ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

PROPOSED DECENTRALIZED TREATMENT FACILITY AT PELELEZA AREA, MWATATE TOWN, TAITA TAVETA COUNTY

Report prepared by:

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On Behalf of TAVEVO Water and Sewerage Co. Ltd

with Funding from The Water Sector Trust Fund

October, 2020

TAVEVO Water and Sewerage Co. Ltd

Mwatate Decentralized Treatment Plant (DTF50)

Environmental and Social Impact Assessment

Final Report

DECLARATION

This Environmental and Social Impact Assessment (ESIA) study report is submitted on behalf of the Proponent, for the proposed Mwatate Decentralized Treatment Facility (DTF50) located in the Peleleza area of Mwatate Town, Taita Taveta County. The ESIA Study has been carried out in accordance with the Environmental Management and Coordination (Amendment) Act, 2015 and the Environmental (Impact Assessment and Audit) Regulations, 2003.

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I. TABLE OF CONTENTS

II. ACRONYMS

ABR	Anaerobic Baffled Reactor
ACZ	Agro-Climatic Zones
AR	Anaerobic Reactor
ASAL	Arid and Semi-Arid Lands
BMGF	Bill and Belinda Gates Foundation
BOD	Bio-chemical Oxygen Demand
CEDAW	UN Convention on the Elimination of all forms of Discrimination Against Women
COD	Chemical Oxygen Demand
dBA	decibels (loudness measure)
DEM	Digital ~Elevation Model
DLPO	District Livestock Production Office
DOSHS	Directorate of Occupational Safety & Health Services
DTF	Decentralised Treatment Facility
EA	Environmental Audits
ECDC	Early Childhood Development Centres
EHS	Environmental Health & Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GE	Google Earth
KEBS	Kenya Bureau of Standards
KfW	German Development Bank
MoH	Ministry of Health
NEMA	National Environment Management Authority
ODF	Open Defecation Free
OS	Operator Store
OSHA	Occupational Safety and Health Act
PPE	Personal Protective Equipment
RBBT	Receiving Bay / Balancing Tank
SDB	Sludge Drying Bed
SRTM	NASA's Shuttle Radar Topography Mission
SS	Suspended solids
TDS	Total Dissolved Solids
UASB	Up flow Anaerobic Sludge Blanket
UBSUP	Upscaling of Basic Sanitation for Urban Poor
UNCRC	UN Convention on the Rights of the Child
UNFCCC	UN Framework Convention on Climate Change
VFCW	Vertical Flow Constructed Wetland
WSTF	Water Sector Trust Fund

II. EXECUTIVE SUMMARY

Background

This document presents the Environmental and Social Impact Assessment (ESIA) for the proposed Decentralized Treatment Facility (DTF50) Project in Mwatate town. It is prepared to meet the Kenyan regulatory requirements. With funding from the Water Sector Trust Fund, TAVEVO proposes to develop the DT50 at Peleleza area of Mwatate town, for the treatment of faecal sludge from flush toilets for safe release of effluent into the environment.

Purpose and scope of the ESIA

An ESIA is a process. It includes the preparation of a comprehensive report (this ESIA document), and covers a variety of other activities such as stakeholder consultation, and the production of a number of supporting and complimentary documents that deal with specific environmental and socio-economic aspects of the Project.

The scope of this ESIA covered:

- A description of the proposed project, and a description of the location of the proposed project area and its environmental setting.
- Collection of baseline socio-economic data of the project area and potential impacts expected from project construction, implementation and operation.
- Provision of a description of the legal and institutional framework for environmental and social management;
- Assessment of the expected impacts (positive & negative) of the proposed project both during construction, operation and decommissioning stages.
- Public consultation;
- Analysis of project activity alternatives; and
- Identification and presentation of a measures to minimize, mitigate, or eliminate negative effects and impacts of the project in an Environmental and Social Management Plan (ESMP).

Public participation

Out of Views were sought on the project from key stakeholders, local administration, and neighbouring communities and other stakeholders in the project site. Community members were engaged mainly via administration of questionnaires and interviews. All were happy with the prospect of benefitting from improved sanitation through the planned DTF project.

Analysis of Public Consultation

65.3% of those interviewed were male, 34.7% female. Respondents' households consist of 3 to 8 members, with an average of 4 members per household. 87% of the respondents use pit latrines, and 8.7% use improved pit latrines. Only 4.3% have flush toilets, the latter citing water availability as a deterrent.

Awareness on the Project

74% of the respondents have not heard of the DTF project; 26% are aware of the project. However, most have heard of a project to assist Mwatate residents in adopting flush toilets. There is still room thus, for more awareness creation, particularly linking the DTF project with the flush toilets i.e. comprehensive information on the UBSUP project.

Concerns raised

Table ES-! Below highlights concerns raised on the DTF project.

Tables ES-1: Key issues from public participation

Aspect	Issues
a. Health and safety	1. Safety measures to allow release of safe water to the environment and for agriculture.
	2. Concerns raised over air pollution from the project.
	3. Concerns that the project could provide breeding site for mosquitoes.
	4. Concerns of drowning cases like in Mwatate Dam.
	5. A lot of water flows from higher ground to lower areas where the DTF site is located. Incorporate flood channelling measures in project.
	6. Ensure no pollution of water from river and Mwatate dam used in households in dry periods by residents of Singila, Majengo and Peleleza. They dig out pits for water in riverbed.
b. Ecological	7. Concerns of spill over when the DTF system blocks. Incorporate / consider a system in place to ensure frequent maintenance to prevent breakage / leakage that can cause flooding,
	8. Ensure clean water flow downstream to Mwatate Dam. The river used to flow before agriculture in the area. Open up (dredge) the river to improver flow.
	9. A lot of water in the general area flows to the river valley after it rains. This coupled with shallow water table in the project site requires proper planning.
c. Agriculture related	10. Farmers grow vegetable in river valley adjacent to the DTF project, Ensure pollution prevention to communities.
d. Inter-agency collaboration	11. Improve inter-agency collaboration. Report of TAVEVO not considering World Vision beneficiaries in water allocation (from village elder - Soko ya zamani).

Reporting and documentation

Various data collection methods were used to ensure study validity and reliability of data collected. The following data collection methods were employed in the study:

a. Field visits and observation.
b. Interviews with key informants including TAVEVO staff, local leaders (chief, village elder), World Vision, Compassion and County government official's representatives in Mwatate.
c. Administered questionnaires to the project beneficiaries.
d. Conducted a literature review on the nature of the proposed activities, policy and legal framework, environmental setting of the area and relevant project documents related to the study.

Project description

The proposed Project site is located in Mwatate sub-county of Taita-Taveta County. Specific location is in the Peleleza area of Mwatate sub-location, denoted by lat-long coordinates 3.507 S and 38.381 E.

The proposed project is a Decentralised Treatment Facility will have a capacity of 50 m3/day (DTF50) for the treatment of faecal sludge from Mwatate Town (Peleleza, Kariobangi, Kitivo and Soko ya zamani areas).

According to 2019 data, for the 23,184 conventional households in Mwatate sub-county, over 92% or 21,491 households use pit latrines. Septic tanks are connected to 11.2% or 2,596 households, and only 0.3% or 69 households are connected to a sewer line (KHPC, 2019). The proposed project thus, could not be more timely.

The proposed DTF50 will consist of the following modules 1.) Operator Store, 2.) Receiving Bay / Balancing Tank, 3.) Anaerobic Reactor, 4.) Vertical Flow Constructed Wetland, 5.) Sludge Drying Bed, and 6.) Waste Disposal Unit

Policy, Legal and Institutional framework

Environmental Impact Assessments and Audits have been a legal requirement since 2004 for projects specified under schedule 2 of EMCA (Amendment) 2015, including Waste Disposal. The National EIA regulations were issued in accordance with the provisions of EMCA (Amendment) 2015, and must be administered considering all its provisions, and other relevant national laws, which are covered under this section. Also covered are relevant policies, regulations, institutions and international conventions.

Compliance with existing legislation

By carrying out this ESIA, the proponent has complied with EMCA (Amendment) 2015 and EIA/EA Rules and Regulations, 2003.

Ecological and Socio-economic baseline

Ecological baseline

Topography: Taita Taveta County broadly comprises of three major topographical zones, namely 1.) The upper zone (between 304 and 2,208 m asl, consisting of Taita, Mwambirwa and Sagalla hills, 2.) the lower zone consisting of plains where there is ranching, national parks and mining, and 3.) the volcanic foothills zone which covers the Taveta region. The project site is in the second zone, in a low area immediately adjacent to Taita hills to the north.

Hydrology: There is marshy area in the low lying area of Mwatate town with a stream adjacent to the project site, and flowing towards Mwatate dam (site visit and communications from residents) that becomes more pronounced after the rains.

Climate: The lowlands comprising a big part of Mwatate sub-county including Mwatate town, receive between 450-750 mm annually and rainfall is more unreliable in amount and distribution. The lower parts are hot with mean temperatures of about 30^0C. The potential annual evaporation rate is about 1800mm. There is therefore a net water deficit.

Soils: Soil in the Mwatate town and surrounding areas consist of mainly well drained, very deep, dark red, loose coarse sand to friable sandy clay loam (rhodic FERRALSOLS); somewhat excessively drained, shallow, reddish brown, friable, rocky or stony, sandy clay loam (eutric REGOSOLS); and well drained to imperfectly drained, very deep, dark brown to yellowish brown, stratified, micaceous, strongly calcareous, predominantly loamy soils (calcaric FLUVISOLS). The project site is in the latter class, found in the lowest parts of Mwatate.

Landcover: Mwatate town and surrounding areas comprise of 4 landcover classes including 1.) rainfed herbaceous crops (small, continuous fields and clustered and isolated fields), merging with, 2.) irrigated and post-flooding herbaceous crops (sisal plantation)" to the south-east. Class 1 is s bordered to the north-west by 3.) closed to open shrubs and woody vegetation, an area that signals the altitudinal increase into the Taita hills to the north. There is a depression in the area, running in a north-south direction and comprising of class 4.) aquatic

closed to open trees, shrubs and woody vegetation (fresh water, permanently or temporarily flooded) class. The proposed project site is in this area.

Socio-economic baseline

Extent of area to be affected by project activities comprises of the Peleleza, Kariobangi, Kitivo and Soko ya zamani areas of Mwatate town. Peleleza covers the largest area, starting from the lower area adjacent to the project, where some agricultural activities are taking place, to merge with Kitivo in the higher areas of Mwatate. Kariobangi is the congested area next to Mwatate's commercial area (shops, and other businesses). Soko ya zamani is located off the Mwatate-Wundanyi road, and also comprises of shops and small businesses, rental housing units, etc. Kitivo has a more farm house feel, with small plots adjacent to the housing units.

Demography: According to the latest national census data (2019), Mwatate sub-county occupies 15.86% of Taita Taveta county land area, and has 23% of the total County's population of 81.659 inhabitants. 78% (64,321) of the inhabitants are rural age 5+ group, while 10.5% (8,260) are urban age 5+ group. This urban age 5+ group is mostly found in Mwatate town and smaller mushrooming market centres along the main roads. About half of this group is in gainful employment, with the other half comprising of those seeking work and those outside the labour force

Education: In 2015, Mwatate had 88 and 27 public and private ECDE's respectively, with an enrolment of 1,899 boys and 1,861 girls, for public ECDEs, and 521 boys and 495 girls for private ECDEs. To date, Mwatate sub-county has a total of 46 primary and 14 secondary schools.

Health: In 2015, health facilities in Mwatate sub-county included - 1 government hospital, 2 government health centres, 15 government dispensaries and 4 private clinics, all with a total of 49 beds and 7 cots capacity. Top causes under 5 childhood morbidity for the same period were listed as follows - Respiratory System ailments, diseases of the skin (incl. wounds), diarrhoea, clinical Malaria and pneumonia.

Land use: Mwatate sub-county has the second highest acreage of agricultural land after Taveta, and the most number of farming households in the County (30,878), with 94% (15,172) of the farming households practicing subsistence farming. There is subsistence farming observed in Mwatate town too.

Water and sanitation: Only 6% (1,391) of conventional households in Mwatate sub-county get their drinking water through a pipe to their dwellings. The rest get water piped in yard (24% or 5,564 households), public tap / stand pipe (20.3% or 4,706 households), from streams / rivers (15.4% or 3,570 households), and from water vendors (11.4% or 2,642 households).

The solid waste disposal situation presents a dire picture with the main waste disposal methods (60%+ or over 13,910 households) burning their waste in the open or in a pit. Collection by the County government caters for a measly 1% or 230 households' waste

Environmental and Social Management Plan (ESMP)

ESMPs for development projects aim to provide a logical framework within which impacts related to the projects are identified, and a plan for mitigation and monitoring of potential negative environmental impacts is formulated.

Table ES-2 below is a summary of the ESMP for this project. A detailed ESMP is given in the relevant section of this document.

Table ES-2: Summarized Environmental and Social Management Plan (ESMP)

ESMP**POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION**			
Aspect	**Potential -ve impact**	**Mitigation**	**Timeframe**
1. Air / Ambient environment	• Emission of dust during transport of building materials and construction activities	• Water rough road to construction site periodically during construction period • Re-vegetate the site as appropriate after construction • Hoard site to curb dust from spreading to the neighbourhood. • Provide workers with PPE (dust masks). • Trucks hauling dirt and debris to and from site, should be covered to reduce spillage. • Stockpiles of sand and soil should be covered or surrounded with wind breaks • Expedite construction so that it can take the shortest time possible.	• During construction
	• Increased noise during transport of building materials and construction activities.	• Construction should be carried out only during daytime. 0800-1700hrs • Provide workers with PPE if working in noisy section. • Hoard site to reduce noise from noisy equipment. • Machinery should be well maintained to reduce noise resulting from friction. • Limit unnecessary hooting. • Provide relevant signage at the construction site on construction activity and timings.	• During construction & decommissioning
	• Emission of smoke from vehicles and equipment	• The number of construction equipment operating simultaneously shall be minimized through efficient management practices; • Vehicle idling time shall be minimized. • Proper servicing of machinery as per the manufacture's specifications to reduce emissions.	• During construction & decommissioning
	• Emission of Smoke from incinerator	• Incinerator chimney stack will be at of minimum 4 metres height • The incinerator must always be maintained to ensure complete combustion, less pollution	• Operational stage
	• Odour from faecal sludge in DTF	• Ensure efficiency and optimal operation of all units • Provide relevant PPE to DTF staff	• Operational stage
2. Soil	• Soil erosion	• Temporary dykes to prevent surface runoff	• During construction & decommissioning
	• Soil compaction from vehicles and machinery	• Use designated route to site • Designate vehicle / machinery parking area • Control construction activities especially during rainy conditions. • Re-surface open areas after completion of the project and introduce appropriate vegetation. • Provide suitable storm water drainage channels to effectively discharge water to safe areas.	• During construction & decommissioning
	• Soil contamination from vehicles and machinery oil	• Designate areas for parking vehicles and machinery	• Before / During construction & decommissioning

ESMP**POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION**			
Aspect	**Potential -ve impact**	**Mitigation**	**Timeframe**
	• Soil contamination from bottom ash from incinerator	• Ensure incinerator waste (ash) is disposed of in designated areas • Line disposal pit with right plastic gauge	• Operational phase
3. Water	• Increased use of water to reduce dust & in construction.	• Educate workers on water conservation and waste management	• During construction
	• Reduced water quality in nearby river	• Temporary dykes to prevent surface runoff, especially if construction coincides with rainy season.	• During construction
	• Increased use of water in AR and VFCW	• Educate workers on water conservation and waste management	• Operational stage
	• Release of treated water to the environment	• Only effluent with mandatory BOD/COD levels will be released to the environment. • Community education on proper use of water released from DTF.	• Operational stage
	• Contamination of water sources	• Only effluent with mandatory BOD/COD levels will be released to the environment.	• Construction, Operational & decommissioning
	• Breeding ground for disease vectors (mosquitoes)	• Mosquito bio-control (e.g. fish like minnow, tadpoles-frogs, etc.)	• Operational stage
4. Biodiversity	• Loss of flora and fauna.	• Ensure proper demarcation and delineation of the project area to be affected by construction works. • Designate access routes and parking within the site. • Preserve individual trees within the site that do not fall on the actual construction area. • The area will be restored to its original state after construction.	• Operational and decommissioning stages
	• Habitat alteration.	• Appropriate landscaping after end of construction to maintain a green environment	• Construction phase
5. Health and Safety	• Solid waste generated from transportation and storage of building materials	• Provide waste bins strategically within the construction site. • Cover bins to prevent access by vermin, and minimise odour and dust	• Construction and decommissioning
	• Human waste disposal (to prevent poor hygiene related issues)	• Provide temporary sanitary facilities for construction workers. • Provide clean water for workers • Conduct EHS education for site workers	• Construction and decommissioning
	• Accidents and injuries	• Provide workers with relevant PPE depending on task (ear muffs, gloves, mask, boots, helmets, overalls). • First-aid kit should be provided within the site plus at least 2 first aiders.	• Construction and decommissioning

ix. **TAVEVO Mwatate DTF50**

ESMP**POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION**			
Aspect	**Potential -ve impact**	**Mitigation**	**Timeframe**
		• Food handlers preparing food the workers at the site should be controlled and monitored to ensure that food is hygienically prepared.	
	• Bad odour and danger of infection from faecal sludge	• Appropriate PPE will be provided to DTF workers	• Operational stage
	• Bottom ash from incinerator disposal	• Dispose of in properly designated and properly lined pit	• Operational stage

Positive impacts from the proposed Project include: -

1. Employment from construction activities, and decommissioning stages.
2. Boost Local economy (sale of project building materials, and taxes to County Government.
3. Employment (DTF staff).
4. Provision of a cleaner, better sanitation alternative to Mwatate town residents.
5. Release of clean water to environment (for use in for agriculture).
6. Dried sludge converted into compost (for use in agriculture).
7. General livelihood improvement from greater USUB project with project beneficiaries as consumers, producers and workers i.e. of toilet materials.

Conclusion

The proponent recognizes that the proposed DTF project has potential impacts on the bio-physical environment, and on the health and safety of those employed. Further it will affect the socio-economic well-being of the local residents. Therefore, a concerted effort will be put on reducing the negative impacts and strengthening the positive impacts associated with the project.

Considering the positive socio-economic and environmental benefits to be accrued as a result of the development of the project, and the ESIA study having found no major adverse impacts arising from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and the full implementation of the proposed Environmental and Social Management Plan (ESMP).

1.0 INTRODUCTION

1.1 Background

This document presents the Environmental and Social Impact Assessment (ESIA) for the proposed Decentralised Treatment Facility (DTF50) Project in Mwatate town. It is prepared to meet the Kenyan regulatory requirements.

The Water Sector Trust Fund (WSTF)[1] received funds from the Government of Kenya, Bill and Belinda Gates Foundation (BMGF) and German Development Bank (KfW) to finance the implementation of 'Upscaling Basic Sanitation for the Urban Poor' (UBSUP) projects. The funds under this grant are to support construction of household and plot level sanitation facilities and related Decentralized Treatment Facilities (DTFs) in low income urban areas of Kenya through eligible Water Service Providers (WSPs). TAVEVO Water and Sewerage Company Limited (the proponent) is one of the implementing partners of the project.

TAVEVO proposes to develop the DT50 at Peleleza area of Mwatate town[2], and has commissioned the development of this ESIA to local permitting standards, to ensure that potential environmental and social impacts associated with development of the Project are identified, assessed and managed appropriately.

1.2 The Purpose of the ESIA Process

1.2.1 ESIA Objectives

The primary objective of this ESIA is to ensure that Project activities are carried out in the most sustainable manner that is compatible with its economic and operational parameters.

This ESIA aims to achieve an acceptable level of compliance with the applicable Kenyan standards and international best practices on environmental and social management and performance. To ensure that that environmental and social risks are comprehensively understood by TAVEVO and that systems and processes are in place to manage these to an acceptable level.

The ESIA will also –

- Provide input to the TAVEVO Project team to ensure an optimised design that reduces as far as practicable, negative environmental and socio-economic impacts;
- Identify and enhance, positive impacts and opportunities arising from development of the Project; and
- Incorporate stakeholder feedback throughout the ESIA process.

1.2.2 Purpose of the ESIA

An ESIA is a process. It includes the preparation of a comprehensive report (this ESIA document), and covers a variety of other activities such as stakeholder consultation, and the production of a number of supporting and complimentary documents that deal with specific environmental and socio-economic aspects of the Project.

[1] A State Corporate body under the Ministry of Water & Sanitation and Irrigation and established under the Water Act 2016.

[2] The DTF project is part of a larger project that will also include 200 flush toilets in the project area consisting of Peleleza, Kariobangi, Kitivo and Soko ya zamani, part of the 'Upscaling Basic Sanitation for the Urban Poor' (UBSUP) projects in Kenya.

1.2.3 Scope of the ESIA

The scope of this ESIA covered:

- A description of the proposed project, and a description of the location of the proposed project area and its environmental setting.
- Collection of baseline socio-economic data of the project area and potential impacts expected from project construction, implementation and operation.
- Provision of a description of the legal and institutional framework for environmental and social management;
- Assessment of the expected impacts (positive & negative) of the proposed project both during construction, operation and decommissioning stages.
- Public consultation;
- Analysis of project activity alternatives; and
- Identification and presentation of a measures to minimize, mitigate, or eliminate negative effects and impacts of the project in an Environmental and Social Management Plan (ESMP).

1.2.4 The ESIA in the Kenyan regulatory context

Under the Kenyan Environment Management and Coordination (Amendment) Act, 2015 a proponent of a project is required to submit a Project Report to allow the National Environmental Management Authority (NEMA), Kenya's national regulatory body, to determine whether or not an EIA is required.

TAVEVO contacted NEMA in late 2019, and following advice from NEMA, appointed a local consultant, to undertake the project ESIA to meet the requirements of Kenyan legislation.

1.3 Public participation

EMCA (Amendment) 2015 calls for effective stakeholder participation and public consultation in the ESIA process. Key stakeholders consulted included Area Chief - Mwatate, Sub-county team manager – public health, Physical planner – Mwatate, World Vision, and Compassion / Full gospel Church – Mwatate. Community participation was carried out using structured questionnaires. (See copy of filled questionnaires in **Annex 4**). The process also coincided with the exercise of land allocation to squatters in lower Peleleza and Singila Mwatate, that involved the area chief and some of the residents. It also coincided with the start of the Coronavirus slow down period.

The following is a profile of the areas of interest in Mwatate town i.e. Peleleza, Kariobangi, Kitivo and Soko ya zamani, and the analysis of the questionnaire responses. The four areas are part of bigger project on "**Upscaling of Basic Sanitation for Urban Poo**r" (**UBSUP**) in Mwatate town, with a key aim – the adoption of flush toilets in Mwatate. The proposed DTF will serve the said planned flush toilets.

Rapid appraisal of the areas of interest in Mwatate town

Peleleza, Kariobangi, and Kitivo are all on gentle sloping areas of Mwatate town, with the project located in lower Peleleza area. Singila is also located on sloping higher ground on the other side of the low lying area. Soko ya zamani is off the Mwatate-Wundanyi road, and also on a gentle slope. Peleleza spatially covers the largest area.

Generally, all the 4 areas have common attributes, that include: -

- Unplanned buildings on tiny plots;
- Perennial lack of water according to respondents;

- Pit latrines, several in some compounds (newer ones dug after old ones are full);
- A lot of bars selling "[3]Mnazi";
- Poverty and lack of jobs;
- Water supply not regular, and prices vary from Ksh 5 for a 20-lt jerry can, Ksh20 for 3 30-lt jerry cans, to Ksh 20 for a 20-lt jerry can depending on whether one buys from a TAVEVO water kiosk / tank or from a water vendor;
- Roads and road reserves are not apparent when one walks in the residential areas.

Peleleza - houses

Kitivo – farm houses

Peleleza begins at the area adjacent to the site in the lower lying areas to meet Kitivo at the higher part or Mwatate town. The latter is characterised by mostly smaller urban housing units (except for area adjacent to river where farming occurs), while the latter has more of farm houses, with small farm plots visible in most households.

Kariobangi - houses

GE Aerial view of Soko ya zamani(left of C104)

Kariobangi is adjacent to what was initially the main Mwatate commercial area. There is hardly any open area between housing units here. Soko ya zamani, consists of a row of shops (organised along the branching road from C104 (Mwatate-Wundanyi road)), and rental houses extending from the shops. The rest of the housing units though are very congested.

These attributes could present a unique challenge for the adoption of flush toilets, that require constant and affordable water supply, and indeed exhauster lorries that will eventually access the area.

[3] Local brew derived from coconut trees.

3. TAVEVO Mwatate DTF50

There is considerable run-off from the higher areas, into the lower lying areas, and storm water channels are visibly lacking.

Run-off after rains near World Vision office, Peleleza

From communication with respondents, pit latrines dug are not very deep (10 ft or so). These fill up, and new ones are dug adjacent to the old ones. Alternatively, newer pits are dug, and the refuse from the filled toilets transferred to the new pits. The proposed flush toilets and the DTF is thus a welcome proposal (interviewees).

Analysis of Public Consultation

65.3% of those interviewed were male, 34.7% female. The respondents have lived in Mwatate for between 5 months (new job-seeker) and 60 years (those born and living in Mwatate); with an average of 18 years living in Mwatate.

Public participation - Kariobangi

Public participation - Kitivo

Most respondents get their water from TAVEVO, from a pipe in the yard, or a TAVEVO water point (tank). Some get their water from water vendors who in turn buy from TAVEVO water points.

Respondents' households consist of 3 to 8 members, with an average of 4 members per household.

87% of the respondents use pit latrines, and 8.7% use improved pit latrines. Only 4.3% have flush toilets, the latter citing water availability as a deterrent.

All the respondents agree this is a good project if implemented well, citing potential expected advantages, including: -

1. Cleaner environment,
2. Water for agriculture,
3. Fertilizer for agriculture,
4. Improved general sanitation,
5. Decent urban environment
6. Reduced contamination of Mwatate Dam, and
7. Fewer diseases.

Awareness on the DTF project

74% of the respondents have not heard of the DTF project; 26% are aware of the project. However, most have heard of a project to assist Mwatate residents in adopting flush toilets. There is still room for more awareness creation thus, particularly linking the DTF project with the flush toilets i.e. comprehensive information on the UBSUP project. There is considerable interest on the adoption of flush toilets, with a lot of questions on the subsidy for construction costs of the said toilets from the UBSUP project. More awareness on the sewage component needed.

Concerns raised

1. Safety measures to allow release of safe water to the environment and for agriculture.
2. A lot of water flows from higher ground to lower areas where the DTF site is located. Incorporate flood channelling measures in project.
3. Concerns of spill over when the DTF system blocks. Incorporate / consider a system in place to ensure frequent maintenance to prevent breakage / leakage that can cause flooding,
4. A lot of water in the general area flows to the river valley after it rains. This coupled with shallow water table in the project site requires proper planning.
5. Farmers grow vegetable in river valley adjacent to the DTF project, Ensure pollution prevention to communities.
6. Ensure clean water flow downstream to Mwatate Dam. The river used to flow before agriculture in the area. Open up (dredge) the river to improver flow.
7. Concerns raised over air pollution from the project.
8. Concerns that the project could provide breeding site for mosquitoes.
9. Concerns of drowning cases like in Mwatate Dam.
10. Ensure no pollution of water from river and Mwatate dam used in households in dry periods by residents of Singila, Majengo and Peleleza. They dig out pits for water in riverbed.
11. Improve inter-agency collaboration. Report of TAVEVO not considering World Vision beneficiaries in water allocation (village elder - Soko ya zamani).

1.4 Reporting and documentation

Various data collection methods were used to ensure study validity and reliability of data collected. The following data collection methods were employed in the study:

a. Field visits and observation.
b. Interviews with key informants including TAVEVO staff, local leaders (chief, village elder), World Vision, Compassion and County government official's representatives in Mwatate.
c. Administered questionnaires to the project beneficiaries.
d. Conducted a literature review on the nature of the proposed activities, policy and legal framework, environmental setting of the area and relevant project documents related to the study.

2.0 PROJECT DESCRIPTION

2.1 Proposed location of the project

The proposed Project site is located in Mwatate sub-county of Taita-Taveta County. The Project site is in Peleleza area of Mwatate sub-location, is denoted by lat-long coordinates 3.507 S and 38.381 E. The proposed site is shown in **Annex 4. (b) Land use plan**, labelled 6_2. Both plots 6_1 and 6_2 were initially set aside in County planning for waste disposal purposes.

2.2 Project cost and Type of activity

The proposed project is a Decentralised Treatment Facility will have a capacity of 50 m^3/day (DTF50) for the treatment of faecal sludge from Mwatate Town (Peleleza, Kariobangi, Kitivo and Soko ya zamani areas). The proposed DTF50 project will cost an estimated Ksh 10 million.

Waste disposal in Taita Taveta County's Mwatate sub-county is pretty rudimentary. For the 2019 population of 81,659 inhabitants (64,231 and 8,260 age 5+ rural and urban respectively), the main the main solid waste disposal methods (60%+) is burning in the open or a pit. Collection of solid waste by the County government caters for a paltry 1% of the total waste.

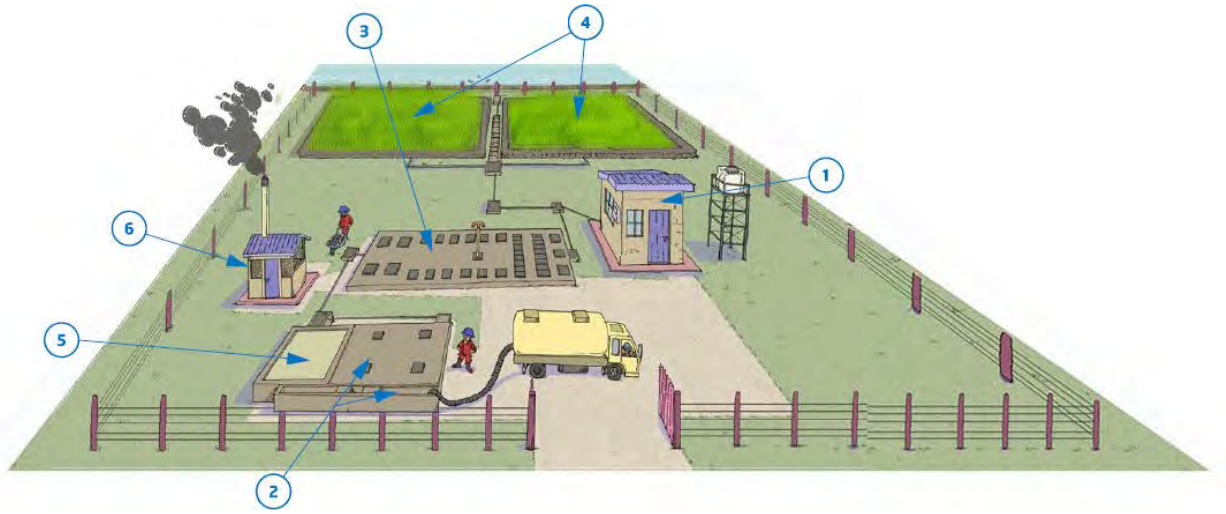
For the 23,184 conventional households in Mwatate sub-county, over 92% or 21,491 households use pit latrines. Septic tanks are connected to 11.2% or 2,596 households, and only 0.3% or 69 households are connected to a sewer line (KHPC, 2019).

2.3 Overview of planned Activities

The planned project activities will involve the construction of the DTF50 comprising of the following modules or stages.

1. Operator Store,
2. Receiving Bay / Balancing Tank,
3. Anaerobic Reactor,
4. Vertical Flow Constructed Wetland,
5. Sludge Drying Bed, and
6. Waste Disposal Unit.

Fig. 1: DTF modules



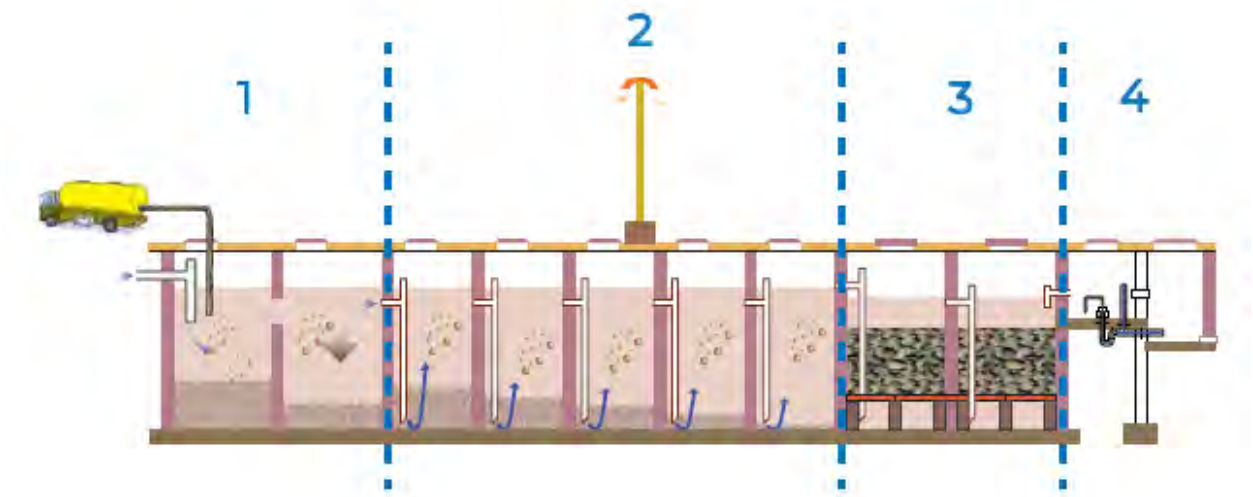
1. **Operator Store (OS)**
A two-room building, with one main office and one washroom with hand washing facility, shower and WC. The building is used as operator's office, tool and equipment store as well as guard's house. It is supplied with water (connected to service line or supplied by water bowser) and electricity (power grid or solar). All visitors report to the OS on entering the DTF.

2. **Receiving Bay / Balancing Tank (RBBT)**
The RBBT is the first module of the DTF which offers preliminary treatment to the faecal sludge or wastewater received. It is divided in two compartments:

1. The RB is an inlet arrangement with coarse and fine screens. The exhauster parks at the dock station and offloads its contents. The solid waste is manually removed from the screens and placed on the platforms to dry-out. Once it is dry the waste is transported in the solid waste incinerator.
2. The BT acts as a buffer tank. It can store up to 50 m^3 of faecal sludge or wastewater. It also controls the discharge towards the rest of the DTF at a flow rate of 2 m^3/h. The opening of the valve at the outlet should be regulated to allow for this flow rate. Therefore, the BT can store the faecal sludge or wastewater up to 24h. In case the balancing tank exceeds its capacity, an overflow pipe has been provided to discharge the surplus of faecal sludge or wastewater.

3. **The Anaerobic Reactor (AR)**
The AR comprises of 4 treatment modules:

Fig. 2: Anaerobic Reactor



1. The Settler provides the first segregation of heavy and light material: the solids and sludge settle and accumulate at the bottom while the scum (lightweight materials including paper, fats and greases) rises to the surface. A baffle wall prevents the scum and sludge layer from moving from one chamber to another. The inlet-outlet level difference is 100 mm to give the required hydraulic gradient. The total volume of the Settler module is 48 m^3 with a water depth of 2.5 m and a Hydraulic Retention time (HRT) of 24 h.

2. The Anaerobic Baffled Reactor (ABR) comprises of 5 successive chambers and 14 parallel downpipes located at the inlet of each chamber, leading the incoming flow towards the bottom of the chamber. The ABR enables a biological secondary treatment through biodegradation of organic material by the micro-organisms contained in the settled

sludge. The inflow is forced to pass through the activated sludge where anaerobic bacteria are feeding from the organic material contained in the inflow to be treated. The inlet-outlet level difference is 150 mm to ensure hydraulic gradient. The water depth is 2.5 m bringing the volume capacity to 96 m^3. The minimum Hydraulic Retention Time (HRT) is 48 h to ensure biological degradation of organic material.

3. The Anaerobic filters are contained in two successive compartments and 11 parallel downpipes located at the inlet of each chamber, leading the incoming flow towards the bottom of the chamber. The volume of both compartments is 48 $m^3$with a water depth of 2.5 m and a minimum Hydraulic Retention Time (HRT) of 24 h. The filter media is seated on elevated 100 mm thick perforated slab to allow free passage of the incoming flow. The filter media consists of aggregates of 30-42 mm diameter. The Anaerobic filters offer both mechanical filtration and anaerobic digestion.

4. The Siphon comprising of a main chamber and a subsequent drainage chamber. The goal of the siphon is to provide intermittent flow to the next module. With the current design, the siphon releases intermittent flushes of 1.5 m^3 every 45minutes towards the Vertical Flow Constructed Wetland. The level difference between the siphon drainage chamber and the VFCW should be at least 0.9 m to allow sufficient pressure in the feeding pipe network.

4. **Vertical Flow Constructed Wetland (VFCW)**

The last module of the DTF treatment line, the VFCW offers the final cleaning process that improves the effluent quality before it is discharged to the receiving environment. The VFCW is a planted filter bed that acts as:

- a filter for removing solids
- a fixed surface upon which bacteria can attach
- a base for the vegetation whose roots permeate the filter media and harbor a variety of micro-organisms

The pre-treated waste water from the ABR is loaded intermittently onto the surface of the VFCW through perforated pipe system. The water flows vertically down through the filter layer to the bottom of the bed where it is collected in a drainage pipe system. The waste water is treated by a combination of biological and physical processes. The intermittent batch loading and long resting periods enhance the oxygen transfer through the porous media and leads to high aerobic degradation activities. By forcing the organisms into a starvation phase between dosing phases, excessive biomass growth can be decreased and porosity increased. This is ensured by the intermittent load from the siphon and the alternate use of each filter bed: 1 bed is used for 15 consecutive days only. Nutrients and organic material are absorbed and degraded by the dense microbial population and pathogens are removed by natural die-off or predation by higher organisms.

5. **Sludge Drying Bed (SDB)**

The SDB is a treatment module that runs parallel to the main DTF treatment line. SDB is a shallow unplanted filter bed with media consisting of sand and gravel. An underdrain pipe at the bottom of the bed collects the leachate which is conveyed to the next treatment module.

6. **Waste Disposal Unit**

The Waste disposal unit includes the following elements:

a. An incinerator (De Montfort model) to burn waste and reduce it. The incinerator destroys 67 kg of solid waste per hour.

b. A waste store to securely accumulate waste that is to be incinerated and to stock the fuel material (wood or agro-residues) required to preheat the incinerator.
c. A shelter to protect the incinerator, the operator and the waste being incinerated, the fuel and the operator's tools. Moreover, it supports the 4 m high chimney.

The incinerator is made of firebricks and prefabricated metal components. It comprises a primary and a secondary chamber. The burning zone of the primary chamber is accessible through a front door, which lets in air, allows the operator to light the fire and also allows the removal of ashes. Once the solid waste screened at the Receiving Bay is dry, it is dropped in through a loading door, above the primary chamber. The secondary chamber, which is inaccessible to the operator, is separated from the primary chamber by a brick column with an opening at the bottom to induce a cross draught during operation. Additional air is drawn into the secondary chamber through a small opening in the lower section of the rear wall of the secondary chamber. This air mixes with the partially burnt flue gas from the primary chamber and causes secondary combustion. The chimney mounted above the secondary combustion chamber releases the flue gases into the atmosphere.

2.4 Project schedule

Subject to the necessary permitting approvals, and given the nature of activities, the Project will commence immediately. The project site covers approximately 0.44 ha (1.087 acres), located in Peleleza area of Mwatate town.

2.5 Unforeseen events

There is the potential for unforeseen events to occur during implementation, operation or decommissioning phases of the Project. Such events may include:

- environmental incidents including or as a consequence of climate change;
- general natural disasters such as flooding, fire, or droughts;
- individual emergencies such as injury, illness, etc.; or
- medical emergencies.

The proponent will develop contingency procedures to cater for such incidents.

3.0 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Environmental Impact Assessments and Audits have been a legal requirement since 2004 for projects specified under schedule 2 of EMCA (Amendment) 2015, including Waste disposal (EMCA, Second schedule, Sub-section 11). The National EIA regulations were issued in accordance with the provisions of EMCA (Amendment) 2015, and must be administered considering its provisions, and also other relevant national laws highlighted below. This section examines the ESIA Policy, Legal and Institutional Framework as it relates to the TAVEVO Mwatate DTF50 project.

3.1 Environmental Policy Framework

3.1.1 Kenya Vision 2030

Kenya Vision 2030 sets the goal of universal access to safe water and sanitation in the country. It proposes strategies for achieving this objective, such as increasing community sanitation, improving the planning of informal urban settlements, and encouraging public-private partnerships in the building and management of sewage infrastructure.

3.1.2 Kenya Environmental and Sanitation Hygiene Policy (KESHP) 2016-2030

KESHP was launched in 2016 to create broad guidelines for both state and non-state actors in their efforts to achieve universal access to water and sanitation. It aspires to make Kenya Open Defecation Free (ODF) by 2030 and to increase public funding of sanitation from its current level of 0.2% of Kenya's GDP to 0.5% in 2020 and 0.9% in 2030. The policy includes provisions for improving urban sanitation facilities and ensuring safe waste disposal and management through low-cost technologies in slum and peri-urban areas. And most importantly, KESHP also seeks to encourage private sector participation, especially as it relates to providing lower cost, market-based solutions for lower income households.

3.1.3 National Environment Action Plan (NEAP), 1994

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programmes that disregarded environmental sustainability. NEAP recognizes that development projects that do not take care of environmental considerations in their operations are not sustainable. Under the NEAP process, EIA was introduced and among the key targets recognized were the industrialists, business community and local authorities.

3.1.2 National Policy on Water Resources Management and Development, 1999

The National Policy on Water Resources Management and Development (Sessional Paper No. 1 of 1999) was established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way.

The overall goal of the national water development policy is to facilitate the provision of water in sufficient quantity and quality and within a reasonable distance to meet all competing uses in a sustainable, rational and economical way. This policy separates policy formulation, regulation and services provision and defines clear roles for sector actors within a decentralized institutional framework and includes private sector participation and increased community development.

Under the policy, the Ministry in-charge of Water is responsible for policy development, sector coordination, monitoring and supervision to ensure **effective Water and Sewerage Services** in the Country, sustainability of Water Resources and development of Water resources for irrigation, commercial, industrial, power generation and other uses. The Ministry executes its mandate through the following sector institutions:

a. Water Services Regulatory Board (WASREB)

The regulatory Board is responsible for the regulation of the water and sewerage services in partnership with the people of Kenya. The mandate of the regulator covers the following key areas;

i. Regulating the provision of water and sewerage services including licensing, quality assurance, and issuance of guidelines for tariffs, prices and disputes resolution,
ii. Overseeing the implementation of policies and strategies relating to provision of water services licensing of Water Services Boards and approving their appointed Water Services Providers,
iii. Monitoring the performance of the Water Services Boards and Water Service Providers,
iv. Establish the procedure of customer complaints,
v. Inform the public on the sector performance, and
vi. Gives advice to the Minister in charge of water affairs.

b. Water Resources Management Authority (WRMA)

The authority is responsible for sustainable management of the Nations Water Resources;

i. Implementation of policies and strategies relating to management of water resources,
ii. Develop principles, guidelines and procedures for the allocation of water,
iii. Development of Catchments level management strategies including appointment of catchments area advisory committees,
iv. Regulate and protect water resources quality from adverse impacts, and
v. Classify, monitor and allocate water resources.

c. Water Services Trust Fund (WSTF)

This body assists in the financing of the provision of Water Services to areas of Kenya that are without adequate water services. This shall include providing financing support to improved water services towards;

i. Capital investment to community water schemes in underserved areas,
ii. Capacity building activities and initiative among communities,
iii. Water services activities outlined in the Water Services Strategic Plan as prioritized by the Government,
iv. Awareness creation and information dissemination regarding community management of water services, and
v. Active community participation in the management of water services.

d. Water Services Boards (WSBs)

The WSBs are responsible for the efficient and economical provision of water and sewerage services in their areas of jurisdiction. Lake Victoria South Water Service Board (LVSWSB) is among the seven catchment Boards established with the mandate to;

i. Develop and rehabilitate water and sanitation infrastructure,
ii. Maintain water and sanitation assets for the Government,
iii. Monitor service provision,
iv. Sourcing of water and sewerage funding,
v. Assurance of water quality,
vi. Handle complaints and complements from clients and customers, and
vii. Appointing and contracting Water Service Provider.

e. Water Services Providers (WSPs)

Water Service Providers are the utilities or water companies. They are state owned but have been commercialized to improve performance and run like business within a context of efficiency, operational and financial autonomy, accountability and strategic, but minor

investment. TAVEVO has been contracted to provide these services in Taita Taveta and has the following responsibilities;

i. Water Services including: -
   - Bulk water sales,
   - Water treatment, and
   - Water sampling for quality guarantee.
   - Laboratory water quality,
   - Daily surveillance of water pressure to ensure reliable supply to consumers,
   - Maintenance of water service lines,
   - Connections of grid water and opening accounts for new customers, and
   - Notifications of water interruptions.

ii. Sewerage Services including: -
   - Sewage treatment and disposal,
   - Unblocking sewer lines, and
   - Repair of burst sewer lines.

3.1.3 Sessional Paper on Environment and Sustainable Development

Among the key objectives of the Sessional Paper No. 6 of 1999 on Environment and Sustainable Development include ensuring that development policies, programmes and projects take environmental considerations into account, ensuring that an independent environmental impact assessment (EIA) report is prepared for any development before implementation and to ensure that effluent treatment standards that conform to acceptable health standards.

Under this paper, broad categories of development issues have been covered that require sustainable approach. These issues include the waste management and human settlement sectors. The paper recommends the need for enhanced re-use/recycling of residues including wastewater and increased public awareness raising and appreciation of clean environment as well as the participation of stakeholders in the management of wastes within their localities. Regarding human settlement, the paper encourages better planning in both rural and urban areas and provision of basic needs such as water, drainage and waste disposal facilities among others for decent housing of every family.

3.2 Legal Framework

3.2.1 Constitution of Kenya

Article 42 of the Bill of Rights of the Kenyan Constitution provides that every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures. Under Chapter 5 (land and Environment), Part 1 is devoted to land. It requires that land be used and managed in 'a manner that is equitable, efficient, productive and sustainable'.

Part 2 of Chapter 5 of the constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides among other things that, the state shall: -

a. Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits,
b. Encourage public participation in the management of, protection and conservation of the environment,

c. Establish systems of environmental impact assessment, environmental audit and monitoring of the environment,
d. Eliminate processes and activities that are likely to endanger the environment, and
e. Utilize the environment and natural resources for the benefit of the people of Kenya.

3.2.2 Environmental Management and Coordination (Amendment) Act, 2015

The Environmental Management and Coordination Act (1999), amended in 2015, established the National Environmental Management Authority to manage all matters dealing with the Environment in Kenya, including the conduct of Environmental Impact Assessments (EIA) and Environmental Audits (EA) for projects deemed to have potential adverse impacts on the environment. Waste disposal projects are in the Second Schedule, as among projects that are required to undergo Environmental Impact Assessment.

3.2.3 The Water Act, 2002

The Water Act seeks to make better provision for the conservation, control of pollution, apportionment and use of the water resources in Kenya, and for purposes they are incidental thereto and connected therewith. Section 73 of the act allows a person with a license to supply water to make regulations for purposes of protecting against degradation of water resources. The water Act protects water bodies and sources from pollution and controls their use by the Project. It ensures that the Project requires amount of water that can be provided for by the existing water system and that the Project design will work to conserve the available water resources both during construction and operation phases.

3.2.4 Physical Planning Act, 1999

The local authorities are empowered under section 29 of the act to reserve and maintain all land planned for open spaces, parks, urban forests and green belts. The same section, therefore, allows for prohibition or control of use and development of land and buildings in the interest of proper and orderly development of an area.

3.2.5 The Penal Code Act (Cap.63)

Section 191 of the penal code states that, *"any person or institution that voluntarily corrupts or foils water for public springs or reservoirs thereby rendering it less fit for its ordinary use is guilty of an offence"*.

3.2.6 Public Health Act, (Cap 242)

Part IX, section 15 of the act states that *"... no person / institution shall cause nuisance or condition liable to be injurious or dangerous to human health"*. Section 116 *"... requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain areas under their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable for injurious or dangerous to human health".*

3.2.7 Occupational Safety and Health Act (OSHA), No. 15 of 2007

OSHA 2007 repealed the Factories Act (Cap 514). Employers are required by OSHA to ensure that a place of work is safe and free of risks to health, to immediately stop any operation where there is an eminent and serious danger to safety and health, and evacuate all persons employed.

3.2.8 The Public Health Act, Cap 242

Section 115 of the Act states that, no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 of the Act requires that Local Authorities take all lawful, necessary, reasonable and practicable measures to maintain in their

jurisdiction, clean and sanitary environment to prevent occurrence of nuisance or condition liable to be injurious or dangerous to health; these includes waste pipes, sewers, drains, refuse pits situated or constructed as in the opinion of a medical officer of health not to be offensive or injurious to health. According to Sec. 118, any noxious matter or wastewater flowing or discharged from any premises into a public street or into the gutter, side channel, watercourse, irrigation canal or bed is also a nuisance.

3.2.9 Work Injury Benefits Act (WIBA), 2007

According to WIBA 2007, an employer is liable to pay compensation in accordance with the provisions of this Act to an employee injured while at work. An employee is not entitled to compensation if an accident, not resulting in serious disablement or death, is caused by the deliberate and wilful misconduct of the employee.

3.2.10 County Governments Act, 2012

Section 109 of the Act empowers Counties to ensure effective coordination of spatial developments.

3.3 Rules and regulations

3.3.1 Environmental (Impact Assessment and Audit) Regulations, 2003

The Impact Assessment and Audit Regulations have been gazetted to guide the conduct of Environmental Impact Assessments and Environmental Audits in Kenya.

3.3.2 Water Quality Management Regulations, 2006

The Environmental Management and Coordination (Water Quality Management) Regulations 2006 set stringent controls to protect sources of water for domestic use. They also prohibit abstraction of ground water or carrying out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of water, without an EIA license issued in accordance with the provision of the Act in section 6.

The project site is adjacent to a stream the drains into Mwatate dam. Community members indicated that the marshy area adjacent to the stream and also the Mwatate Dam are utilised as sources of water in dry season. The proponent will ensure due consideration is taken in project design and implementation.

3.3.3 Wetlands, Riverbanks & Seashores Management Regulations, 2009

Wetlands are areas permanently or seasonally flooded by water where plants and animals have become adapted and incorporates riparian and coastal zones. The Environmental Management and Coordination (Wetlands, Riverbanks, Lakeshores, and Seashores Management) Regulations, 2009 seeks to ensure wetland resources are utilized in a sustainable manner compatible with the continued presence of wetlands and their ecological goods and services. The project will ensure direct benefits (abstraction for domestic and agricultural use, fishing) of the river in the low-lying marshy area of Mwatate and Mwatate Dam downstream of the proposed project are taken into consideration.

3.3.4 Waste Management Regulations, 2006

The Environmental Management and Coordination (Waste Management Regulations) 2006 were formed under sections 92 and 147 of the EMCA, 1999.
Relevant parts of this regulation include: -

- Prohibition of any waste disposal on a public highway, street, road, recreation area or in any public place except in designated waste receptacle,

- All waste transporters to be licensed according to the act,
- All vehicles used to transport waste to be labelled in such a manner as may be directed by the Authority,
- Collection and transportation of the waste to be done in such a manner no to cause scattering of the waste;
- The vehicle and equipment for waste transportation to be in such a manner not to cause scattering of or flowing out of waste, and
- The vehicles for transportation and other means of conveyance of waste to follow the scheduled routes approved by the Authority from the point of collection to the disposal site.

Part IV of the regulations deal with hazardous wastes and covers the handling, storing and transportation; treatment; and disposal sites for hazardous wastes.

3.3.5 Noise and Excessive Vibrations Pollution Control Regulations 2009

The Environmental Management and Coordination (Noise and Excessive Vibrations Pollution Control) Regulations 2009 prohibits any person from causing unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) states that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations. It gives standards for maximum permissible noise levels for various aspects including for construction sites, mines and quarries. Relevant considerations apply to this project during the construction phase, as well as in the operation phase.

3.3.6 Air Quality Regulations 2009

The Environmental Management and Coordination (Air Quality Regulations) 2009 under the general prohibitions (Part II), section 5 states that no person shall act in a way that directly or indirectly causes immediate or subsequent air pollution. Among the prohibitions are priority air pollutants (as listed under schedule 2 of the regulations) that include general pollutants, mobile sources and greenhouse gases. Odours are also prohibited under section 9 of the regulations (offensive emissions).

3.4 Institutional and Administrative Framework

At present there are over twenty (20) institutions and departments which deal with environmental issues in Kenya. Some of the relevant key institutions include the National Environmental Management Authority (NEMA), Ministry of Water, Ministry of Health, Ministry of Labour and Social Protection, Local Authorities, and the Directorate of Occupational Safety and Health Services (DOSHS).

3.4.1 National Environment Management Authority (NEMA)

The Authority is established to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of Government in the implementation of all policies relating to the environment. It comprises of the following bodies:

- **The National Environment Council**. Responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment.
- **The Standards and Enforcement Review Committee**. EMCA 1999 provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC).

- **County Environment Committees**. According to EMCA, 1999, the Cabinet Secretary in charge of the matters relating to environment by notice in the gazette appoints County Environment Committees of the Authority in respect of every County.
- **Public Complaints Committee.** A Public Complaints Committee established under EMCA 1999 has the mandate to investigate any allegations or complaints against any person or against the authority in relation to the condition of the environment in Kenya and on its own motion, any suspected case of environmental damage and degradation and to make a report of its findings together with its recommendations thereon to the Council.

3.4.2 County Council of Taita Taveta

Charged with coordination of all matters pertaining to physical development and development control within the urban areas of the County. The council is empowered by two key acts of parliament (**County Governments Act, 2012** and **Urban Areas and Cities Act, 2011**) to carry out physical planning and development control within its area of jurisdiction. A number of by-laws enable it to carry out its daily operations.

3.4.3 Ministry of Labour and Social Protection

The Ministry is charged with the promotion of a safe and health workplace by implementing effective systems for the prevention of Occupational diseases, ill health accidents and damage to property in order to reduce the cost of production and improve productivity in all sectors of our economic activities. The Ministry's **Directorate of Occupational Safety & Health Services (DOSHS)** is mandated to ensure compliance with the provisions of the Occupational safety and health Act 2007 and promote safety and health of all workers.

3.4.4 Ministry of Health

The mandate of MoH is to support the attainment of the health goals of the people of Kenya by implementing priority interventions in public health. The department of Preventive and Promotive Health's **Environmental Health and Sanitation Division** aims to reduce disease burden arising from environmental pollution, by preventing disease transmission from general environmental health pollutants.

3.5 International Conventions, Treaties and Standards

Conventions are legally binding contracts that bind all concerned member countries to respect and act according to their provisions. Kenya has ratified several international conventions and those relevant to the proposed Project are highlighted below.

3.5.1 Convention on Biological Diversity, 1992

The Convention was ratified on 11th September 1994. Agenda 21, a programme of action for sustainable development worldwide, the Rio Declaration on Environment and Development was adopted by more than 178 governments at the United Nations Conference on Environment and Development, known as the Earth Summit, held in Rio de Janeiro, Brazil from 3rd to 14th June 1992.

Principle No. 10 of the declaration underscore that environmental issues are best handled with participation of all concerned citizens at all the relevant levels. At the national level, each individual shall have appropriate access to information that is concerning environment that is held by public authorities. States shall encourage and facilitate public participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy shall be provided. The foregoing discussion is relevant to the proposed development because EMCA demands that public must be involved before any

development project that is likely to have adverse impacts to the environment is initiated by a proponent. The Act has further established Public Complaints Committee (PCC) where the issues raised by the public in regard to any proposed development can be addressed.

3.5.2 UN Framework Convention on Climate Change (UNFCCC), 1992

International environmental treaty produced at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro in 1992. The treaty is aimed at reduced emissions of greenhouse gas in order to combat global warming.

3.5.3 Convention on the Elimination of Discrimination Against Women, 1979

The 1979 UN Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) specifically explicitly recognizes the Human Right to Water and Sanitation (HRWS) recognised as a Human Right by the UN General assembly on 28th July 2010.

3.5.4 UN Convention on the Rights of the Child (UNCRC), 1989

This human rights treaty sets out the civil, political, economic, social, health and cultural rights of children. It also explicitly recognizes the Human Right to Water and Sanitation (HWRS).

3.6 Compliance with existing legislation

By carrying out this Environmental and Social Impact Assessment, the proponent has complied with EMCA (Amendment) 2015 and the Environmental (Impact Assessment and Audit) Regulations (2003) which require that an EIA must be carried out for a project of such magnitude.

4.0 ECOLOGICAL AND SOCIO-ECONOMIC BASELINE

This chapter describes the natural and human environment within which the Project will be implemented. The proposed Mwatate DTF50 Project is located in the Peleleza area of Mwatate Town, Mwatate Sub-County of Taita Taveta County.

4.1 Ecological baseline

4.1.1 Topography

Taita Taveta County broadly comprises of three major topographical zones, namely: -

1. The upper zone (between 304 and 2,208 m asl.), consisting of Taita, Mwambirwa and Sagalla hills, suitable for horticultural farming,
2. The lower zone consisting of plains where there is ranching, national parks and mining, and
3. The volcanic foothills zone which covers the Taveta region with potential for underground water and springs emanating from Mt. Kilimanjaro.

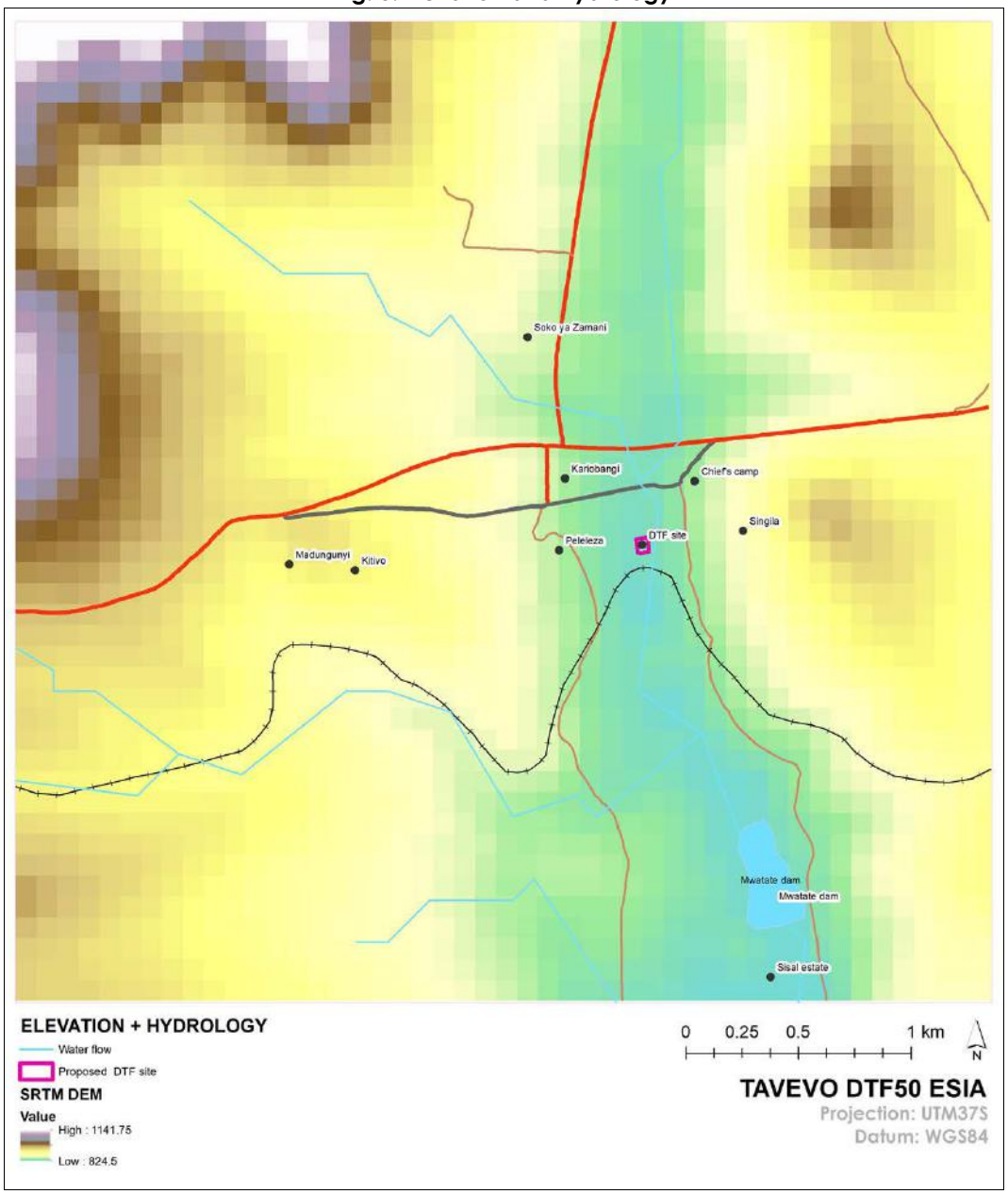
The project site is in the second zone, in a low area immediately adjacent to Taita hills to the north. This zone is part is part of the expansive lowland area extending from the Yatta Plateau in the East to beyond the Tanzanian boundary in the west and which contains the Tsavo East and West National Parks. Relief is dominated by a generally flat, monotonous plains, interrupted by minor local depressions and occasional inselbergs. Altitude generally averages 700 m above sea level.

Figure 3 shows elevation based on SRTM data for Mwatate town and its environs. The project site, and roads are overlaid for perspective, with the project site located in the lower part of Mwatate town.

4.1.2 Hydrology

From **Fig. 3**, it is discernible that there is a low lying area (blue) in Mwatate with decreasing elevation in a north-south direction. Main water flow, mostly seasonal and run-off after it rains, is also shown. There is marshy area in the low lying area of the town, with a stream (Mwatate River) adjacent to the right of the project site, and flowing towards Mwatate dam (site visit and communications from residents) that becomes more pronounced after the rains. This stream will receive the treated effluent from the DTF. Mwatate dam further downstream is a key source of water for the nearby Sisal estate. Communities nearby also use water from the dam in dry seasons.

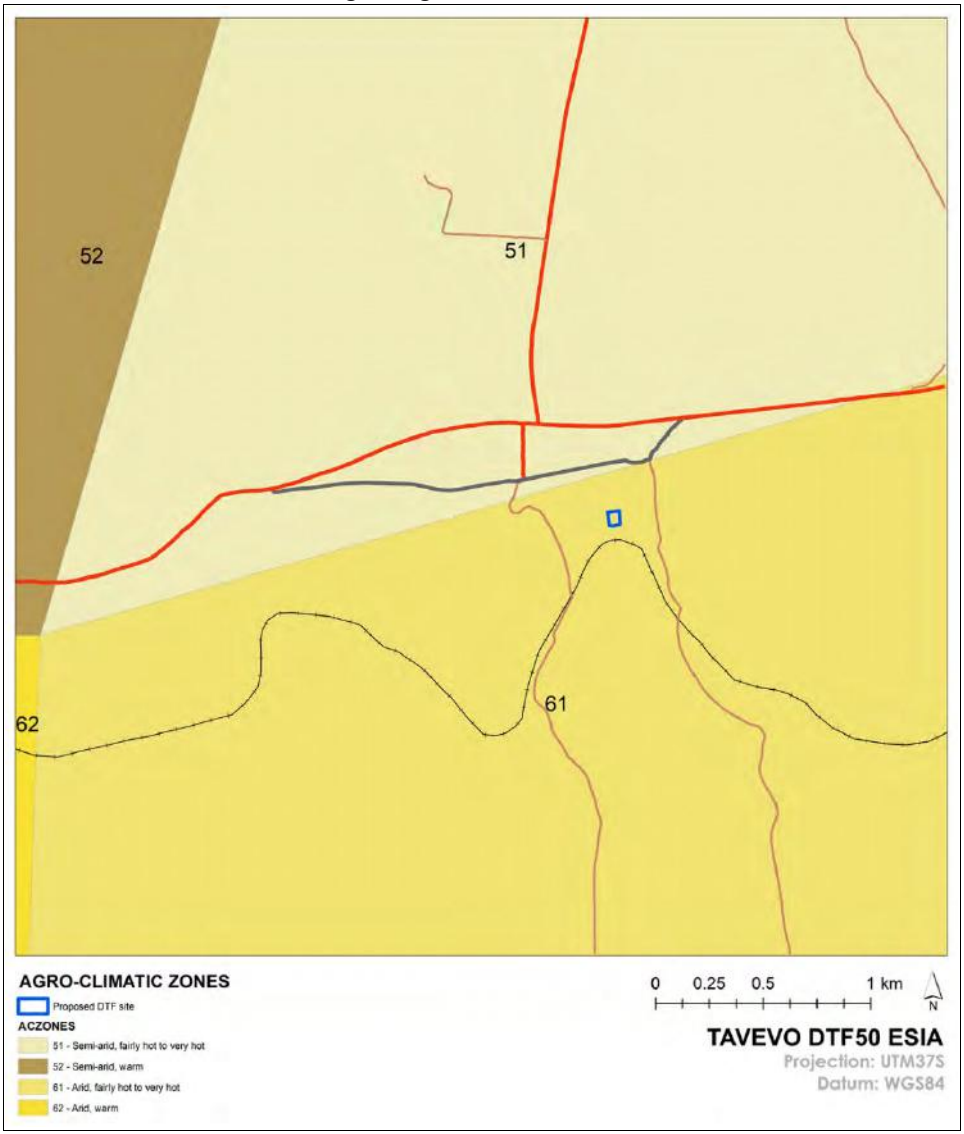
Fig. 3: Elevation and hydrology



4.1.3 Climate

Taita Taveta County has a bimodal rainfall pattern with two rain seasons. The long rains occur between March and May with a maximum in April. The short rains take place between October and December with a peak in November. The rainfall distribution varies depending on elevation and aspect. The lowlands comprising a big part of Mwatate sub-county including Mwatate town, receive between 450-750 mm annually and rainfall is more unreliable in amount and distribution. The lower parts are hot with mean temperatures of about 30^0c. The potential annual evaporation rate is about 1800mm. There is therefore a net water deficit (DEAP, 2009-13). The Project site comprises of the following Agro-Climatic Zones (**Fig. 4**).

Fig. 4: Agro-Climatic Zones



The Agro-Climatic zones for Mwatate town and its environs are described in the **Table 1** below.

Table 1: ACZ descriptions

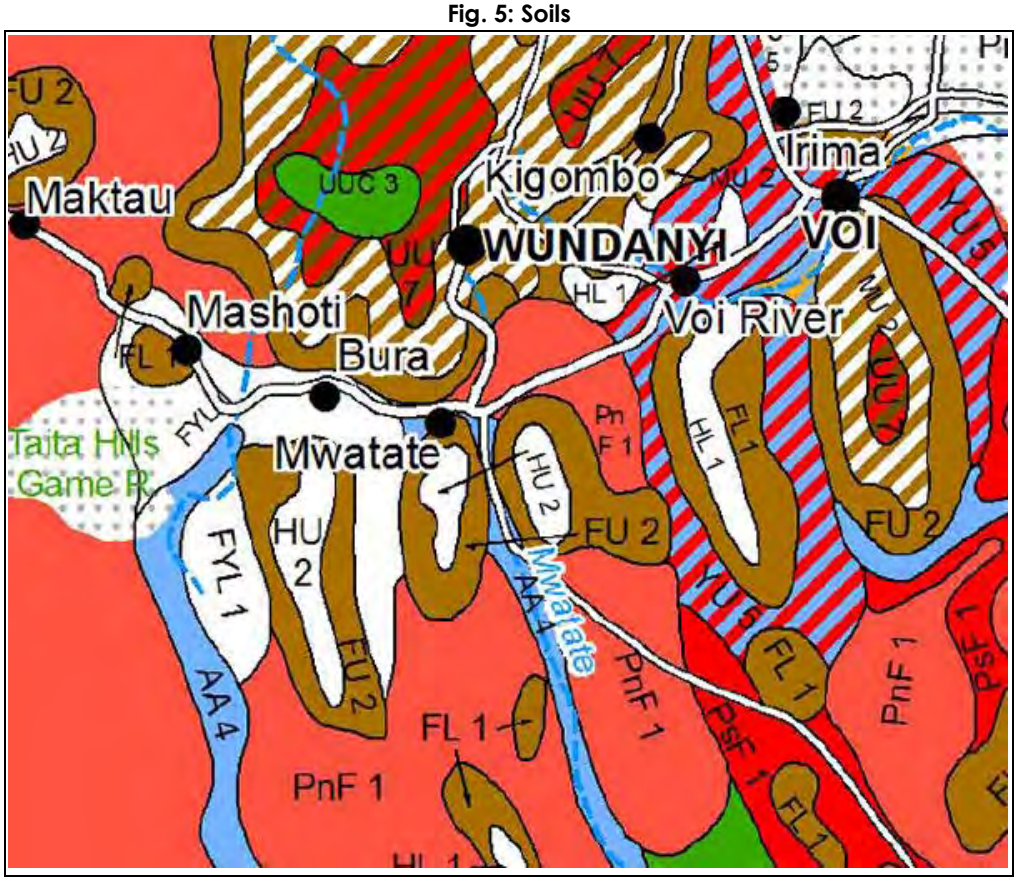
Zone	Description
51	Semi-arid; Fairly hot to very hot (mean annual temperature – 24-30^0 C); moisture availability 15-25%.moisture availability 25-40% and temperatures of 24- 30^0 C; and average annual rainfall – 450-900mm.
52	Semi-arid; Warm weather (mean annual temperature – 22-24^0 C); moisture availability 15-25%; and average annual rainfall – 450-900mm.
61	Arid; Fairly hot to very hot (mean annual temperature – 24-30^0 C); moisture availability 15-25%.moisture availability 25-40% and temperatures of 24- 30^0 C; and average annual rainfall – 300-550mm.
62	Arid; Warm weather (mean annual temperature – 22-24^0 C); moisture availability 15-25%; and average annual rainfall – 300-550mm.

Source: Sombroek et. al, 1982

4.1.4 Soils

Soil in the Mwatate town and surrounding areas consist of mainly of classes FU 2, HU 2 and AA 4 in the low lying areas (**Fig. 5**). Class FU 2 consists of well drained, very deep, dark red, loose coarse sand to friable sandy clay loam (rhodic FERRALSOLS); with ferralic ARENOSOLS and ferralo-chromic LUVISOLS. Class HU 2 consists of somewhat excessively drained, shallow, reddish brown, friable, rocky or stony, sandy clay loam (eutric REGOSOLS), lithic phase; with Rock Outcrops and calcic CAMBISOLS. Class AA 4 consists of well drained to imperfectly drained, very deep, dark brown to yellowish brown, stratified, micaceous, strongly calcareous, predominantly loamy soils (calcaric FLUVISOLS).

Fig. 5: Soils



Source: FMH, 2009

The project site is in this low lying AA 4 zone. As well as being ideal for agriculture (visible from site visits), the calcareous loams are great for supporting foundations because of its evenly balanced properties, a mixture of sand, silt and clay, with limestone infused (calcareous) sub-soil. Limestone offers strong support for construction [4]. Moreover, the approved engineering designs (**Annex 4 (3)**) specify a study construction, to ensure containment of faecal sludge in the DTF unit in all stages of treatment.

4.1.5 Landcover

Vegetation types in Kenya correspond to the climatic conditions and physiography in each area. The Mwatate area near the project site, is characterised mainly 4 Africover[5] classes, including: -

1) Rainfed herbaceous crops (small, continuous fields and clustered and isolated fields), merging with,
2) irrigated and post-flooding herbaceous crops (sisal plantation)" to the south-east. Class 1 is s bordered to the north-west by
3) closed to open shrubs and woody vegetation, an area that signals the altitudinal increase into the Taita hills to the north. There is a depression in the area, running in a north-south direction and comprising of

[4] https://soilsmatter.wordpress.com/2015/05/01/what-type-of-soil-is-good-for-a-foundation-for-buildings-or-houses/
[5] Kenya Spatially Aggregated Multipurpose Landcover database. FAO - AFRICOVER. 2003.

4) aquatic closed to open trees, shrubs and woody vegetation (fresh water, permanently or temporarily flooded) class. The proposed project site is in this area. (**Fig. 6**).

Class1 is now peppered with settlements, though plots with agricultural activities are visible in lower Peleleza and Kitivo areas, and below Kariobangi and in the lower areas adjacent to Soko ya zamani.

Zone 4 is the lowest part of Mwatate, and where the study area is in. It comprises of a fresh water (Mwatate River), and is permanently or temporarily flooded especially after the rains. Downstream to the south, Mwatate dam is found in this zone. There are agricultural activities in the area, and also residential houses in the general vicinity, including, CARE Mwatate offices. Care will be taken in building a study DTF as per its design specifications.

Fig. 6: Landcover

Source: FAO Africover, 2003

4.2 Socio-economic baseline

4.2.1 Project site introduction

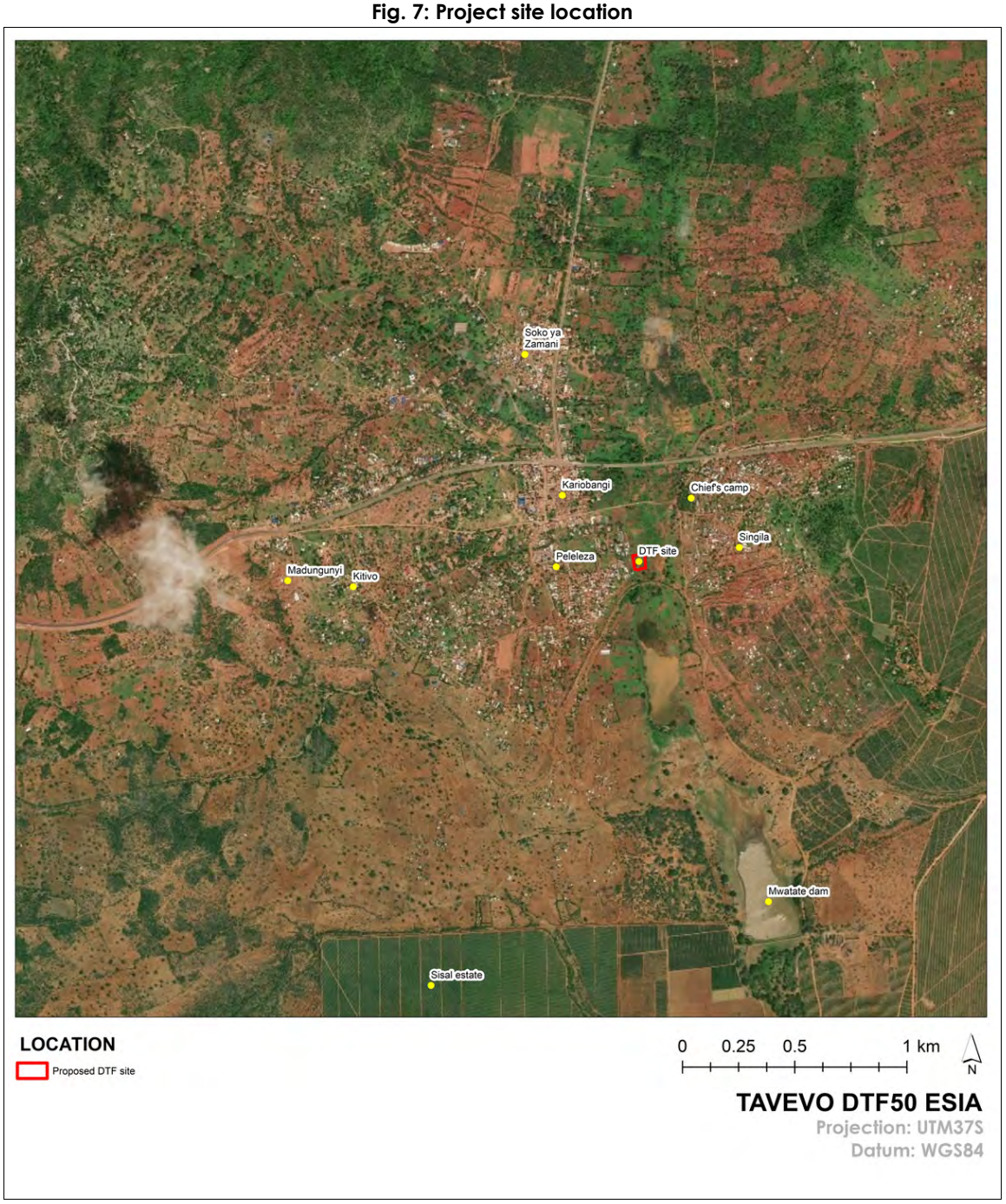
Mwatate sub-county is primarily inhabited by the Taita who are native to this area. However, the employment and trade opportunities presented by large-scale sisal farming, tourism,

mining and cross-border trade at Taveta have attracted people from other communities who have formed cosmopolitan settlements in Mwatate Town.

The Study Area

Extent of area to be affected by project activities comprises of the Peleleza, Kariobangi, Kitivo and Soko ya Zamani areas of Mwatate town (**Fig. 7**). Peleleza covers the largest area, starting from the lower area adjacent to the project, where some agricultural activities are taking place, to merge with Kitivo in the higher areas of Mwatate. Kariobangi is the congested area next to Mwatate's commercial area (shops, and other businesses). Soko ya zamani is located off the Mwatate-Wundanyi road, and also comprises of shops and small businesses, rental housing units, etc. Kitivo has a more farm house feel, with small plots adjacent to the housing units.

Fig. 7: Project site location



In general, all the areas of interest (Peleleza, Kariobangi, Kitivo and Soko ya Zamani) have certain common characteristics i.e. they are unplanned, are congested, and lack of water was the key issue raised.

Socio-economic Baseline Structure

This baseline section provides information for Mwatate sub-county and the local communities in the vicinity of the Project, with relevant County level data also provided as context where possible. This section thus tackles the following sub-sections i.e. demography, education, health, landuse, and water and sanitation.

4.2.2 Demographic profile

According to the latest national census data (2019), Mwatate sub-county occupies 15.86% of Taita Taveta county land area, and has 23% of the total County's population of 81.659 inhabitants. 78% (64,321) of the inhabitants are rural age 5+ group, while 10.5% (8,260) are urban age 5+ group (**Table 2**).

Table 2: Demographic profile

County / Sub-county	Land Area (km^2)	Population	Male	Female	Inter-sex	No. of households	Household size	Pop. Density (per km^2)
Taita-Taveta	**17,152.0**	**340,671**	**173,337**	**167,327**	**7**	**96,429**	**3.5**	**20**
Mwatate	2,722.6	81,659	41,426	40,231	2	23,698	3.4	30
Taita	477.9	55,959	28,386	27,573	-	15,094	3.7	117
Taveta	6,398.7	91,222	47,410	43,812	-	24,115	3.7	14
Voi	7,552.8	111,831	56,115	55,711	5	33,522	3.4	15

Source: KHPC, 2019

This urban age 5+ group is mostly found in Mwatate town and smaller mushrooming market centers along the main roads. About half of this group is in gainful employment, with the other half comprising of those seeking work and those outside the labour force (**Table 3**).

Table 3: Distribution of Urban Population Age 5+ activity

Sub-County/Sex1	Persons in the Labour Force				
	Total	Working	Seeking Work/No Work Available	Persons outside the Labour Force	Not Stated
TAITA/TAVETA	**79,385**	**38,716**	**7,172**	**33,483**	**14**
Male	38,923	20,574	3,788	14,552	9
Female	40,458	18,140	3,382	18,931	5
MWATATE	**8,260**	**4,257**	**520**	**3,481**	**2**
Male	3,973	2,185	244	1,543	1
Female	4,287	2,072	276	1,938	1
TAITA	**3,605**	**2,064**	**212**	**1,329**	**-**
Male	1,816	1,054	148	614	-
Female	1,789	1,010	64	715	-
TAVETA	**18,534**	**9,155**	**1,333**	**8,046**	**-**
Male	8,958	4,574	766	3,618	-
Female	9,576	4,581	567	4,428	-
VOI	**48,986**	**23,240**	**5,107**	**20,627**	**12**
Male	24,176	12,761	2,630	8,777	8
Female	24,806	10,477	2,475	11,850	4

Source: KHPC, 2019

4.2.3 Education profile

In 2015, Mwatate had 88 and 27 public and private ECDE's respectively, with an enrolment of 1,899 boys and 1,861 girls, for public ECDEs, and 521 boys and 495 girls for private ECDEs (KNBS,

2015). To date, Mwatate sub-county has a total of 46 primary and 14 secondary schools.

According to the KHPC, 2019 data on learning for age 3+, Mwatate sub-county caters for 24%, 24%, 26% and 22% of pre-primary, primary, secondary and university categories in Taita Taveta County (**Table 4**).

Table 4: Learning data for Population Age 3+

County/ Sub-County	Total*	Pre-Primary	Primary	Secondary	Middle Level/ Technical and Vocational Training (TVET)	University	Adult Basic Education	Madrasa / Duksi	Don't Know	Not Stated
TAITA/TAVETA	**116,381**	**20,535**	**67,662**	**22,938**	**3,236**	**1,710**	**78**	**11**	**211**	**-**
Male	59,272	10,439	34,682	11,327	1,677	989	35	8	115	-
Female	57,108	10,095	32,980	11,611	1,559	721	43	3	96	-
MWATATE	**28,635**	**4,949**	**16,398**	**6,121**	**716**	**393**	**18**	**1**	**39**	**-**
Male	14,632	2,507	8,425	3,051	385	230	9	1	24	-
Female	14,002	2,441	7,973	3,070	331	163	9	-	15	-
TAITA	**19,302**	**3,293**	**10,719**	**4,504**	**475**	**246**	**16**	**1**	**48**	**-**
Male	9,800	1,642	5,560	2,174	252	143	6	-	23	-
Female	9,502	1,651	5,159	2,330	223	103	10	1	25	-
TAVETA	**31,879**	**5,677**	**19,728**	**5,352**	**716**	**350**	**20**	**5**	**31**	**-**
Male	16,342	2,890	10,234	2,653	343	192	9	4	17	-
Female	15,537	2,787	9,494	2,699	373	158	11	1	14	-
VOI	**36,565**	**6,616**	**20,817**	**6,961**	**1,329**	**721**	**24**	**4**	**93**	**-**
Male	18,498	3,400	10,463	3,449	697	424	11	3	51	-
Female	18,067	3,216	10,354	3,512	632	297	13	1	42	-

Source: KHPC, 2019.

4.2.4 Health profile

In 2015, health facilities in Mwatate sub-county included - 1 government hospital, 2 government health centres, 15 government dispensaries and 4 private clinics, all with a total of 49 beds and 7 cots capacity. **Table 5** below showing age under 5 morbidity data for 2015 for Mwatate sub-county, gives an indication of health issues experienced (KNBS, 2015).

Table 5: Outpatient morbidity for patients below 5 years

Reporting rates		Nos. Mwatate sub-county
1.	Other Respiratory System ailments	17,046
2.	Diseases of the skin (incl. wounds)	3,199
3.	Diarrhoea	2,489
4.	Clinical Malaria	1,215
5.	Pneumonia	1,104
6.	Eye Infections	609
7.	Ear Infections	401
8.	Accidents - Fractures, injuries, etc.	273
9.	Chicken Pox	226
10.	Burns	152
11.	Confirmed Malaria	141
12.	Infectious worms	116
13.	Urinary Tract Infection	80
14.	Dysentery	76
15.	Dental Disorders	55
16.	Bites - Animal, Snake, etc.	39
17.	Malnutrition	20
18.	Mental Disorders	18
19.	Poisoning	14
20.	Epilepsy	13
21.	Measles	10
22.	Sexual Assault	10

Reporting rates		Nos. Mwatate sub-county
23.	Bilharzia	6
24.	Diabetes	6
25.	Typhoid fever	4
26.	Meningococcal Meningitis	1
27.	New AIDS Cases	1
28.	Tuberculosis	1

Source: KNBS, 2015

4.2.5 Land use profile

Mwatate sub-county has the second highest acreage of agricultural land after Taveta, and the greatest number of farming households in the County (30,878), with 94% (15,172) of the farming households practicing subsistence farming (**Table 6**).

Table 6: Land use distribution

County/Sub County	Area of Agricultural land (Hectares)	Area of agricultural land by main purpose (Hectares)		Total number of Farming Households	Number of farming households by main purpose of agricultural production	
		Subsistence	Commercial		Subsistence	Commercial
TAITA/TAVETA	**125,193**	**105,987**	**17,985**	**56,920**	**49,969**	**5,481**
MWATATE	30,878	29,709	923	16,123	15,172	639
TAITA	25,390	15,108	10,052	12,139	11,195	829
TAVETA	45,596	39,836	5,406	14,591	10,798	3,165
VOI	23,328	21,335	1,603	14,067	12,804	848

Generally, though, for households in agriculture, activities are broken down as follows for Mwatate county: - 68% of the population is involved in farming, 59%crop production, 52% livestock production. Only 4% practice irrigation (**Table 7**).

Table 7: Distribution of households practicing agriculture

County/Sub County	Total	Farming	Crop Production	Livestock Production	Aquaculture	Fishing	Irrigation
TAITA/TAVETA	**96,429**	**56,920**	**48,382**	**43,462**	**275**	**670**	**10,225**
MWATATE	23,698	16,123	14,021	12,325	50	75	1,020
TAITA	15,094	12,139	11,254	9,162	89	112	1,287
TAVETA	24,115	14,591	12,053	10,851	92	428	7,239
VOI	33,522	14,067	11,054	11,124	44	55	679

Crops grown include maize, sorghum, rice, potatoes, beans, cassava, sweet potatoes green grams, cabbage, tomatoes, onion, groundnuts, watermelons, kales, sugarcane and cotton.

Animal husbandry includes exotic dairy cattle, exotic beef cattle, indigenous cattle, sheep, goats, camels, donkeys, pigs, indigenous chicken, exotic chicken beehives fish ponds and fish cages.

4.2.6 Water and sanitation profile

Only 6% (1,391) of conventional households in Mwatate sub-county get their drinking water through a pipe to their dwellings. The rest get water piped in yard (24% or 5,564 households), public tap / stand pipe (20.3% or 4,706 households), from streams / rivers (15.4% or 3,570 households), and from water vendors (11.4% or 2,642 households) (**Table 8**).

This probably explains the varying water prices for drinking water mentioned by those engaged in public participation.

Table 8: Main sources of drinking water in conventional households

County/ Sub-County	Conventional Households	Source of Drinking Water (%)						
		Pond	Dam / Lake	Stream / River	Protected Spring	Unprotected Spring	Protected Well	Unprotected Well
TAITA/TAVETA	**94,468**	**0.2**	**1.3**	**15.4**	**3.6**	**1.9**	**1.9**	**1.0**
MWATATE	23,184	0.4	1.4	21.2	2.8	1.2	0.7	0.3
TAITA	14,985	0.5	1.8	38.1	4.4	5.1	0.5	1.3
TAVETA	23,417	0.1	1.5	13.8	4.8	2.1	6.2	1.9
VOI	32,882	0.0	0.9	2.0	2.8	0.7	0.3	0.9

Contd.

County/ Sub-County	Source of Drinking Water (%)							
	Borehole/ Tube well	Piped into dwelling	Piped to yard/ Plot	Bottled water	Rain/ Harvested water	Water Vendor	Public tap/ Standpipe	Not Stated
TAITA/TAVETA	**5.1**	**12.0**	**24.1**	**0.4**	**1.3**	**11.4**	**20.3**	**0.0**
MWATATE	6.2	6.2	14.8	0.6	1.8	16.0	26.5	0.0
TAITA	1.4	10.8	15.1	0.2	2.9	1.9	16.1	0.0
TAVETA	9.6	13.2	25.4	0.2	0.1	6.5	14.7	0.0
VOI	3.0	15.9	33.8	0.5	1.2	16.0	21.9	0.0

Source: KHPC, 2019

The solid waste disposal situation presents a dire picture with the main waste disposal methods (60%+ or over 13,910 households) burning their waste in the open or in a pit. Collection by the County government caters for a measly 1% or 230 households' waste (**Table 9**).

Table 9: Solid waste disposal

County/ Sub-County	Conventional Households	Mode of Solid Waste Disposal (%)										
		Collected by County Government	Collected by Community Association (CBOs Youth Groups Faith based organizations)	Collected by private company	Dumped in the compound	Dumped in the street/ Vacant plot/ Drain/ Waterways	Dumped in the Latrine	Burnt in open	Buried	Compost pit	Burnt in a pit	Not Stated
TAITA/TAVETA	**94,468**	**5.9**	**0.6**	**0.9**	**9.6**	**1.0**	**3.7**	**26.1**	**1.4**	**13.0**	**37.7**	**0.0**
MWATATE	23,184	1.0	0.0	0.5	13.0	0.3	3.1	16.1	1.2	19.2	45.5	0.0
TAITA	14,985	2.2	0.0	0.3	17.6	0.2	1.8	18.8	2.5	24.9	31.6	0.0
TAVETA	23,417	5.1	0.4	1.0	6.3	0.7	5.9	33.8	1.8	6.4	38.6	0.0
VOI	32,882	11.7	1.5	1.3	5.9	2.3	3.4	31.0	0.7	7.8	34.4	0.0

Source: KHPC, 2019

Data available on human waste disposal with potential health and medical problems, also paints a grim picture for Mwatate sub-county. Over 92% or 21,491 households use pit latrines (**Table 10**). Septic tanks are connected to 11.2% or 2,596 households (KHPC, 2019).

Table 10: Human waste disposal

County/ Sub-County	Conventional Households	Main Sewer	Septic tank	Cess pool	VIP Latrine	Pit latrine covered	Pit Latrine uncovered	Bucket latrine	Open/ Bush	Bio-septic tank/ Biodigester	Not Stated
TAITA/TAVETA	**94,468**	**1.1**	**11.2**	**0.2**	**13.8**	**58.7**	**12.1**	**0.3**	**2.4**	**0.1**	**0.0**
MWATATE	23,184	0.3	4.3	0.1	17.4	63.7	11.6	0.3	2.0	0.2	0.0
TAITA	14,985	0.4	4.6	0.2	18.8	65.5	8.6	0.3	1.5	0.0	0.0
TAVETA	23,417	2.1	5.5	0.2	12.2	54.3	21.5	0.2	4.1	0.0	0.0
VOI	32,882	1.3	23.2	0.3	10.1	55.2	7.5	0.4	1.8	0.0	0.0

Source: KHPC, 2019

Source of and composition of sewage

The bulk of the sewage will be from residential areas, and also schools, community service offices and traders in the town and market. There are no big industries. Each person is assumed o contribute 55 grams of BOD and 80 grams of Suspended Solids (SS) every day, as per the [6]Water and Irrigation Practice Manual. However, unlike Voi and Taveta towns, there is no Waste Water Masterplan for Mwatate, and this project is aimed at encouraging adoption of flush toilets in the Town.

[6] Draft Water and Irrigation Practice Manual. Ministry of Water and Irrigation. 2008.

5.0 ENVIRONMENTAL IMPACTS AND MITIGATION

This section identifies both the positive and negative impacts associated with the proposed DTF50 project to be located in Mwatate town's Peleleza area.

5.1 Potential impacts and mitigation measures

Pollution is the undesirable state of the environment being contaminated with substances, which disturb the natural balance of nature and can lead to health consequences for flora, fauna and humans. Although domestic wastewater is mainly organic, the high concentration of the substances has a polluting effect on open-water bodies, groundwater or soil, due to the oxygen-draining chemical and bio-chemical reactions that result.

Pathogens, including helminth eggs, protozoal cysts, bacteria and viruses, are responsible for innumerable cases of disease and death in the world.

Phosphorus and nitrogen are essential nutrients for plant growth. Their introduction to water bodies can generate great algae populations, which limit the amount of sunlight that can shine into the water, thereby leading to excessive oxygen consumption within the water body until other aquatic life-forms can no longer survive. Nitrogen is also poisonous to fish in the form of ammonia gases and may also become poisonous to other life-forms, including humans, in the form of nitrite.

Studies[7] have shown that domestic wastewater can be a source of heavy metals including copper, chromium, mercury, cadmium, lead and zinc. These could come from various sources such as detergents and cosmetics, and are then discharged to wastewater from lavatory, kitchen, laundry and bath. Another source is the improper disposal of solvents, drugs, fibrous materials (cotton buds, hair, sanitary products), oil and grease into the waste water system. Most heavy metals are toxic or carcinogenic. They harm the aquatic life of the receiving water and affect humans through the food chain.

Adequate environmental management aspects will be incorporated during the entire planning and design, implementation (construction) and operating stages of the project to minimize any adverse environmental impacts and assure sustainable development of the area.

The checklist below (**Table 11**) gives an indication of potential impacts.

Table 11: Checklist for identifying potential project impacts

Potential impacts from a DTF50			
	Project Stage		
Potential impacts generated	**Construction**	**Operation**	**Decommissioning**
1. Air / Noise Pollution			
Increased noise	X	X	X
Dust Emissions	X		X
Climate change (GHG emission)	X	X	
Odour		X	

[7] Tjadraatmadja G and Diaper C 2006.Sources of critical contaminants in domestic wastewater - a literature review. CSIRO: Water for a Healthy Country National Research Flagship. 2006, and Decentralized Wastewater Treatment Systems (DEWATS) and Sanitation in Developing Countries. Ulrich, A., Reuter, S. and Gutterer, B. (eds) with Sasse, L., Panzerbieter, T. and Reckerzügel, T. (contributors). WEDC, Loughborough University, UK in association with BORDA, Germany. 2009

Potential impacts from a DTF50			
	Project Stage		
Potential impacts generated	**Construction**	**Operation**	**Decommissioning**
Increased evaporation		X	
2. Soil			
Soil loss	X		
Contamination	X		
Compaction	X		X
3. Water			
Increased demand	X		
Water balance/ hydrology		X	
Surface flow/ Site drainage	X	X	X
Contamination	X	X	X
4. Bio-diversity			
Loss of flora	X		
Loss of fauna	X		
Habitat alteration	X	X	
Extinction of species			
5. Socio-economic / Health impacts			
Population increase	X		X
Solid waste creation	X		X
Job creation	X	X	X
Quality of life		X	
Diseases	X	X	X
Social / Aesthetic	X	X	
Landscape modification	X	X	X

Below is a brief description of the potential positive and negative impacts of the DTF50 project, and the different aspects of the environment they might impact on.

5.1.1 Impacts on air and climate

Impact on air and climate include potential proposed project impacts on air, noise pollution, and any effects on climate.

Dust emissions (carbon, hydrocarbons, particulate matter, etc.) will be generated during the site-specific clearance and construction phase, as well as movement of trucks to and from the site. There will also be smoke emissions from vehicles and equipment e.g. concrete mixer) for the duration of the construction period.

During the operation phase of the project, the incinerator will emit smoke for the duration of the project. Exposure to incinerator emissions has the potential to cause various health effects. Locally, incinerator workers and individuals living or working nearby can be exposed directly through inhalation, the so-called 'direct' exposure pathway. Additionally, air pollutants deposited in soil, vegetation and water can lead to so-called 'indirect' exposures through ingestion of locally-produced foods or water, and dermal absorption due to contact with contaminated dusts, soil, water, etc. These discharges can lead to occupational and

environmental exposures to toxic chemicals and subsequent health risks affecting waste workers, the general public, and the environment.

Regionally (at some distance from incinerators), individuals are exposed through a different mix of pathways for persistent and/or bio-accumulative pollutants, e.g., polycyclic aromatic hydrocarbons (PAHs), dioxins, furans, polychlorinated biphenyls, mercury, chromium, cadmium, etc., that undergo chemical and physical transformations, cycling in and out of soil, vegetation, and surface water. At regional scales, most exposure is believed to occur through ingestion of food and water, and incidental soil and house dust).

The waste stream from incinerators also includes solid and liquid wastes, namely, bottom ash and residues from pollution control equipment (if any). Typically, solid wastes are disposed in soils (typically landfills or pits). Disposal of waste, ash, or other residues in unlined pits or other improperly managed facilities may contaminate groundwater, which may be used for drinking water.

During transfer from septic tanks to exhauster and to the DTF, activities are associated with bad odour, and pose danger of contamination. Workers at the DTF will be provided with relevant PPE.

GHC emissions

The construction and operation of the treatment plant and the transportation of sludge will lead to an increase in energy consumption, and the related GHG emissions. Recovering methane for energy use can mitigate the generation of GHGs. Energy connection to the OR can also use solar power instead of connection to normal power grid.

5.1.2 Impacts on soil

Impact on soil will be localized since the DTF covers a small area. Loosening of the soil in site preparation might result in soil erosion to the nearby river, especially if it coincides with rainy season. Temporary dykes will mitigate this in the construction phase, and landscaping (grass and vegetation) after construction will help stabilize the DTF site against soil loss

Soil compaction may occur from movement of the heavy machinery to site during the construction phase. There is also the possibility soil contamination from oil spills emanating from the machinery on site. As such adequate measures will be put in place to mitigate this.

All solid waste resulting from the construction activities will be controlled by designating a particular site for all building inputs. All equipment and vehicles will also be parked at a designated site for pollution monitoring.

In the operational phase, exhausters transporting faecal sludge could contaminate soil. The DTF site is in a valley in the lower part of Mwatate Town and any runoff end up in a stream that eventually ends up in Mwatate Dam. All site restoration after DTF construction is complete shall be done to the satisfaction of the Principal Engineer's specifications.

Bottom ash from the incinerator will be disposed of in a designated area in a landfill or pit, properly lined with the right plastic material gauge as per NEMA and other regulations in operation in the country, as well as per international best practice. The dried sludge will be mixed with other organic material at a designated spot to create compost for use in farming.

Typically, solid wastes are disposed in soils (typically landfills or pits). Disposal of waste, ash, or other residues in unlined pits or other improperly managed facilities may contaminate groundwater, which may be used for drinking water.

5.1.3 Impacts on water resources

The DTF will release treated effluent into the immediate environment, after conforming to set standards to prevent the pollution of the nearby river. The treated water can potentially be used for agriculture (irrigation).

Coincidentally, there is a stream nearby, and also farms where subsistence farming takes place. Care will be taken to minimize pollution to the stream, and to educate communities on use of water in the vicinity of the DTF.

There are concerns that Mwatate being a water-deficit area, community members dig shallow wells on stream bed for water in the drier periods, and any contamination could be detrimental on their health.

5.1.4 Impacts on flora and fauna (Bio-diversity)

The construction process will involve some clearing of vegetation on the borehole site. Vegetation will also be disturbed when moving machinery to and from site. Care will be taken to ensure that any disturbance to flora and fauna is restricted to the actual project area and avoid spill-over effects on the neighbouring areas. The site will be appropriately re-greened after construction decommissioning i.e. grass trees to prevent loose soil erosion into the nearby river.

5.1.5 Socio-economic and Health impacts

During the construction and decommissioning phases, the DTF project will create employment for casual and skilled workers from the immediate communities. The contractor assigned should ensure that the community is involved actively in the entire project to create a sense of ownership.

As per local regulations, the contractor must ensure that there are sufficient toilet facilities, clean water and relevant PPE for the workers. Hygiene cannot be over-emphasized in an area a stone-throw away from congested urban quarters.

Where a group of workers are involved, potential minor accidents and injuries are expected. The contractor will ensure there are on-site first-aid kits, and knowledgeable first-aiders, at all times for the duration of the construction.

Typically, construction sites also attract local food vendors. This in addition to local businesses stocking building materials (ballast, stones, cement, etc.), has economic advantage to the local business environment.

A considerable number of Malaria cases are reported in Mwatate for under-5 age group morbidity. Mosquitoes can present a problem in the VFCW ponds. Aside from their nuisance characteristics, certain mosquitoes are also vectors for other diseases such as encephalitis, and yellow fever, and constitute a hazard to public health.

Upon successful completion of the project, Mwatate town residents will benefit from a cleaner and safer alternative to cater for their sanitation needs that are currently in dire need. This was

one of the key benefits the respondents mentioned during the public participation exercise. In general, improved sanitation will potentially reduce the risk of hygiene–related maladies. It will also reduce the construction of many pit latrines, and potentially result in an overall livelihood improvement.

The incinerator unit emits smoke, and can potentially emit other hazardous substances depending on waste burnt. Care will be taken to provide PPE to DTF staff, and to ensure incinerator is built to acceptable standards, and also well-maintained to limit effects on DTF staff and also the surrounding community.

Faecal sludge needs proper handling to prevent disease outbreaks on the site. The danger of such accidents spilling over to the nearby community cannot be over-emphasized. Faecal sludge has bad odour, and is potentially hazardous to those handling it. Care will be taken to provide proper protection (appropriate PPE) to DTF staff in the operation stage. The DTF site area is located a distance away from residential areas, and will also be fenced off, to allow in only authorized personnel.

The potential impacts and their mitigation are summarized in **Table 12,** complete with an impact index to give an indication of severity of each impact on the environment.

Table 12: Summary of impacts and mitigation measures

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Source of impact**	**Impact**	**Impact Index**	**Mitigation**	**Notes**
1. Air / Ambient environment	• Construction phase	• Emission of dust during transport of building materials and construction activities	-1	• Water rough road to construction site periodically during construction period • Re-vegetate the site as appropriate after construction • Hoard site to curb dust from spreading to the neighbourhood. • Provide workers with PPE (dust masks). • Trucks hauling dirt and debris to and from site, should be covered to reduce spillage. • Stockpiles of sand and soil should be covered or surrounded with wind breaks • Expedite construction so that it can take the shortest time possible.	• Comply with the Environmental Management and Coordination (Air Quality Regulations) 2009 • Comply with maximum permissible noise levels for constructions sites as per Second Schedule of the Environmental Management and Coordination (Noise and Excessive Vibration Pollution) Control Regulations, 2009. • Noise PPE guide for workers = of ≥ 80 dBA continuously for 8 hours or more should use ear muffs; workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.
		• Increased noise during transport of building materials and construction activities.	-1	• Construction should be carried out only during daytime. 0800-1700hrs • Provide workers with PPE if working in noisy section. • Hoard site to reduce noise from noisy equipment. • Machinery should be well maintained to reduce noise resulting from friction. • Limit unnecessary hooting. • Provide relevant signage at the construction site on construction activity and timings.	
		• Emission of smoke from vehicles and equipment	-1	• The number of construction equipment operating simultaneously shall be minimized through efficient management practices; • Vehicle idling time shall be minimized. • Proper servicing of machinery as per the manufacture's specifications to reduce emissions.	
	• Operational phase	• Emission of Smoke from incinerator	-2	• incinerator chimney stack will be at recommended height • The incinerator must always be maintained to ensure complete combustion, less pollution	• Comply with UNFCCC guidelines. • Comply with the Environmental Management and Coordination (Air Quality Regulations) 2009
		• Odour from faecal sludge in DTF	-1	• Ensure efficiency and optimal operation of all units	

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Source of impact**	**Impact**	**Impact Index**	**Mitigation**	**Notes**
				• Provide relevant PPE	
	• Decommissioning	• Emission of Dust.	-1	• Hoard site to curb dust from spreading to the neighbourhood. • Provide workers with PPE (dust masks). • Trucks hauling dirt and debris to and from site, should be covered to reduce spillage	• Comply with UNFCCC guidelines. • Comply with the Environmental Management and Coordination (Air Quality Regulations) 2009
		• Emission of smoke from vehicles and equipment	-1	• Minimize number of construction equipment operating simultaneously Vehicle idling time shall be minimized. • Proper servicing of machinery as per the manufacture's specifications to reduce emissions.	
2. Soil	• Construction	• Soil erosion	-1	• Temporary dykes to prevent surface runoff	• Comply with the Environmental Management and Coordination (Waste Management Regulations) 2006
		• Soil compaction from vehicles and machinery		• Use designated route to site • Designate vehicle / machinery parking area	
		• Soil contamination from vehicles and machinery oil		• Designate areas for parking vehicles and machinery	
	• Operational Phase	• Soil contamination from bottom ash from incinerator	-2	• Ensure incinerator waste (ash) is disposed of in designated areas • Line disposal pit with right plastic gauge	
	• Decommissioning	• Soil compaction from vehicles and machinery		• Use designated route to site • Designate vehicle / machinery parking area	
		• Soil contamination for vehicles and machinery		• Designate areas for parking vehicles and machinery	
3. Water	• Construction	• Increased use of water to reduce dust & in construction.	-1	• Educate workers on water conservation and waste management	• Comply with the Environmental Management and Coordination (Waste Management Regulations) 2006; KEBS standards e.g. KS 1966-1:2007 for effluents discharged into surface waters; and also, international best practise e.g. WHO maximum permissible limits for BOD and COD.
		• Reduced water quality in nearby river	-1	• Temporary dykes to prevent surface runoff, especially if construction coincides with rainy season.	
	• Operational Phase	• Increased use of water in AR and VFCW	-1	• Educate workers on water conservation and waste management	
		• Release of treated water for agriculture and other use	+1	• Only effluent with required BOD levels will be released to the environment. • Community education on proper use of water released from DTF.	

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Source of impact**	**Impact**	**Impact Index**	**Mitigation**	**Notes**
		• Contamination of water sources	-2	• Only effluent with required BOD levels will be released to the environment.	
		• Breeding ground for disease vectors (mosquitoes)	-2	• Mosquito bio-control (e.g. fish like minnow, tadpoles-frogs, etc.)	
	• Decommissioning	• Contamination of water sources	-2	• Only effluent with required BOD levels will be released to the environment.	
4. Biodiversity	• Construction	• Loss of flora and fauna.	-1	• Ensure proper demarcation and delineation of the project area to be affected by construction works. • Designate access routes and parking within the site. • Preserve individual trees within the site that do not fall on the actual construction area. • Preserve individual trees within the site that do not fall on the proposed site to be drilled.	• During site preparation for construction, ensure that any disturbance to flora and fauna is restricted to the actual project area and avoid spill-over effects on the neighbouring areas. • Revegetate the site area as appropriate after construction and decommissioning (landscaping) i.e. grass to prevent loose soil erosion into nearby river.
	• Operational Phase	• Habitat alteration.	-1	• Appropriate landscaping after end of construction to maintain a green environment	
	• Decommissioning	• Loss of flora and fauna.	-1	• Preserve individual trees within the site that do not fall on the proposed site to be drilled.	
5. Health and Safety	• Construction	• Solid waste generated from transportation and storage of building materials	-1	• Provide waste bins strategically within the construction site. • Cover bins to prevent access by vermin, and minimise odour and dust	• Implement OSHA and other worker / EHS related guidelines i.e. a proposed ratio of 1 toilet for approx. 20 workers. • Comply with OSHA, register construction site. • Restrict unattended public access to the construction site. • All construction works and delivery of materials shall be carried out during the day between 0800 Hrs and 1700 Hrs. • The contractor should have workmen's compensation cover
		• Human waste disposal (to prevent poor hygiene related issues)	-1	• Provide temporary sanitary facilities for construction workers. • Provide clean water for workers	
		• Accidents and injuries	-1	• Provide workers with relevant PPE depending on task (ear muffs, gloves, mask, boots, helmets, overalls). • First-aid kit should be provided within the site plus at least 2 first aiders. • Food handlers preparing food the workers at the site should be controlled and monitored to ensure that food is hygienically prepared.	

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Source of impact**	**Impact**	**Impact Index**	**Mitigation**	**Notes**
	• Operational Phase	• Bad odour and danger of infection from faecal sludge	-2	• Appropriate PPE will be provided to DTF workers	in compliance with the with Workmen's Compensation Act. • Adhere to NEMA regulations and KEBSs standards for transport and transfer of faecal sludge to DTF, and also international best practise.
		• Bottom ash from incinerator disposal	-2	• Dispose of in properly designated and properly lined pit	
		• Release of water to environment	+1	• Adhere to legally prescribe BOD levels	
	• Decommissioning	• Solid waste generation	-1	• Provide waste bins strategically within the construction site.	
		• Accidents and injuries	-1	• Provide workers with relevant PPE • Provide first aid kits on site	
6. Socio-economic	• Construction	• Employment – construction activities	+1		• Locals will be hired in construction phase and also decommissioning phase. • Local food vendors may be hired to supply food and water. • Access to reliable, clean sanitation alternative can potentially contributes to improved health (fewer hygiene-related disease incidences)
		• Boost Local economy (sale of materials and tax to County Government)	+1		
	• Operational phase	• Employment (DTF staff)	+2		
		• Provision of a cleaner, better sanitation alternative to Mwatate town residents.	+2		
		• Release of clean water to environment (for use in for agriculture)	+2		
		• Dried sludge converted into compost (for use in agriculture)	+2		
	• Decommissioning	• Employment.	+1		

Measure of the impact indicated as follows

Impact Index	Description of the impact
-2	Very bad impact which might have long-term effect
-1	Small impact which is temporary or may be mitigated fully
0	No impact
+1	Good impact but will last for a short period or may change with other effects
+2	Long-term good impact

5.2 Impacts, mitigation measures and project implementation

Considering the proposed location, construction, management and mitigation measures that will be put in place and the project's contribution in the improvement of sanitation and health of the hosting community, this DTF project is both important and beneficial. Studies[8] are increasingly showing the need to consider the (poor) communities not simply as beneficiaries of sanitation projects, but as consumers, producers and workers in a livelihood approach. Viewed broadly, community members know what toilets (needs, type, local materials) they want, and also what constitutes an acceptable, usable and sustainable toilet. In which case then, improved sanitation has a direct link to livelihood improvement.

Major effort will be directed towards safeguarding the environment. This can be effectively achieved through the implementation of the Environmental and Social Management Plan (ESMP) recommendations.

[8] Enhancing Livelihoods Through Sanitation. Thematic Overview Paper 19. By Maria-Lúcia Borba, Jo Smet and Christine Sijbesma (IRC). !RC. 2007

6.0 ANALYSIS OF PROJECT ALTERNATIVES

The consideration of Project alternatives is one of the more proactive sides of environmental assessments. It enhances the project design through examination of options, in addition to focusing on the core task of reducing potential adverse impacts of a single design. This calls for the comparison of feasible alternatives for the proposed project site, technology, and/or operational alternatives. In considering the project options, the following three (3) options were considered.

6.1 The "No Project" Option

The selection of the "No Project" option would mean discontinuing project implementation and retaining the site in its existing form. There are physical, biological and socio-economic implications of this option. At present, the 0.44 ha plot is idle with encroachment from farmers in the area.

Maintaining the status quo means the residents of Mwatate town will miss out on the DTF project being constructed in close proximity to their residential dwellings. The "No Project" option has potential implications on the health and socio-economic environment of the surrounding communities, seeing as over 90% of conventional households in Mwatate sub-county, including Mwatate town, still use pit latrines. The proposed quality of the development, will potentially reduce hygiene-related maladies resulting from poor sanitation.

When the hosting community members are considered as consumers, producers and workers in a livelihood approach, improved sanitation such as the proposed project, potentially has a direct link to livelihood improvement, including the inherent benefits like employment.

If this alternative were adopted, the afore-mentioned potential benefit will be foregone, and the proponent would need to find an alternative site for the development or to implement it outside Mwatate town.

6.2 Alternative site

An alternative site considered for the DTF project is at the current solid waste site, at Mgeno some 10 Km from Mwatate Town off the Mwatate-Voi road. In comparison, the 4 areas of interest i.e. Peleleza, Kitivo, Kariobangi and Soko ya zamani are all within 2 km to the currently proposed DTF site.

6.3 Alternative technology

Based on wastewater characteristics, appropriate technologies have been identified to arrive at the probable combination of treatment technologies in a wastewater treatment project. A number of parameters were considered before arriving at combination of technologies that are appropriate for treatment of wastewater expected from the proposed Mwatate town households.

Table 13 below gives a guiding matrix about the characteristics of wastewater and technologies that have been considered for their treatment.

When each person is assumed to contribute 55 grams of BOD and 80 grams of Suspended Solids (SS) every day, this coincides with a **Low TDS, high BOD and low difference between COD & BOD** profile. The best treatment option is a combined Anaerobic and aerobic treatment.

Table 13: Technologies for treatment of wastewater

Combination	Quality of Effluent	Treatment options
1. High TDS, and high COD and equivalently high BOD	Waste is not easily biodegradable but toxic	• Thermal decomposition (based on calorific value) • Chemical oxidation by hydrogen peroxide, ozone *etc.* • Evaporation + secured landfill
2. High TDS, High COD and high difference between COD and BOD	May be toxic; not suitable for biological treatment; mostly inorganic salts	• Chemical treatment (recovery, precipitation etc.) • Evaporation + secured landfill of evaporated residue
3. High TDS, high BOD and low difference between COD & BOD	Highly organic effluent fully biodegradable	• Anaerobic + Aerobic treatment. • If quantity is less, incineration(based on calorific value) + secure land fill of incineration ash
4. High TDS, low BOD and low BOD & COD difference	Only inorganic salts, no need for biological treatment	• Solar evaporation • Forced evaporation (after separation of volatile organic matter) • Membrane technologies
5. Low TDS, and high COD and equivalently high BOD	Highly organic effluent, may not be easily biodegradable	• Thermal decomposition • Chemical oxidation by hydrogen peroxide or ozone or sodium hypochlorite etc. • Chemical + biological treatment
6. Low TDS, High COD and high difference between COD and BOD	Highly inorganic effluent, not suitable for biological treatment	• Chemical recovery • Chemical oxidation + biological treatment
7. Low TDS, high BOD and low difference between COD & BOD	Organic effluent, fully biodegradable	• Anaerobic + aerobic treatment
8. Low TDS, low BOD and low BOD & COD difference	Low organic and low inorganic effluent	• Recycle and reuse (after preliminary treatment)

Provision of effluent treatment at low cost is a key factor considered. Typically for small scale units, low capital investment, and lower operation and maintenance costs for treatment are the main factors. Other factors considered include: -

1. Mechanical and chemical processes are more preferable to reduce the suspended solid concentration in effluents before biological treatment,
2. To minimize the electrical cost, it is possible to use bio-energy as an alternative, and
3. Proper management of sludge with its nutritive value would mobilize resources to substitute the operational cost (i.e. compost sold to farmers).

[9]T**ables 14** below gives a summary of treatment capacities of the biological treatment processes considered in the selection of appropriate technology i.e. Activated sludge with biological N/P removal offering a combination of anaerobic and aerobic treatment. Facultative pond, constructed wetland, and UASB digester technologies, are compared to illustrate treatment efficiency and maintenance and operations costs., where the key goal is to release treated effluent to the environment.

Whereas, facultative pond, and constructed wetland have a lower capacity in achieving BOD and COD standards in effluent quality (Table 14) though they require less operation and maintenance cost than Activated Sludge and N/P removal (Table 15). And UASBs need post-treatment as pathogens are not removed completely, and have toxicity and corrosion problem. The combination of efficiency in achieving effluent quality and low operation and maintenance costs favour the Activated Sludge with Biological N/P Removal system. Additional for the DTF50 design, the receiving bay has filter screens for removing solid waste in the faecal sludge, which is incinerated for more efficiency.

[9] Wastewater Characteristics, Treatment and Disposal. Marcos Von Sperling. 2007

Table 14: Capacity of various wastewater treatment technologies in achieving effluent quality in terms of BOD, COD and SS

System	BOD					COD			SS		
	100 mg/L	80 mg/L	60 mg/L	40 mg/L	20 mg/L	200 mg/L	150 mg/L	100 mg/L	90 mg/L	60 mg/L	30 mg/L
1. Facultative pond											
2. Anaerobic pond + facultative pond											
3. Facultative aerated lagoon											
4. Complete-mix aerated lagoon + sedimentation pond											
5. Anaerobic pond + facultative pond + maturation pond											
6. Anaerobic pond + facultative pond + high rate pond											
7. Anaerobic pond – facultative pond + algae removal											
8. Slow rate treatment											
9. Rapid infiltration											
10. Overland flow											
11. Constructed wetlands											
12. Septic tank + anaerobic filter											
13. Septic tank + infiltration											
14. UASB reactor											
15. UASB + activated sludge											
16. UASB + submerged aerated bio-filter											
17. UASB + anaerobic filter											
18. UASB + high rate trickling filter											
19. UASB + maturation ponds											
20. UASB + overland flow											
21. Conventional activated sludge											
22. Extended aeration											
23. Sequencing batch reactor											
24. Activated sludge with biological N removal											
25. Activated sludge with biological N/P removal											
26. Activated sludge + tertiary filtration											
27. Low rate trickling filter											
28. High rate trickling filter											
29. Submerged aerated bio-filter											
30. Submerged aerated bio-filter with biological N removal											
31. Rotating biological contactor											

Table 15 highlights per capita annual operation and maintenance costs of various treatment systems.

Table 15: Per capita annual operation and maintenance costs in various sewage treatment systems

System	Operation and maintenance costs (US$/inhab.year)	Operation and maintenance costs (US$/inhab. year)								
			1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Primary treatment (septic tanks)	0.5–1.0									
1. Conventional primary treatment	0.5–1.0									
2. Advanced primary treatment (chemically enhanced)	3.0–6.0									
3. Facultative pond	0.8–1.5									
4. Anaerobic pond + facultative pond	0.8–1.5									
5. Facultative aerated lagoon	2.0–3.5									
6. Complete-mix aerated lagoon + sedimentation pond	2.0–3.5									
7. Anaerobic pond + facultative pond + maturation pond	1.0–2.0									
8. Anaerobic pond + facultative pond + high rate pond	1.5–2.5									
9. Anaerobic pond + facultative pond + algae removal	1.5–2.5									
10. Slow rate treatment	0.4–1.2									
11. Rapid infiltration	0.5–1.5									
12. Overland flow	0.8–1.5									
13. Constructed wetlands	1.0–1.5									
14. Septic tank + anaerobic filter	2.5–4.0									
15. Septic tank + infiltration	1.2–2.0									
16. UASB reactor	1.0–1.5									
17. UASB + activated sludge	2.5–5.0									
18. UASB + submerged aerated bio filter	2.5–5.0									
19. UASB + anaerobic filter	1.5–2.2									
20. UASB + high rate trickling filter	2.0–3.0									
21. UASB + dissolved-air flotation	2.5–3.5									
22. UASB + maturation ponds	1.8–3.0									

System	Operation and maintenance costs (US$/inhab.year)	Operation and maintenance costs (US$/inhab. year)								
			1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
23. UASB + facultative aerated pond	2.0–3.5									
24. UASB + compl.mix aerated lagoon + sediment. pond	2.0–3.5									
25. UASB + overland flow	2.0–3.0									
26. Conventional activated sludge	4.0–8.0									
27. Activated sludge – extended aeration	4.0–8.0									
28. Sequencing batch reactor (extended aeration)	4.0–8.0									
29. Conventional activated sludge with biological N removal	4.0–9.0									→
30. Convention. activated sludge with biological N/P removal	6.0–10.0									→
31. Conventional activated sludge + tertiary filtration	6.0–10.0									→
32. Low rate trickling filter	4.0–6.0									
33. High rate trickling filter	4.0–6.0									
34. Submerged aerated bio filter with nitrification	3.0–6.0									
35. Submerged aerated bio filter with biological N removal	3.0–6.0									
Rotating biological contactor	4.0–6.0									

Source: Marcos Von Sperling. 2007

6.4 Comparison of Alternatives (Recommended alternative)

No other location was able to offer the comprehensive package as indicated above. As a result, no location was more suitable or amenable than the presently identified site i.e. the site allocated in the lower Peleleza area of Mwatate town.

Household wastewater from a (growing) urban area has a complex composition with BOD, COD and SS implications from nutrient loads (N, P). In addition, the wastewater can harbour pathogens (helminths, protozoa, bacteria, viruses, etc.), and even heavy metals. Activated sludge with biological N/P removal would be an ideal option for a project of this magnitude.

The recommended alternative is the "Proposed Alternative" because it recognizes the viability, capacity and effectiveness of the proposed development. Not only is it located in Mwatate town, it is also designed to address environmental health issues and concerns, and meets local regulatory requirements. The community members in the vicinity of the project fully support the project also, and have raised concerns that the proponent will consider in the spirit of collaboration and communication in all stages of the project development.

7.0 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

ESMPs for development projects aim to provide a logical framework within which impacts related to the project are identified, and a plan for mitigation and monitoring of potential negative environmental impacts formulated. In addition, the ESMP assigns responsibilities to various actors and provides a timeframe within which mitigation measures and monitoring can be done.

A comprehensive Environmental and Social Management Plan (ESMP) **[Table 16**] has been developed to assist the project proponent in mitigating these negative impacts, and for monitoring the project. It is worth noting that the project has its own dynamics. It is generally recommended that the implementation of the ESMP be subjected to regular reviews in the form of Environmental Audits after a period of one (1) year, depending on the threats noticed on the environment.

Table 16: Environmental and Social Management Plan (ESMP)

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Project Phase**	**Potential impact**	**Mitigation**	**Timeframe**	**Responsibility**
1. Air / Ambient environment	• Construction phase • Operational phase • Decommissioning	• Emission of dust during transport of building materials and construction activities	• Water rough road to construction site periodically during construction period • Re-vegetate the site as appropriate after construction • Hoard site to curb dust from spreading to the neighbourhood. • Provide workers with PPE (dust masks). • Trucks hauling dirt and debris to and from site, should be covered to reduce spillage. • Stockpiles of sand and soil should be covered or surrounded with wind breaks • Expedite construction so that it can take the shortest time possible.	• During construction	• Contractor • Proponent
		• Increased noise during transport of building materials and construction activities.	• Construction should be carried out only during daytime. 0800-1700hrs • Provide workers with PPE if working in noisy section. • Hoard site to reduce noise from noisy equipment. • Machinery should be well maintained to reduce noise resulting from friction. • Limit unnecessary hooting. • Provide relevant signage at the construction site on construction activity and timings.	• During construction & decommissioning	• Contractor
		• Emission of smoke from vehicles and equipment	• The number of construction equipment operating simultaneously shall be minimized through efficient management practices; • Vehicle idling time shall be minimized. • Proper servicing of machinery as per the manufacture's specifications to reduce emissions.	• During construction & decommissioning	• Contractor
		• Emission of Smoke from incinerator	• Incinerator chimney stack will be at of minimum 4 metres height • The incinerator must always be maintained to ensure complete combustion, less pollution	• Operational stage	• Proponent
		• Odour from faecal sludge in DTF	• Ensure efficiency and optimal operation of all units • Provide relevant PPE to DTF staff	• Operational stage	• Proponent
2. Soil	• Construction	• Soil erosion	• Temporary dykes to prevent surface runoff	• During construction & decommissioning	• Contractor

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Project Phase**	**Potential impact**	**Mitigation**	**Timeframe**	**Responsibility**
	• Operational Phase • Decommissioning	• Soil compaction from vehicles and machinery	• Use designated route to site • Designate vehicle / machinery parking area • Control construction activities especially during rainy conditions. • Re-surface open areas after completion of the project and introduce appropriate vegetation. • Provide suitable storm water drainage channels to effectively discharge water to safe areas.	• During construction & decommissioning	• Contractor
		• Soil contamination from vehicles and machinery oil	• Designate areas for parking vehicles and machinery	• Before / During construction & decommissioning	• Contractor
		• Soil contamination from bottom ash from incinerator	• Ensure incinerator waste (ash) is disposed of in designated areas • Line disposal pit with right plastic gauge	• Operational phase	• Proponent
3. Water	• Construction • Operational Phase • Decommissioning	• Increased use of water to reduce dust & in construction.	• Educate workers on water conservation and waste management	• During construction	• Contractor • Proponent
		• Reduced water quality in nearby river	• Temporary dykes to prevent surface runoff, especially if construction coincides with rainy season.	• During construction	• Contractor
		• Increased use of water in AR and VFCW	• Educate workers on water conservation and waste management	• Operational stage	• Proponent
		• Release of treated water to the environment	• Only effluent with mandatory BOD/COD levels will be released to the environment. • Community education on proper use of water released from DTF.	• Operational stage	• Proponent
		• Contamination of water sources	• Only effluent with mandatory BOD/COD levels will be released to the environment.	• Construction, Operational & decommissioning	• Proponent
		• Breeding ground for disease vectors (mosquitoes)	• Mosquito bio-control (e.g. fish like minnow, tadpoles-frogs, etc.)	• Operational stage	• Proponent
4. Biodiversity	• Construction • Operational Phase • Decommissioning	• Loss of flora and fauna.	• Ensure proper demarcation and delineation of the project area to be affected by construction works. • Designate access routes and parking within the site. • Preserve individual trees within the site that do not fall on the actual construction area. • The area will be restored to its original state after construction.	• Operational and decommissioning stages	• Contractor

POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION					
Aspect	**Project Phase**	**Potential impact**	**Mitigation**	**Timeframe**	**Responsibility**
		• Habitat alteration.	• Appropriate landscaping after end of construction to maintain a green environment	• Construction phase	• Contractor
5. Health and Safety	• Construction • Operational Phase • Decommissioning	• Solid waste generated from transportation and storage of building materials	• Provide waste bins strategically within the construction site. • Cover bins to prevent access by vermin, and minimise odour and dust	• Construction and decommissioning	• Contractor
		• Human waste disposal (to prevent poor hygiene related issues)	• Provide temporary sanitary facilities for construction workers. • Provide clean water for workers • Conduct EHS education for site workers	• Construction and decommissioning	• Contractor
		• Accidents and injuries	• Provide workers with relevant PPE depending on task (ear muffs, gloves, mask, boots, helmets, overalls). • First-aid kit should be provided within the site plus at least 2 first aiders. • Food handlers preparing food the workers at the site should be controlled and monitored to ensure that food is hygienically prepared.	• Construction and decommissioning	• Contractor
		• Bad odour and danger of infection from faecal sludge	• Appropriate PPE will be provided to DTF workers	• Operational stage	• Proponent
		• Bottom ash from incinerator disposal	• Dispose of in properly designated and properly lined pit	• Operational stage	• Proponent

8.0 CONCLUSION

The proponent recognizes that the proposed DTF project has potential impacts on the bio-physical environment, and on the health and safety of those employed. Further it will affect the socio-economic well-being of the local residents. Therefore, a concerted effort will be put on reducing the negative impacts and strengthening the positive impacts associated with the project.

Considering the positive socio-economic and environmental benefits to be accrued as a result of the development of the project, and the ESIA study having found no major adverse impacts arising from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and the full implementation of the proposed Environmental and Social Management Plan (ESMP).

ANNEXES

Annex 1: References

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Annex 2: Expert Practicing License

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/11772

Application Reference No: NEMA/EIA/EL/15858

M/S **Cuthbert Idawo**
(individual or firm) of address

P.O. Box 12886 - 00100, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **6249**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **2/17/2020** Expiry Date: **12/31/2020**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

Annex 3: Sample filled questionnaires

a. List of sampled community respondents

Area	Respondent	Job	Contact
Kitivo	Kanjele Kisombe	Farmer	0703237130
	Mwarigha Matana	Mechanic	-
	Makenga Kilio	Masonry	0736115798
	Anna Wandoe	Grocery	0728047854
	Michael makenga	Masonry	0715571474
	Florence Nyambura	Artisan	-
Kariobangi	Peter Kegode	Security guard	0748955013
	Zainabu Nyange	House wife	O719482847
	Kenyatta Ngure	Laundry	-
	Ackloid Mutegi	-	0700437750
	Mary Mwavala	Video shop	0759725090
Peleleza	Janet Rita	Business	0738 988786
	Mrs Andisi	Housewife	-
	Maritina Chinia	Housewife	0700484565
	Susan Mwamburi	Grocery	0714776787
	Juma Babu	Businessman	0713563954
	Rachel Ngumbi Mlisha	-	0715427322
	Isaac Kibet Chelimo	Farmer	0768701545
Soko ya zamani	Pwaru Esther Mwailongo	Shop owner / Village elder	0704219556
	Jeslinah Wanjala	Grocery	0727 754426
	Alice Wambugha Mwambogho	Shop owner	0716944337
	Robert Mwandoro Mwatume	Artisan	0721164073
	Susan Mwamburi	Grocery	0714776787

b. Sample filed questionnaires

Environmental and Social Impact Assessment [ESIA] Questionnaire
Proposed construction of a Decentralised Treatment Facility (DTF50)
at Peleleza area, Mwatate Town.

TO BE FILLED BY KEY INFORMANTS
(GOVERNMENT LINE MINISTRIES, CBOs AND OTHER DEVELOPMENT PARTNERS)

Description of the Project:
TAVEVO Water and Sewerage Company Ltd is proposing to construct a Decentralised Treatment Facility (DTF50) in Peleleza are of Mwatate Town, for the treatment of faecal sludge from flush toilets. This questionnaire is administered to collect views on the project from all persons likely to be affected by the project, in order to facilitate the compilation of an Environmental and Social Impact Assessment report as per the provisions of the Environmental Management and Coordination(Amendment) Act 2015 and EIA/EA Rules and Regulations, 2003.

This questionnaire acts as a guide for the respondents to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study and shall be treated confidentially. We appreciate your cooperation and thank you for your willingness to participate in this exercise.

KEY INFORMANT INFORMATION:

Key Informant / Lead Agency: ~~Peter Aho~~ World Vision Kenya

Representative's name: Peter Mwandoni

Designation: Area Program Manager ID No: 9786276

Signature: [signature] Date: 10/3/2020

1. Do you perceive any conflicts that could emerge between your institution and the proposed Decentralised Treatment Facility project? If the answer is YES, give details.

No.

2. In your opinion, what benefits does your institution stand to reap from the proposed Decentralised Treatment Facility?

Enhanced achievement of total Sanitation (~~CLTS~~) Sanitation Coverage.

Construction of TAVEVO DTF50, Mwatate 1.

3. What are the potential impacts from the proposed Decentralised Treatment Facility project that are likely to adversely affect your institution?

- Good Sanitation
- Reduced ~~lost of~~ Individual use of Chemicals.
- Improved Drainage Systems.

* Dam Contamination?
* Spill overs when System block.

4. What would you propose as measures to mitigate against the above potential impacts?

- ~~Ensure~~ There should be a system in place to ensure the drainage system is kept on check and frequently ~~M~~aintained to prevent breakage/Leakages that can cause flooding.

5. What is your general opinion on the Decentralised Treatment Facility?

- Good Concept, but the Community will need
- to be educated about it & duly accept it.

6. What are your recommendations on the Decentralised Treatment Facility project?

Recommended ☑ Not recommended ☐

6.1 List your reasons for **recommending** the project.

~~Cost~~ - Cost Saving
- Improves general Sanitation.
- Results in to decent urban environment.
- Reduce Mwatate dam Contamination

6.2 List your reasons for **not recommending** the project.

Environmental and Social Impact Assessment [ESIA] Questionnaire
Proposed construction of a Decentralised Treatment Facility (DTF50) at Peleleza area, Mwatate Town.

TO BE FILLED BY KEY INFORMANTS
(GOVERNMENT LINE MINISTRIES, CBOs AND OTHER DEVELOPMENT PARTNERS)

Description of the Project:
TAVEVO Water and Sewerage Company Ltd is proposing to construct a Decentralised Treatment Facility (DTF50) in Peleleza are of Mwatate Town, for the treatment of faecal sludge from flush toilets. This questionnaire is administered to collect views on the project from all persons likely to be affected by the project, in order to facilitate the compilation of an Environmental and Social Impact Assessment report as per the provisions of the Environmental Management and Coordination(Amendment) Act 2015 and EIA/EA Rules and Regulations, 2003.

This questionnaire acts as a guide for the respondents to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study and shall be treated confidentially. We appreciate your cooperation and thank you for your willingness to participate in this exercise.

KEY INFORMANT INFORMATION:

Key Informant / Lead Agency: CHURCH (FULL GOSPEL CHURCH - MWATATE.

Representative's name: Rev. Prinstone Mwailongo

Designation: PASTOR ID No: 10755890

Signature: Date: 3/3/2020

ALSO COMPASSION NGO

1. Do you perceive any conflicts that could emerge between your institution and the proposed Decentralised Treatment Facility project? If the answer is YES, give details.

NO
BUT LOCATION ON RIVER
NEED A CLEAN FOR COMMUNITY (CHURCH)
MEMBERS

2. In your opinion, what benefits does your institution stand to reap from the proposed Decentralised Treatment Facility?

CLEAN ENVIRONMENT
BETTER HEALTH
- IF SAFETY MEASURES INSTALLED
- IF WATER CAN BE USED FOR AGRICULTURE
- WATER FOR AGRICULTURE
VALUE ADDITION FROM WASTE

3. What are the potential impacts from the proposed Decentralised Treatment Facility project that are likely to adversely affect your institution?

20001 - 20FT DEPTH HIT LWATER - SHALLOW WATER TABLE
PASTURE HOME 25FT DEPTH HITS LWATER
DANGER OF FLOODING
ROAD FLOODED (DOWNHILL) WHEN IT RAINS!

4. What would you propose as measures to mitigate against the above potential impacts?

ROAD FLOODING — CULVERTS

5. What is your general opinion on the Decentralised Treatment Facility?

GOOD PROJECT IF IMPLEMENTED
- RECYCLING
- FERTILIZER
- CLEAN ENVIRONMENT

6. What are your recommendations on the Decentralised Treatment Facility project?

Recommended ☒ Not recommended ☐

6.1 List your reasons for **recommending** the project.

EDUCATE COMMUNITIES
GOOD FOR THE COMMUNITY
NO AWARENESS ON SEWAGE

6.2 List your reasons for **not recommending** the project.

Environmental and Social Impact Assessment [ESIA] Questionnaire
Proposed construction of a Decentralised Treatment Facility (DTF50) at Peleleza area, Mwatate Town.

TO BE FILLED BY NEIGHBOURING COMMUNITY MEMBERS, AND ALL OTHER STAKEHOLDERS LIKELY TO BE AFFECTED BY THE PROJECT.

Description of the Project:
TAVEVO Water and Sewerage Company Ltd is proposing to construct a Decentralised Treatment Facility (DTF50) in the Peleleza area of Mwatate Town, for the treatment of faecal sludge from flush toilets. This questionnaire is administered to collect views on the project from all persons likely to be affected by the project, in order to facilitate the compilation of an Environmental and Social Impact Assessment report as per the provisions of the Environmental Management and Coordination(Amendment) Act 2015 and EIA/EA Rules and Regulations, 2003.

This questionnaire acts as a guide for the respondents to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study and shall be treated confidentially. We appreciate your cooperation and thank you for your willingness to participate in this exercise.

STAKEHOLDER INFORMATION:

Respondent's name: ROBERT MWANDORO MWATUME
Occupation: ARTISAN
Telephone: 0721164073
Sub-location / Area: MWATATE – SOKO YA ZAMANI VILLAGE
Signature: Mwatume Date: 4/3/2020

A. DEMOGRAPHIC, WATER AND SANITATION DATA

1. Are you a household head? [**Tick appropriate box**]: Yes ☑ No ☐
2. Age: 69 years
3. Sex [**Tick appropriate box**]: M ☑ F ☐
4. Occupation: ARTISAN
5. Total household members: 7
6. How long have you lived in the area? FROM 1970
7. What is your main source of water? TAVEVO
8. What kind of toilet facility do members of your household uses? [**Tick appropriate box**]
   - ☐ Flush to septic tank
   - ☐ Flush to pit latrine
   - ☐ Ventilated improved pit latrine ✓
   - ☐ Pit latrine with slab
   - ☐ Pit latrine without slab / Open pit
   - ☐ Other (**Please specify**) _____

B. DATA ON DECENTRALISED TREATMENT FACILITY (SEWAGE) PROJECT

9. Has the proposed TAVEVO Decentralised Treatment Facility been mentioned to you before?

NO

10. Should the development of the proposed Decentralised Treatment Facility be allowed to continue or be stopped?

CONTINUE

11. What do you like about the Decentralised Treatment Facility project?

IT MAKES EASIER TO MANAGE THE WASTE

12. What don't you like about the proposed Decentralised Treatment Facility project? Please explain.

NO

13. Do you think the proposed Decentralised Treatment Facility project will affect the environment? If so, which aspect of the environment?

IT WILL NOT AFFECT

14. What improvements should the Decentralised Treatment Facility project developers include to reduce or minimize any adverse effects on people and environment if the project is to continue?

IT SHOULD BE CONSTRUCTED CAREFULLY TO AVOID ~~To Avoid~~ ANY EFFECTS.

15. What benefits do you think the proposed Decentralised Treatment Facility project will bring the people of Mwatate?

IT HELPS TO MAINTAIN CLEANLINESS

16. Any other relevant comments related to the proposed Decentralised Treatment Facility project.

* ISSUE: LORRIES (EXHAUSTER) WILL HAVE PROBLEM ACCESSING TOILET / SEPTIC TANKS!

Environmental and Social Impact Assessment [ESIA] Questionnaire

Proposed construction of a Decentralised Treatment Facility (DTF50) at Peleleza area, Mwatate Town.

TO BE FILLED BY NEIGHBOURING COMMUNITY MEMBERS, AND ALL OTHER STAKEHOLDERS LIKELY TO BE AFFECTED BY THE PROJECT.

Description of the Project:
TAVEVO Water and Sewerage Company Ltd is proposing to construct a Decentralised Treatment Facility (DTF50) in the Peleleza area of Mwatate Town, for the treatment of faecal sludge from flush toilets. This questionnaire is administered to collect views on the project from all persons likely to be affected by the project, in order to facilitate the compilation of an Environmental and Social Impact Assessment report as per the provisions of the Environmental Management and Coordination(Amendment) Act 2015 and EIA/EA Rules and Regulations, 2003.

This questionnaire acts as a guide for the respondents to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study and shall be treated confidentially. We appreciate your cooperation and thank you for your willingness to participate in this exercise.

STAKEHOLDER INFORMATION:

Respondent's name: THE MAN - MWATUATA
Occupation: VIDEO SHOP
Telephone: 0759725090
Sub-location / Area: KARIOBANGI
Signature: _____ Date: 05.03.2020

A. DEMOGRAPHIC, WATER AND SANITATION DATA

1. Are you a household head? [**Tick appropriate box**]: Yes ☒ No ☐
2. Age: 26
3. Sex [**Tick appropriate box**]: M ☐ F ☑
4. Occupation: VIDEO SHOP
5. Total household members: 3
6. How long have you lived in the area? OVER 10
7. What is your main source of water? TAVEVO PIPED (*HIGH BILL - KSH 3,000)
8. What kind of toilet facility do members of your household uses? [**Tick appropriate box**]
   - ☐ Flush to septic tank
   - ☐ Flush to pit latrine
   - ☐ Ventilated improved pit latrine
   - ☐ Pit latrine with slab
   - ☒ Pit latrine without slab / Open pit
   - ☐ Other (**Please specify**) _____

B. DATA ON DECENTRALISED TREATMENT FACILITY (SEWAGE) PROJECT

9. Has the proposed TAVEVO Decentralised Treatment Facility been mentioned to you before?

NO

10. Should the development of the proposed Decentralised Treatment Facility be allowed to continue or be stopped?

CONTINUE

11. What do you like about the Decentralised Treatment Facility project?

12. What don't you like about the proposed Decentralised Treatment Facility project? Please explain.

* DEVELOPMENTS UNPLANNED, NO SPACE FOR LORRIES / EXHAUSTERS

13. Do you think the proposed Decentralised Treatment Facility project will affect the environment? If so, which aspect of the environment?

= NONE
= WATER ON DRIVE (LITTLE WATER WHEN IT RAINS)

14. What improvements should the Decentralised Treatment Facility project developers include to reduce or minimize any adverse effects on people and environment if the project is to continue?

15. What benefits do you think the proposed Decentralised Treatment Facility project will bring the people of Mwatate?

* CLEANER ENVIRONMENT
* JOBS

16. Any other relevant comments related to the proposed Decentralised Treatment Facility project.

Environmental and Social Impact Assessment [ESIA] Questionnaire

Proposed construction of a Decentralised Treatment Facility (DTF50) at Peleleza area, Mwatate Town.

TO BE FILLED BY NEIGHBOURING COMMUNITY MEMBERS, AND ALL OTHER STAKEHOLDERS LIKELY TO BE AFFECTED BY THE PROJECT.

Description of the Project:
TAVEVO Water and Sewerage Company Ltd is proposing to construct a Decentralised Treatment Facility (DTF50) in the Peleleza area of Mwatate Town, for the treatment of faecal sludge from flush toilets. This questionnaire is administered to collect views on the project from all persons likely to be affected by the project, in order to facilitate the compilation of an Environmental and Social Impact Assessment report as per the provisions of the Environmental Management and Coordination(Amendment) Act 2015 and EIA/EA Rules and Regulations, 2003.

This questionnaire acts as a guide for the respondents to provide relevant information on the proposed project. All the information obtained shall be used entirely for the proposed study and shall be treated confidentially. We appreciate your cooperation and thank you for your willingness to participate in this exercise.

STAKEHOLDER INFORMATION:

Respondent's name: JUMA BABU

Occupation: BUSINESS MAN

Telephone: 0713563954

Sub-location / Area: MWATATE / PELELEZA

Signature: _____ Date: 5/03/2020

A. DEMOGRAPHIC, WATER AND SANITATION DATA

1. Are you a household head? [**Tick appropriate box**]: Yes ☑ No ☐
2. Age: 32
3. Sex [**Tick appropriate box**]: M ☑ F ☐
4. Occupation: BUSINESSMAN
5. Total household members: 3
6. How long have you lived in the area? 10 YRS
7. What is your main source of water? TAP WATER
8. What kind of toilet facility do members of your household uses? [**Tick appropriate box**]
   - ☐ Flush to septic tank
   - ☐ Flush to pit latrine
   - ☐ Ventilated improved pit latrine
   - ☑ Pit latrine with slab
   - ☐ Pit latrine without slab / Open pit
   - ☐ Other (**Please specify**) _____

B. DATA ON DECENTRALISED TREATMENT FACILITY (SEWAGE) PROJECT

9. Has the proposed TAVEVO Decentralised Treatment Facility been mentioned to you before?
YES, I HEARD OF DUMPSITE NOT A TREATMENT FACILITY

10. Should the development of the proposed Decentralised Treatment Facility be allowed to continue or be stopped?
FROM MY KNOWLEDGE TOWN SEWAREGE SYSTEM IS SUPPOSED TO BE IN SAID LOCATION AND ITS IN THE MWATATE A MAP

11. What do you like about the Decentralised Treatment Facility project?
IT WILL HELP IN MANAGEMENT OF GULLIES AROUND HERE, SINCE THE COUNCIL WILL CONSTRUCT A NICE DRAINAGE SYSTEM TOWARDS THE DRAINAGE SYSTEM

12. What don't you like about the proposed Decentralised Treatment Facility project? Please explain.
- PUNGENT SMELL FROM THE SITE
- IT CAN ALSO AFECT THE NEARBY WATER SOURCE

13. Do you think the proposed Decentralised Treatment Facility project will affect the environment? If so, which aspect of the environment?
- CONTAMINATION OF THE WATER SOURCE DOWN THERE
- OUTBREAK OF DISEASES
- THE SITE CAN ALSO ACT AS A BREEDING ZONE FOR MOSQUITOES
- DROWNING CASES LIKE THE OTHES IN SISAL DAM

14. What improvements should the Decentralised Treatment Facility project developers include to reduce or minimize any adverse effects on people and environment if the project is to continue?
BUILD SOMETHING MODERN AND SECURE AND ENVIRONMENTALLY SAFE

15. What benefits do you think the proposed Decentralised Treatment Facility project will bring the people of Mwatate?
MODERNIZE MWATATE, IMPROVE SANITATION & HYGIENE

16. Any other relevant comments related to the proposed Decentralised Treatment Facility project.
WHAT PORTION OF MWATATE WILL IT BE SERVING

Annex 4: County Government of Taita Taveta Approvals

1. Letter from County Government

COUNTY GOVERNMENT OF TAITA TAVETA

DEPARTMENT OF LANDS, MINING AND HOUSING

County Survey Office

P.O BOX 1066 - 80304
Ardhi Hse Wundanyi

REF No. TTCG/LENAR/SUR/2019/10/1 **October 30th, 2019**

To: Director Water and Sanitation
County Government of Taita Taveta

RE: CONFIRMATION OF OWNERSHIP STATUS FOR PLOT EARMARKED FOR DECENTRALISED TREATMENT FACILITY (DTF) FOR FAECAL SLUDGE

This is to inform of you about the subject matter above, the area that has been proposed and therefore earmarked for the development of a Decentralized Treatment Facility (DTF) for faecal sludge is located on Mwatate Town Advisory Plan of Ref No. **TTA/227/2007/1** on zone **6_1** which according to our records it was proposed for sewage disposal site as per the attached plan copy and hence it suits the usage herein proposed. Moreover, this falls under a public utility hence managed by the County Government. The plot measure approximately 0.44Ha.

However, documentation in regard to ownership is still pending on approval of the plan.

Yours Faithfully

JAMES MTUA
COUNTY SURVEYOR
COUNTY GOVERNMENT OF TAITA TAVETA.

CC
CCO LANDS, MINING AND HOUSING

2. Copy of land use plan

3. Copy of CGTT Approved Designs

Annex 4: County Government of Taita Taveta (CGTT) Approvals

3. Scanned copy of CGTT Approved Designs

STRUCTURAL AND ENGINEERING DRAWINGS

DECENTRALISED TREATMENT FACILITY

50m^3 daily capacity

DTF 50

Up-Scaling Basic Sanitation for the Urban Poor (UBSUP)

May 2018

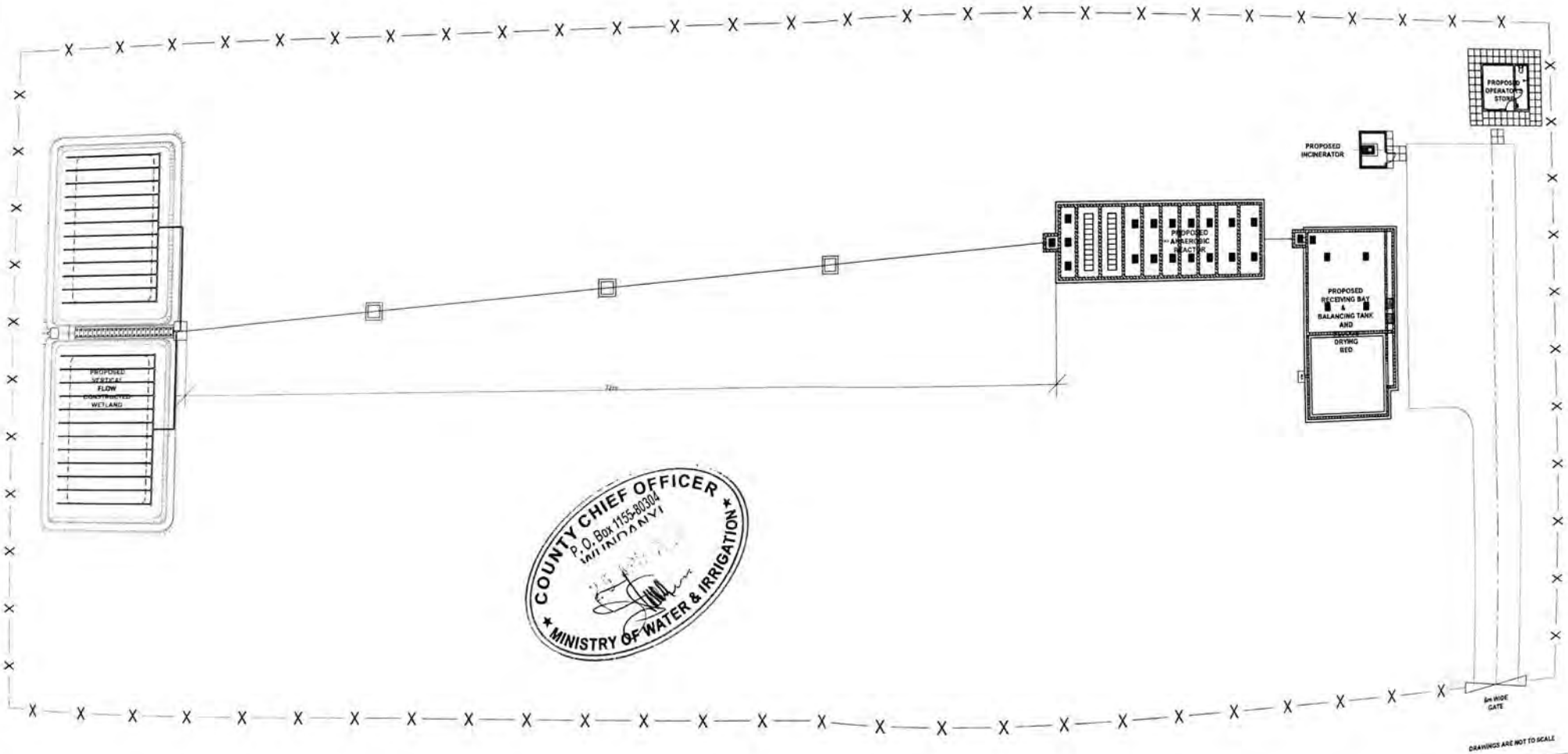
LEGEND

PROPOSED CHAINLINK FENCE

PROPOSED GATE

NOTES

1. DRAWINGS ARE NOT TO SCALE
2. ACTUAL SETTING OUT TO BE DONE ON SITE



COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MALINDI
MINISTRY OF WATER & IRRIGATION

DRAWINGS ARE NOT TO SCALE

SITE LAYOUT - DECENTRALISED TREATMENT FACILITY (DTF)

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	**Index-No.:** / **Description:**	**Date:** Scale: As show page: -

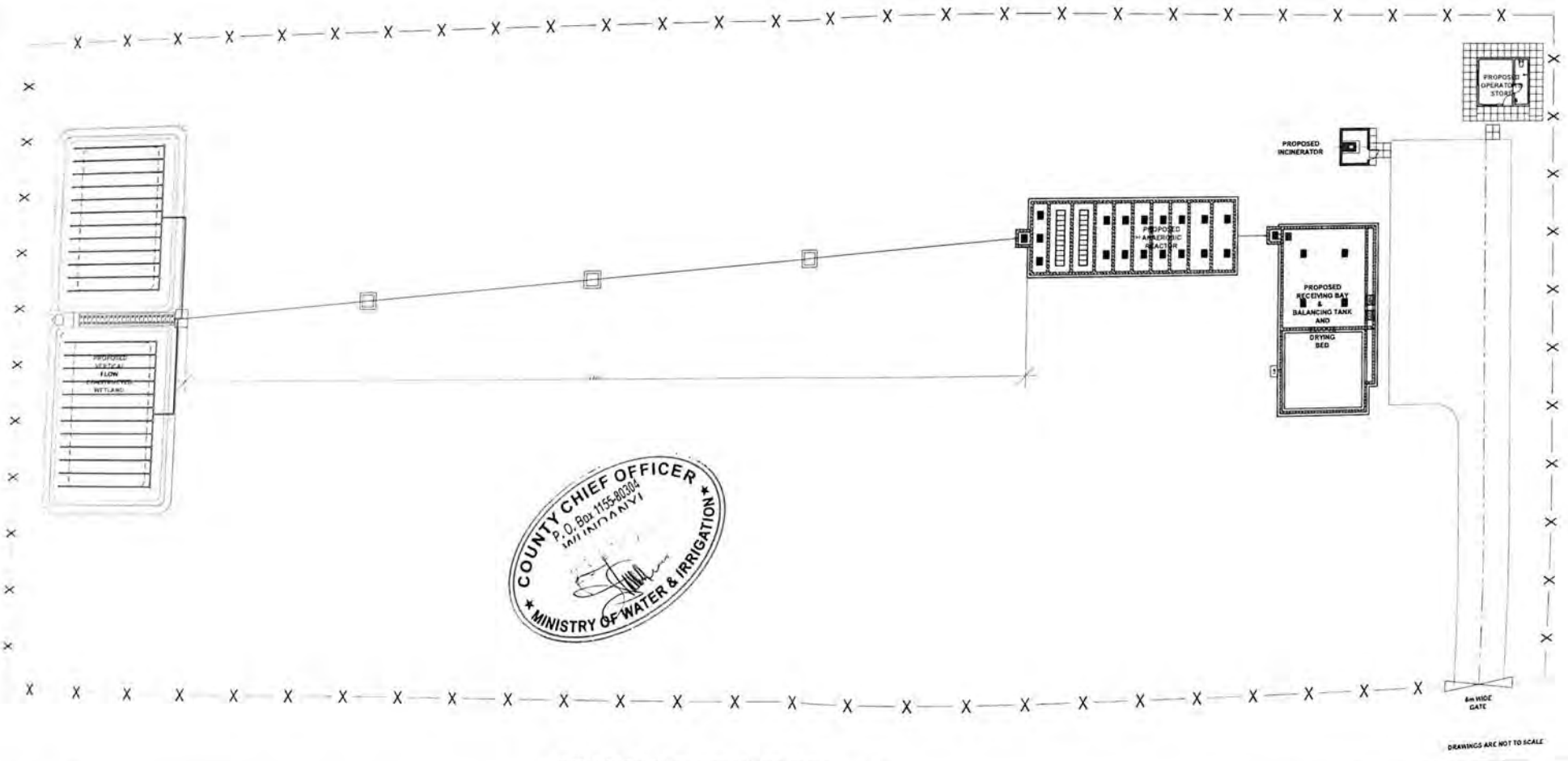
LEGEND

— X — · PROPOSED CHAINLINK FENCE

PROPOSED GATE

NOTES

1. DRAWINGS ARE NOT TO SCALE
2. ACTUAL SETTING OUT TO BE DONE ON SITE

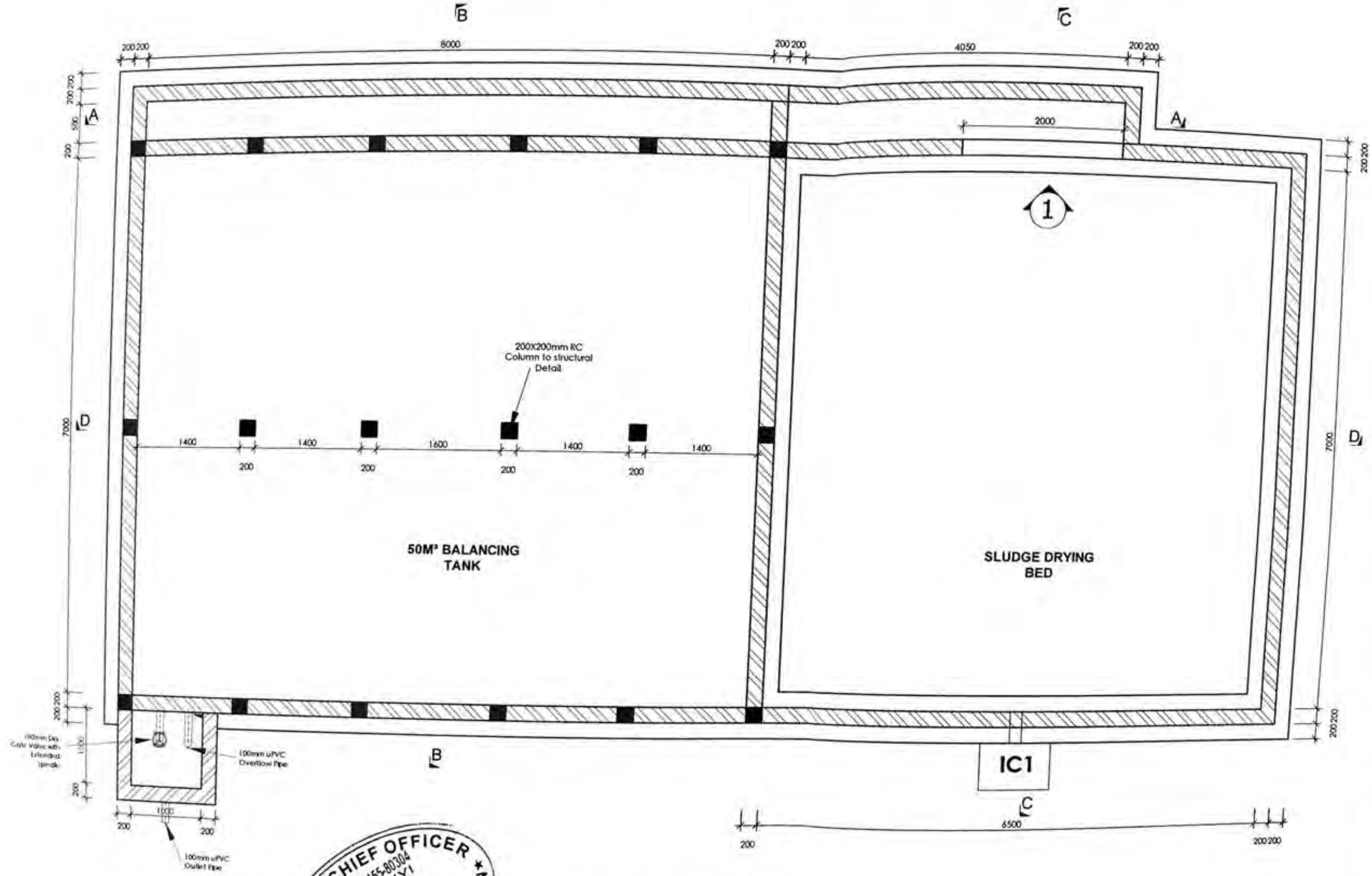


COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MALINDI
MINISTRY OF WATER & IRRIGATION

DRAWINGS ARE NOT TO SCALE

SITE LAYOUT - DECENTRALISED TREATMENT FACILITY (DTF)

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	Project Area	Designed and drawn by: UBSUP technical team Checked by: Programme Manager Urban Investments Approved by: CEO WSTF	Notes: See Above	Index-No.: / Description:	Date: Scale: As shown page:



FOUNDATION LAYOUT PLAN

SCALE 1:75

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 15/10
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/COLLUMNS 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

(d) EXAMPLE 16 Y12 - 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. 5212 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. BBBT/01

50M³ BALANCING TANK

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Project Area

Designed and drawn by: UBSUP technical team

Checked by: Programme Manager Urban Investments

Approved by: CEO WSTF

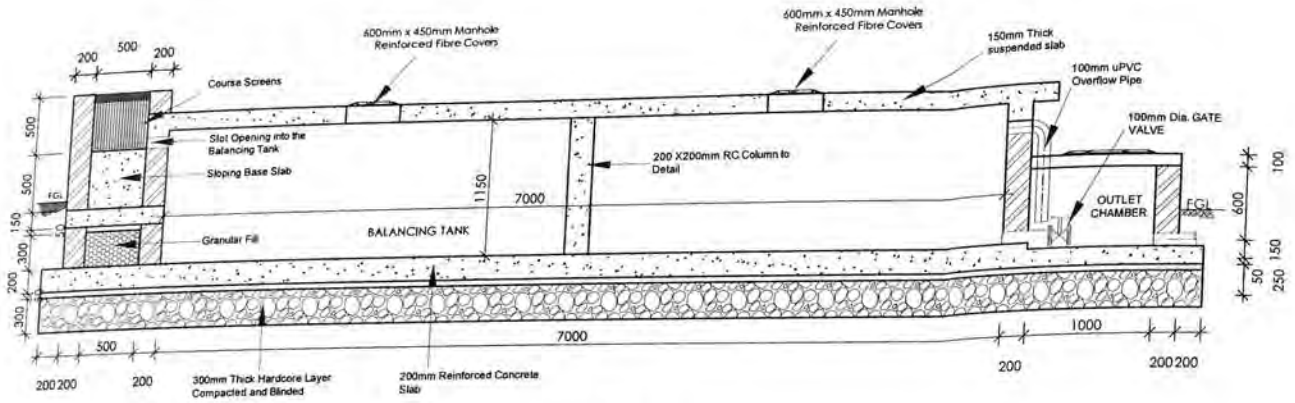
Notes: See Above

Index-No.:	Description:

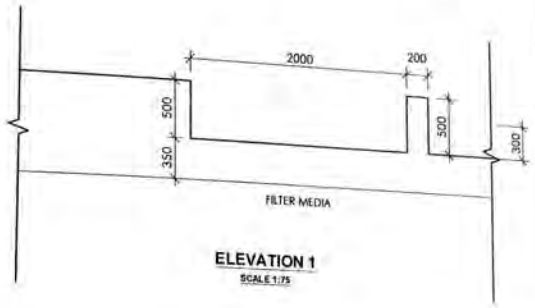
Date:

Scale: As shown

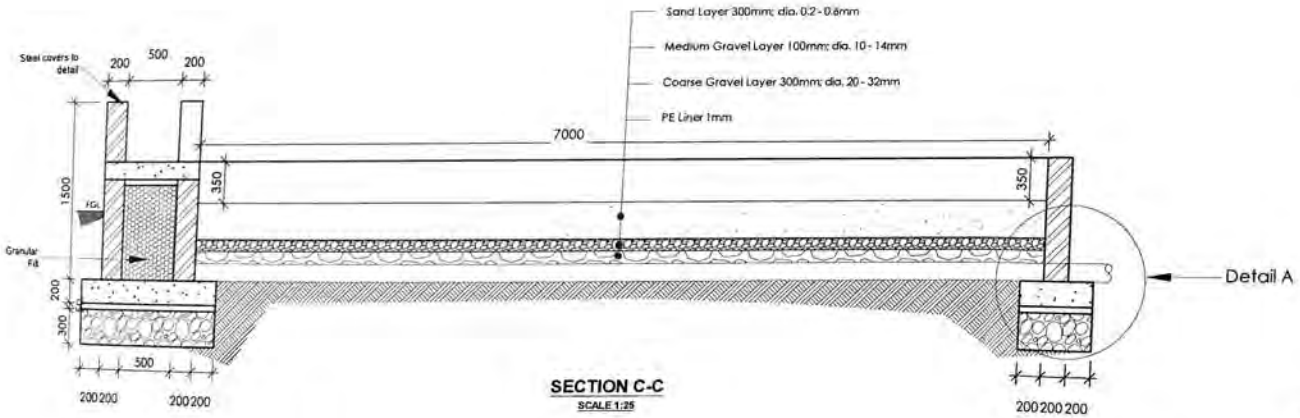
page:



SECTION B-B
SCALE 1:25



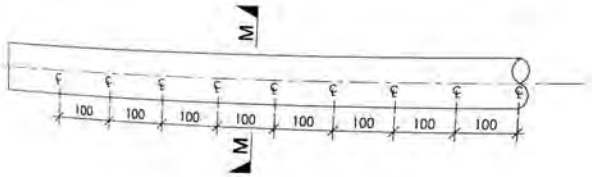
ELEVATION 1
SCALE 1:75



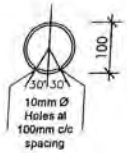
SECTION C-C
SCALE 1:25

KEY

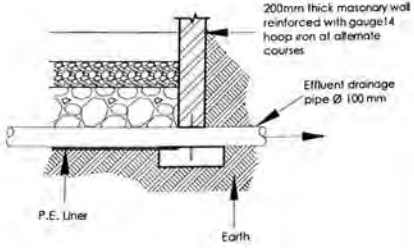
- Sand Layer; 300mm thick, size 0.2 - 0.6mm
- Medium Gravel Layer; 100mm thick, size 10 - 14mm
- Coarse Gravel Layer; 300mm thick, size 20 - 32mm



100mm Dia. UNDERDRAIN PIPES
SCALE 1:100



SECTION M-M
SCALE 1:10



COUPLING DETAIL A
SCALE 1:50

COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

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 GRADE 15/10
REINFORCED CONCRETE CLASS 25/20
(e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 50mm 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
(d) EXAMPLE 16 T12 – 02 – 100 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA BARS IDENTIFICATION MARK 02 AT 100mm CENTRE TO CENTRE SPACING

3 JOINTS
(a) THE POSITION AND NUMBER OF INTERMEDIATE JOINTS TO BE AS DIRECTED BY THE ENGINEER OR AS SHOWN ON 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 FREE FROM WATER SHOULD BE REMOVED SO THAT THE CONSTRUCTION JOINT MAY BE IN A SATURATED BUT SURFACE DRY CONDITION
(b) ALL WALL/COLUMN BASE CONNECTIONS SHOULD BE 100mm KICKER UNLESS OTHERWISE SPECIFIED
(c) THE UPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
(d) JOINT FILLER TO B.S. 1242 AND TO BE APPROVED BY THE ENGINEER

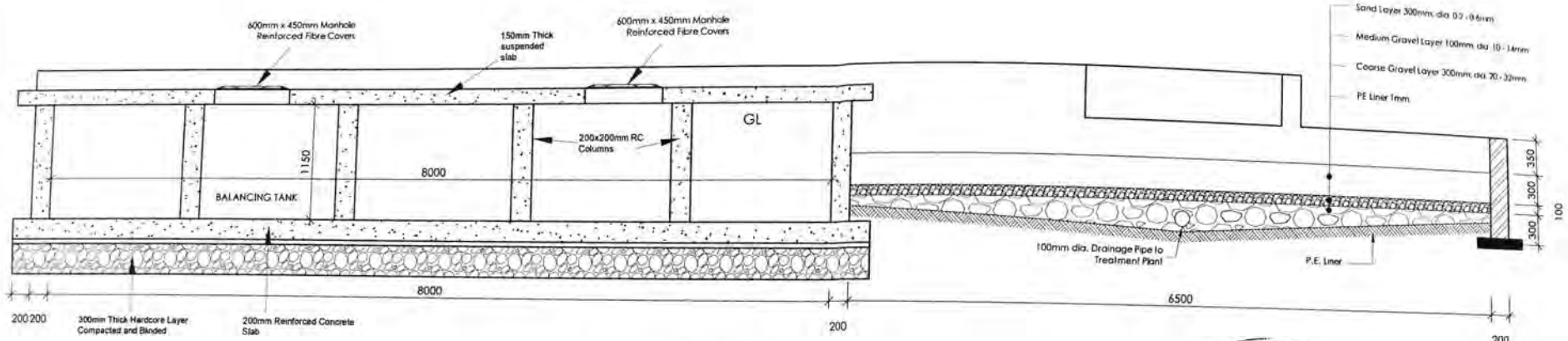
4 ABBREVIATIONS
T — TOP
N.F. — NEAR FACE
F.F. — FAR FACE
B — BOTTOM
F.) — FAR FACE
E.F. — NEAR FACE

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NO. WSTF/01

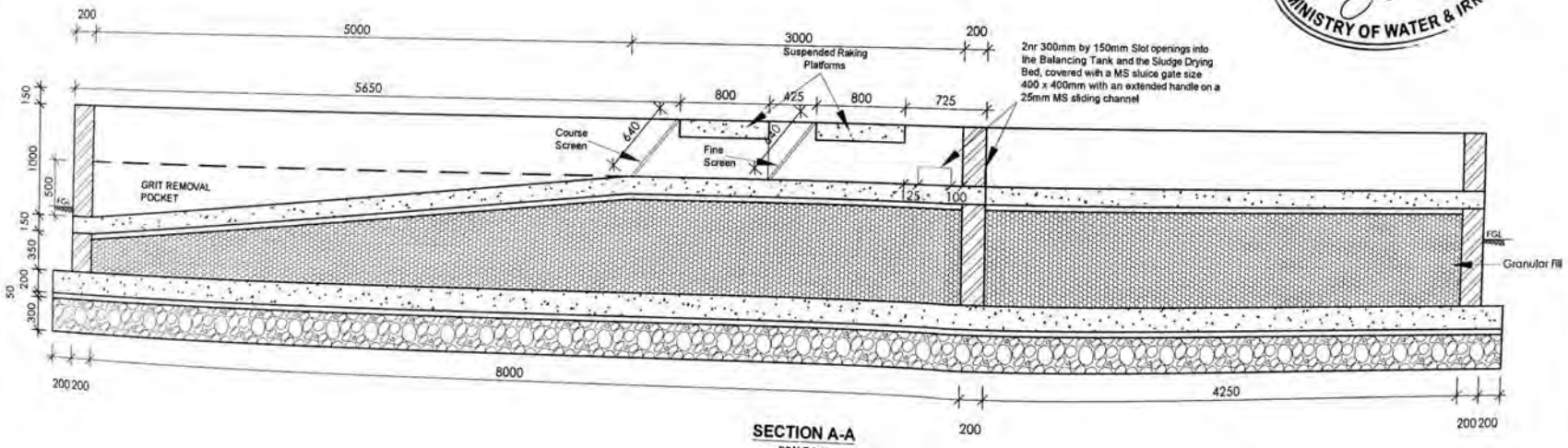
50M³ BALANCING TANK

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	**Index-No.:** / **Description:**

Date:
Scale: As shown
page:



SECTION D-D
SCALE 1:25



SECTION A-A
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 7.5N AND BLINDING MIX CLASS 11/15N
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 - 100 mm
(f) WALLS/COLUMNS SHOULD BE POURED IF POSSIBLE IN A SINGLE HEIGHT POUR AS SOON AS POSSIBLE AFTER THE MASS 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 YIELD 12mm DIA. BARS IDENTIFICATION MARK 07 AT 150mm CENTRES TO CENTRE SPACING

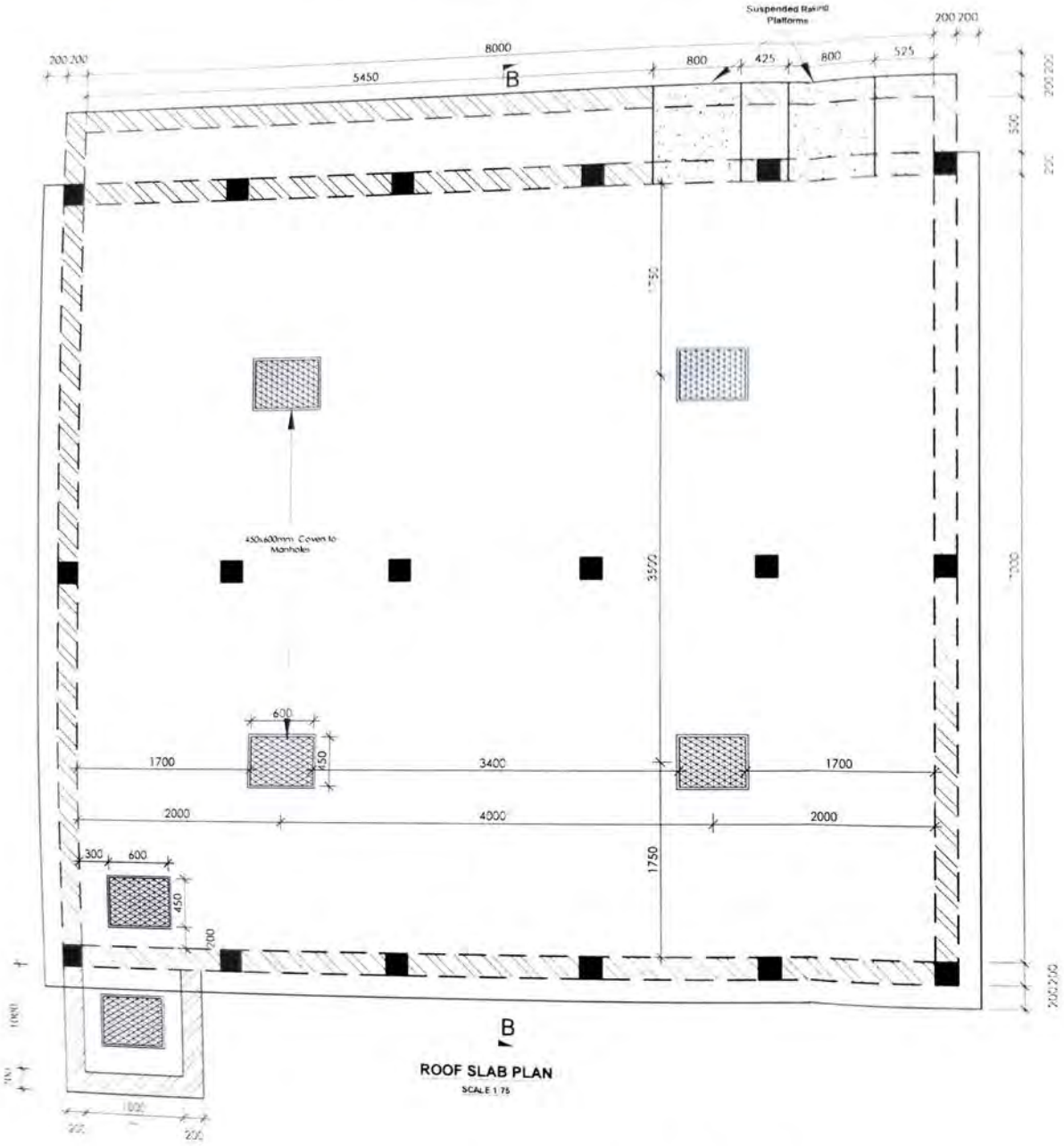
3 JOINTS
(a) THE POSITION AND NUMBER OF WATERTIGHT JOINTS TO BE AS DIRECTED BY THE ENGINEER OR AS SHOWN ON THE DRAWINGS
BEFORE PLACING FRESH CONCRETE THE OLD SURFACE SHALL BE ROUGHENED AND ALL LAITANCE AND LOOSE MATERIAL REMOVED
THE SURFACE SHALL BE THOROUGHLY WETTED BUT EXCESS WATER SHOULD BE REMOVED SO THAT THE CONSTRUCTION JOINTS ARE IN A SATURATED BUT SURFACE DRY CONDITION
(b) ALL WALL/FLOOR BASE CONNECTIONS SHOULD HAVE 100mm FILLET 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
NF - NEAR FACE
FF - FAR FACE
EF - EACH FACE
EW - EACH WAY

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

50M³ BALANCING TANK

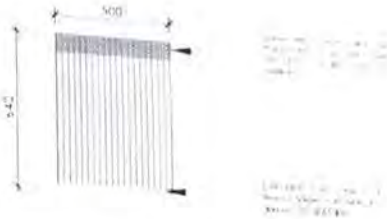
Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	**Index-No.:** / **Description:**	**Date:** **Scale:** As shown **page:**



B

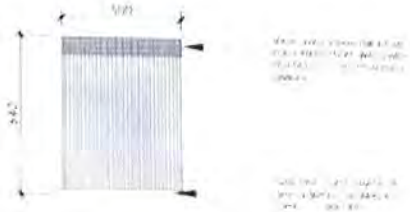
ROOF SLAB PLAN

SCALE 1:75



COARSE SCREEN DETAILS

SCALE 1:5



COARSE SCREEN DETAILS

SCALE 1:5

NOTES

COUNTY CHIEF OFFICER
P.O. BOX 1155
MINISTRY OF WATER & IRRIGATION

50M³ BALANCING TANK

Project Title:
Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Project Area

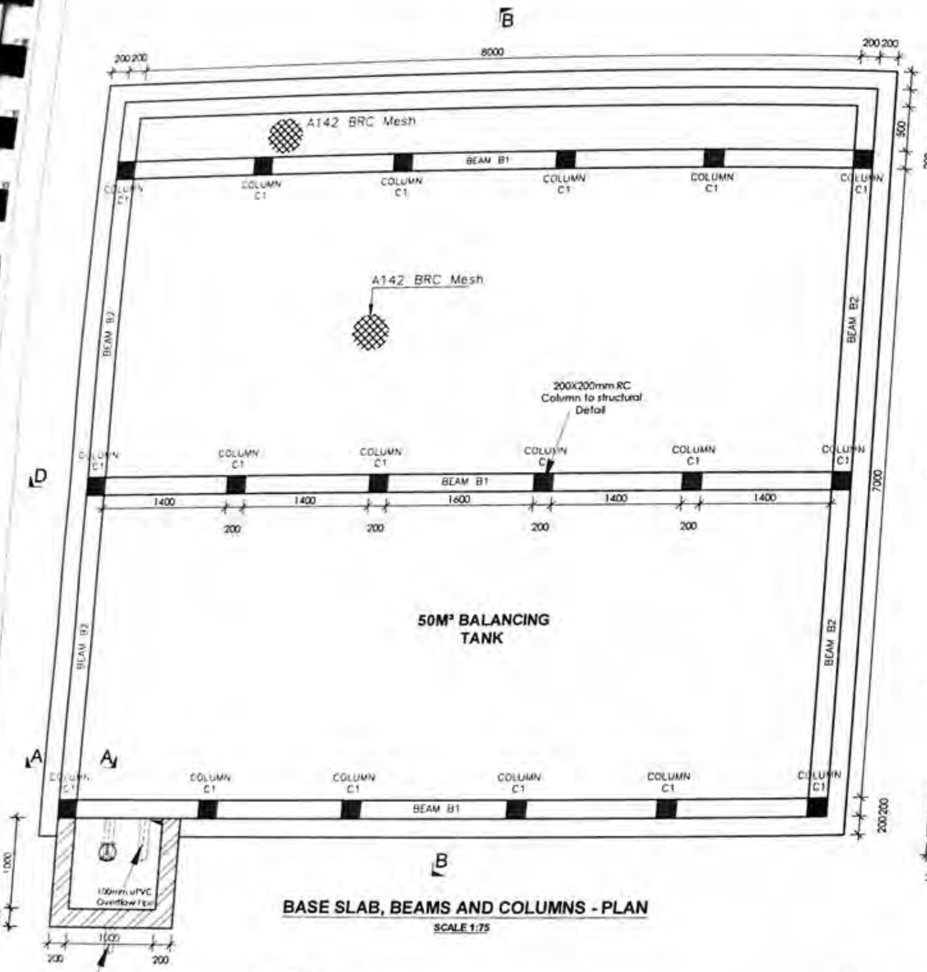
Designed and drawn by: UBSUP technical team
Checked by: Programme Manager Urban Investments
Approved by: CEO WSTF

Notes:
See Above

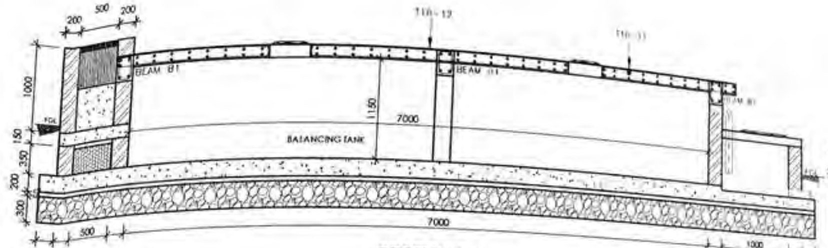
Index-No.	Description	Date

Scale: As shown

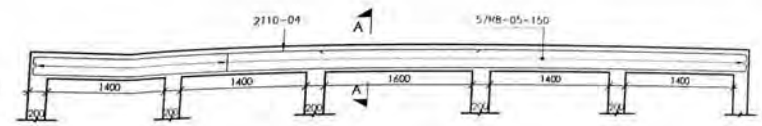
page



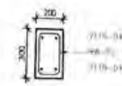
BASE SLAB, BEAMS AND COLUMNS - PLAN
SCALE 1:75



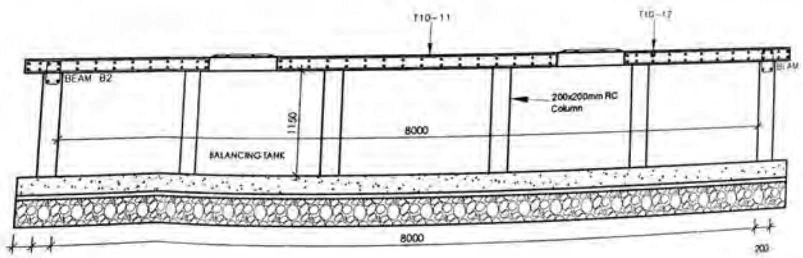
SECTION B-B
SCALE 1:25



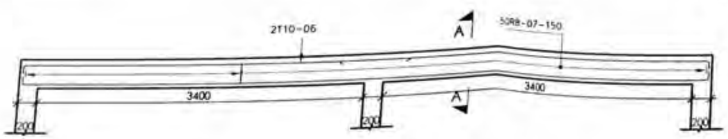
BEAM B1
3NR REQUIRED
SCALE 1:100



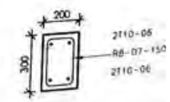
BEAM B1 - SECTION A-A
SCALE 1:50



SECTION D-D
SCALE 1:25



BEAM B2
2NR REQUIRED
SCALE 1:100



BEAM B2 - SECTION A-A
SCALE 1:50

NOTES

1 CONCRETE
(a) CEMENT TO BE ORDINARY PORTLAND CEMENT [illegible]
(b) CONCRETE AGGREGATE TO COMPLY WITH [illegible]
(c) WATER IN CONCRETE [illegible]
(d) CONCRETE CLASSES TO BE AS FOLLOWS
MASS CONCRETE FILL AND BLINDING MIX CLASS [illegible]
REINFORCED CONCRETE CLASS [illegible]
(e) MINIMUM COVER TO ALL REINFORCEMENT [illegible] AS SPECIFIED BELOW FOR BUILDINGS
MEMBERS OF BUILDINGS
- SLABS - 20 mm
- BEAMS - 25 mm
- COLUMNS - 40 mm
- FOUNDATIONS & FOOTINGS [illegible]
(f) WALLS/COLUMNS SHOULD BE POURED [illegible] 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 [illegible]
(d) EXAMPLE [illegible] 12mm DIA BARS IDENTIFICATION MARK [illegible] CENTRE TO CENTRE SPACING

3 JOINTS
(a) THE POSITION AND NUMBER OF INTERMEDIATE JOINTS [illegible] 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 [illegible] SHOULD BE REMOVED SO THAT THE CONSTRUCTION JOINTS [illegible] IN A SATURATED BUT SURFACE DRY CONDITION
(b) ALL WALL/COLUMN BASE CONNECTIONS SHOULD HAVE [illegible] UNLESS OTHERWISE SPECIFIED
(c) THE PVC WATER STOP SHALL BE [illegible] UNLESS OTHERWISE SPECIFIED
(d) [illegible] TO B.S. [illegible] ENGINEER

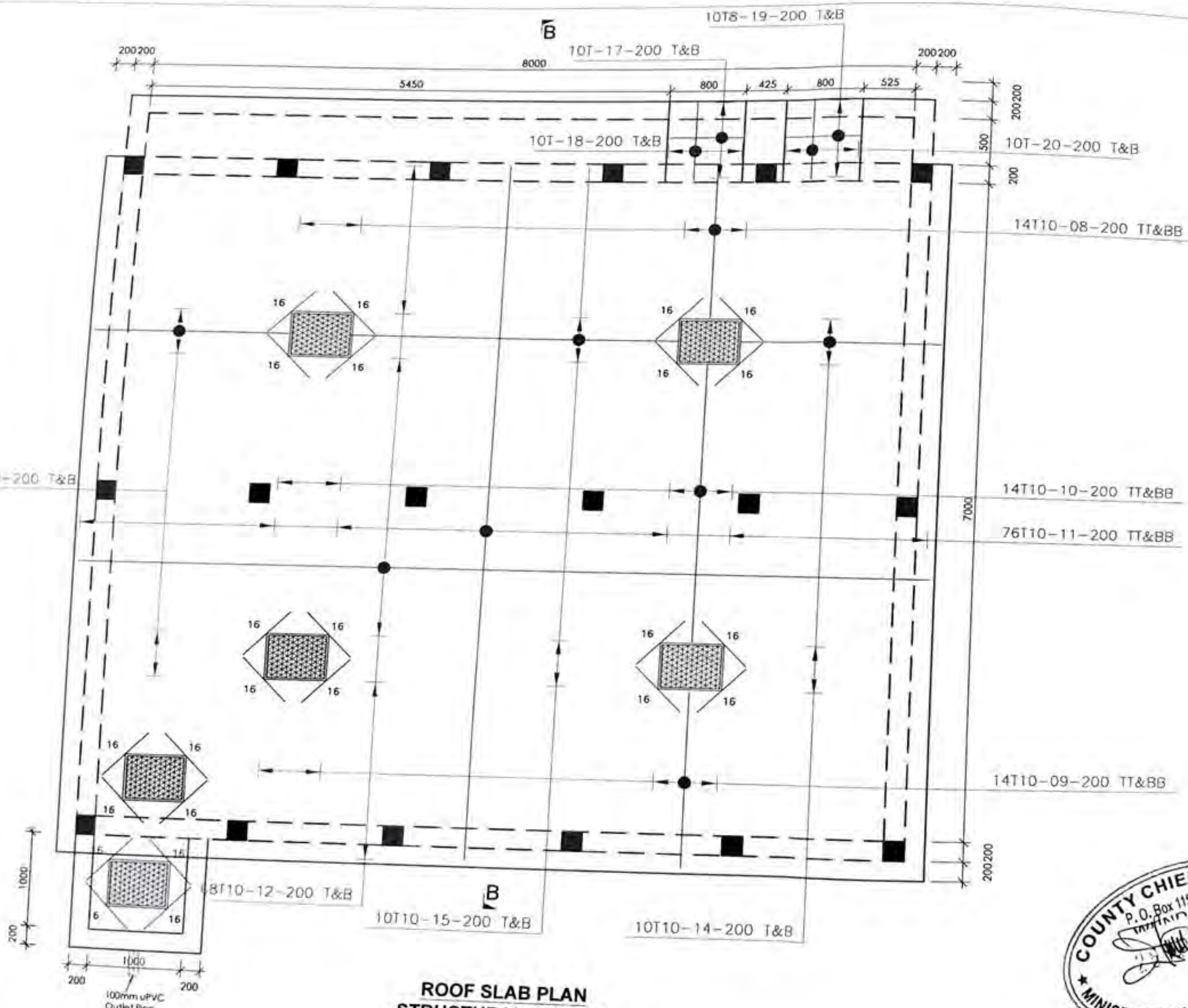
4 ABBREVIATIONS
T - TOP
N.F. - NEAR FACE
E.F. - EACH FACE
B - BOTTOM
[illegible]

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH [illegible]

COUNTY CHIEF OFFICER
P.O. Box 1155-80304
WUNDANYI
MINISTRY OF WATER & IRRIGATION

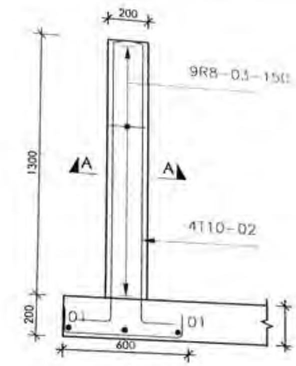
50M³ BALANCING TANK

Project Title: **Up-scaling Basic Sanitation for Urban Poor (UBSUP)**	***Project Area***	***Designed and drawn by:*** *UBSUP technical team* ***Checked by:*** *Programme Manager Urban Investments* ***Approved by:*** *CEO WSTF*	***Notes:*** *See Above*	***Index-No.:***	***Description:***	***Date:*** ***Scale: As shown*** ***page:***



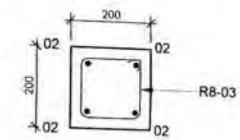
ROOF SLAB PLAN STRUCTURAL DETAILS

SCALE 1:25



COLUMN C1

SCALE 1:50



COLUMN C1 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 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
(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 150mm 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
NF - NEAR FACE
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EF - EACH FACE
EW - EACH WAY

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. [illegible]/01

50M³ BALANCING TANK

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	**Index-No.:** / **Description:**

Date:	
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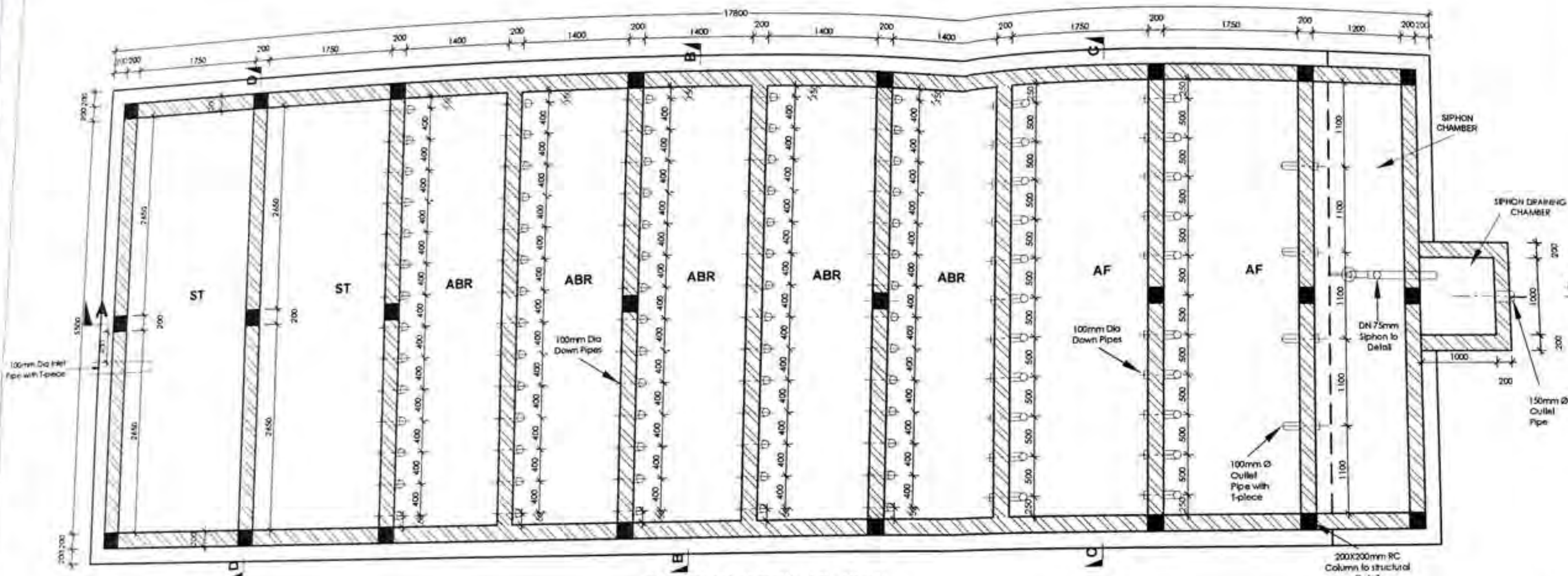
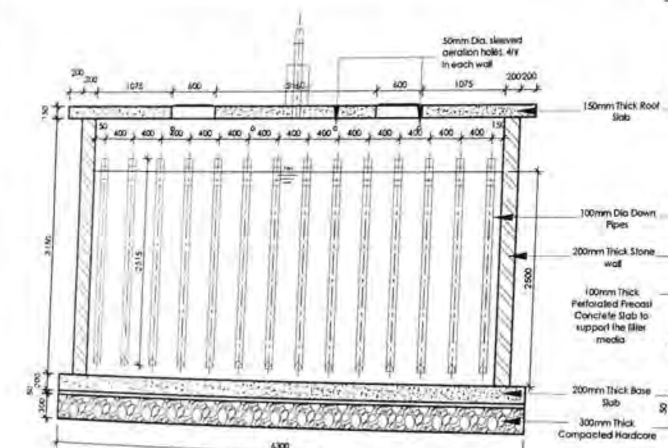
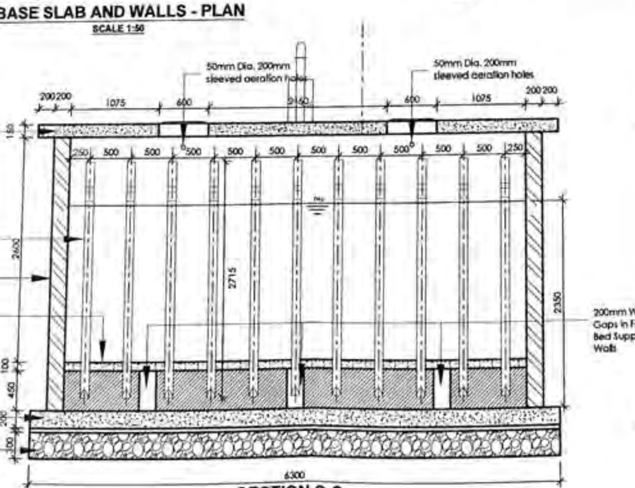


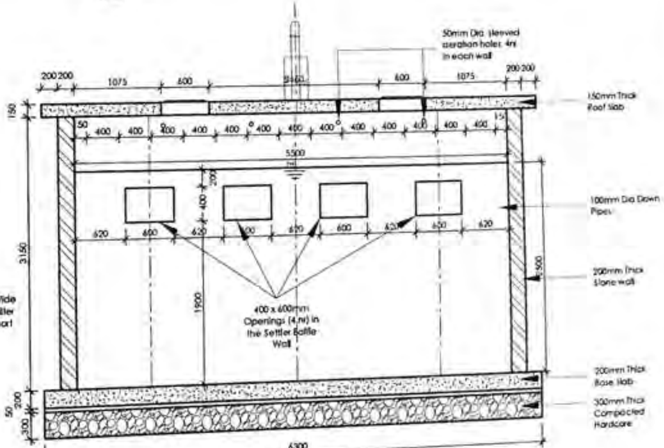
BASE SLAB AND WALLS - PLAN
SCALE 1:50



SECTION B-B
SCALE 1:50



SECTION C-C
SCALE 1:50



SECTION D-D
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 WALLS TO B.S. 3148
(d) CONCRETE CLASSES TO BE AS FOLLOWS:-
MASS CONCRETE FILL AND BLINDING MIX CLASS 15/20
REINFORCED CONCRETE CLASS 25/20
(e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm EXCEPT 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
(d) EXAMPLE: 16 Y12 - 01 - 150 DENOTES 16 No. HIGH YIELD 12mm DIA. BARS IDENTIFICATION MARK 01 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
NF - NEAR FACE FF - FAR FACE
EF - EACH FACE EW - EACH WAY

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. [illegible]/01

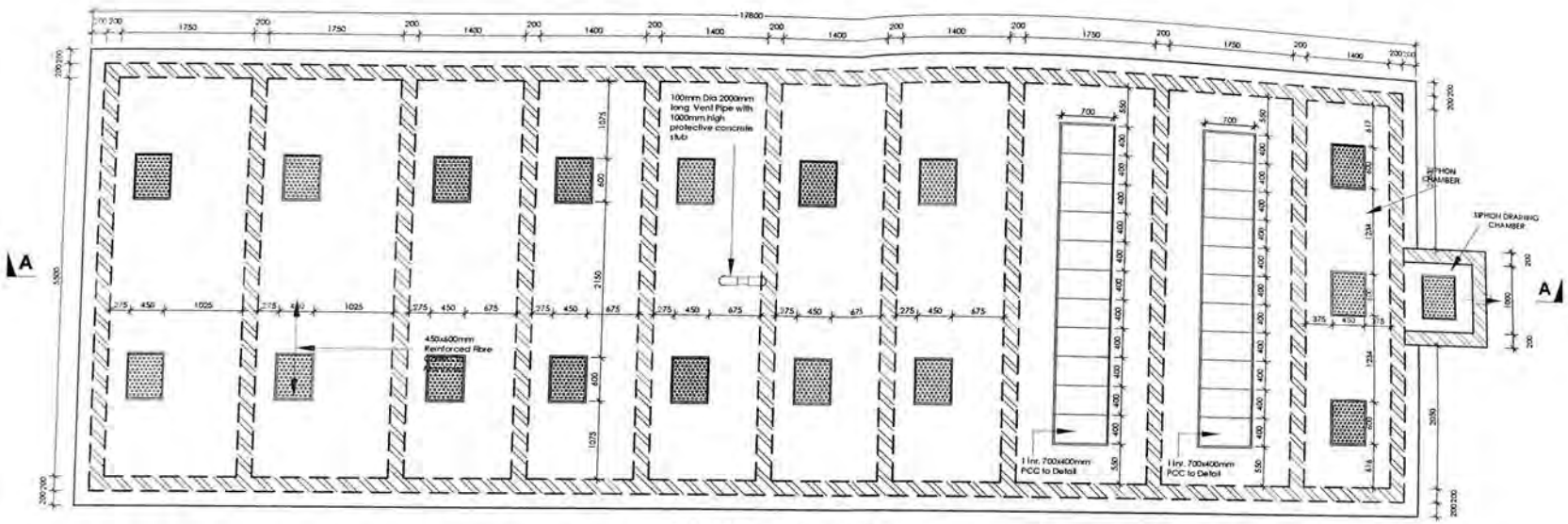
ANAEROBIC REACTOR

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above

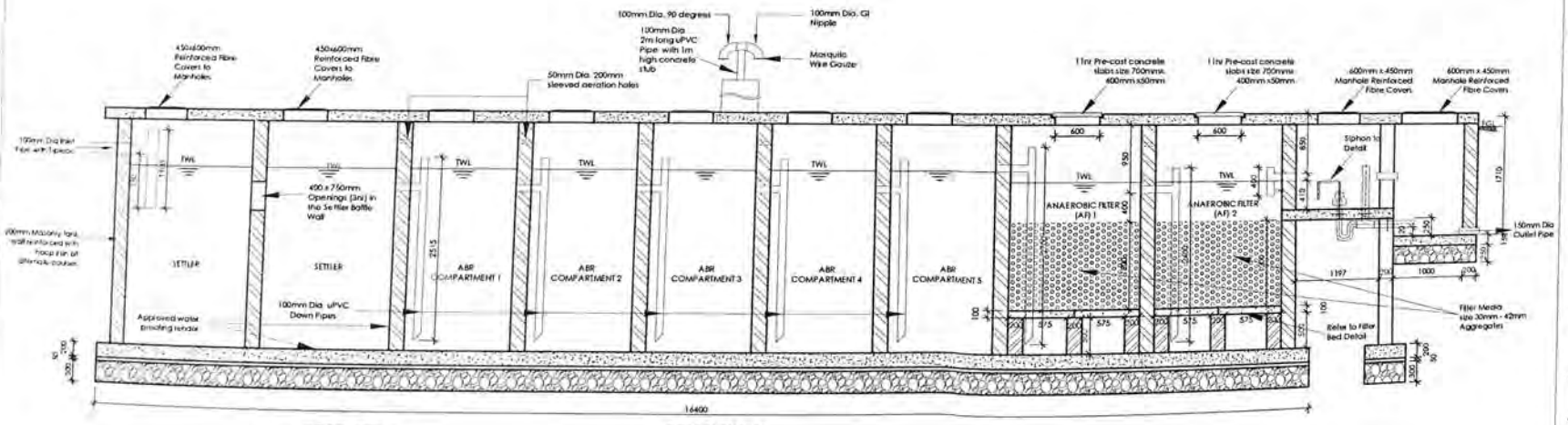
Index-No.:	Description:

Date:
Scale: As shown
page:

COUNTY CHIEF OFFICER ★ P.O. Box 1155-80304 WUNDANYI ★ MINISTRY OF WATER & IRRIGATION



ROOF SLAB AND WALLS - PLAN
SCALE 1:50



SECTION A-A
SCALE 1:50

ANAEROBIC FILTER

NOTES

1 CONCRETE
(a) CEMENT TO BE ORDINARY PORTLAND CEMENT (O.P.C.)
(b) CONCRETE AGGREGATE TO COMPLY WITH BS 882.
(c) WATER TO CONCRETE MIXES TO BS 3148
(d) CONCRETE CLASSES TO BE AS FOLLOWS
MASS CONCRETE FILL AND BLINDING MIX CLASS 15/20
REINFORCED CONCRETE CLASS 25/20
(e) MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm UNLESS AS SPECIFIED BELOW FOR BS 8007
MEMBERS OF BUILDINGS
- SLABS - 20 mm
- BEAMS - 25 mm
- COLUMNS - 40 mm
- FOUNDATIONS & FOOTINGS - 50 mm
(f) WALLS/COLUMNS SHOULD BE POURED IN PROVISION IN A ONE 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 BS 4461
(b) BENDING DIMENSIONS TO BS 4466
(c) THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL SPACER BLOCKS, CHAIRS AND TYING WIRE
(d) EXAMPLE T8 T12 - 07 - 150 SHOWS 12 NO. HIGH YIELD 12mm DIA BARS IDENTIFICATION MARK 07 AT 150CRS CENTRES TO CENTRE SPACING

3 JOINTS
(a) THE POSITION AND NUMBER OF INTERMEDIATE JOINTS TO BE DECIDED ON THE ENGINEER OR AS SHOWN ON 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 CONCRETE JOINTS ARE IN A SATURATED BUT SURFACE DRY CONDITION
(b) ALL WALL/FLOOR SLAB CONNECTIONS SHOULD BE MONOLITHIC EXCEPT UNLESS OTHERWISE SPECIFIED
(c) THE UPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
(d) JOINT FILLER TO BS 5292 AND TO BE APPROVED BY THE ENGINEER

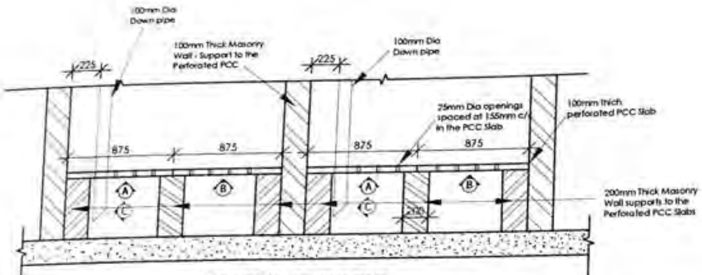
4 ABBREVIATIONS
T - TOP
NF - NEAR FACE
FF - FAR FACE
B - BOTTOM
LH - LEFT HAND
RH - RIGHT HAND

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NO. BSSE/01

COUNTY CHIEF OFFICER P.O. Box 1155-80304 MINISTRY OF WATER & IRRIGATION

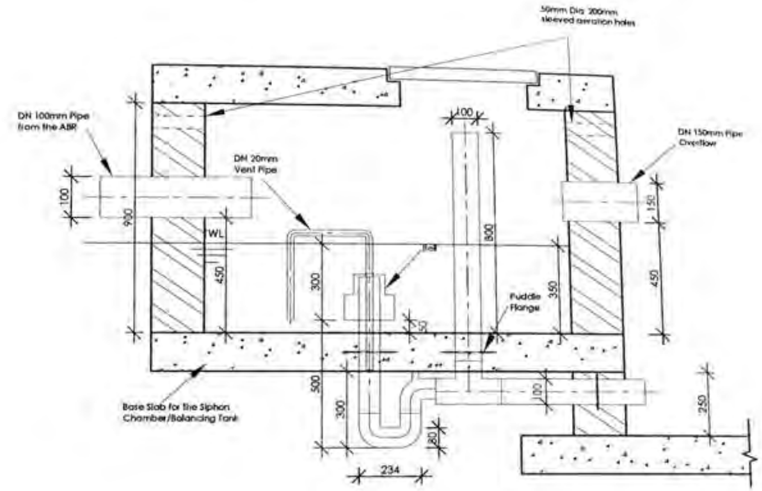
Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above

Index-No.:	Description:	Date:
		Scale: As shown
		page:



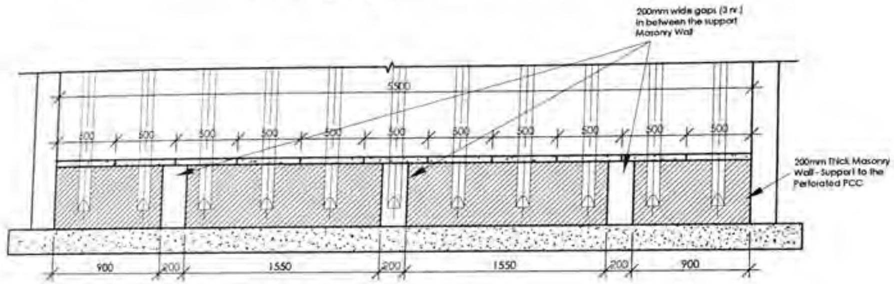
SECTION - FILTER BED

SCALE 1:50



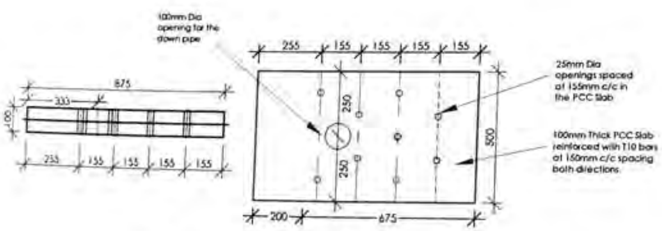
SIPHON DETAILS

SCALE 1:50



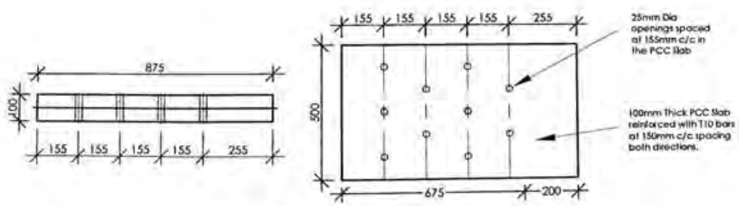
ELEVATION C

SCALE 1:50



DETAIL AT ELEVATION A
PLAN AND SECTION OF FILTER BED
(PERFORATED PCC) - 22NR REQUIRED

SCALE 1:50



DETAIL AT ELEVATION B
PLAN AND SECTION OF FILTER BED
(PERFORATED PCC) - 22NR REQUIRED

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 50mm 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
(d) EXAMPLE 16 Y12 - 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
NF - NEAR FACE	FF - FAR FACE
EF - EACH FACE	EW - EACH WAY

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

COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

ANAEROBIC FILTER

Project Title:
Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Project Area

Designed and drawn by: UBSUP technical team

Checked by: Programme Manager Urban Investments

Approved by: CEO WSTF

Notes:
See Above

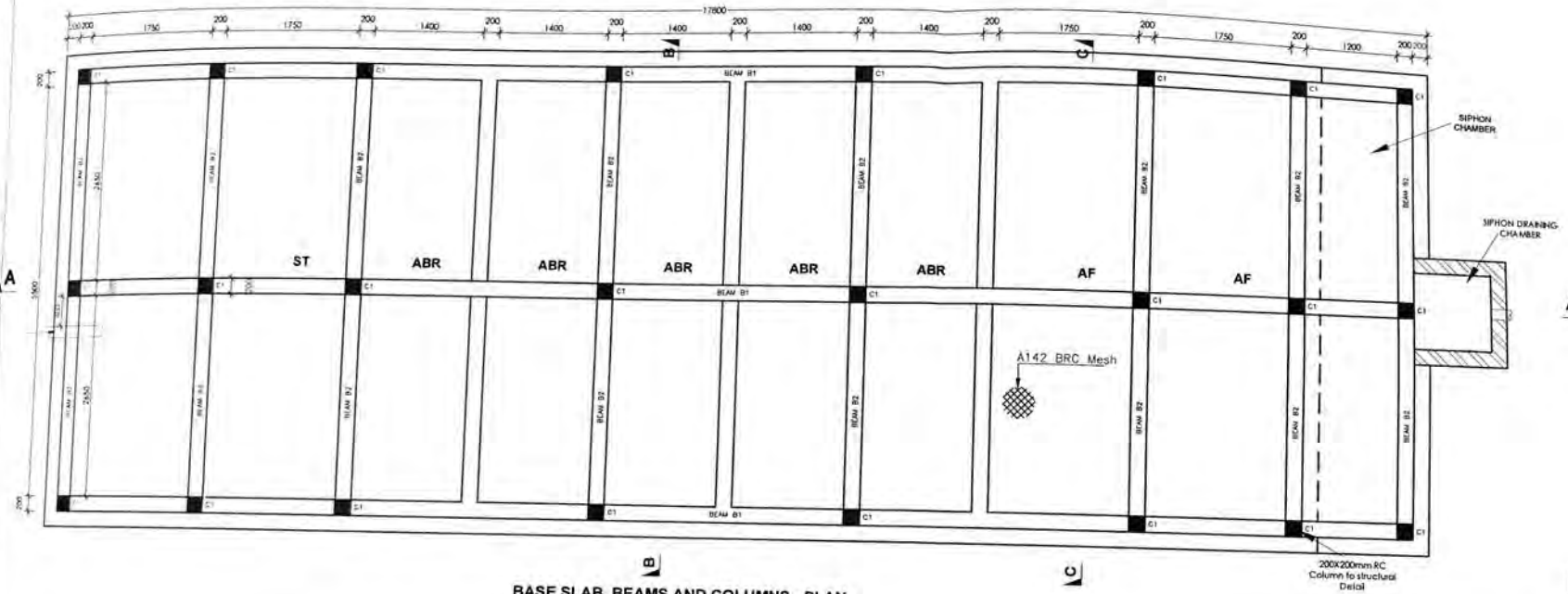
Index-No.:

Description:

Date:

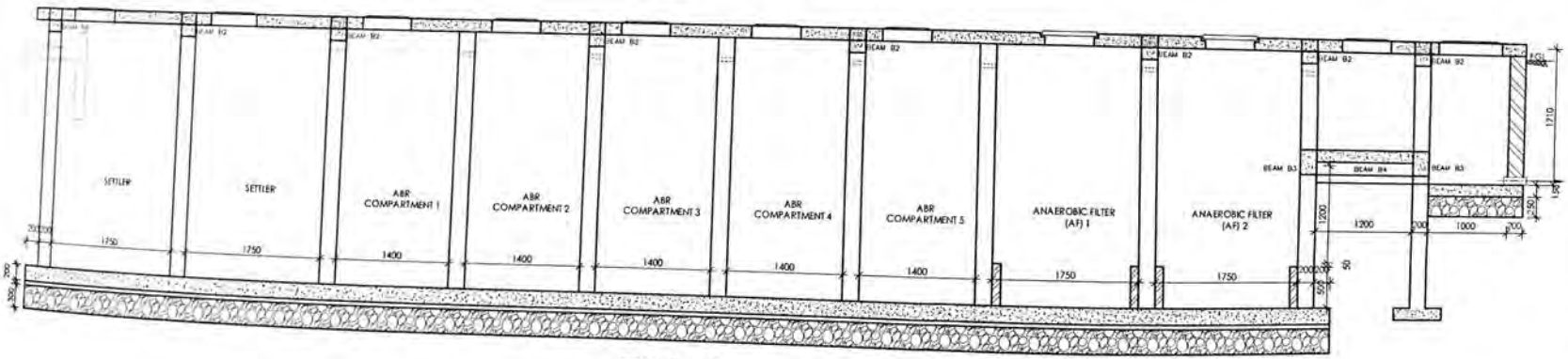
Scale: As shown

page:



BASE SLAB, BEAMS AND COLUMNS - PLAN

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 15/10
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 IN 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.

(d) EXAMPLE 16 T12 - 01 - 150 SIGNIFIES 16 NO. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 01 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
NF – NEAR FACE	FF – FAR FACE
EF – EACH FACE	EW – EACH WAY

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

COUNTY CHIEF OFFICER
P.O. Box 4155-80304
MINISTRY OF WATER & IRRIGATION

ANAEROBIC FILTER

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Project Area

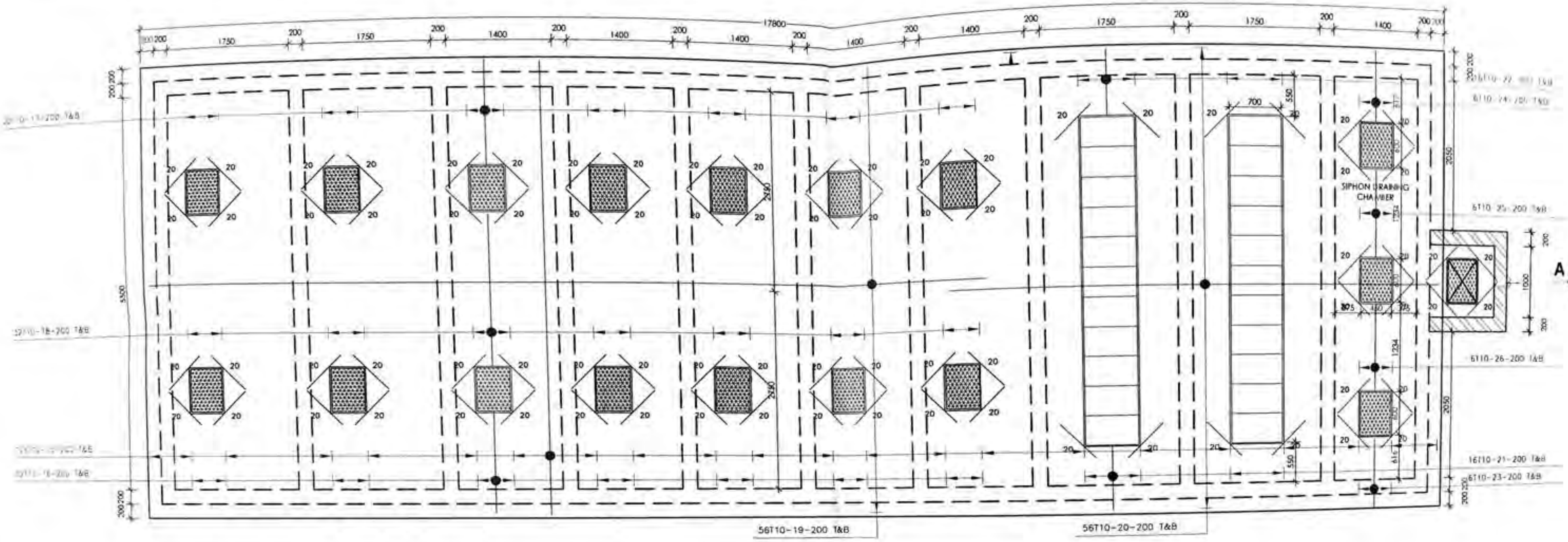
Designed and drawn by: UBSUP technical team

Checked by: Programme Manager Urban Investments

Approved by: CEO WSTF

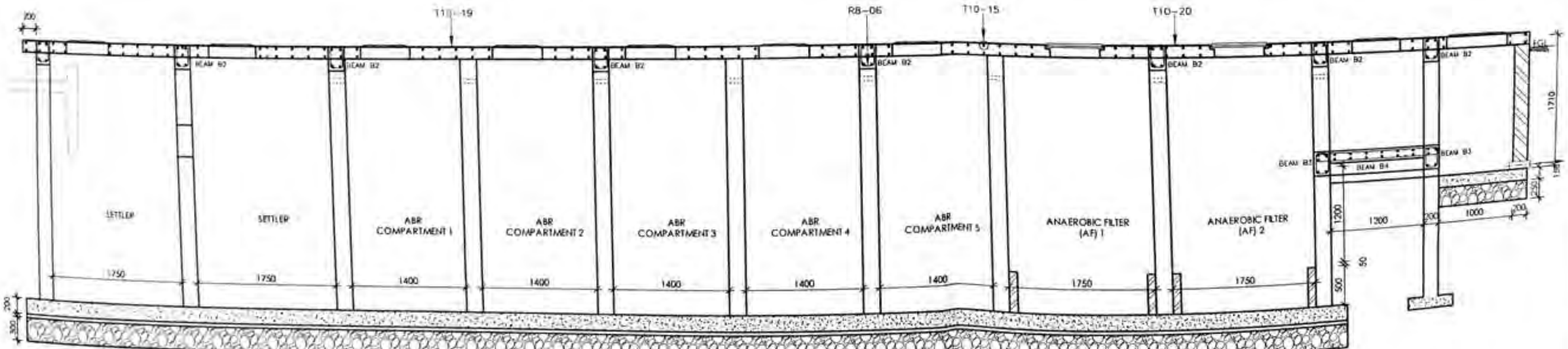
Notes: See Above

Index-No.:	Description:	Date:
		Scale: As shown
		page:



ROOF SLAB - PLAN

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 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
(d) EXAMPLE 16 T12 - 01 - 150 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 01 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 150mm KICKER UNLESS OTHERWISE SPECIFIED
(c) THE UPVC WATER STOP SHALL BE 200mm WIDE UNLESS OTHERWISE SPECIFIED
(e) JOINT FILLER TO B.S. 5212 AND TO BE APPROVED BY THE ENGINEER

4 ABBREVIATIONS
T - TOP
NF - NEAR FACE
EF - EACH FACE
B - BOTTOM
FF - FAR FACE
EW - EACH WAY

5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. [illegible]/01

ANAEROBIC FILTER

Project Title:
Up-scaling Basic Sanitation for Urban Poor (UBSUP)

COUNTY CHIEF OFFICER
P.O. Box 1156-80304
MINISTRY OF WATER & IRRIGATION

Project Area

Designed and drawn by: UBSUP technical team
Checked by: Programme Manager Urban Investments
Approved by: CEO WSTF

Notes:
See Above

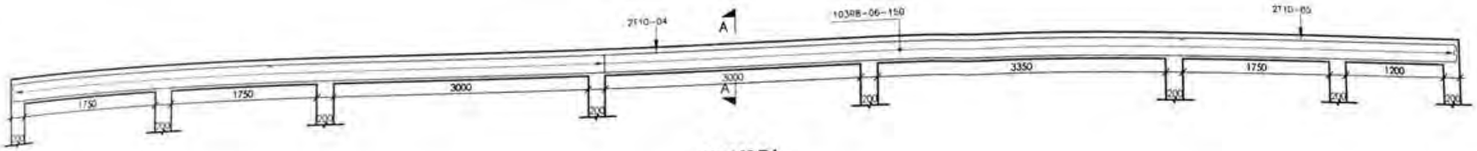
Index-No.:

Description:

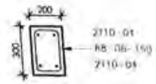
Date:

Scale: As shown

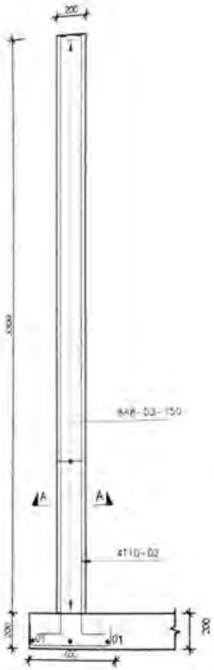
page:



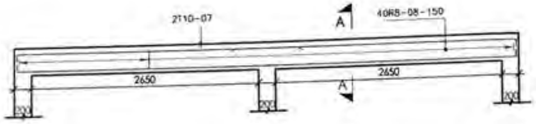
BEAM B1
3NR REQUIRED
SCALE 1:100



BEAM B1 - SECTION A-A
SCALE 1:50



COLUMN C1
21NR REQUIRED
SCALE 1:50



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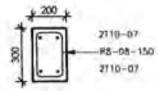
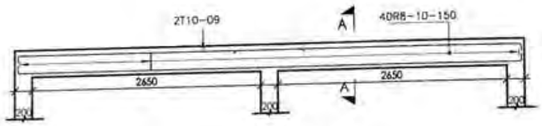
7NR REQUIRED
SCALE 1:100



BEAM B2 - SECTION A-A
SCALE 1:50



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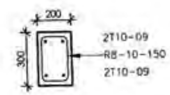
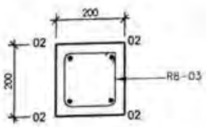
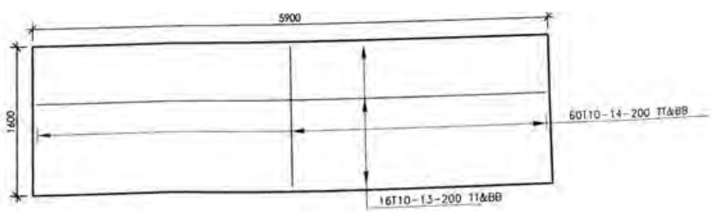
SCALE 1:100



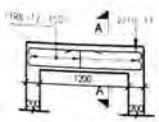
BEAM B3 - SECTION A-A
SCALE 1:50



COLUMN C1
SECTION A-A
SCALE 1:50



BASE SLAB PLAN - SIPHON CHAMBER
SCALE 1:100



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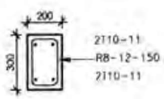


BEAM B4 - SECTION A-A
SCALE 1:50

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 50mm 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
(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. 5202 AND TO BE APPROVED BY THE ENGINEER

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

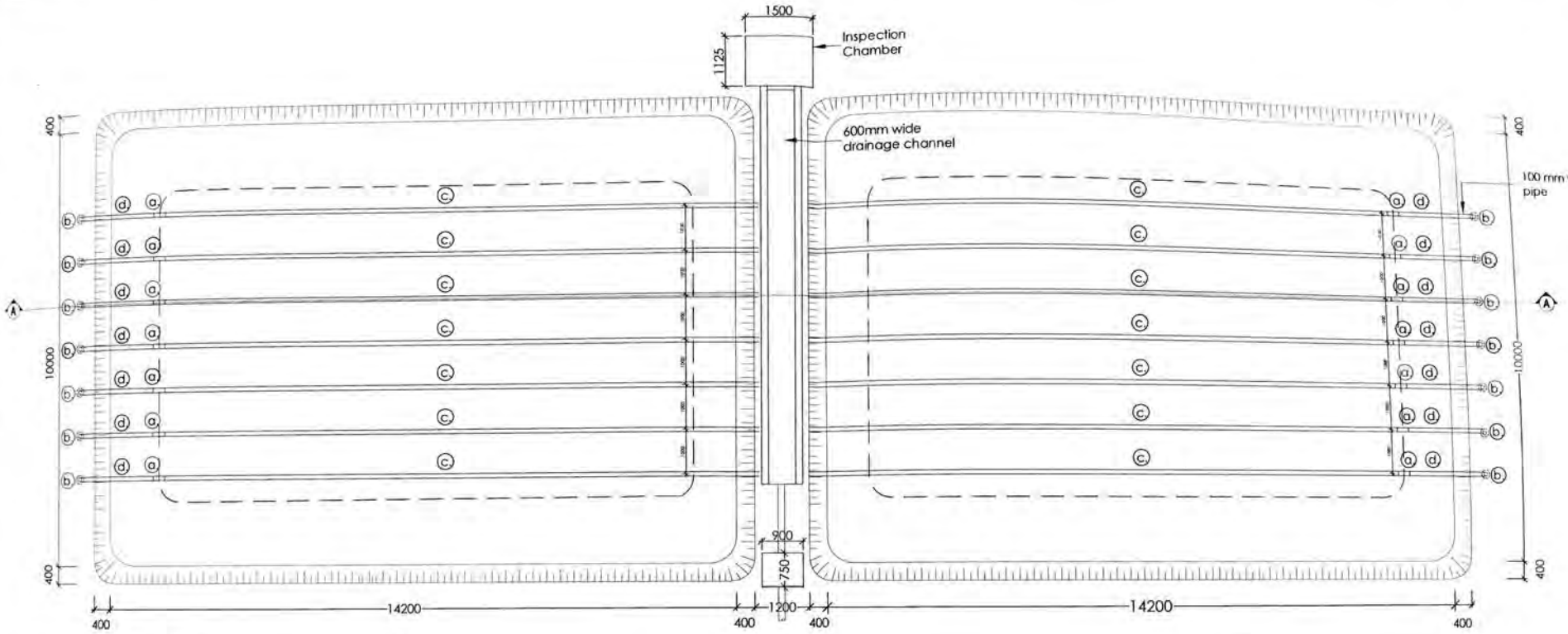
5 THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING No. 4961/01

ANAEROBIC FILTER

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	***Project Area***	***Designed and drawn by:*** *UBSUP technical team* ***Checked by:*** *Programme Manager Urban Investments* ***Approved by:*** *CEO WSTF*	***Notes:*** *See Above*	***Index-No.:***	***Description:***

Date:
Scale: As shown
page:

COUNTY CHIEF OFFICER P.O. Box 1155-80304 MINISTRY OF WATER & IRRIGATION



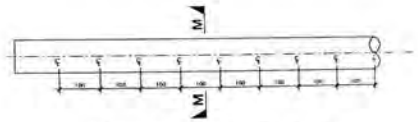
SCHEDULE OF PIPES AND FITTINGS

	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

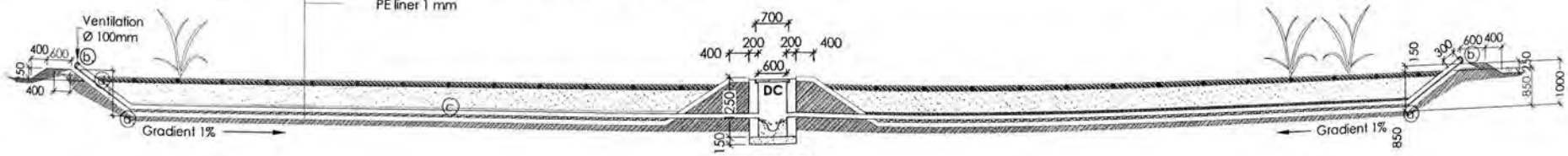
KEY

- 100mm Distribution Layer - Medium Gravel; dia. 10 - 14mm
- 450mm Filter Layer - Sand; dia. 0.1 - 0.4mm
- 100mm Transition Layer - Medium Gravel; dia. 10 - 14mm
- 100mm Drainage Layer - Course Gravel; dia. 20 - 32mm
- PE liner 1 mm



100mm Dia. UNDERDRAIN PIPES
SCALE 1:100

SECTION M-M
SCALE 1:10

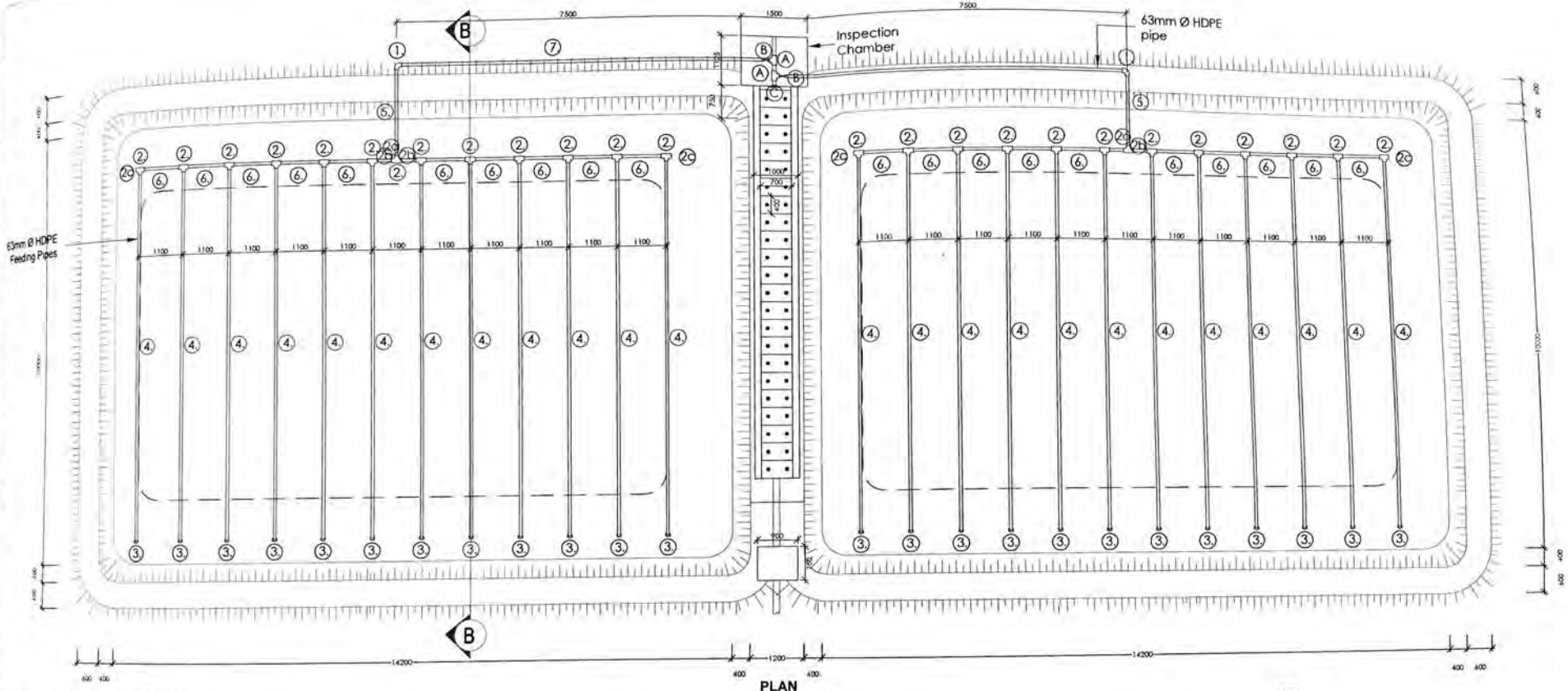


SECTION A-A
SCALE 1:100

COUNTY CHIEF OFFICER P.O. Box 1155-80304 MINISTRY OF WATER & IRRIGATION

VERTICAL FLOW CONSTRUCTED WETLAND

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Project Area**	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	**Index-No.:** / **Description:** **Date:** **Scale:** As shown **page:**

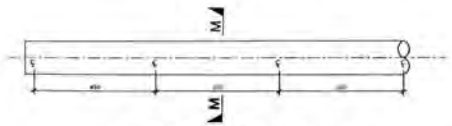


PLAN
SCALE 1:100

SCHEDULE OF PIPES AND FITTINGS

	Description	Length	Qty
①	150mm Dia. uPVC 90° Bends	-	6
②	100x40mm Dia. uPVC reducing Tee	-	24
②a	150mm Dia. uPVC Equal Tee	-	2
②b	150x100mm Dia. uPVC Reducer	-	4
②c	100mm Dia. uPVC End Caps		4
③	40mm Dia. uPVC End Caps	-	24
④	40mm Dia. uPVC Pipe	8.5m	24
⑤	150mm Dia. uPVC Pipe	2.0m	2
⑥	100mm Dia. uPVC Pipe	1.1m	22
⑦	150mm Dia. uPVC Pipe	8.3m	2

	Description	Length	Qty
Ⓐ	150mm Dia. uPVC Equal Tee	-	2
Ⓑ	150mm Dia. uPVC Ball Cock valve	-	2
Ⓒ	150mm Dia. uPVC end cap	-	1

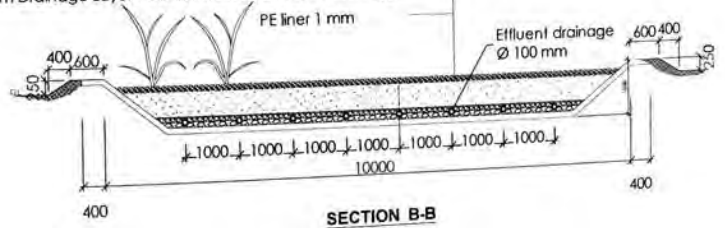


40mm Dia. FEEDING PIPES
SCALE 1:100

SECTION M-M
SCALE 1:10

KEY

100mm Distribution Layer - Medium Gravel; dia. 10 - 14mm
450mm Filter Layer - Sand; dia. 0.1 - 0.4mm
100mm Transition Layer - Medium Gravel; dia. 10 - 14mm
100mm Drainage Layer - Course Gravel; dia. 20 - 32mm
PE liner 1 mm

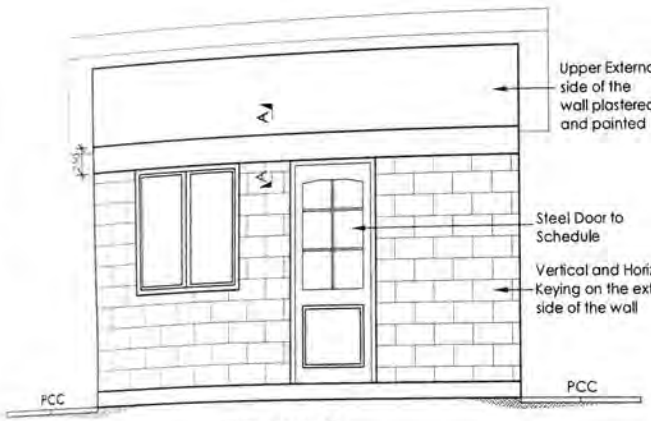


SECTION B-B
SCALE 1:100

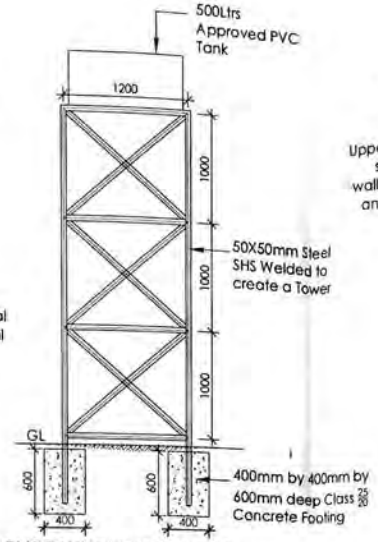
VERTICAL FLOW CONSTRUCTED WETLAND

COUNTY CHIEF OFFICER P. O. Box 1155-80300 MINISTRY OF WATER & IRRIGATION

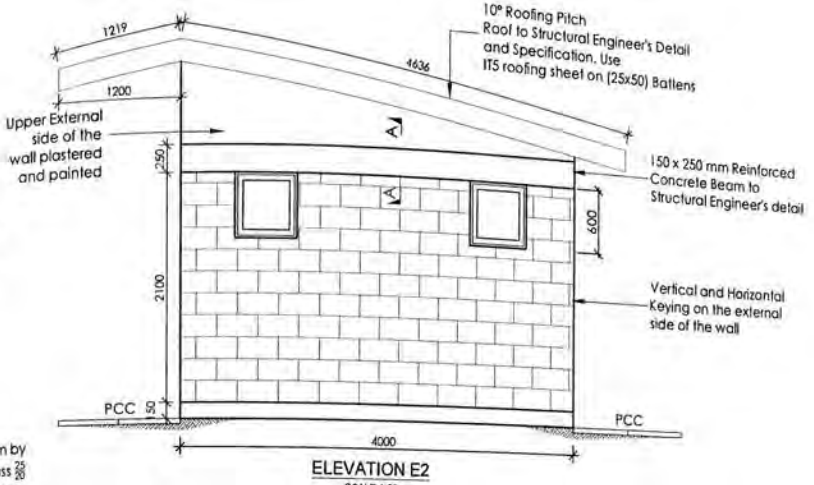
Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	**Designed and drawn by:** UBSUP technical team **Checked by:** Programme Manager Urban Investments **Approved by:** CEO WSTF	**Notes:** See Above	Index-No.: / Description:	Date: Scale: As shown page:



ELEVATION E1
SCALE 1:50



PVC TANK ELEVATED ON A STEEL TOWER
SCALE 1:50



ELEVATION E2
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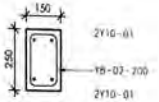
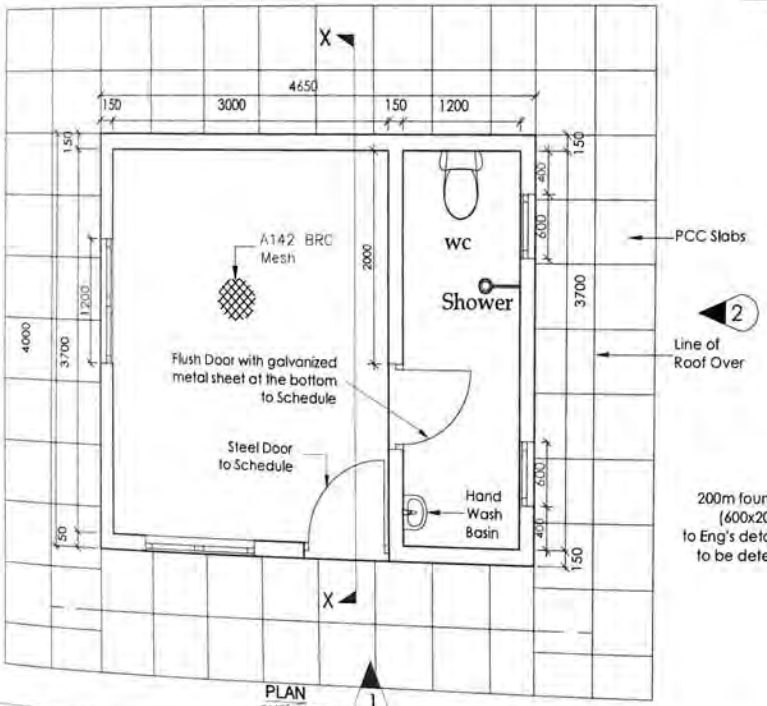
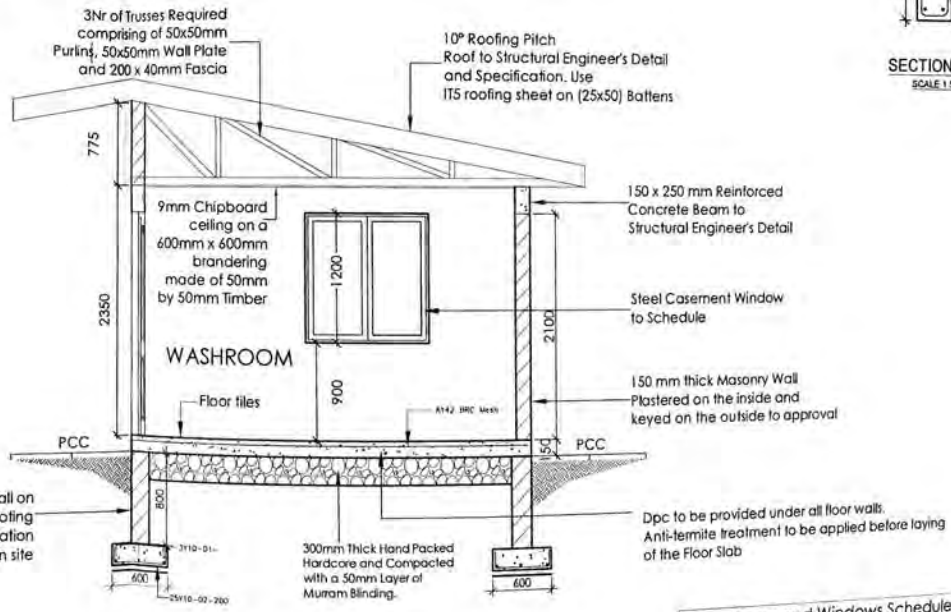


SECTION A-A
SCALE 1:50



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

COUNTY CHIEF OFFICER P.O.Box 1155-80304 MINISTRY OF WATER & IRRIGATION

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Project Area

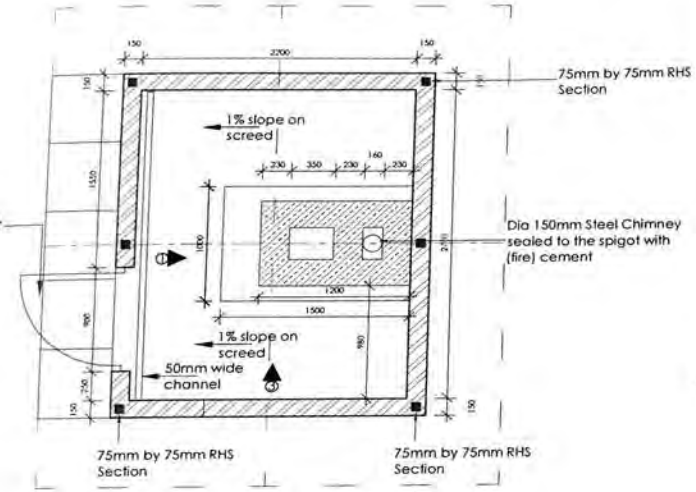
Designed and drawn by UBSUP technical team

Checked by: Programme Manager Urban Investments

Approved by CEO WSTF

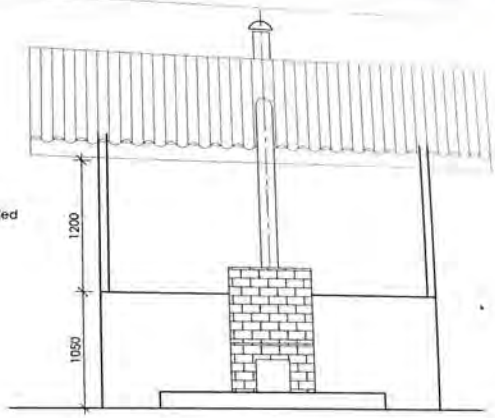
Notes: See Above

Index-No.:	Description:	Date:
		Scale: As shown
		page:

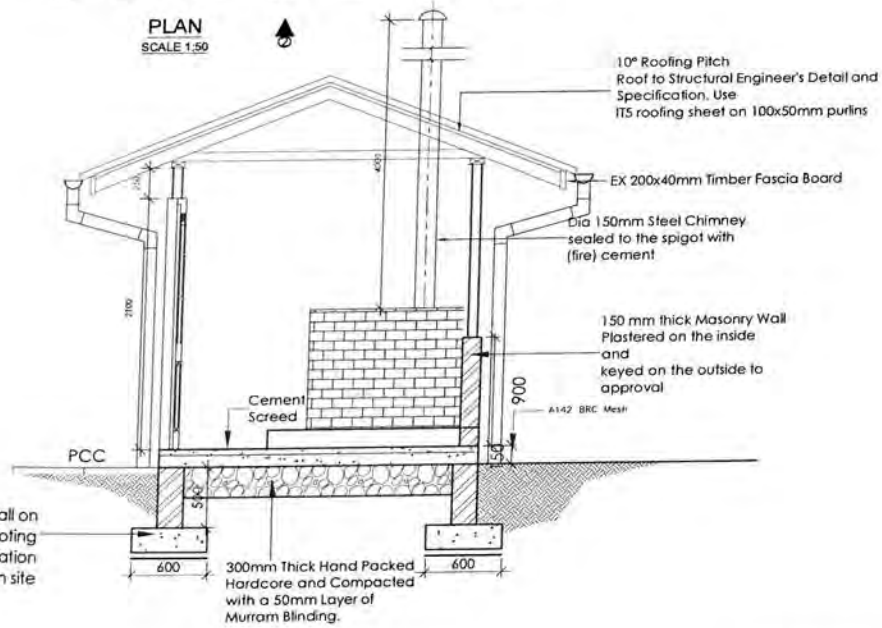


PLAN
SCALE 1:50

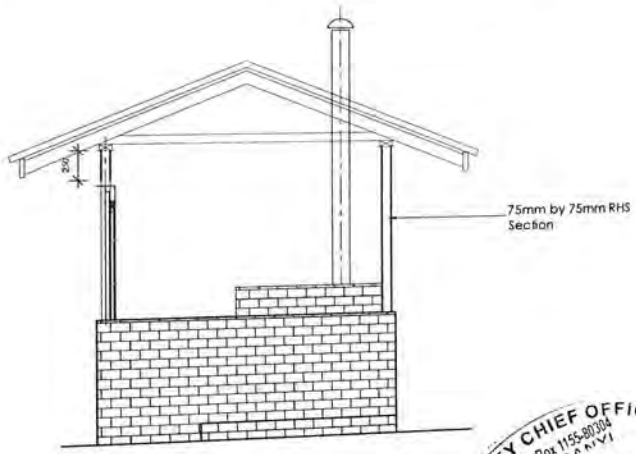
FRONT ELEVATION
SCALE 1:50



ELEVATION 1
SCALE 1:50



ELEVATION 3
SCALE 1:50

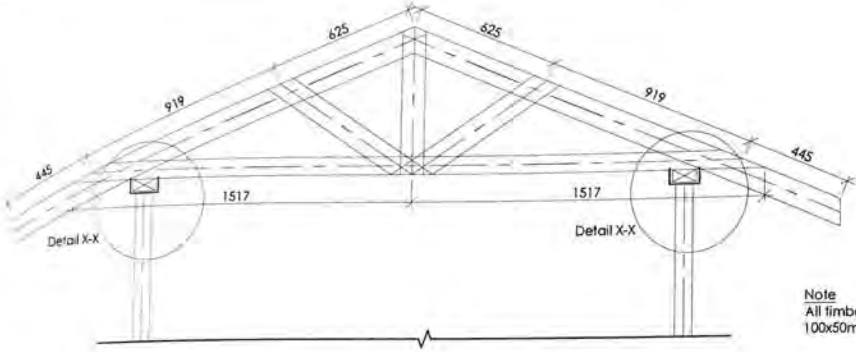


ELEVATION 2
SCALE 1:50

COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

INCINERATOR SHED

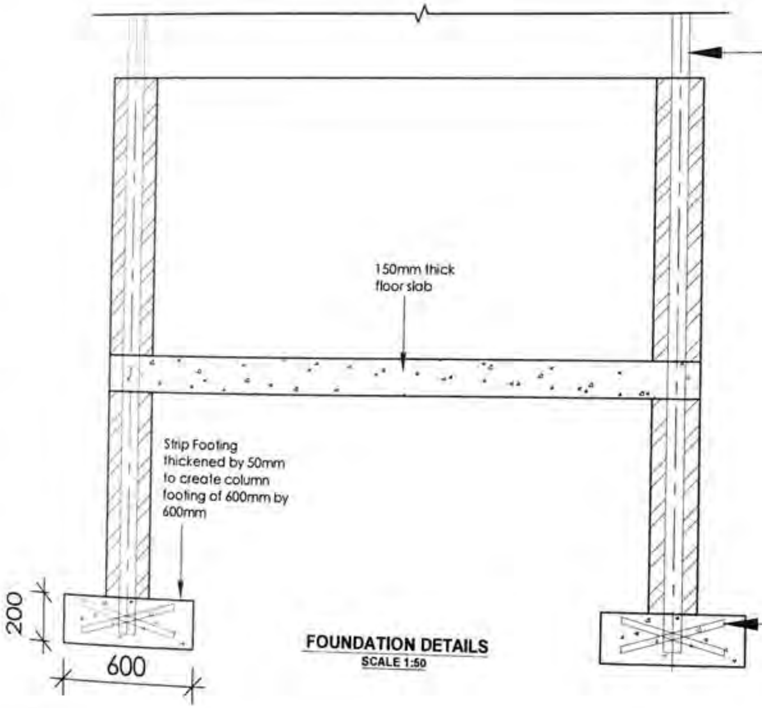
Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	Project Area	Designed and drawn by UBSUP technical team Checked by: Programme Manager Urban Investments Approved by CEO WSTF	Notes: See Above	Index-No.: / Description:	Date: Scale: As shown page:



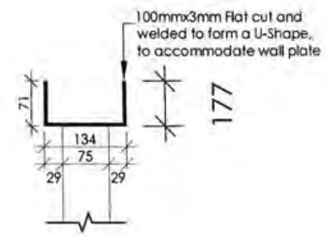
TRUSS DETAILS - 3 NR REQUIRED
SCALE 1:50

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

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	Project Area	Designed and drawn by UBSUP technical team ***Checked by:*** *Programme Manager Urban Investments* Approved by CEO WSTF	***Notes:*** *See Above*	***Index-No.:*** ***Description:***	***Date:*** ***Scale: As shown*** ***page:***

De Montfort Mark 8a Incinerator

Introduction

This is the recommended incinerator for all but large hospitals.

The instructions which follow are meant to be used in all countries. The building instructions give the number and position of the bricks, but not the overall dimensions of the incinerator. This is because bricks differ slightly in size between one country and another, and it is simpler to adjust the overall size of the incinerator to the available bricks than to have to cut bricks to an exact dimension.

Similarly, only approximate dimensions of the steelwork are given. The correct procedure is to lay out the first two layers of bricks, and then measure the length and breadth of the steel which fits on top. The steel top can then be made to fit the finished brickwork.

The steel tunnel and ash door can also be dimensioned to fit the brickwork by taking measurements from the brickwork once the tunnel is formed in the first five layers of bricks.

Summary of characteristics

Use: designed espacially for most healthcare facilities, except large hospitals (more than 300 - 400 beds)

Capacity: 12 kg/h

Lifespan (average): 3-5 years

Approximate unit cost in USD (materials only): 250 - 1'000 depending on the availability of refractory bricks

Time necessary to build: 3-4 days

Remarks: Where the load to be burned consists almost entirely of **sharps boxes** filled with used hypodermics, special conditions apply:

1. The plastic in the syringes has a very high calorific value and additional fuel will not be required after the initial warm up period.

2. Boxes should be introduced **one at a time.** There will be a brief delay, then an increase in smoke level followed by a gradual decrease. The next box should be introduced when the smoke level is observed to be decreasing.

3. Tests have shown that this means that boxes of up to 100 syringes can be burned at a rate of about **one every 10 minutes.**

4. Introducing boxes at a higher rate than this will result in very high smoke rates and molten plastic at the base of the incinerator.

List of materials

item	dimensions	quantity
Fire bricks		200 (approx.)
Sand		200 kg
Fire cement (high alumina)		50 kg
Rolled steel angle (mild steel)	30x30x3mm thick	12 metres
Rolled steel channel (mild steel)	100x40x5mm thick	4 metres
Flat sheet (mild steel) for loading door	600 x 750 x 3mm	1 sheet
Flat sheet (mild steel) for ash door	250 x 250 x 3mm	1 sheet
Flat sheet (mild steel) for chimney spigot support	250 x 150 x 3mm	1 sheet
Mild steel pipe	150mm diameter x 3mm thick (approx)	4 metres
Hinges for ash door		
Pipe, for loading door hinge	1 inch	1
Rod, for loading door hinge	3/4 inch	1
Masonry plugs (rawlplugs), screws, etc	no 10	16
Welding rods (mild steel)		40
Steel cable (optional)	5 mm 7 strand	40 metres
Turnbuckles (optional)	M8 x 150 mm long	4 (not essential)
Wire Mesh (optional)	Any fine gauge	loose fill
Fuel tank, tap and pipe (optional)		1 set

Note

If required, the incinerator body can be clamped together with steel bars. It can also be surrounded by an outer case of common bricks to give extra strength and weather protection. In this case, the two thicknesses of brick should be "capped" with cement.

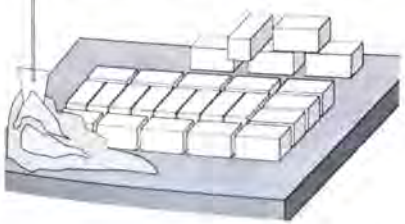
Materials should be obtained before starting the construction !

Complete layout

Figure 1: De Montfort incinerator Mark 8a

FOUNDATION

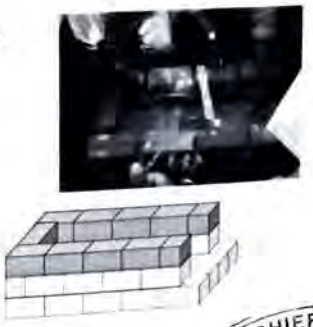
Concrete foundation: L x W x H = 2m x 2m x 0.15m
Refractory bricks: L x W x H = approx. 230 x 110 x 65 mm
Mortar: Refractory cement (high alumina)



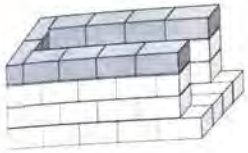
LAYER 1

LAYER 2

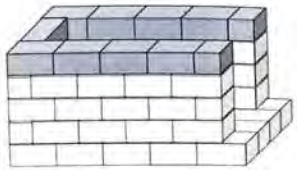
LAYER 3



LAYER 4

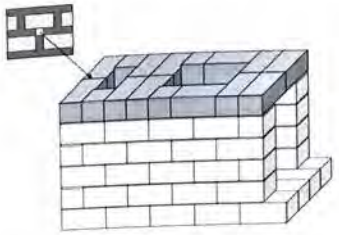


LAYER 5

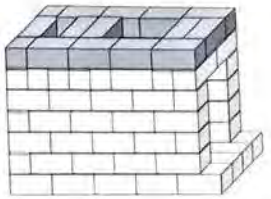


LAYER 6

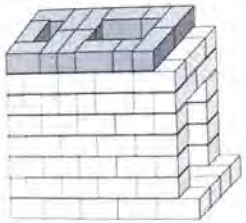
Make a viewing hole by creating a gap in the cement between layer 6 & 7. Insert a piece of wood that can be removed.



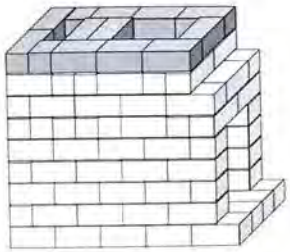
LAYER 7



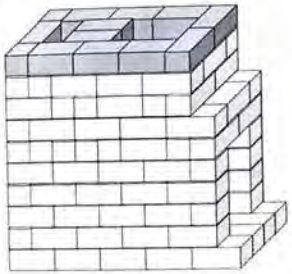
LAYER 8



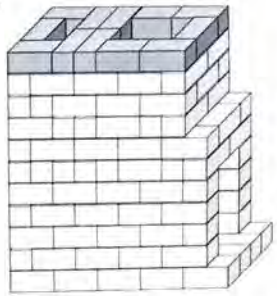
LAYER 9



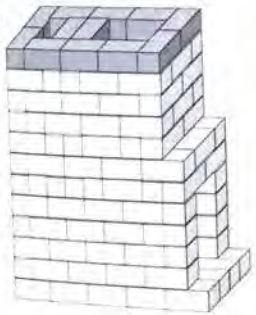
LAYER 10



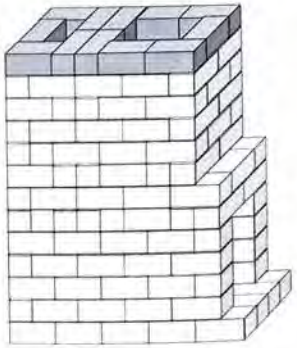
LAYER 11



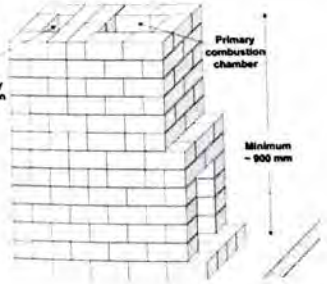
LAYER 12



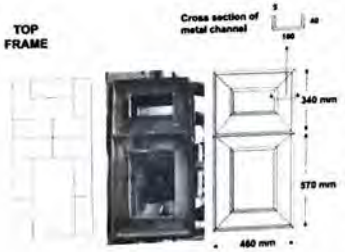
LAYER 13



BODY

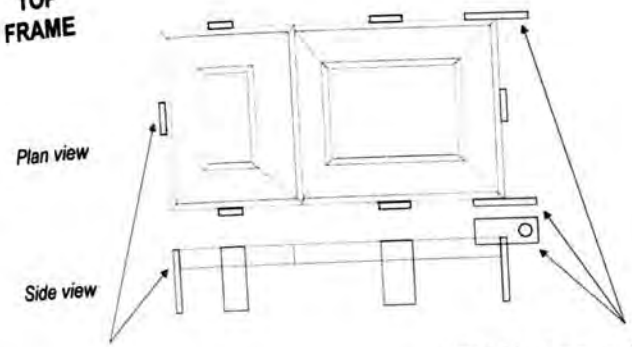


TOP FRAME



COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

TOP FRAME



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

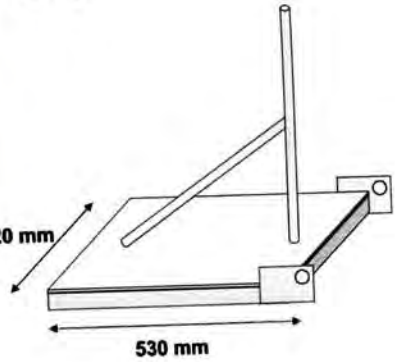
HINGES: 3mm metal plate is used for the loading door hinges

LOADING DOOR

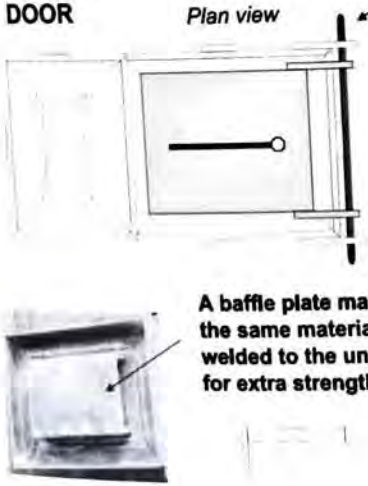
The loading door is made from a frame of metal angle (30 x 30 x 3) with a plate of 3mm steel welded on top.

Underside

Metal Angle



LOADING DOOR



The loading door is hinged with metal bar threaded through the locating holes.

A baffle plate made from the same materials can be welded to the underside for extra strength.

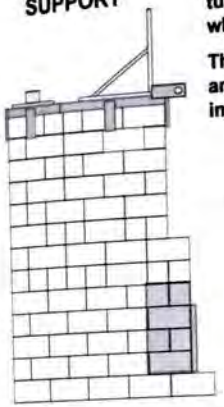
FITTING THE TOP FRAME TO THE INCINERATOR BODY

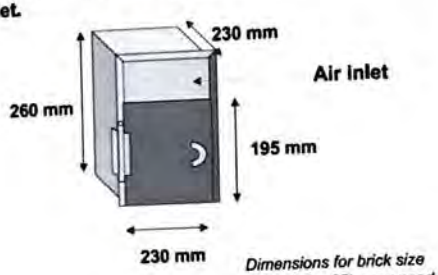
Seal with refractory cement

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.



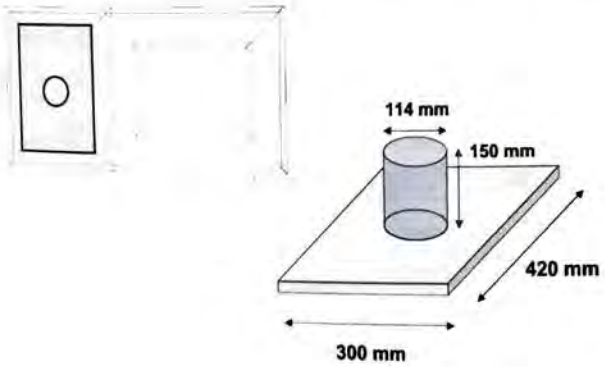


Dimensions for brick size (230 x 100 x 65), may need to be adjusted

BODY OF INCINERATOR WITH ASH DOOR AND TOP FRAME

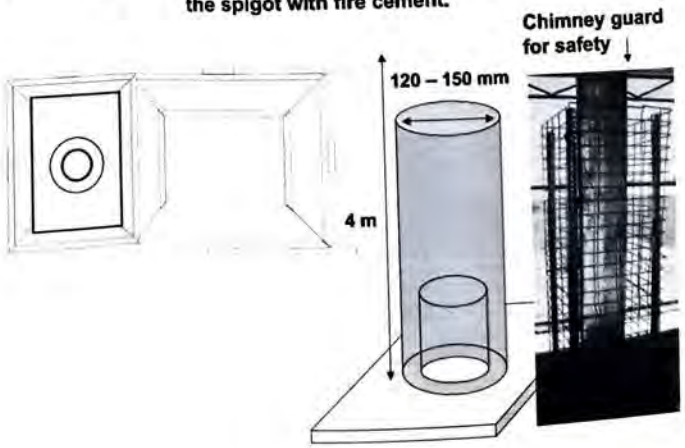
CHIMNEY SPIGOT

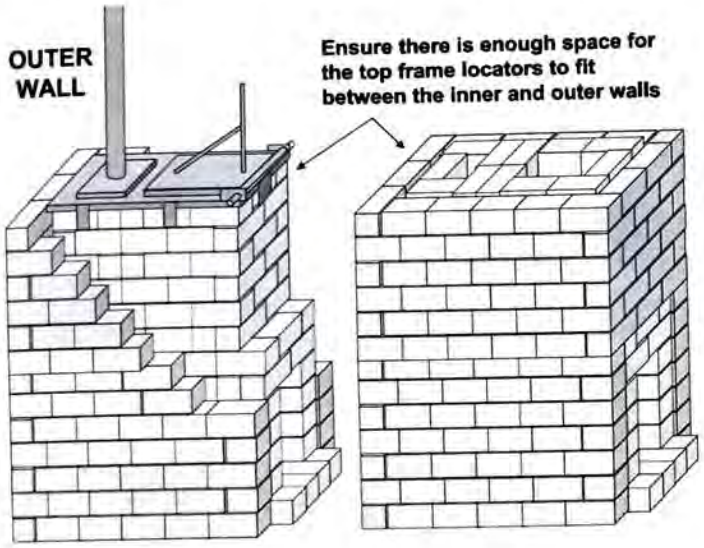
The chimney spigot is made from a frame of metal angle (30 x 30 x 3) with a plate of 5mm steel welded on top and a piece of steel pipe (3mm thickness)

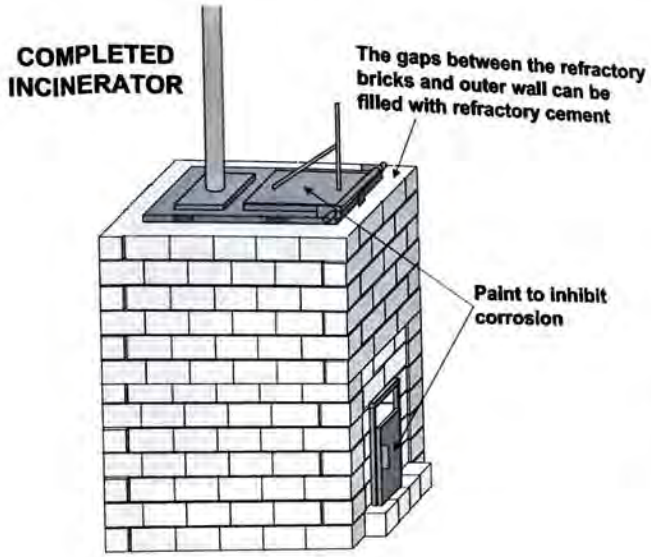


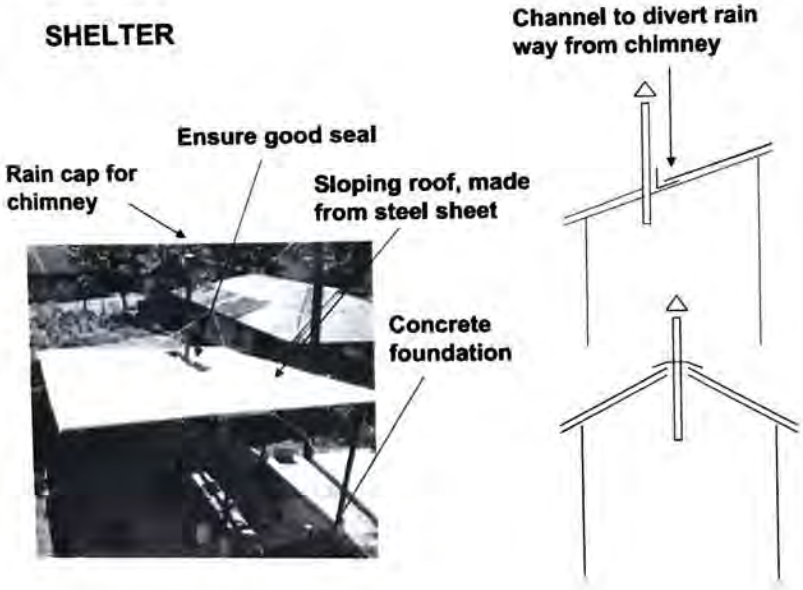
CHIMNEY

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









Operation

The incinerator should be started by putting **waste paper, cardboard** or similar easily ignited material over the grate. Burning paper can then be dropped on top, and when a good flame is established, more combustible material added till the combustion chamber is half full. If available, about 100 cc of kerosene, diesel oil or used lubricating oil can be poured on top to speed the heating process. Only dry, non-infected waste should be added for the first 10 minutes or until a fierce flame is established.

The combustion chamber should be **kept at least half full**, and infectious and/or wet waste should be added above dry materials to ensure that it dries before reaching the combustion zone. Additional liquid fuel can be added if it is suspected that the combustion rate is decreasing. Any plastic waste available will also help to raise the temperature of combustion, but both this and the oil will give rise to black smoke if used to excess.

The incinerator will be most efficient if it is operated for fairly long periods once it is ignited. The grate and the flue passage to the base of the chimney must be kept clear by poking a steel rod through the air inlet hole from time to time. It may also be necessary to push down the load from time to time to prevent it "arching" above the grate. **The last load before closing down should be as dry and safe as possible**, so that no unburned material is left.

Maintenance

As with any type of equipment, there is a need to perform some regular maintenance to ensure both that the system will continue to work properly and to prolong the life span of the incinerator.

Before each operation.

- Check that ashes have been completely cleared from the grate and floor of incinerator.
- Check that loading door closes properly onto the sand seal in an air-tight manner. Loosen sand if necessary.

Annual inspection and rectifications

Component	Check	Rectify if necessary
Chimney	Vertical fixings	Reset or renew
	Corrosion	Repair any holes or weak points. Replace chimney or section thereof if necessary
Chimney support plate	Corrosion	Replace if necessary
Top sand seals	Cement seal to brickwork. Adequate sand level	Re-seal with refractory cement. Top up sand
Ash door	Corrosion, hinges, catch, blockage in door-frame	Repair and clean as necessary
Brickwork	Missing cement	Replace with refractory cement
	Evidence of thermal damage to bricks	Line inner surface of bricks with 10 mm refractory cement

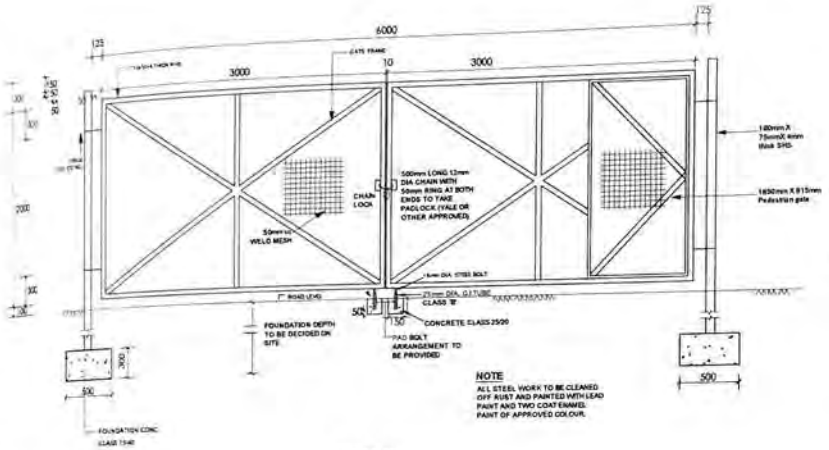
Disclaimer

Since the safe and successful use of the incinerator, which operates at very high temperatures, is entirely dependent on the building, operation and maintenance thereof, the University and the organizations supplying the drawings and instructions can bear no responsibility for any mishaps to personnel or inadequate technical performance of the incinerator.

Information & questions

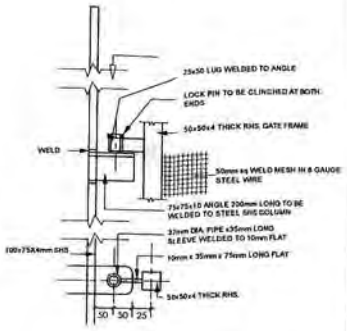
Any questions relating to these instructions should be referred to: Professor D.J. Picken (De Montfort University, Leicester, UK)

Contact formulae available at:



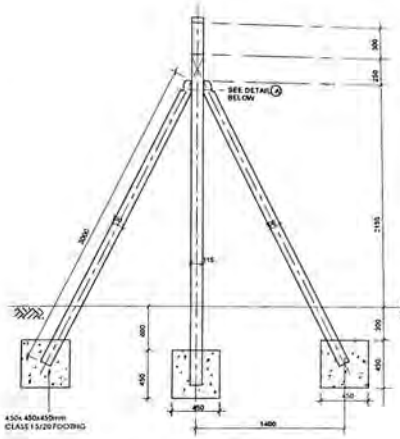
ELEVATION
SCALE 1:25

NOTE
ALL STEEL WORK TO BE CLEANED OFF RUST AND PAINTED WITH LEAD PAINT AND TWO COAT ENAMEL PAINT OF APPROVED COLOUR.



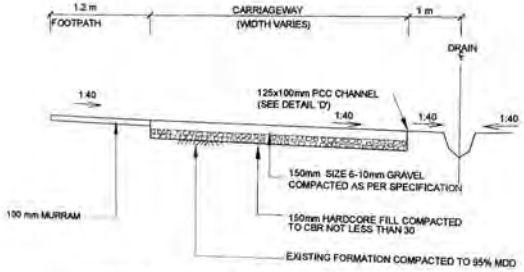
DETAILS OF HINGE
(VIEW AT Y - Y)
SCALE 1:5

DETAILS OF 6M WIDE GATE

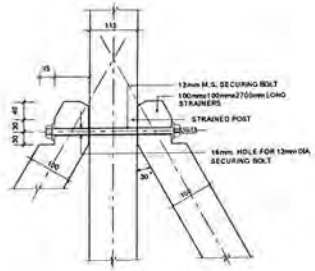


DETAILS OF STRAINING POST FOR CHAIN LINK FENCE AT 33.3m Cts.
SCALE 1:50

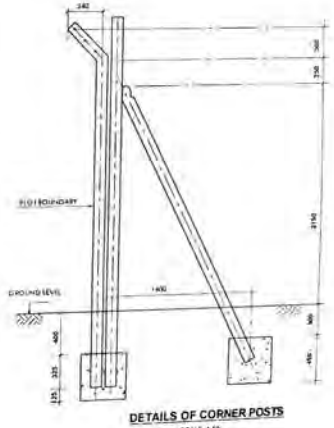
DETAILS OF SINGLE P.C.C. POST AT 3.30m Cts.
SCALE 1:50



TYPICAL SECTION OF GRAVEL ROAD
SCALE 1:50



DETAIL (A)
SCALE 1:50



DETAILS OF CORNER POSTS
SCALE 1:50

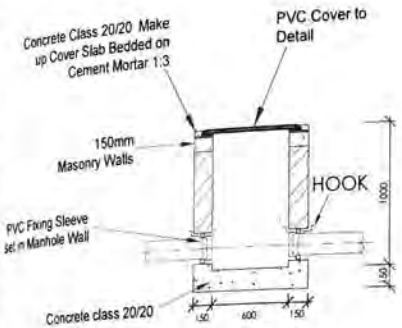
NOTES
a. ALL CORNER POSTS AND EVERY 10th SINGLE POST TO HAVE 2 No. STAYS
b. POSTS TO BE AT 3000mm CENTRES
c. TOP OF ALL POSTS TO BE KEPT IN UNIFORM LIN
d. EXTENT OF FENCING IS SHOWN ON THE LAYOUT PLAN
e. CHAINLINK TO BE GAUGE 12 GALVANIZED STEEL WIRE
f. EXTENT OF FENCING IS SHOWN ON THE LAYOUT PLAN

CHAIN LINK FENCE

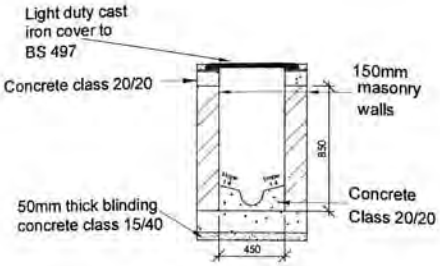
COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

FENCE, GATE AND ROAD

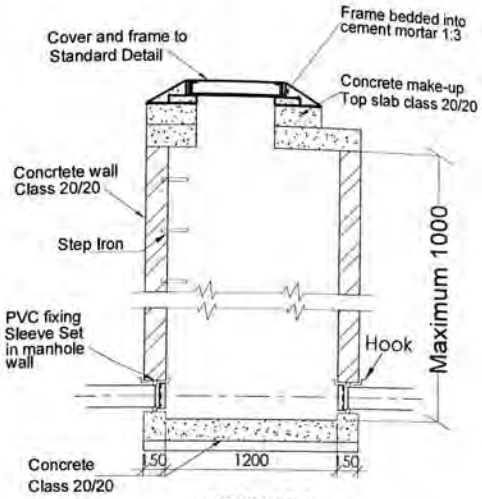
Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	Project Area	Designed and drawn by: UBSUP technical team Checked by: Programme Manager Urban Investments Approved byCEO WSTF	Notes: See Above	Index-No.:	Description:	Date: Scale: As shown page:



SECTION B-B
SCALE 1:40



SECTION A-A
SCALE 1:40



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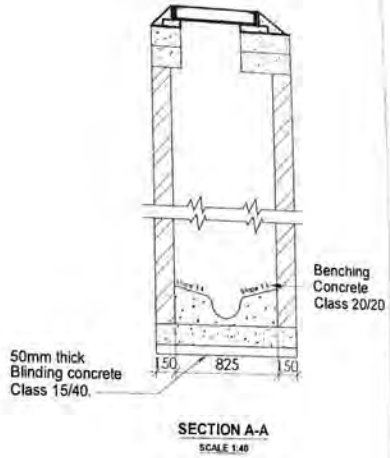
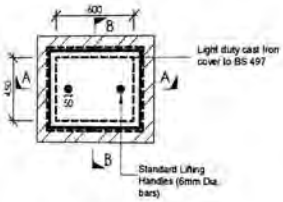
SCALE 1:40



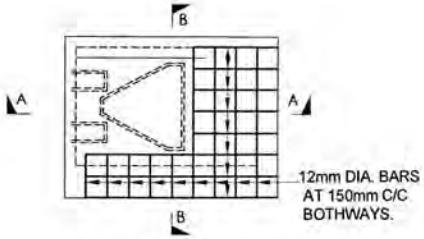
SECTION A-A
SCALE 1:40



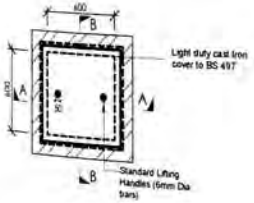
PLAN
600mmx450mm PVC Cover
SCALE 1:40

NOTES:

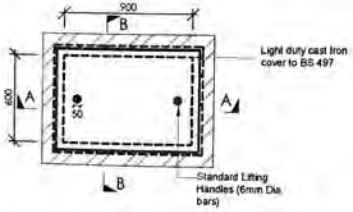
1. INSPECTION CHAMBER SHOULD BE SIZE 600x450mm UP TO DEPTH OF 1000mm
2. FOR CHAMBERS EXCEEDING DEPTH 1000mm SIZE SHOULD BE 850x1200mm
3. WALLS OF INSPECTION CHAMBER TO BE OF MASONRY
4. ALL CONCRETE TO BE CLASS 20/20 IN ACCORDANCE WITH THE SPECIFICATION



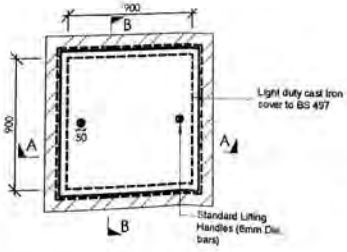
PLAN
SCALE 1:40



PLAN
600mmx600mm PVC Cover
SCALE 1:40

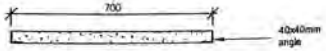


PLAN
900mmx600mm PVC Cover
SCALE 1:40



PLAN
900mmx900mm PVC Cover
SCALE 1:40

RECTANGULAR MANHOLE DETAILS



SECTION
700mmx400mm PCC Cover
SCALE 1:40

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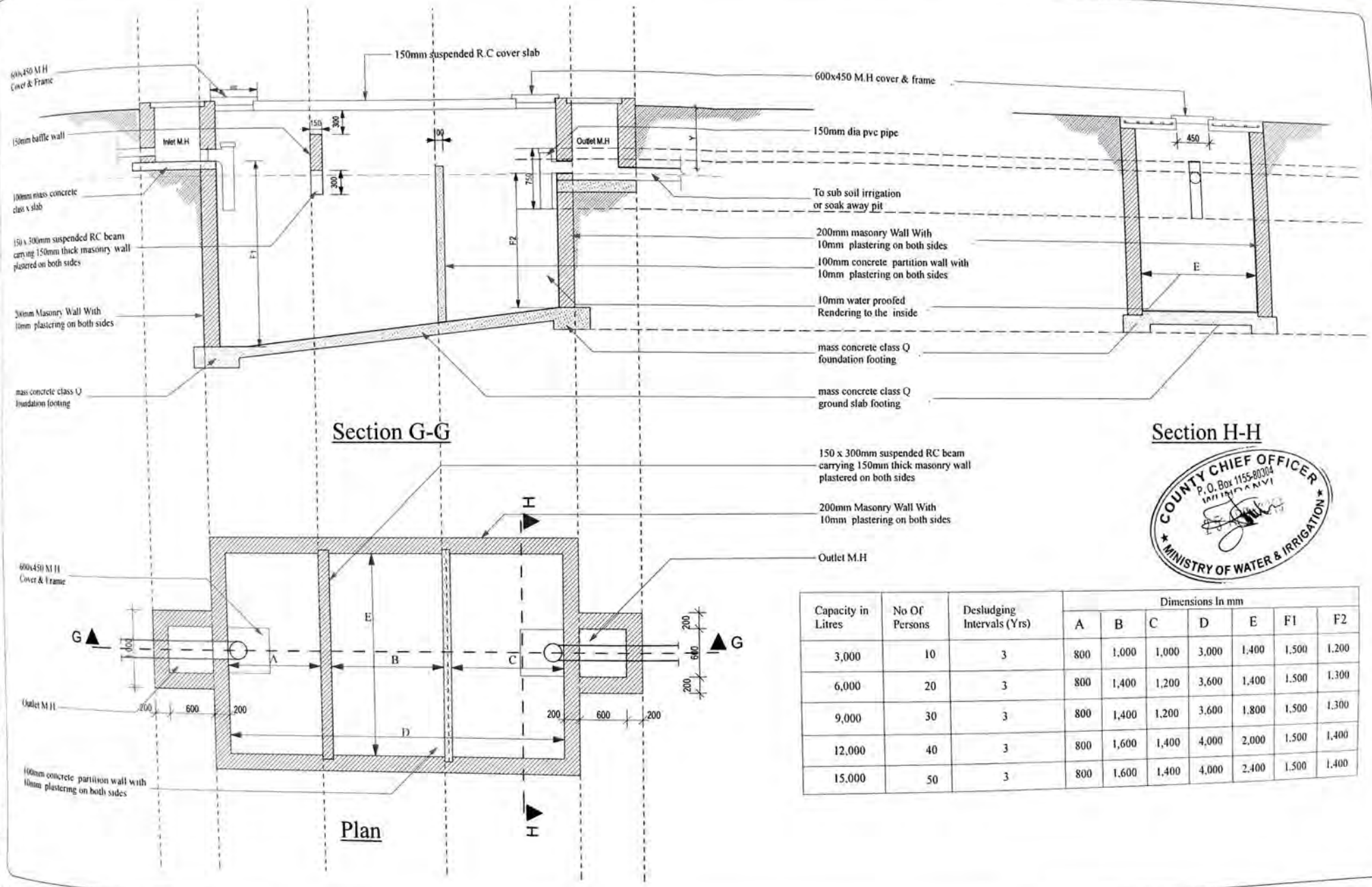
MINISTRY OF WATER & IRRIGATION

INSPECTION CHAMBER DETAILS

CHAMBERS AND MANHOLES

Project Title: Up-scaling Basic Sanitation for Urban Poor (UBSUP)	Project Area	Designed and drawn by UBSUP technical team Checked by: Programme Manager Urban Investments Approved by CEO WSTF	Notes: See Above	Index-No.: / Description:	Date: Scale: As shown page:



COUNTY CHIEF OFFICER
P.O. Box 1155-80304
MINISTRY OF WATER & IRRIGATION

Capacity in Litres	No Of Persons	Desludging Intervals (Yrs)	Dimensions In mm						
			A	B	C	D	E	F1	F2
3,000	10	3	800	1,000	1,000	3,000	1,400	1,500	1,200
6,000	20	3	800	1,400	1,200	3,600	1,400	1,500	1,300
9,000	30	3	800	1,400	1,200	3,600	1,800	1,500	1,300
12,000	40	3	800	1,600	1,400	4,000	2,000	1,500	1,400
15,000	50	3	800	1,600	1,400	4,000	2,400	1,500	1,400

Project Title:
Up-scaling Basic Sanitation for Urban Poor (UBSUP)

Drawing Title:
Septic Tank Details Drawings

Drawn by:
Edward Kung'u

Approved by:

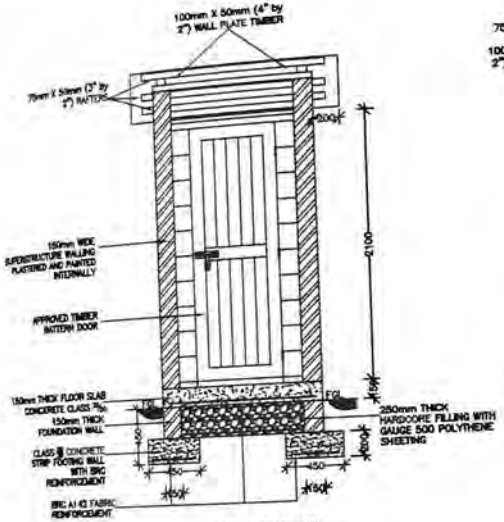
Notes: **GENERAL**

Cover slab to be reinforced with 10mm diameter bars @ 10cm c/c (conc. 20/20 mix 1:2:4.
Base slab to be concrete class Q mix 1:3:6.
Outlet and inlet pipes to be 100mm diameter cast iron.
Scum baffle to be 100mm diameter thick reinforced with 2no. 10mm at both ends (conc 20/20 mix 1:2:4)
Dividing wall to be 100mm thick concrete class 20/20 reinforced with weld mesh no. 65
'GL' denotes unfinished ground level.
All dimensions are shown in mm unless otherwise specified.
Drawings are not to be scaled. Only figured dimensions to be used.
The Contractor must check and verify all dimensions on site before commencement of any work.

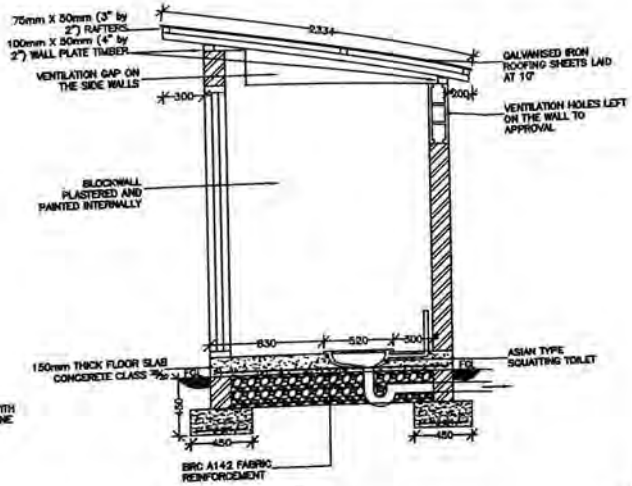
CONSTRUCTION

All slabs at ground level to be poured over 1000 gauge polythene sheeting on 50mm thick murram blinding on hard-core
All soil under slabs and around external foundations to be poisoned for termite control.
All soils on cut embankments to be stabilized. The slope not to exceed the natural angle of repose.
For all R.C. work, refer to Structural Engineer's details.

Date: 07/02/2013
Scale: 1 50
page: 1 / 1

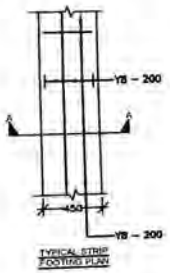


FRONT ELEVATION

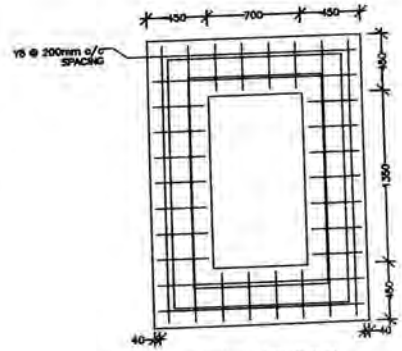


SECTION A-A

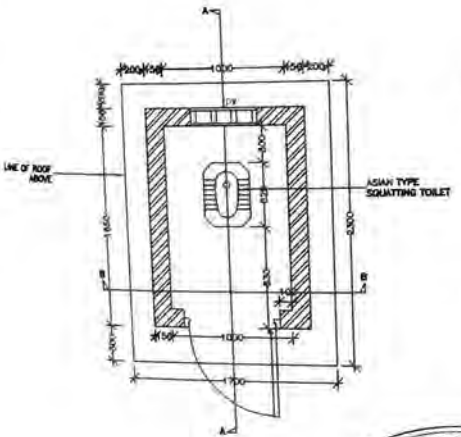
SECTION A-A- STRIP FOOTING FOR WALL



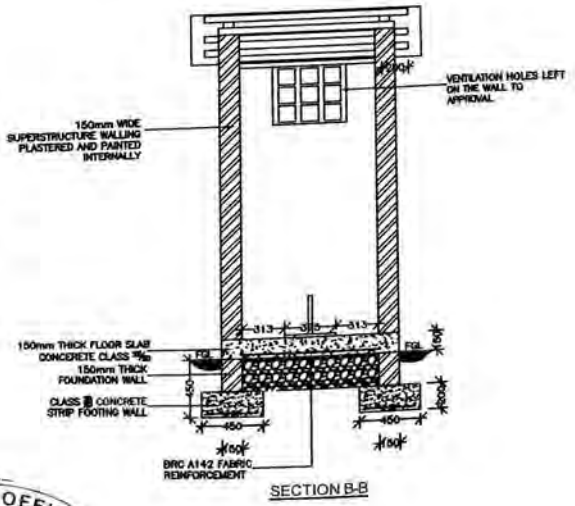
TYPICAL STRIP FOOTING PLAN



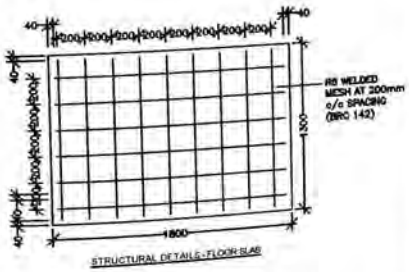
STRUCTURAL DETAILS - STRIP FOOTING PLAN



PLAN



SECTION B-B



STRUCTURAL DETAILS - FLOOR SLAB

NOTES

1. DIMENSIONS AND CONDITIONS MUST BE CHECKED ON SITE AND ANY DISCREPANCIES REFERED TO ENGINEER. ALL DIMENSIONS IN mm UNLESS OTHERWISE SPECIFIED.
2. DEPTH OF FOUNDATION TO BE DETERMINED ON SITE. FOUNDATION TO BE CARRIED DOWN TO HARD BASE TO APPROVAL OF ENGINEER AND ALL UNSUITABLE SOILS TO BE EXCAVATED AND THE OPENINGS FILLED WITH HARDCORE.
3. ALL WALLS TO BE REINFORCED WITH HEAVY DUTY GAUGE HOOP IRON AT EVERY ALTERNATIVE COURSE AND JOINTED IN 1:3 CEMENT SAND MORTAR.
4. ALL TIMBER WORK TO HAVE UNDERCOAT AND PAINTED WITH 3 COATS APPROVED GLOSS PAINT.
5. HANDWASH FACILITY TO HAVE A MINIMUM OF 100 LITRES CAPACITY PVC STORAGE TANK WITH STAND. TAP MUST BE HEAVY DUTY

REINFORCEMENT

1. CONCRETE CLASSES TO BE AS FOLLOWS:
   - 1.1. MASS CONCRETE FILL AND BLINDING MIX, CLASS 15
   - 1.2. REINFORCED CONCRETE, CLASS 25/20
2. MINIMUM COVER TO ALL REINFORCEMENT TO BE 40mm UNLESS AS SPECIFIED BELOW FOR BUILDINGS:
   - 2.1. MEMBERS OF BUILDINGS:
   - 2.2. SLABS – 20 mm
   - 2.3. BEAMS – 25 mm
   - 2.4. COLUMNS – 40 mm
   - 2.5. FOUNDATIONS & FOOTINGS – 50 mm
3. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL SPACER BLOCKS, CHAIRS AND TYING WIRE
4. EXAMPLE: 16 T12 – 07 – 150 SIGNIFIES 16 No. HIGH TENSILE 12mm DIA. BARS IDENTIFICATION MARK 07 AT 150mm CENTRE TO CENTRE SPACING

FINISHES SCHEDULE

INTERNAL FINISHES

- FLOOR – 300x300 CERAMIC TILES/15mm FLOOR SCREED PAINTED WITH 1 UNDERCOAT AND 2 COATS OF APPROVED RED OXIDE FLOOR PAINT
- SKIRTINGS – CERAMIC TILES (150mm HIGH)/150mm HIGH SCREED PAINTED WITH 1 UNDERCOAT AND 2 COATS OF APPROVED RED OXIDE FLOOR PAINT
- WALLS – INTERNALLY PLASTERED WITH 12.5mm THICK CEMENT PLASTER AND PAINTED WITH THREE COATS OF PAINT.

EXTERNAL FINISHES

- NATURAL STONE WITH HORIZONTAL JOINTS RAKED AND KEYED.

ABBREVIATIONS

E.G.L – EXISTING GROUND LEVEL
F.G.L – FINISHED GROUND LEVEL

PROJECT TITLE:
UPSCALING BASIC SANITATION FOR URBAN POOR (UBSUP)

DRAWING TITLE:
POUR FLUSH TOILET SQUATTING TYPE

Designed and drawn by	UBSUP technical team
Checked by	Programme Manager Urban Investments
Approved by	CEO WSTF