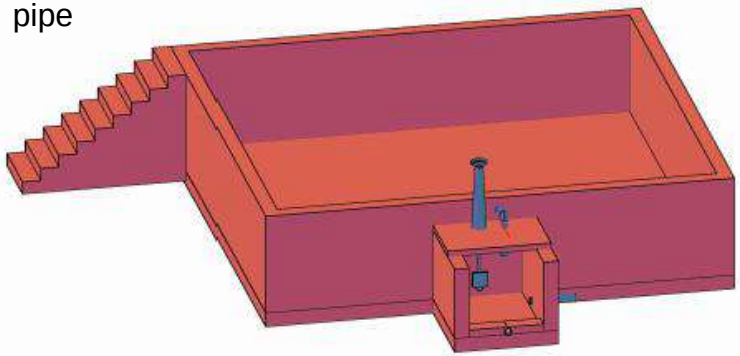
SCREENS

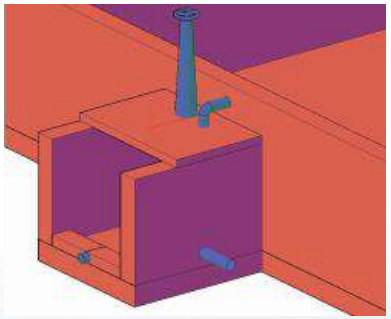

FISH TAIL LUGS
50mm LONG, AT
200mm SPACING)
50mm WIDE x 6mm
THICK GMS PLATE FIXED
TO CONCRETE WALL
WITH FISH TAIL LUGS
R=140
A
GMS COARSE
SCREEN MADE OF
5mm x 50mm FLAT
BARS AT 30mm c/c
SPACING
1015
FISH TAIL LUGS
50mm LONG, AT
200mm SPACING)
50mm WIDE x 6mm
THICK GMS PLATE FIXED
TO CONCRETE WALL
WITH FISH TAIL LUGS
R=140
B
GMS FINE SCREEN
MADE OF 6mm x
50mm FLAT BARS AT
15mm c/c SPACING
150
600
150
RECEIVING
BAY BASE

CONTROL VALVE





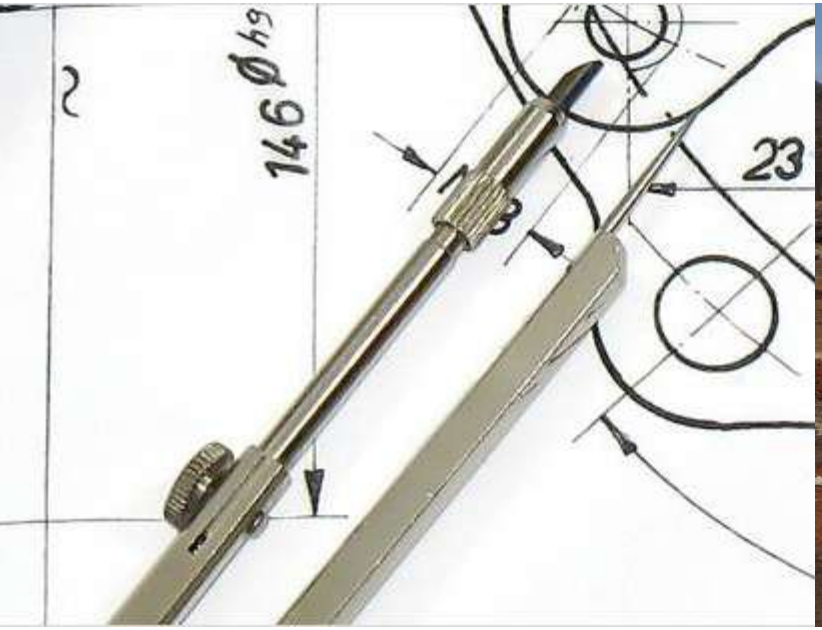




DIFFERENT EXAMPLES OF RBBT

SETTLER

TECHNICAL SPECIFICATION AND REQUIREMENTS



NOTES

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(b) CONCRETE AGGREGATE TO COMPLY WITH B.S. 882
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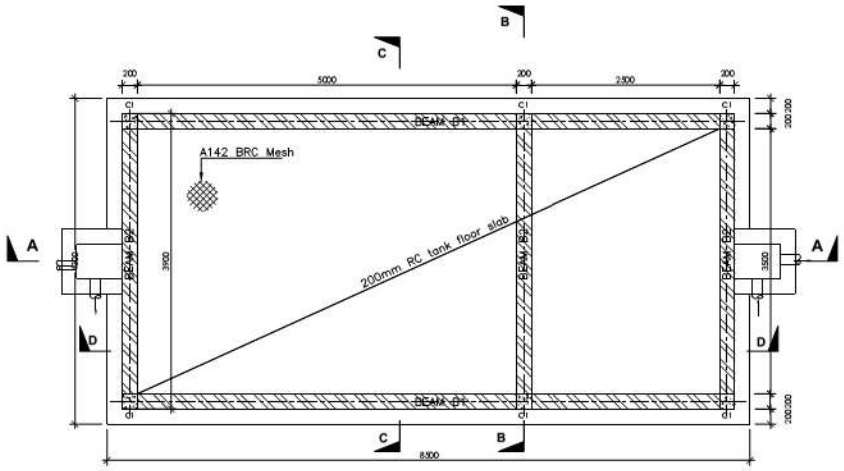
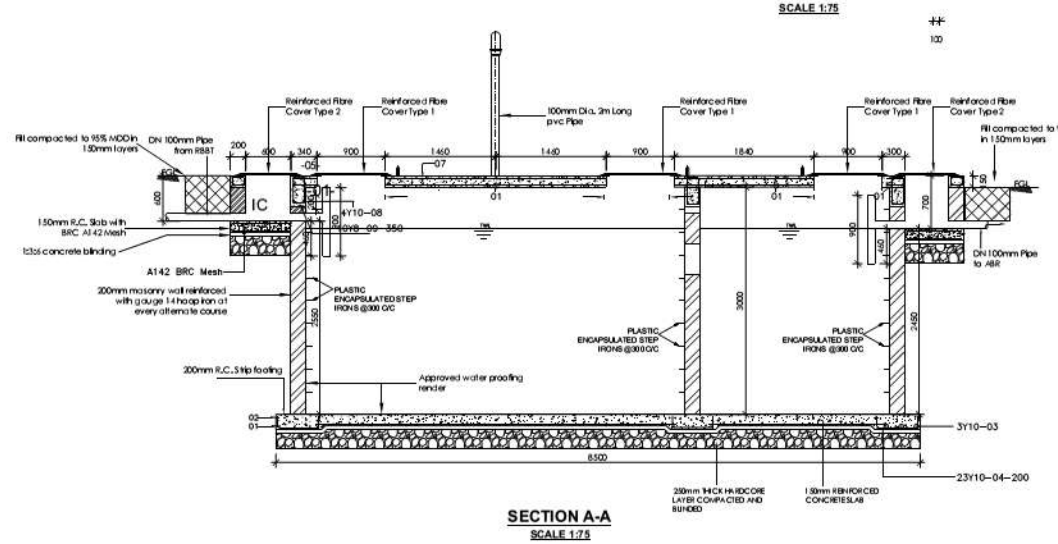
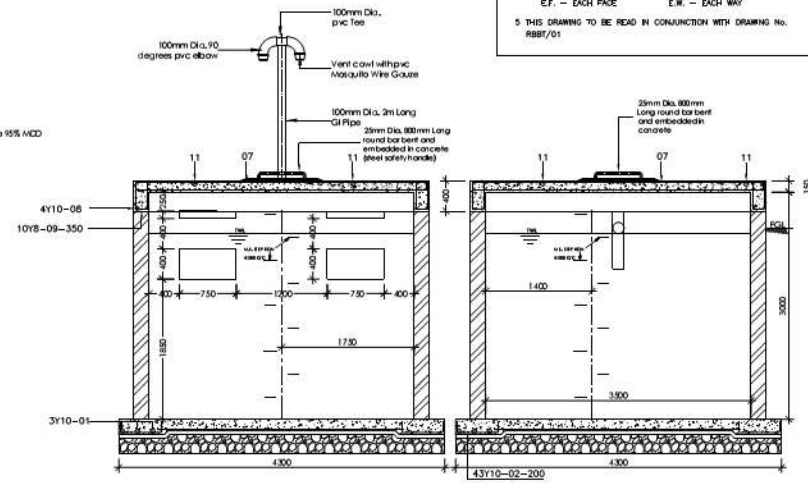


BASE SLAB PLAN
SCALE 1:75



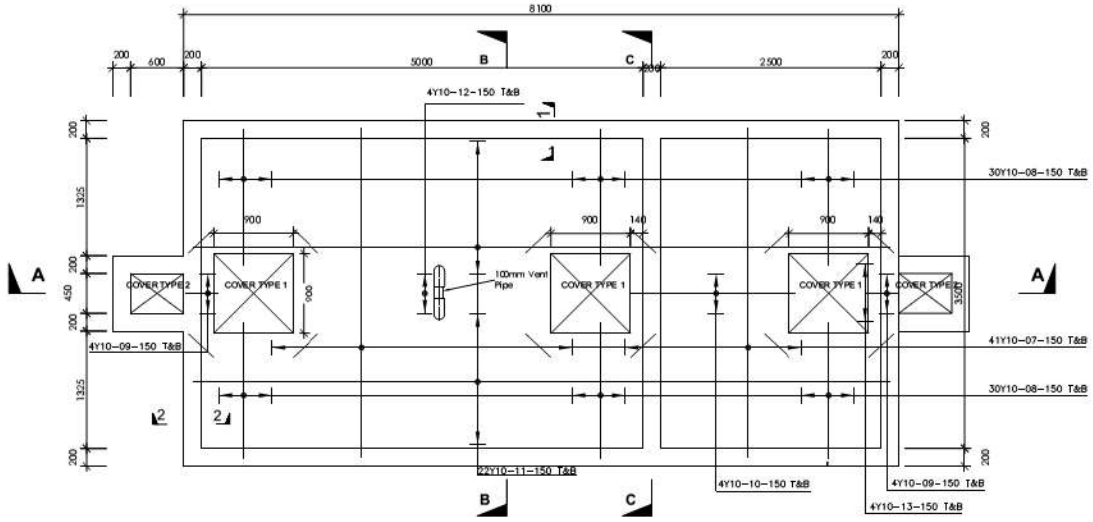
SECTION A-A
SCALE 1:75



SECTION B-B
SCALE 1:50

SECTION C-C
SCALE 1:50

SETTLER TANK



ROOF SLAB PLAN
SCALE 1:75

NOTES

1 CONCRETE:
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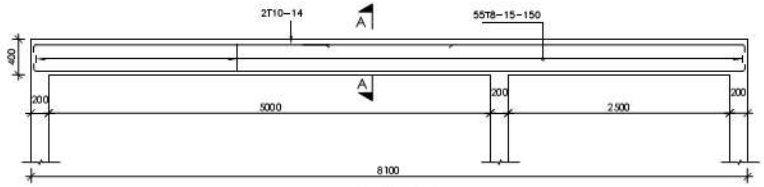
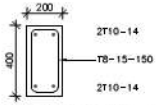
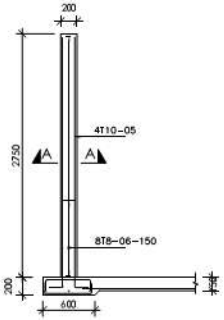


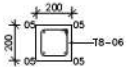
BEAM B1
SCALE 1:100



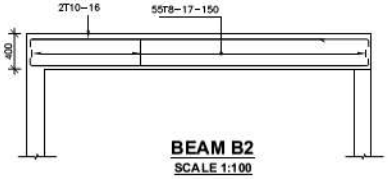
BEAM B1 SECTION A-A
SCALE 1:50



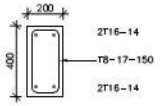
COLUMN C1
SCALE 1:50



COLUMN C1 SECTION A-A
SCALE 1:50



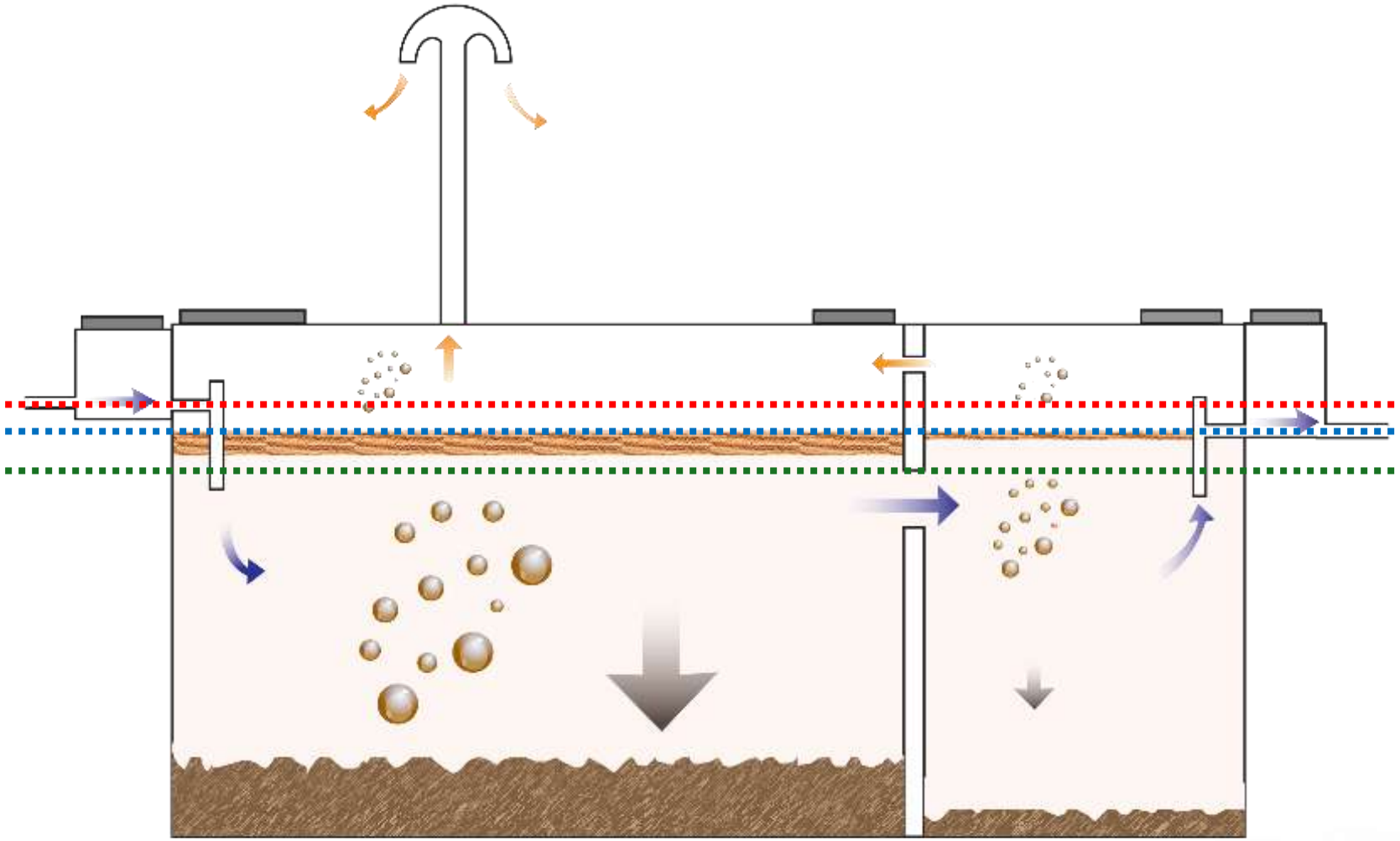
BEAM B2
SCALE 1:100



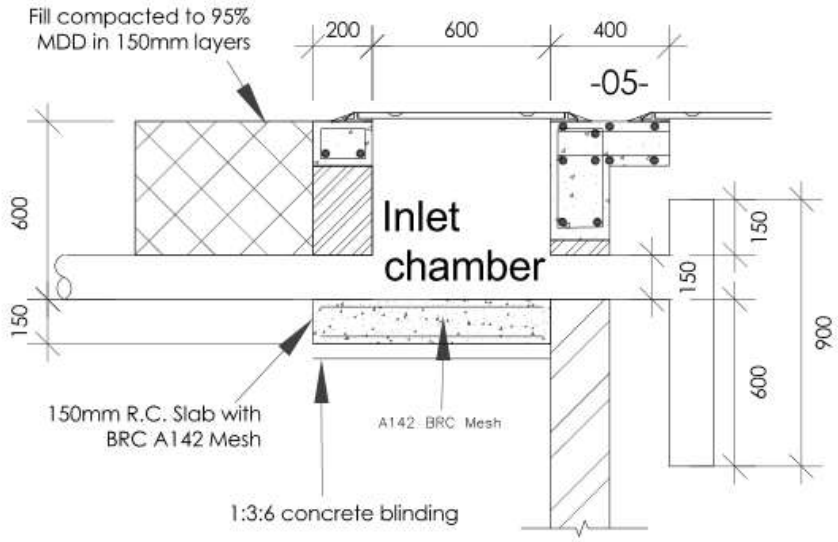
BEAM B2 SECTION A-A
SCALE 1:50

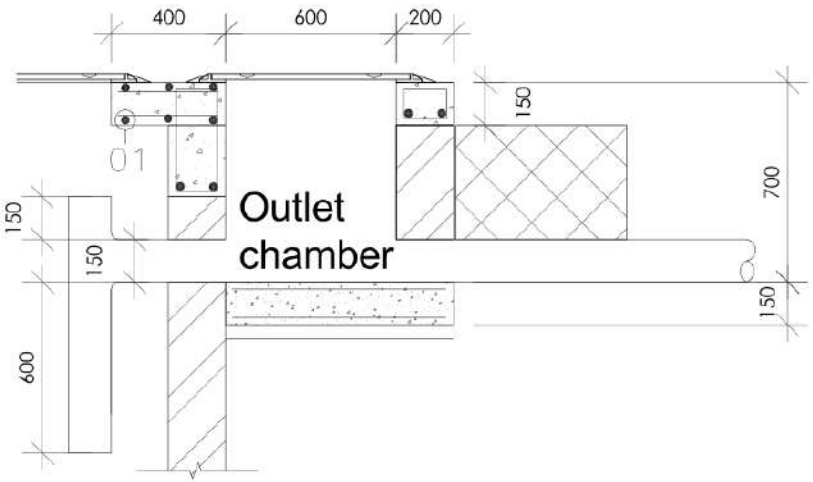
SETTLER TANK

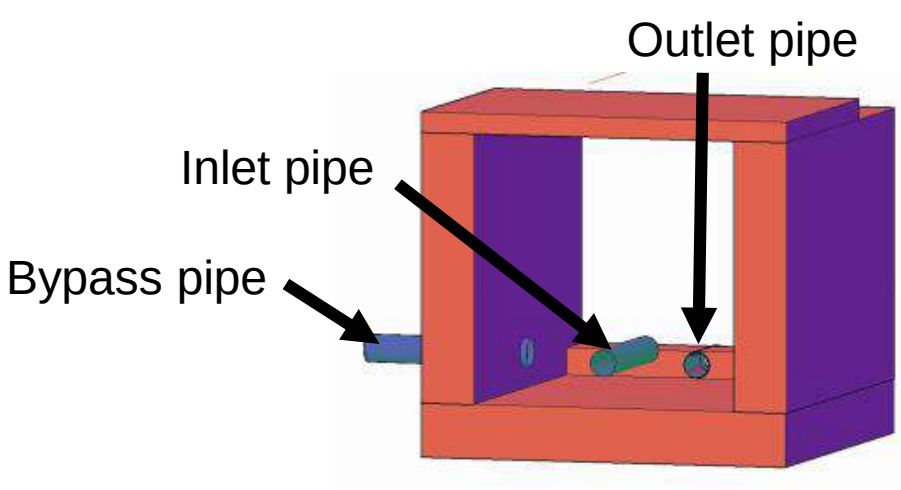
Importance of Levels

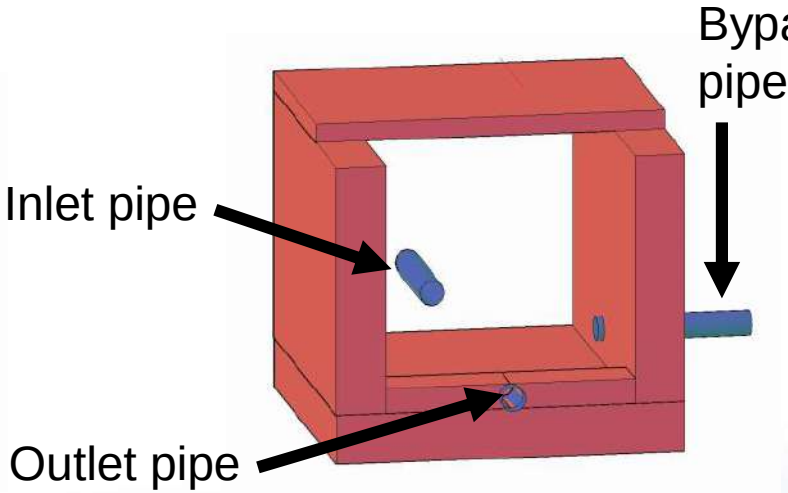


INLET AND OUTLET CHAMBER





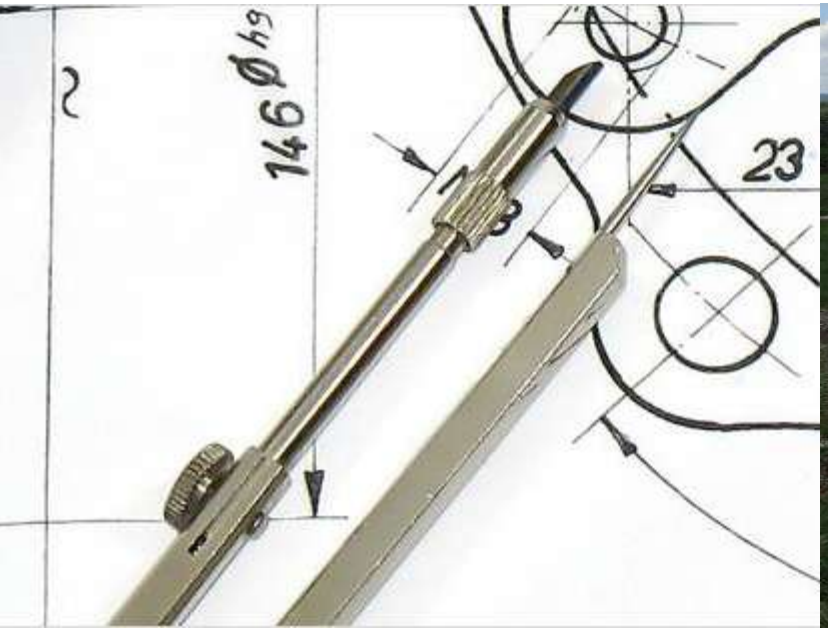


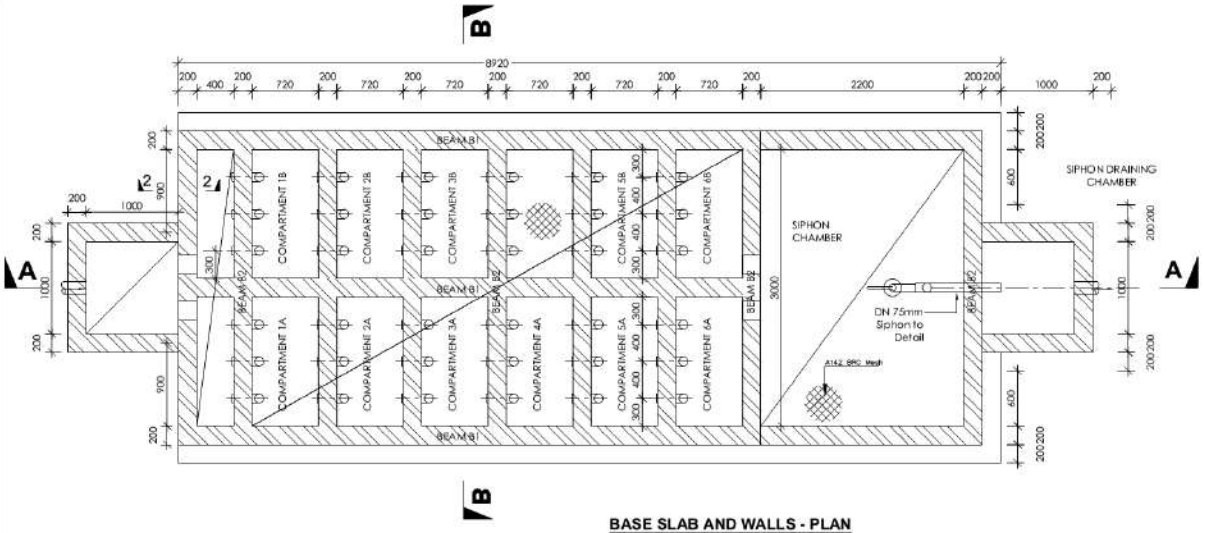


Different Examples of Settler

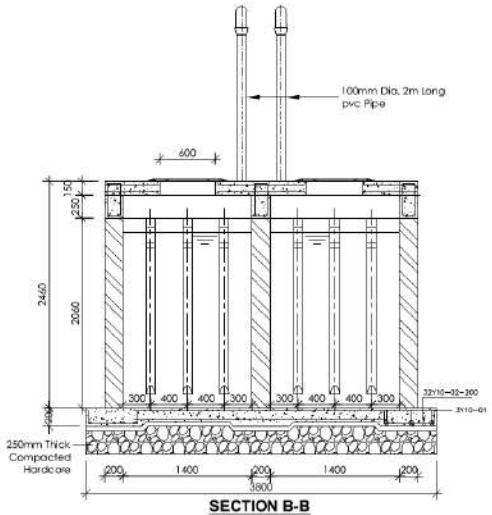
ANAEROBIC BAFFLED REACTOR

TECHNICAL SPECIFICATION AND REQUIREMENTS

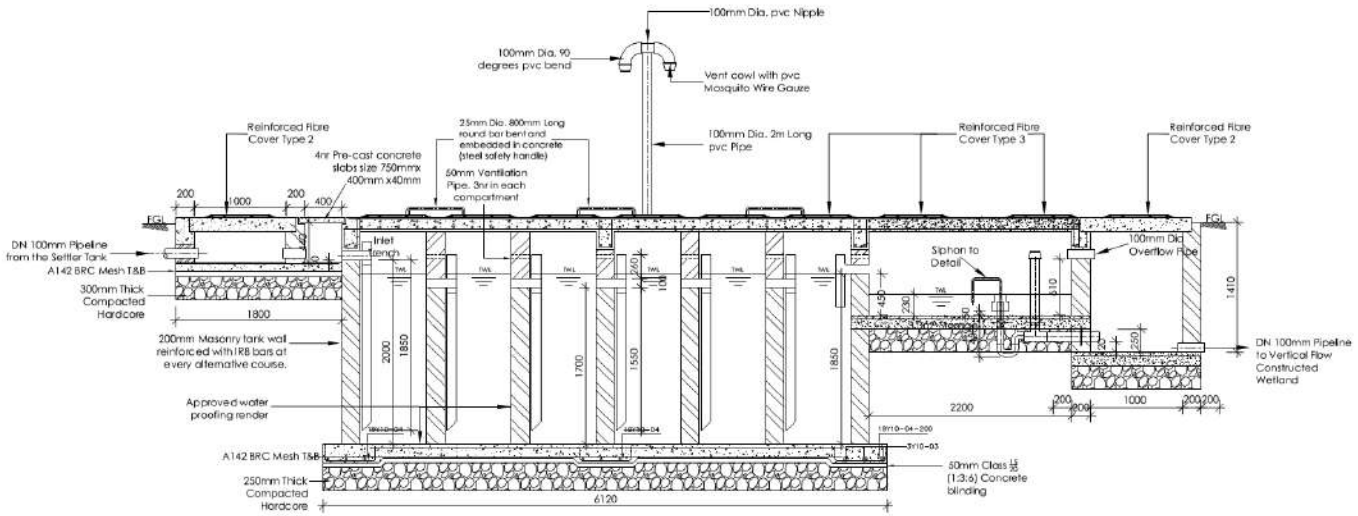




BASE SLAB AND WALLS - PLAN
SCALE 1:50



SECTION B-B
SCALE 1:50



SECTION A-A
SCALE 1:50

NOTES

1 CONCRETE:
(a) CEMENT TO BE ORDINARY PORTLAND CEMENT TO B.S. 12
(b) CONCRETE AGGREGATE TO COMPLY WITH B.S. 882
(c) WATER IN CONCRETE MIXES TO B.S. 3148
(d) CONCRETE CLASSES TO BE AS FOLLOWS:-
MASS CONCRETE FILL AND BLINDING MIX. CLASS 15/40
REINFORCED CONCRETE. CLASS 25/20
(e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm UNLESS AS SPECIFIED BELOW FOR BUILDINGS
MEMBERS OF BUILDINGS
– SLABS – 20 mm
– BEAMS – 25 mm
– COLUMNS – 40 mm
– FOUNDATIONS & FOOTINGS – 50 mm
(f) WALLS/COLUMNS SHOULD BE POURED, IF POSSIBLE, IN A FULL MONTH POUR AS SOON AS POSSIBLE AFTER THE BASE HAS BEEN CONCRETED (2 TO 3 DAYS)

2 REINFORCEMENT:
(a) REINFORCEMENT TO BE HIGH YIELD SQUARE TWISTED BARS TO B.S. 4461
(b) BENDING DIMENSIONS TO B.S. 4466
(c) THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL SPACER BLOCKS, CHAIRS AND TYING WIRE
(d) EXAMPLE: 16.T12 – 07 – 150 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 07 AT 150mm CENTRE TO CENTRE SPACING

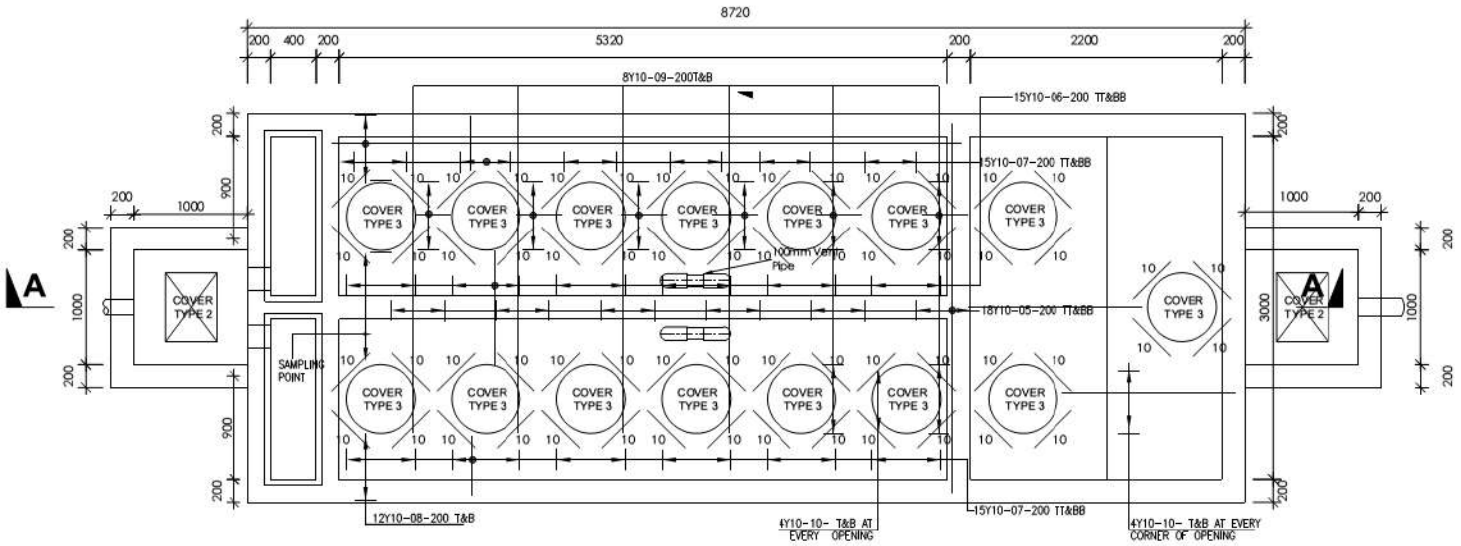
3 JOINTS:
(a) THE POSITION AND NUMBER OF INTERMEDIATE JOINTS TO BE AS DIRECTED BY THE ENGINEER OR AS SHOWN IN THE DRAWINGS.
BEFORE PLACING FRESH CONCRETE THE OLD SURFACE SHALL BE ROUGHENED AND ALL LAITANCE AND LOOSE MATERIAL REMOVED.
THE SURFACE SHALL BE THOROUGHLY WETTED BUT EXCESS WATER SHOULD BE REMOVED SO THAT THE CONSTRUCTION JOINTS ARE IN A SATURATED BUT SURFACE DRY CONDITION
(b) ALL WALL/COLUMN BASE CONNECTIONS SHOULD HAVE 100mm KICKER UNLESS OTHERWISE SPECIFIED
(c) THE uPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
(d) JOINT FILLER TO B.S. 5292 AND TO BE APPROVED BY THE ENGINEER

4 ABBREVIATIONS:
T. – TOP
B – BOTTOM
N.F. – NEAR FACE
F.F. – FAR FACE
E.F. – EACH FACE
E.W. – EACH WAY

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. R807/01

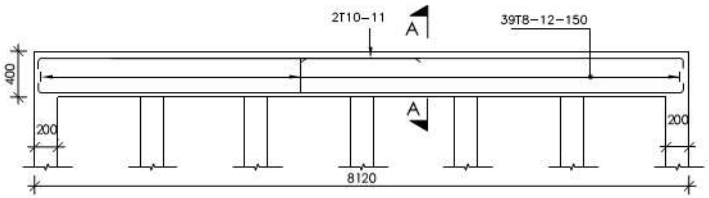
ANAEROBIC BAFFLED REACTOR

ISO 9001:2008 CERTIFIED



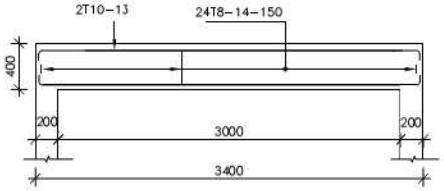
TOP SLAB PLAN

SCALE 1:50



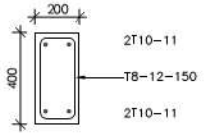
BEAM B1

SCALE 1:100



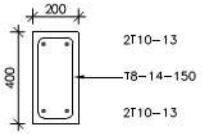
BEAM B2

SCALE 1:100



BEAM B1 SECTION A-A

SCALE 1:50



BEAM B2 SECTION A-A

SCALE 1:50

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(c) WATER IN CONCRETE MIXES TO B.S. 3148
(d) CONCRETE CLASSES TO BE AS FOLLOWS:–
MASS CONCRETE FILL AND BUNDING MIX, CLASS 15/40
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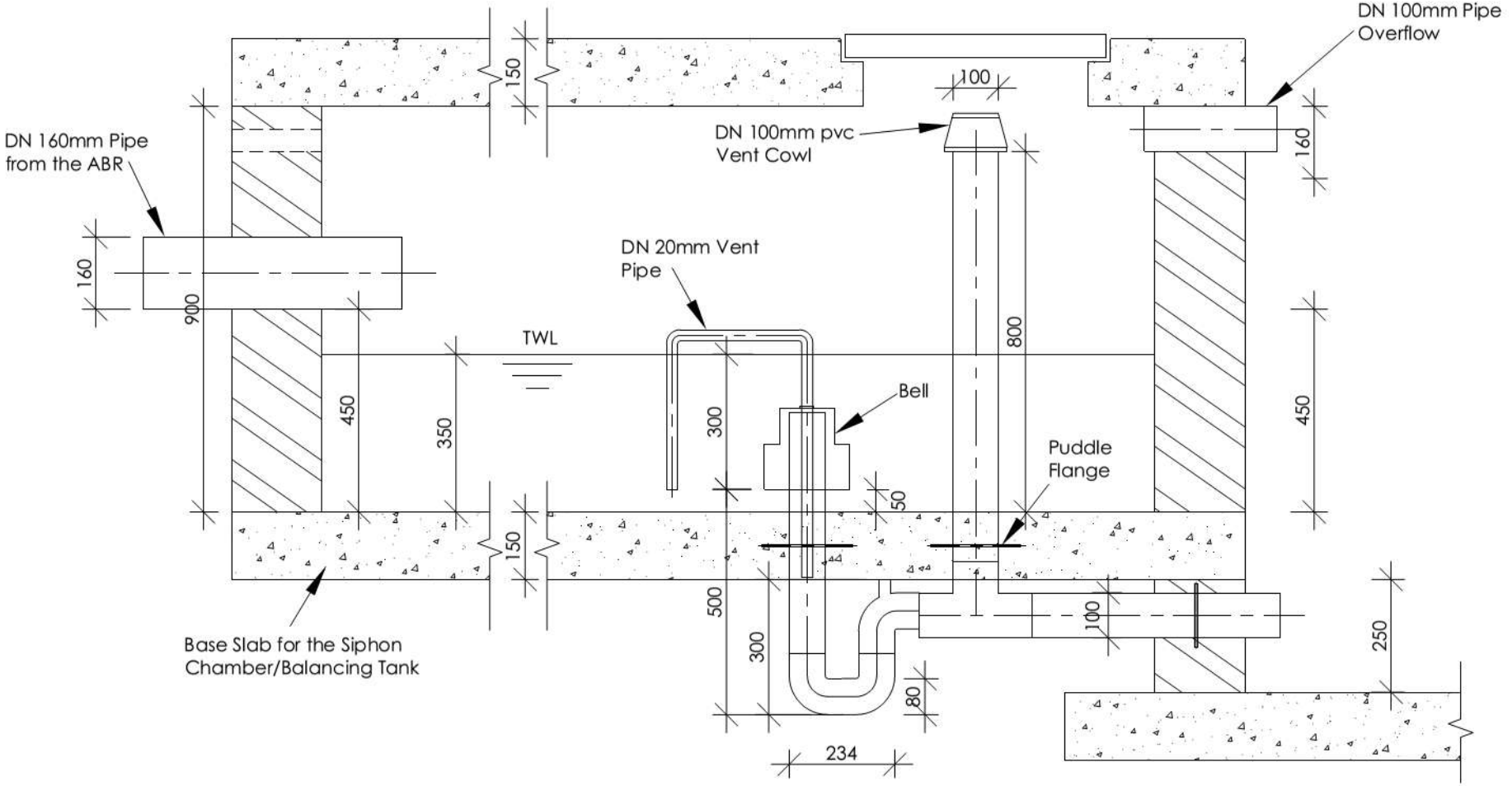
E.F. – EACH FACE
E.W. – EACH WAY

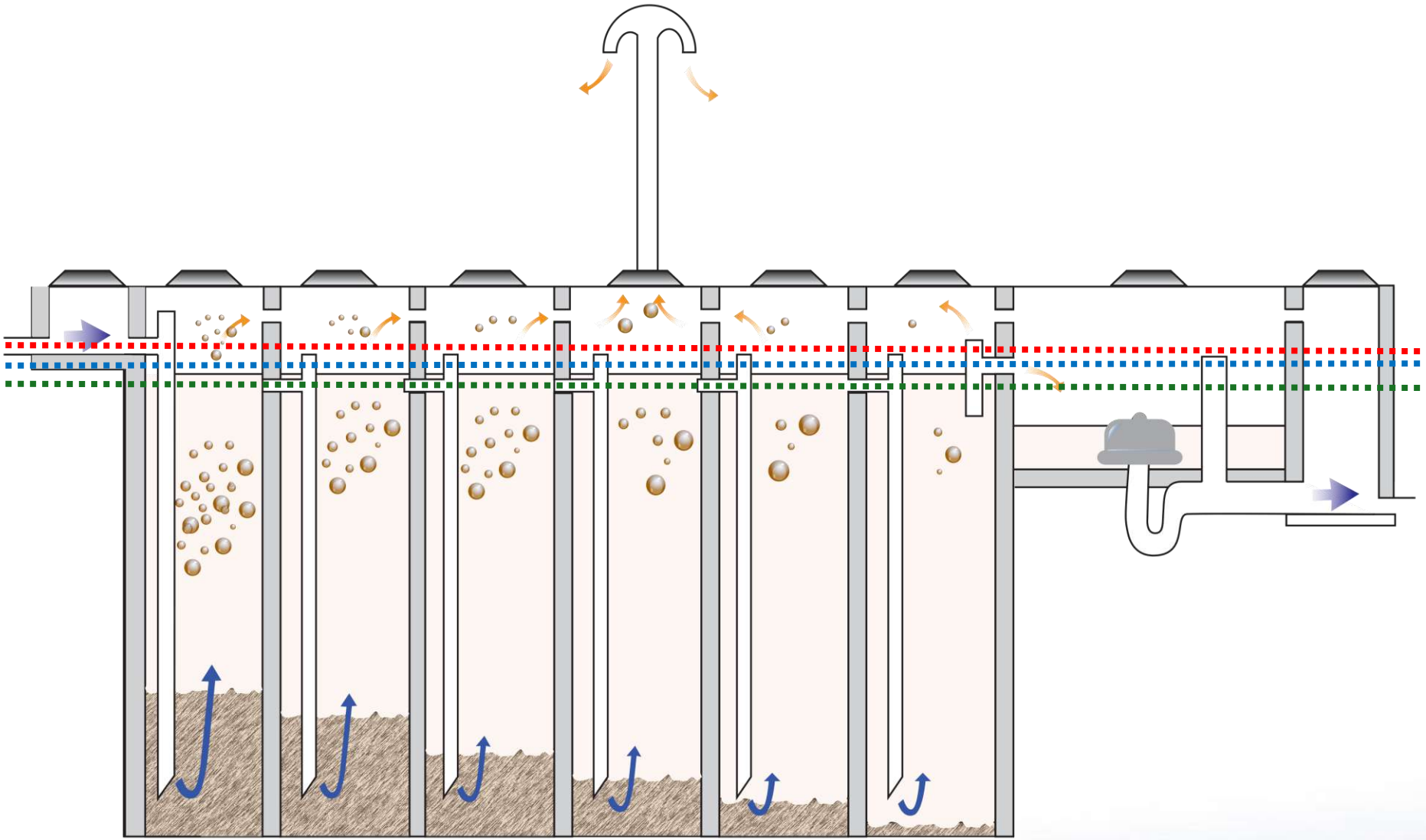
5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. RBBF/01

ANAEROBIC BAFFLED REACTOR



ANAEROBIC BAFFLED REACTOR

Importance of Levels

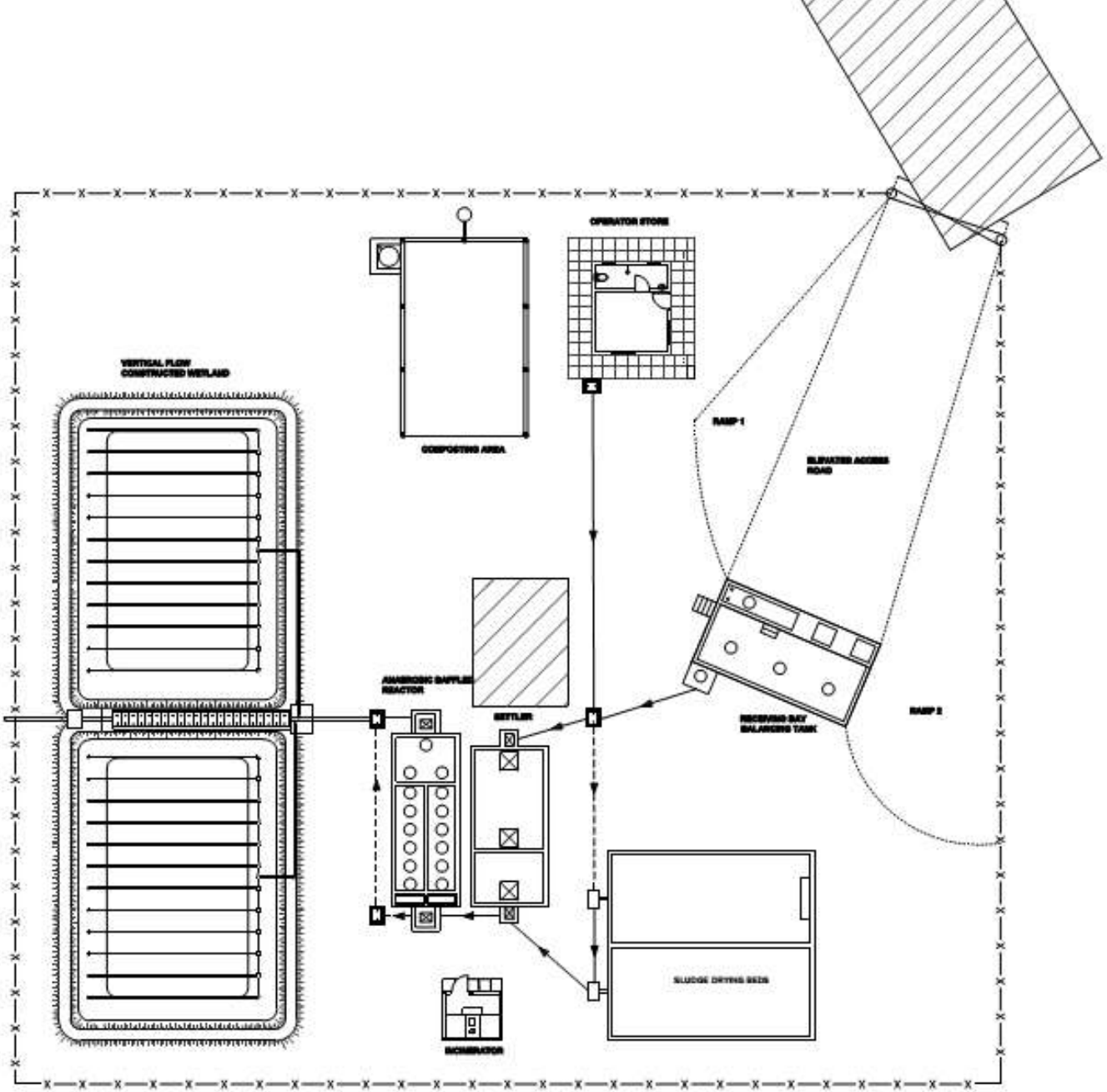


INSTALLATION OF THE SIPHON

DIFFERENT EXAMPLES OF ABR

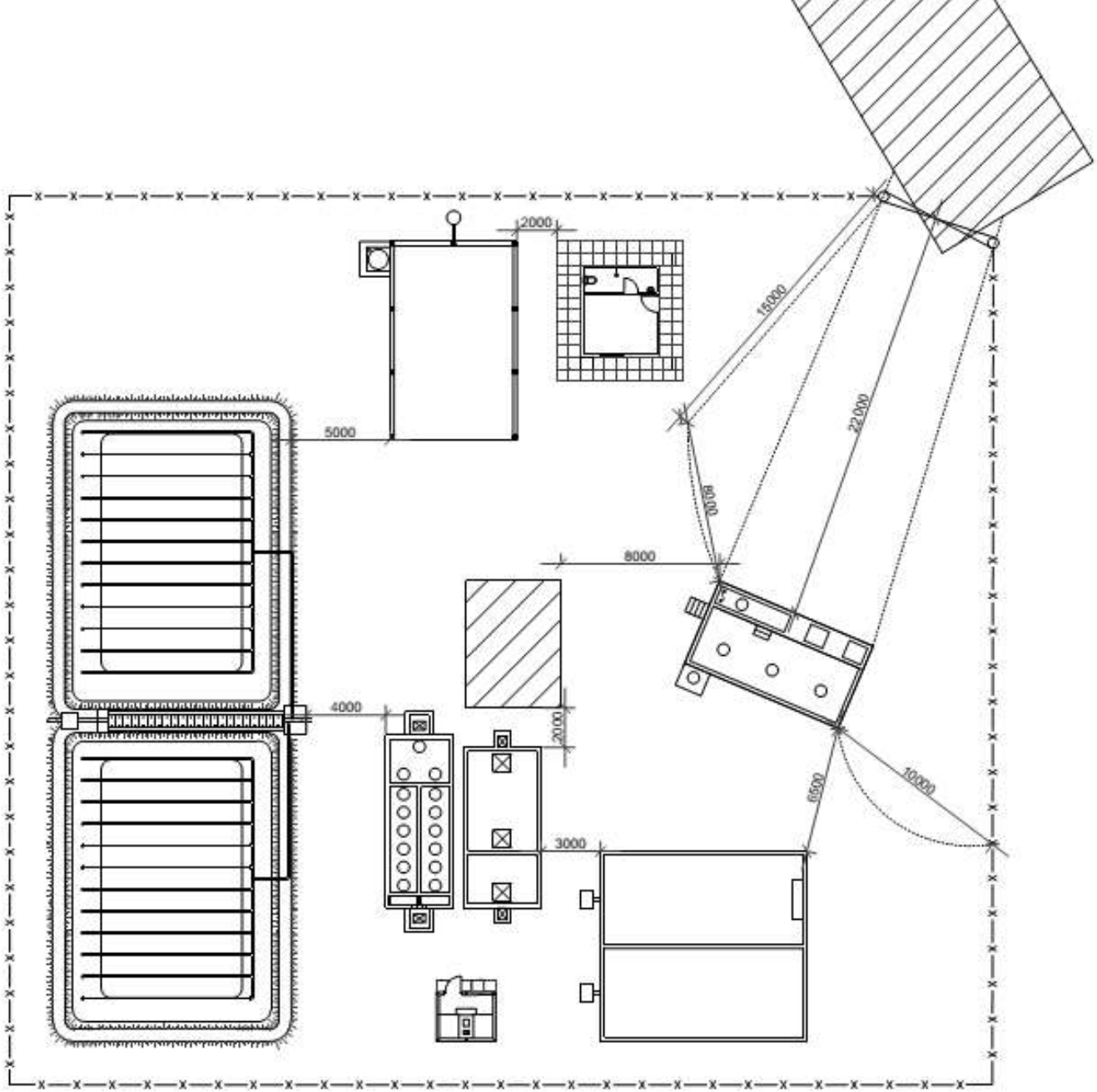
Setting Out of the DTF Modules

LAYOUT PLAN



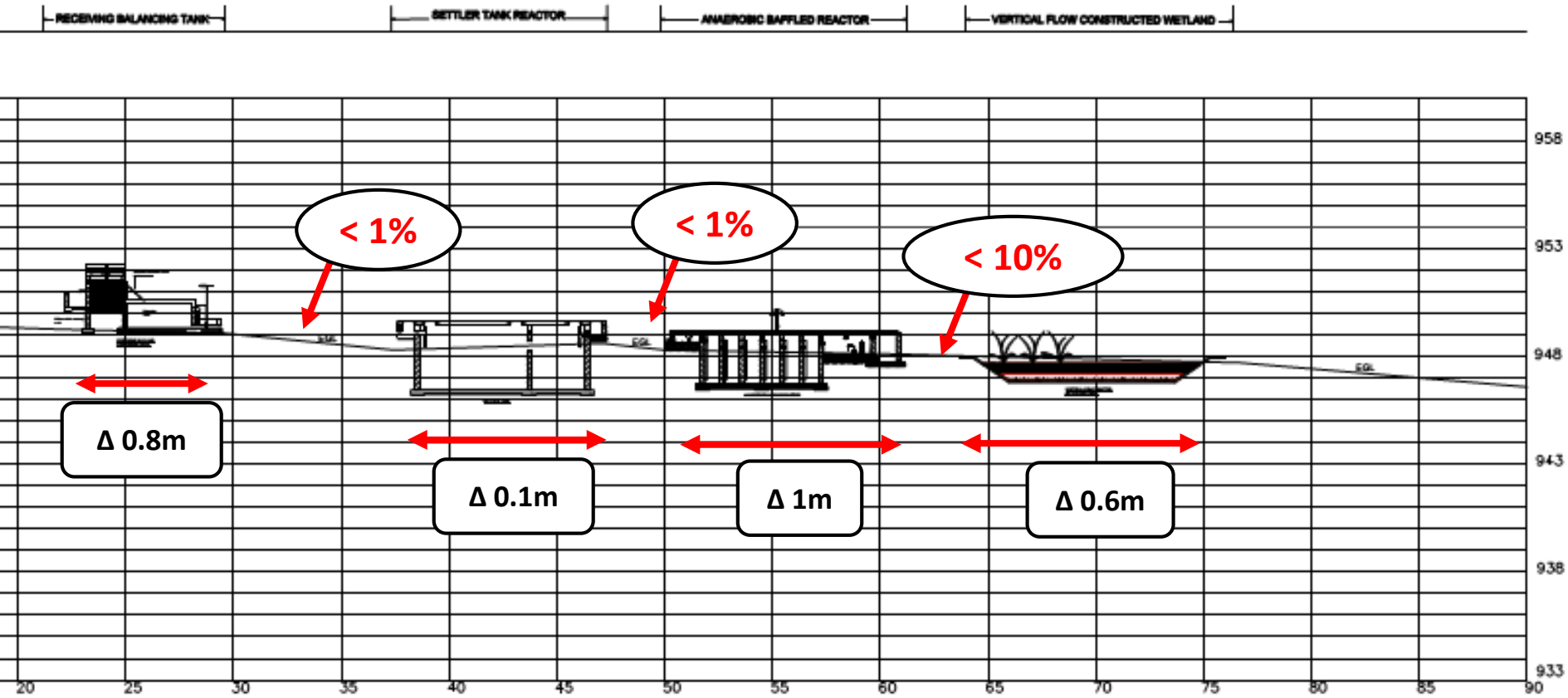
LAYOUT PLAN OF THE PIPEWORK

LAYOUT PLAN

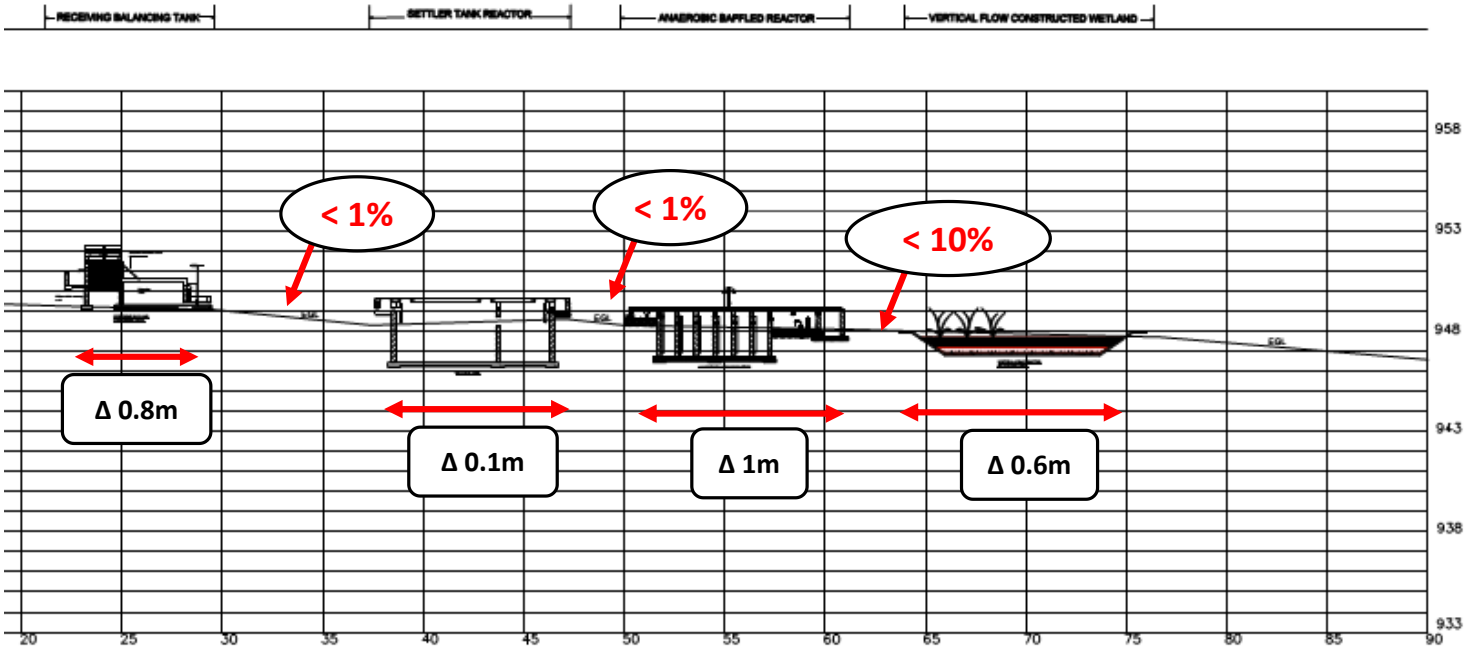


LAYOUT PLAN SHOWING DIMENSIONS

LONGITUDINAL PROFILE



LEVELS

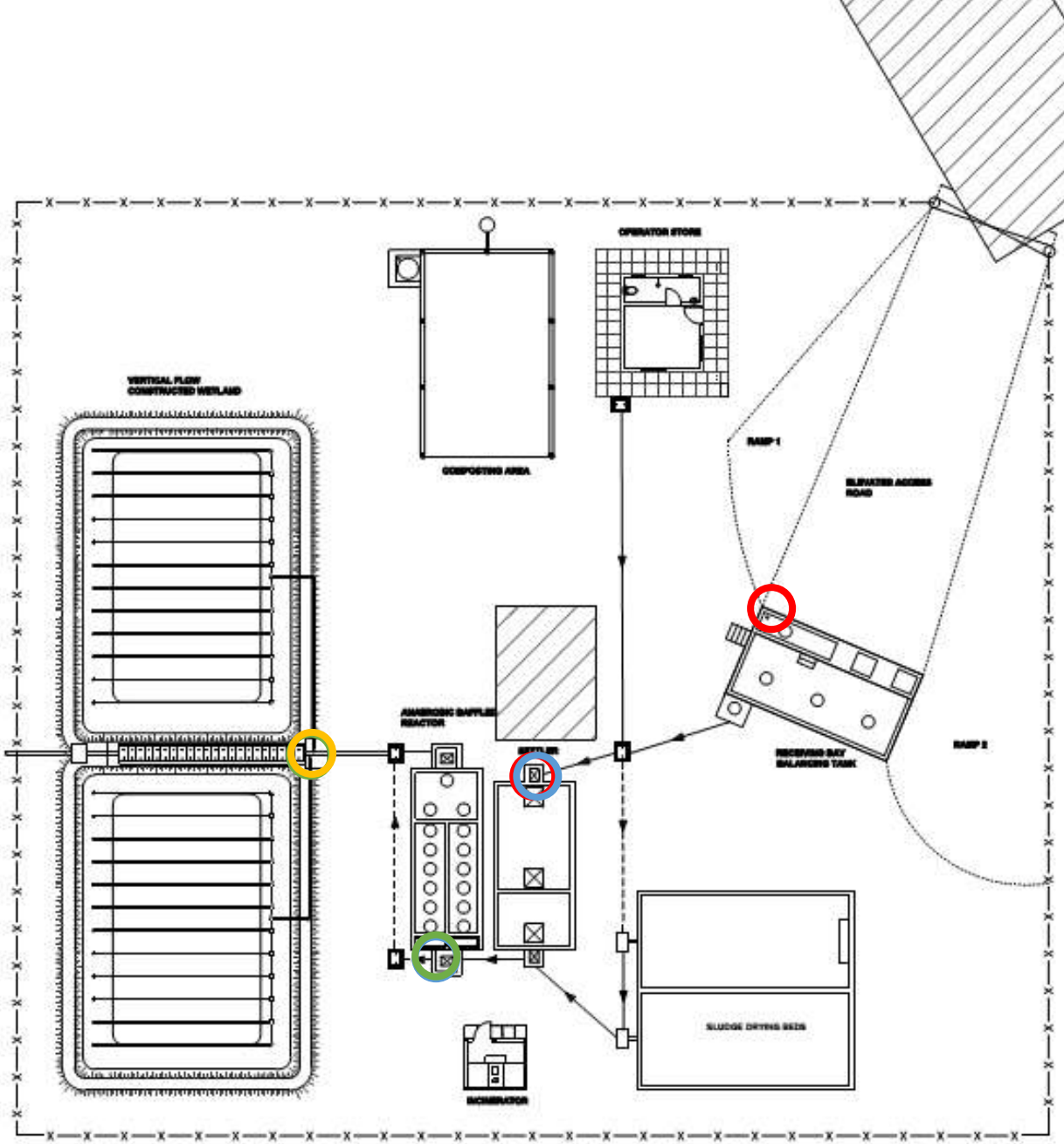


Module inlet	Distances of piping [m]	Minimum level difference [m]
Inlet RBBT and Inlet Settler	10	0.8 + 0.1 = **0.9**
Inlet Settler and inlet ABR	4	0.1 + 0.04 = **0.14**
Inlet ABR and Inlet VFCW	5	1 + 0.5 = **1.5**
Inlet VFCW and Water body	> 10	**> 0.1**

PROCEDURE (in the case of Oloolaiser DTF)

1. Mark the position of the first module RBBT with pegs (on the 4 corners), using the distances from the layout plan
2. Mark the position of the Settler using the distances from the layout plan and double checking the expected level from the longitudinal profile
3. Same way: mark the position of the ABR (distances double checked with levels)
4. Same way mark the position of the VFCW (distances double checked with levels)
5. Mark the position of the SDB, the Operator Store and the incinerator using the layout plan (levels not as important as with the rest of the modules)

Remember: the BoQ has been done according to the initial setting out. Changing the setting out might lead to a variation in costs (excavation)



LAYOUT PLAN OF THE PIPEWORK

Δ 0.9 m

Δ 0.14 m

Δ 1.5 m

Δ > 0.1 m

DTF Construction Monitoring

Request for Action

When: Every time a new major task is to be started

What is it about: Communication from the Contractor to the WSP – request for approval or acknowledgment of a new action

Who prepares: The Site Agent

Who approves: The Resident Engineer

REQUEST FOR ACTION

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

RFA number: ..... **Date of issue:** .....

From the **site Agent** (Contractor) to the **Resident Engineer** (WSP)	For:	
	Clarification	
	Information	
	Decisions	
	Inspections/Approvals	

REQUEST:

On behalf of Contractor :

Name:.....Sign:.....Date:.....

Comments:

Received and approved by the Resident Engineer – WSP

Name:.....Sign:.....Date:.....

Copy to:

1. Contractor
2. Resident Engineer (WSP)
3. WSTF representative

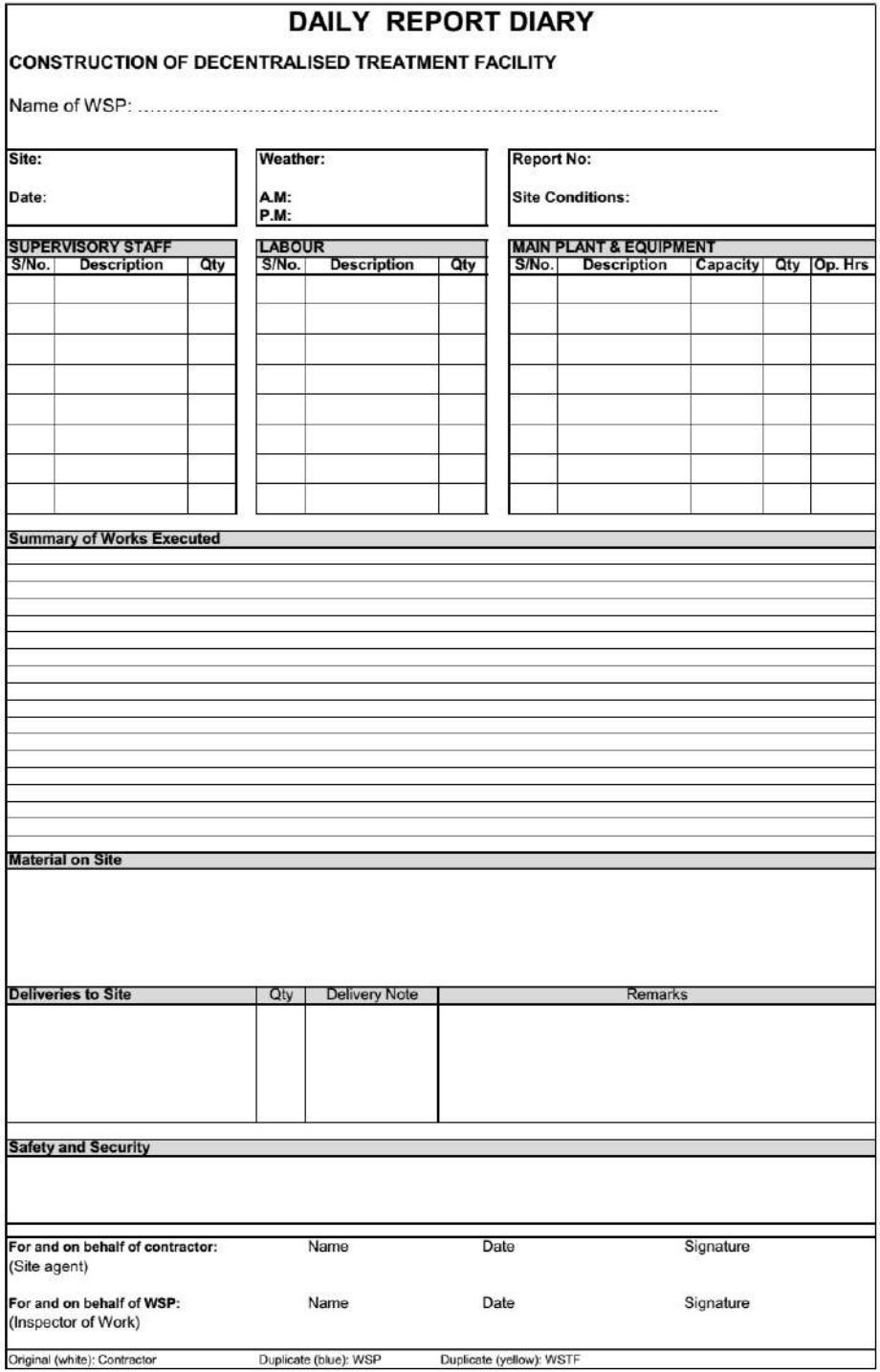
Daily Report Diary

When: Every day of the construction

What is it about: Reporting of the work being undertaken on a daily basis

Who prepares: The Site Agent

Who approves: The Inspector of Work



DAILY REPORT DIARY

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

Site:	Weather:	Report No:
Date:	A.M: P.M:	Site Conditions:

SUPERVISORY STAFF

S/No.	Description	Qty

LABOUR

S/No.	Description	Qty

MAIN PLANT & EQUIPMENT

S/No.	Description	Capacity	Qty	Op. Hrs

Summary of Works Executed

Material on Site

Deliveries to Site	Qty	Delivery Note	Remarks

Safety and Security

	Name	Date	Signature
For and on behalf of contractor: (Site agent)			
For and on behalf of WSP: (Inspector of Work)			

Original (white): Contractor Duplicate (blue): WSP Duplicate (yellow): WSTF

Approval for Commencement of Concrete Placing

When: Every time concrete is to be placed

What is it about: Inspection of the concrete placement for approval

Who requests: The Contractor

Who inspects: The Inspector of Work and Resident Engineer

Who approves: The Resident Engineer

APPROVAL FOR COMMENCEMENT OF CONCRETE PLACING

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP.....

No:

Contractor's Name and Address:

STRUCTURE:
ELEMENT:
REF. DRAWINGS:
CONCRETE CLASS: **CONCRETE VOLUME:** m3

CHECK ITEMS		Inspection				Follow-up Inspection				Remarks
		Contractor		IoW (WSP)		Contractor		RE (WSP)		
		Check	Date	Check	Date	Check	Date	Check	Date	
Foundation Preparation	No loose material									
	Clean Surface									
Formwork	Well supported									
	Correct internal dimensions									
	Correct position (Surveyed)									
	Clean and Oiled									
	Joints mortar tight									
Reinforcement	Assembly (No. and spacing)									
	Diameter and Type (Y/R/T)									
	Cover to reinforcement (mm)									
	Cleanliness, no formwork oil									
	Binding and fixtures									
Surface Finish	Control for finished levels									
	Floating equipment on site									
Embedded Item	Correctly positioned									
	Correct number									
	Fixed securely									
Waterproofing	Yes / No									
	Description:									
Concrete Placing	Vibrators on site									
	Placing equipment available									
Concrete Curing	Curing Material Availability									
Any Other Item										

Inspection Request: (Contractor) Signature:_____ Date:_____ Time:_____

Inspection Done: (Inspector of Work WSP) Signature:_____ Date:_____ Time:_____

Follow up Inspection Request: (Contractor) Signature:_____ Date:_____ Time:_____

FINAL APPROVAL: (Resident Engineer WSP) **Signature:**_____ **Date:**_____ **Time:**_____

Joint Work Measurement

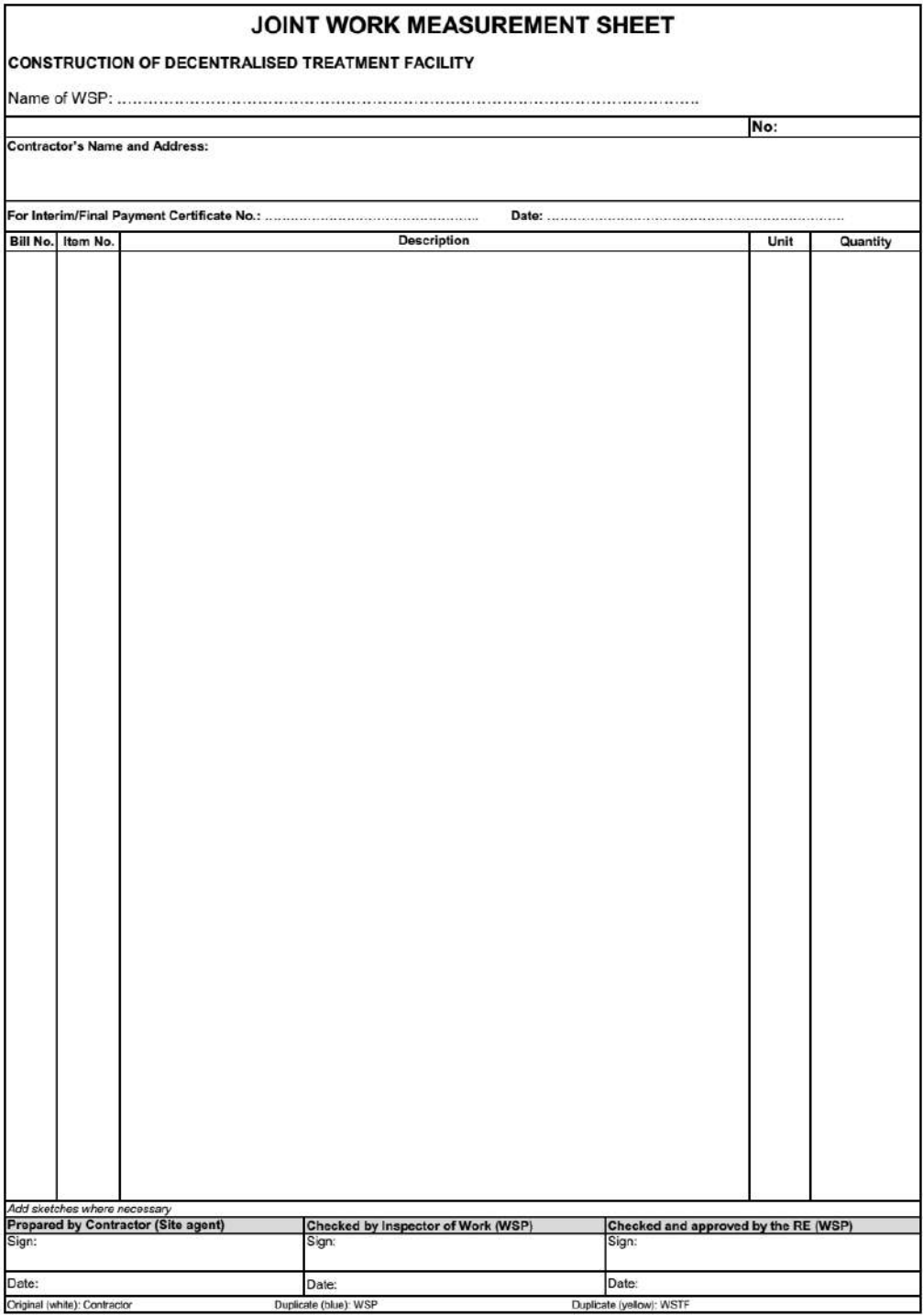
When: Every week (at least)

What is it about: Measuring the actual material used to compare with the contractual BoQ

Who prepares: The Site Agent

Who checks: The Inspector of Work

Who approves: The Resident Engineer



JOINT WORK MEASUREMENT SHEET

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

No:

Contractor's Name and Address:

For Interim/Final Payment Certificate No.: ..... **Date:** .....

Bill No.	Item No.	Description	Unit	Quantity

Add sketches where necessary

Prepared by Contractor (Site agent)	Checked by Inspector of Work (WSP)	Checked and approved by the RE (WSP)
Sign:	Sign:	Sign:
Date:	Date:	Date:

Original (white): Contractor Duplicate (blue): WSP Duplicate (yellow): WSTF

Interim Payment Certificate

When: After the agreed % of the work that has been completed

What is it about: Document for the payment of the work done. Two IPC in total

Who prepares: The Contractor

Who checks: The Resident Engineer

Who approves: The Managing Director

INTERIM PAYMENT CERTIFICATE

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: ……

		No:
Contract Title: **Contract Number:** **Contract Start Date:**		
Employers Name and Address:		
Contractor's Name and Address:		

Percentage of payment for this certificate:	……..%
	AMOUNT in KSH
Accepted Contract Value:	
Paid to Date:	
Remaining Contract Balance:	
Payment for work executed for this certificate:	
Description of work executed:	
Payment for other claims including variation:	
Description of claims including variations (must have supporting documents):	
Sub-total	
Deduct 10% Retention fee	
Withholding Tax 3%	
Deduct 6% VAT	
NET AMOUNT DUE	

I Certify that the sum of KSH (Kenya Shillings)

……

only is due to

……

and payable on demand and according to terms of Contract

Prepared by Contractor	**Received and checked by Resident Engineer (WSP)**	**Appoved by Managing Director (WSP)**
Name: Date: Sign:	Name: Date: Sign:	Name: Date: Sign:

Final Payment Certificate

When: After the substantial completion of the DTF, once the certificate of substantial completion has been issued

What is it about: Document for the last payment of the work done

Who prepares: The Contractor

Who checks: The Resident Engineer

Who approves: The Managing Director

FINAL PAYMENT CERTIFICATE

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

Contract Title: **Contract Number:** **Contract Start Date:**	
Employers Name and Address:	
Contractor's Name and Address:	

Percentage of payment for this certificate:	.....%
	AMOUNT in KSH
Accepted Contract Value:	
Paid to Date:	
Remaining Contract Balance:	
Payment for work executed for this certificate:	
Description of work executed:	
Payment for other claims including variation:	
Description of claims including variations (must have supporting documents):	
Sub-total	
Deduct 10% Retention fee	
Withholding Tax 3%	
Deduct 6% VAT	
NET AMOUNT DUE	

I Certify that the sum of KSH (Kenya Shillings)

.....

only is due to

.....

and payable on demand and according to terms of Contract

Prepared by Contractor	**Received and checked by Resident Engineer (WSP)**	**Appoved by Managing Director (WSP)**
Name: Date: Sign:	Name: Date: Sign:	Name: Date: Sign:

Certificate of Substantial Completion

When: After the substantial completion of the DTF

What is it about: Certify that the DTF is substantially completed stating the liability period and the list of remaining items to be completed or corrected

Who prepares: The Resident Engineer

Who approves: The Managing Director and the Contractor

CERTIFICATE OF SUBSTANTIAL COMPLETION

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

Contract Title:	
Contract Number:	
Initial Contract Amount:	
Total Contract Amount:	
Contract Start Date:	
Contractor's Name and Address:	
Employers Name and Address:	

In accordance with the Conditions of Contract, the Works were inspected and are certified as being complete on
Date: ...../...../.....

The Defects Liability Period ends on
Date: ...../...../.....

☐ Complete ☐ Partial - List Areas Accepted: .....

Substantial Completion and warranty time periodes affected are defined in the General Conditions of the Contract. All parties listed below have reviewed the work under this Contract and recommend issuance of the substantial completion. The WSP will assume full possession and responsibility for the project and designated area, less punch list items, on the above listed. All warranties will start the day of substantial completion, with the exception of those items on the punch list, which will start on the date defined below.

Punch List:
A list of items to be completed or corrected, prepared by the Resident Engineer (WSP), checked and augmented as required by the Contractor is appended hereto. The failure to include any item on such list does not relieve the Contractor of the responsibility to complete all work in accordance with the contract documents.
The Contractor shall complete or correct the work on the punch list appended herto by

Date: ...../...../.....

The punch list consists of .....items

Notes:

1. Final Payment Certificate to be processed 7 days after the elapse of the Contract period and succesful completion of work under the Contract.
2. The Employer takes over the Site as from .....
3. The contractor is supposed to hand over the as built drawings within the Defects Liability Period

Contractor	Resident Engineer (WSP)	Managing Director (WSP)
Name:	Name:	Name:
Date:	Date:	Date:
Sign:	Sign:	Sign:

Certificate of Final Acceptance

When: After the liability period when the DTF is completed

What is it about: Certify that the DTF is completed for the official hand-over of the site to the WSP

Who prepares: The Resident Engineer

Who approves: The Managing Director and the Contractor

CERTIFICATE OF FINAL ACCEPTANCE

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: ……

Contract title:

Contract No:

Initial Contract Amount:

Total Contract amount:

Contract Start Date:

Date of Final Acceptance:

Contractor Name and Address:

Employer's Name and Address:

Signing of the Final Acceptance form shall certify that the work contained in the subject contract has been inspected and assessed by the parties listed below, that all punch list items on the Substantial Completion form have been completed, that the contractor has fulfilled all his contractual obligations, that the warranties have been accepted and the contractor may be authorized to receive final payment in full, including all retainage.

DECLARATION

"……" (Name of the Project) which is supervised by "……" (Name of the WSP) is completed by the Contractor in accordance with the drawings, technical specifications and science and craft rules.
Supervisor decided that Permanent Works are satisfactory in accordance with the Contract and the final acceptance of the said work has been approved by the Supervisor.

SIGNATURES

Contractor …… (Contractor's Name and Stamp)

Name:……Sign:……Date:……

Resident Engineer - **WSP** …… (WSP's Name)

Name:……Sign:……Date:……

Managing Director - **WSP** …… (WSP's Name)

Name:……Sign:……Date:……

ENGINEER'S INSTRUCTION

When: Every time the WSP needs to give instruction to the Contractor when changes occur

What is it about: Detailed description of the instruction indicating whether variations are involved

Who prepares: The Resident Engineer

Who approves: The Contractor

ENGINEER'S INSTRUCTION

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP: .....

Instruction number: ..... **Date of issue:** .....

The Contractor is instructed to act on or carry out works in accordance with the undernoted instruction

To:.....(Contractor)
From: .....(Resident Engineer – WSP)

INSTRUCTION:

The following instruction leads to a variation ☐ YES ☐ NO

Prepared by Resident Engineer (WSP)	**Received and approved by Contractor:**
Name:	Name:
Date:	Date:
Sign:	Sign:

Copy to:
1. Contractor
2. Resident Engineer (WSP)
3. WSTF Representative

Variation Order

When: When a variation has been agreed between the Contractor and the WSP

What is it about: Basis for the confirmation of the variation: breakdown of the varied work with calculation of incurred costs

Who prepares: The Contractor (in agreement with the Resident Engineer)

Who approves: The Managing Director

VARIATION ORDER

CONSTRUCTION OF DECENTRALISED TREATMENT FACILITY

Name of WSP:.....

Contract Title:	
Contract Number:	
Contract Start Date:	
Employer's Name and Address:	
Contractor's Name and Address:	

Basis for the confirmation of the variation

Variation Application form fully filled: ☐
Supporting documents attached: ☐
Quotation for additional material attached : ☐
Contractor informed Employer in time of the variation: ☐

Breakdown of Works confirmed as a variation to the contract

No	Description	Unit	Quantity	Unit Rate (Kes)	Cost (Kes)
				Cost of Variation (excl. VAT)	
				VAT (16%)	
				Total Cost of Variation	
				Original Contract Price	
				Revised Contract Price	

Note: The price of the variation is due and payable at the same time as the next Payment Certificate after it is carried out unless a different time is agreed.

Extension of Time for Completion

Estimated time for Variation: .....days Revised Completion Date:.....

Reason for Variation & Effect on Works (if not requested by WSP):

Variation Acceptance

The Contractor and the WSP accept this Variation Order and acknowledge and affirm that it is incorporated into the Contract as varied.

On behalf of the Contractor:	On behalf of WSP:
Name:	Name:
Date:	Date:
Sign:	Sign:

Notes:

1. *The variation order Form has to be prepared by the Resident Engineer (WSP) and approved by the Managing Director*
2. *No approval shall be given without a fully filled variation application form and supporting documents. If the variation is based on an instruction given at the site by the responsible supervisor from the WSP, the contractor is supposed to attach a copy of this instruction to the application form.*

List of Construction Monitoring Forms

- Contractor Side
- WSP Side

No	Form	Prepared by	Received, checked and approved by
01	Request for Action	Site Agent	Resident Engineer
02	Daily Report Diary	Site Agent	Inspector of Work
03	Monthly report	Resident Engineer	Managing Director
04	Approval for commencement of concrete placing	Site Agent	Inspector of Work and Resident Engineer
05	Joint Measurement sheet	Site Agent	Resident Engineer
06	Interim Payment Certificate	Contractor	Resident Engineer and Managing Director
07	Final Payment Certificate	Contractor	Resident Engineer and Managing Director
08	Certificate of Substantial Completion	Resident Engineer	Managing Director and Contractor
09	Certificate of Final Acceptance	Resident Engineer	Managing Director and Contractor
10	Engineer Instruction Form	Resident Engineer	Contractor
11	Variation Order Form	Contractor and Resident Engineer	Managing Director

WSTF Involvment

No	Form
01	Request for Action
02	Daily Report Diary
03	Monthly report
04	Approval for commencement of concrete placing
05	Joint Measurement sheet
06	Interim Payment Certificate
07	Final Payment Certificate
08	Certificate of Substantial Completion
09	Certificate of Final Acceptance
10	Engineer Instruction Form
11	Variation Order Form

Legend

Copy to send to WSTF for approval (sending of the disbursement)

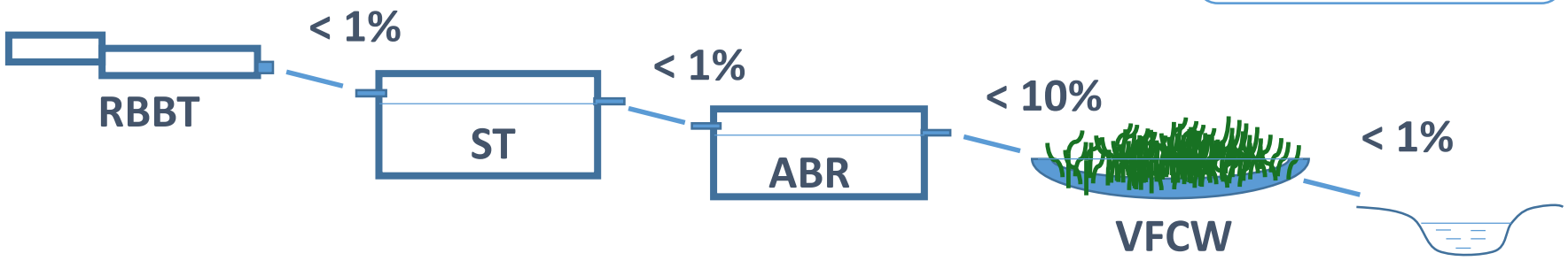
Copies to attach to the main document

CONSTRUCTION OF A DTF

DO's and DON'Ts

LEVELS

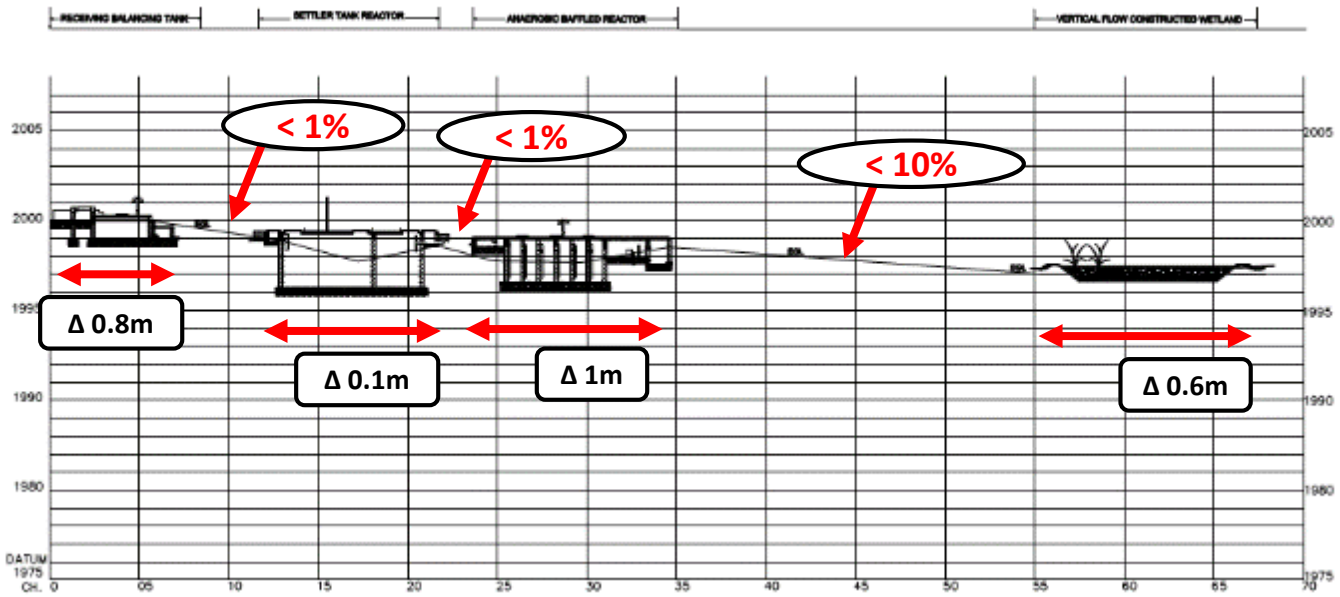
$$\text{Slope \%} = \frac{\Delta h}{d}$$



Ensure sufficient gradient to enable the DTF to operate by gravity:

- At least 1% slope between each module (10% between ABR and VFCW)
- Design head of each module which is the level difference between the inlet and outlet

- Minimum slope between modules: minimum of 0.5 m
- Head difference of all modules: 3.15 m

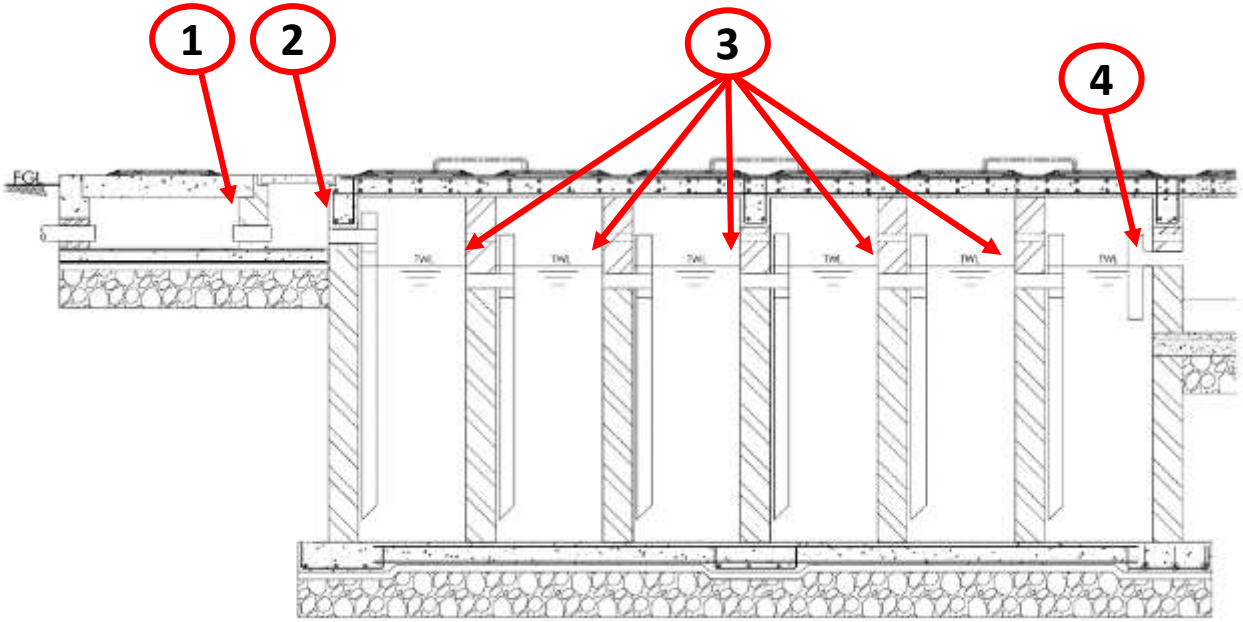


Module inlet	Distances [m]	Minimum level difference [m]
Inlet RBBT and Inlet Settler	5	0.8 + 0.05 = 0.85
Inlet Settler and inlet ABR	1	1 + 0.1 = 1.1
Inlet ABR and Inlet VFCW	20	1 + 0.2 = 1.2
Inlet VFCW and Water body	450	4.5

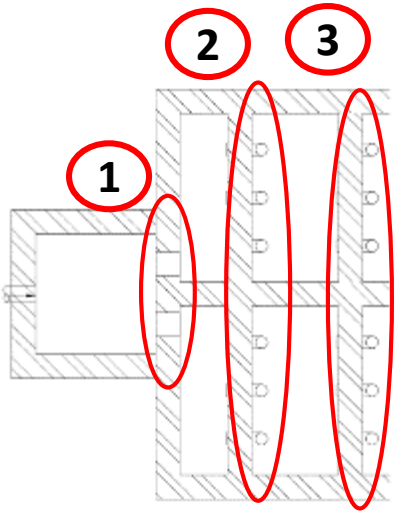
ABR Pipes

There are 4 different levels of pipes. It is extremely important that each pipes of the same level is placed accurately to ensure equal distribution and avoid shortcuts:

Use water tube to ensure straight level



ABR Cross-section



Inlet ABR Layout plan

Concrete Work

Concrete class 25 (1 : 1.5 : 3)

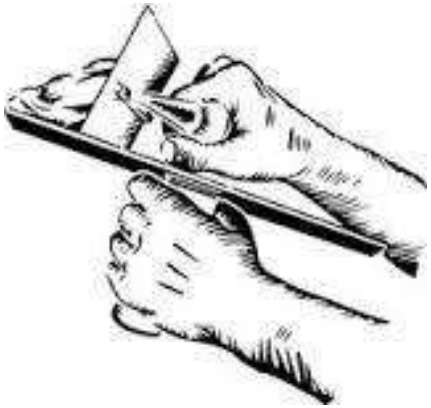
- Correct ratio of cement/sand/aggregate (volumetric boxes)
- Mix of concrete with clean water
- Use of concrete mixer (no hand mixing)
- Slump test (cone) to be done at each mixing of concrete to test the correct amount of water
- Smooth transport to prevent adulteration, segregation and loss of ingredients
- Pouring to be done as close as possible to final position

CURING

- Curing process starts 4h after concrete placing
- Keep moistened for a minimum of 7 days and protect from heat with a piece of fabric during the first 4h to keep the plastering moist and avoid cracks

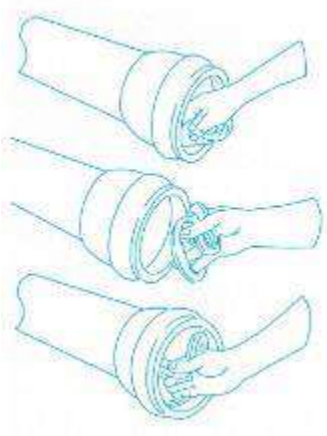
PLASTERING

- Plaster walls internally and externally
- Ensure that a proper water proofing is added to the plastering mix. Clean and remove all roughness and loose material of the exposed surface (brushing) before plastering
- Wet down prepared areas immediately prior to use
- Mortar joints should be bonded and sound. Any defective mortar joint should be raked out to a depth of 12.0mm and repointed using water proofing additive
- Ensure that finishing mortar and plastering are mixed with clean water in a clean drum using paddle mixer



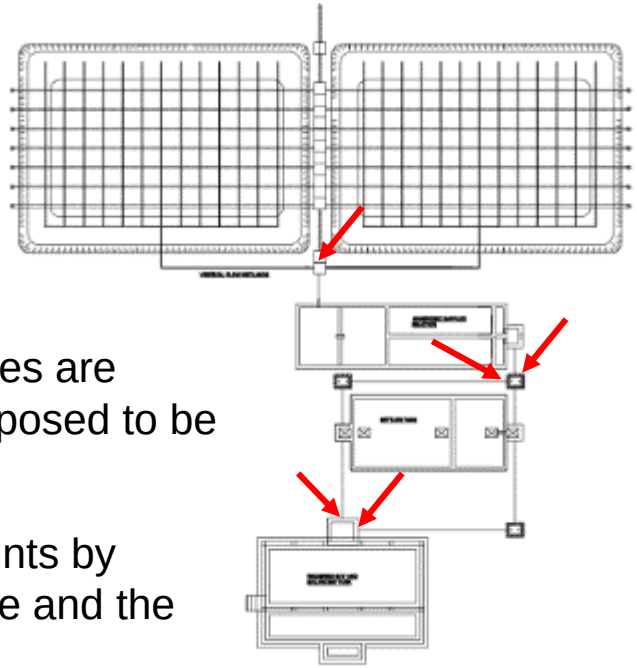
0.75Ltrs of water proofing additive per 25kg bag of cement

Plugs and Socket End Pipes



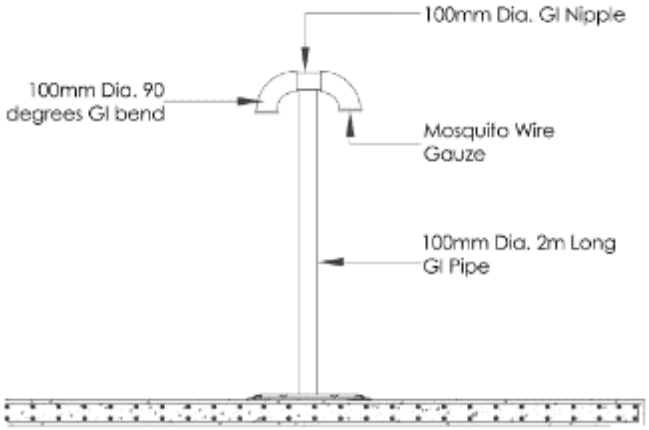
A minimum of 5 PVC plugs:

- ✓ RBBT outlet and bypass
- ✓ ST outlet and bypass
- ✓ VFCW bypass



- Ensure that the socket end of the pipes are placed where the PVC plugs are supposed to be located
- Ensure water tightness of the plug joints by adding a rubber ring between the pipe and the plug

Exhaust Pipes



1 for the settler and 2 for the ABR

- 100mm uPVC (class E) vent pipe with 3 coats of quality gloss paint
- PVC wire gauze + vent caps
- Protective concrete stub (min. 1m)
- Provide aeration holes in between chambers to allow the gas to reach the exhaust pipes

Metal and Surface Reinforcement

- All reinforcement (mesh and bars) must be covered with concrete to avoid contact with water, oxygen and other strong oxidants or acids and therefore avoid rust
- All metal surfaces (screens) must be painted with 1 coat of primer and 2 coats of **quality** gloss paint

Manholes and Covers

- Inspection chamber placed every 25m of buried pipe and any bend of the pipe
- Ensure proper manhole benching to lead the flow
- Encourage the implementation of reinforced fibreglass manhole cover (over polythen) as much as possible
- For PCC (in the VFCW) ensure :
  - proper dimensioning (to avoid heavy lifting)
  - recess on the supporting edges
  - Metal framework
  - Two lifting handles

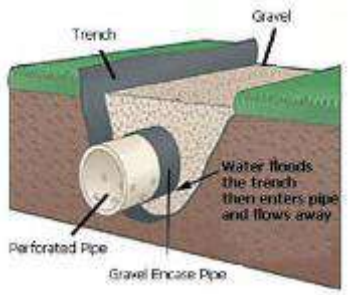
WATER TIGHTNESS TEST

- Each tank should be filled with water (drinking water or from a water body) for at least 48H
- The reference water level should be measured after half a day to take into account the soaking effect of the wall
- The chambers of the ABR should be filled all together progressively to avoid putting pressure on the walls

Storm Runoff Drainage

Ensure proper drainage to avoid flooding and erosion issues:

- ✓ Open trenches
- ✓ Buried perforated pipes
- ✓ Stone pitched or grass planted slope
- ✓ Partitioning walls



Access Road

Access road must be stable enough to prevent exhauster to get stuck by rainy day:

- Access road **to the DTF**: Compacted marram road laid on a hardcore compacted base
- Access road **within the DTF**: 6-10mm gravel road laid on a hardcore compacted base

CONSTRUCTION OF A DTF

CRITICAL STAGES

Stages of Construction

1. Site identification, acquisition and securing
2. Procurement of material and equipment
3. Setting out of structures
4. Construction
5. Testing of works
6. Commissioning

1. Site identification, acquisition, securing

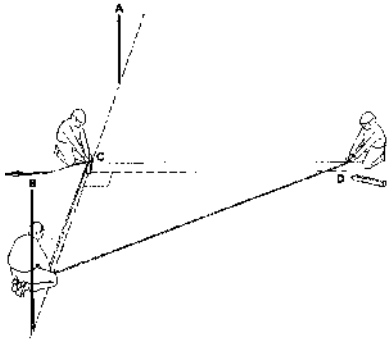
- Appropriate slopes/gradient and dimensions
- Legal documents
- Fence to restrict access

2. Procurement of materials and equipment

- Construction material of right quality
- Proper equipment for construction
- Appropriate storage of material

3. Setting out of structures

- Site clearance
- Correct position of modules (dimension and level)



4. Construction

a. Excavation for foundation

- Correct dimension and level (avoid over-excavation)
- Free from water (at least 4 hours after concrete is placed)

b. Formwork

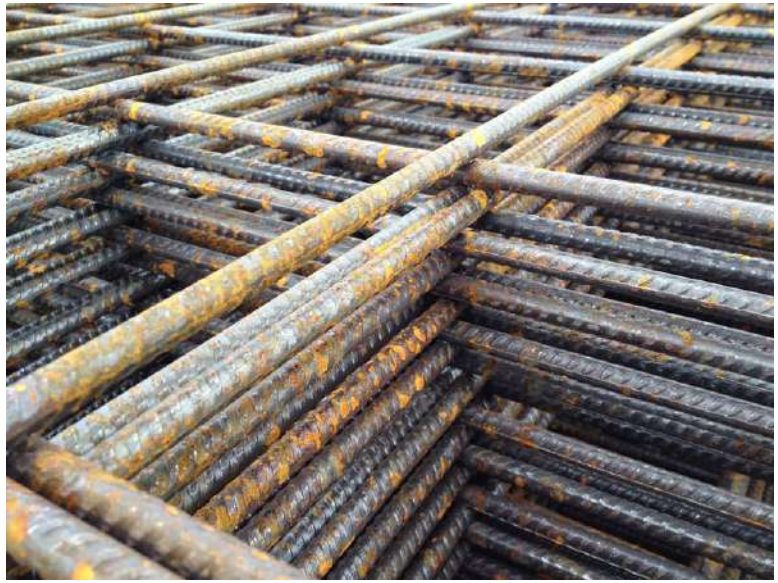
- Respected minimum period before removal
- Cleaned and dressed with clear oil before fixing
- Tight joints
- Holes and spaces tightly sealed

c. Reinforcement

- Reinforcement bars (beams and columns): right size, length and shape (see bar bending schedule)
- BRC mesh (ground slab) : right spacing and size
- No movement during concrete placing
- Should not touch the formwork

BRC Mesh A142 :
spacing 200mm
size 6 mm

Y10 reinforcement bar:
size



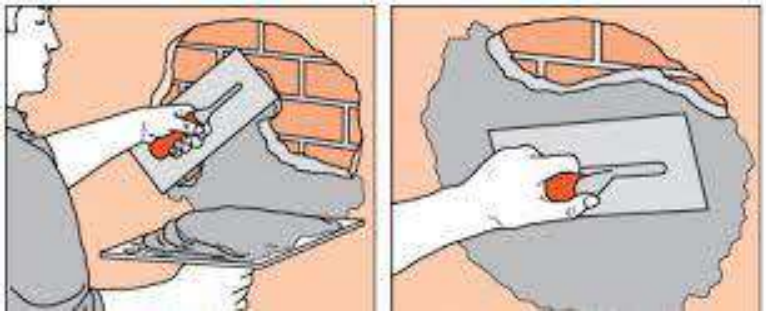
4. Concrete work

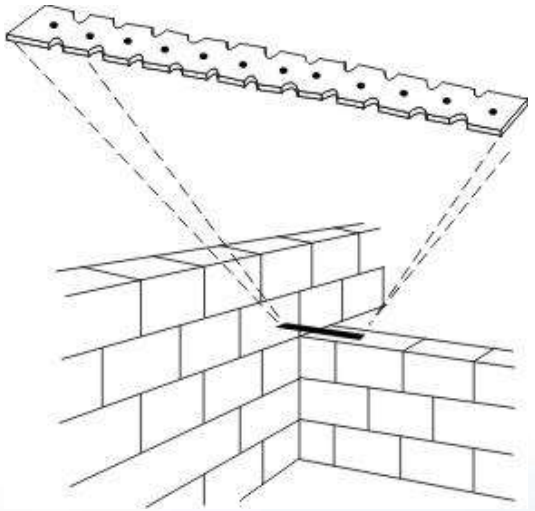
- Correct ratio of cement/sand/aggregate (volumetric boxes)
- Mix of concrete with clean water
- Slump test (cone) to be done at each mixing of concrete to test the correct amount of water
- Smooth transport to prevent adulteration, segregation and loss of ingredients
- Pouring to be done as close as possible to final position
- Curing process start 4h after concrete placing and last at least 7 consecutive days
- During the first 4h, exposed concrete surface is protected with impermeable sheeting

Concrete class 25 (1 : 1.5 : 3)

5. Masonry works

- Walls need to be straight, square and plumb (basic tools: square and plumb bob)
- Walls should be plastered (with water proof additive) and painted where specified
- Hoop iron shall be fixed every other course of bricks
- All masonry work must be plumb and square





6. Flooring, doors, windows, ironmongery, roofing

- Doors and windows shall be procured in accordance to their sizes and type.
- All the doors and windows ironmongery including locks, stays, jambs and wall passes must be of the right quality.
- Roofing must be done using treated timber

5. Testing of works

- Each tank should be filled with water (drinking water or from a water body) for at least 48H

- The reference water level should be measured after half a day to take into account the soaking effect of the wall
- The chambers of the ABR should be filled all together progressively to avoid putting pressure on the walls

6. Commissioning and Handing over

Once all necessary repairs have been done and the facility is considered operational, the certificate of completion can be signed. The DTF can be handed over to the WSP and commissioned with septage or wastewater