URBAN SANITATION & PUBLIC HEALTH

GOOD AFTERNOON

Presented by –

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MES –CCM, N.S.C – UNs, INGOs & NGOs

URBAN SANITATION & PUBLIC HEALTH

SWEDEN eawaq & HONOI - Public Health


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REGIONAL WORKSHOP ON PLAN


acer


HYUNDAI

Urban Sanitation & Public Health

MAIN CONCEPTS

LEARNING	OBSERVING	THINKING
+	+	
THEORY	ENVIRONMENT	HYPOTHESIS

Environmental Sanitation

1. General Sanitation (Building orientation to all)
2. Air Sanitation (Pollution, CO_2, CO, H_2S, NO, CLFLC, CH_4, NH_3)
3. Lighting (minimum 50 foot candle for reading)
4. Ventilation (30%-40% of walling, 50-70ft^2/c, 35m^3/c.hr)
5. Soil Sanitation (free Disease Produc^N: Bat, Pathogenic Organism)
6. Sound Sanitation (Noise Control <80 decibel)
7. Refuse Disposal (Dump^N:, San. LF, CP, Hog Feeding,
   - Incineration).
8. Sewage Treatment (San.Pit, Septic Tank, IMT, TF, AS, MF)

Source: Environmental Engg; & Sanitation- Joseph A. Salvato New York Nov: 1971

What is Sanitation?

Definitions

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a)
Sanitation is the means of collecting and disposing of excreta and liquid wastes in a hygienic way so as not to endanger the health of individuals or the community as a whole. [1]

b) *(less common)*
General term used to describe a battery of actions that all aim to reduce the spread of pathogens and maintain a healthy living environment. Specific actions related to sanitation include wastewater treatment, solid waste management and stormwater management. [2]

Municipal Concerns

So it mostly addresses on– WW treatment, solid waste & storm water management

Sanitation Challenges

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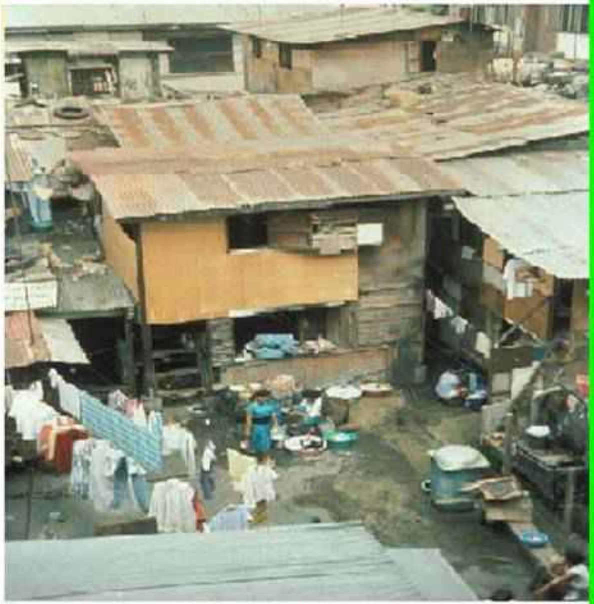
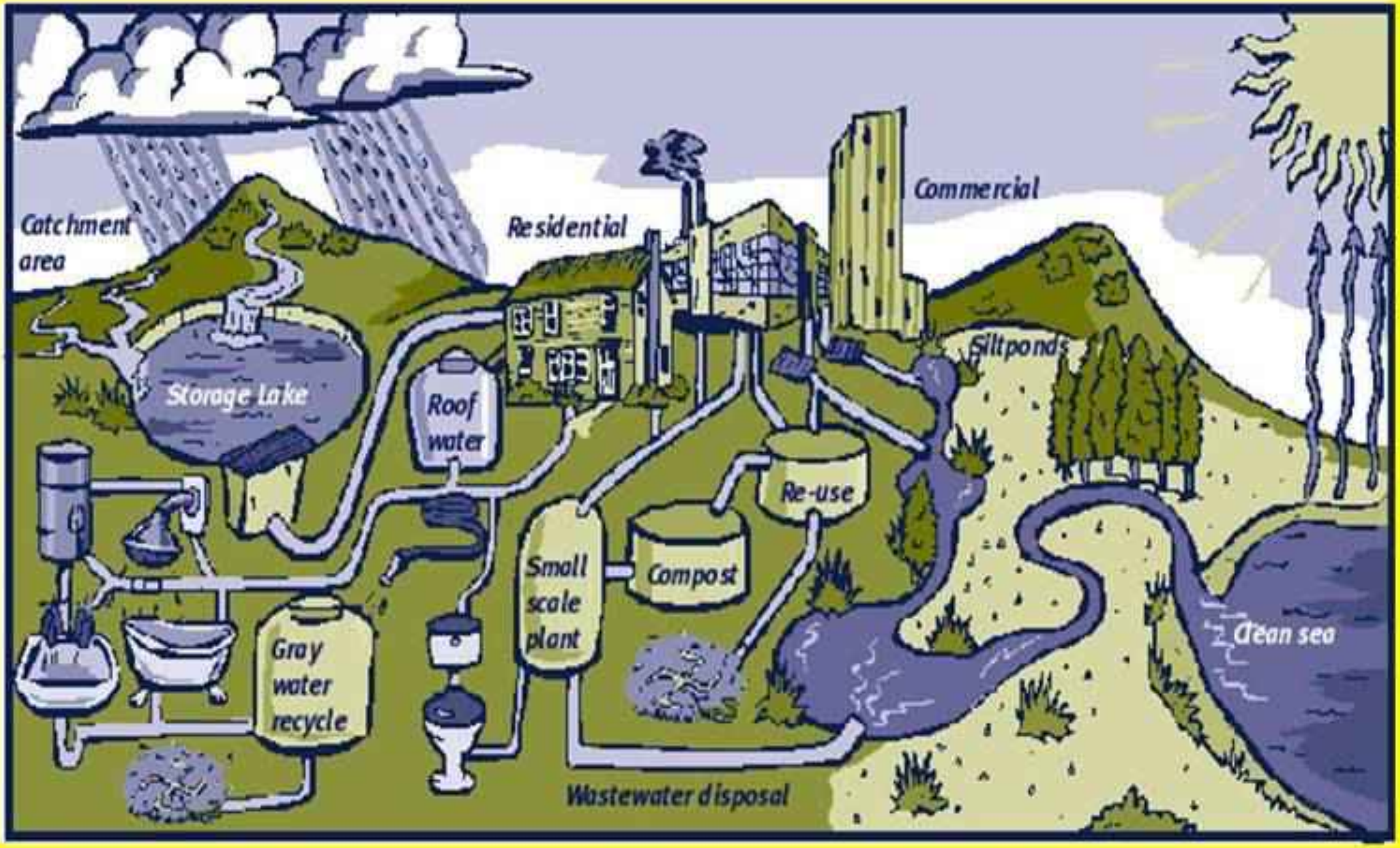
Sanitation Challenges: Urban

- Greatest socio-economic & technical challenges
- Disease transmission – public health
- The numbers !
- Simple (rural) versus complex (urban) solutions



The Water Cycle and RelatedUrban Infrastructure



Source: http://www.mfe.govt.nz/publications/waste/wastewater-mgmt-jun03/html/figure3-3.html

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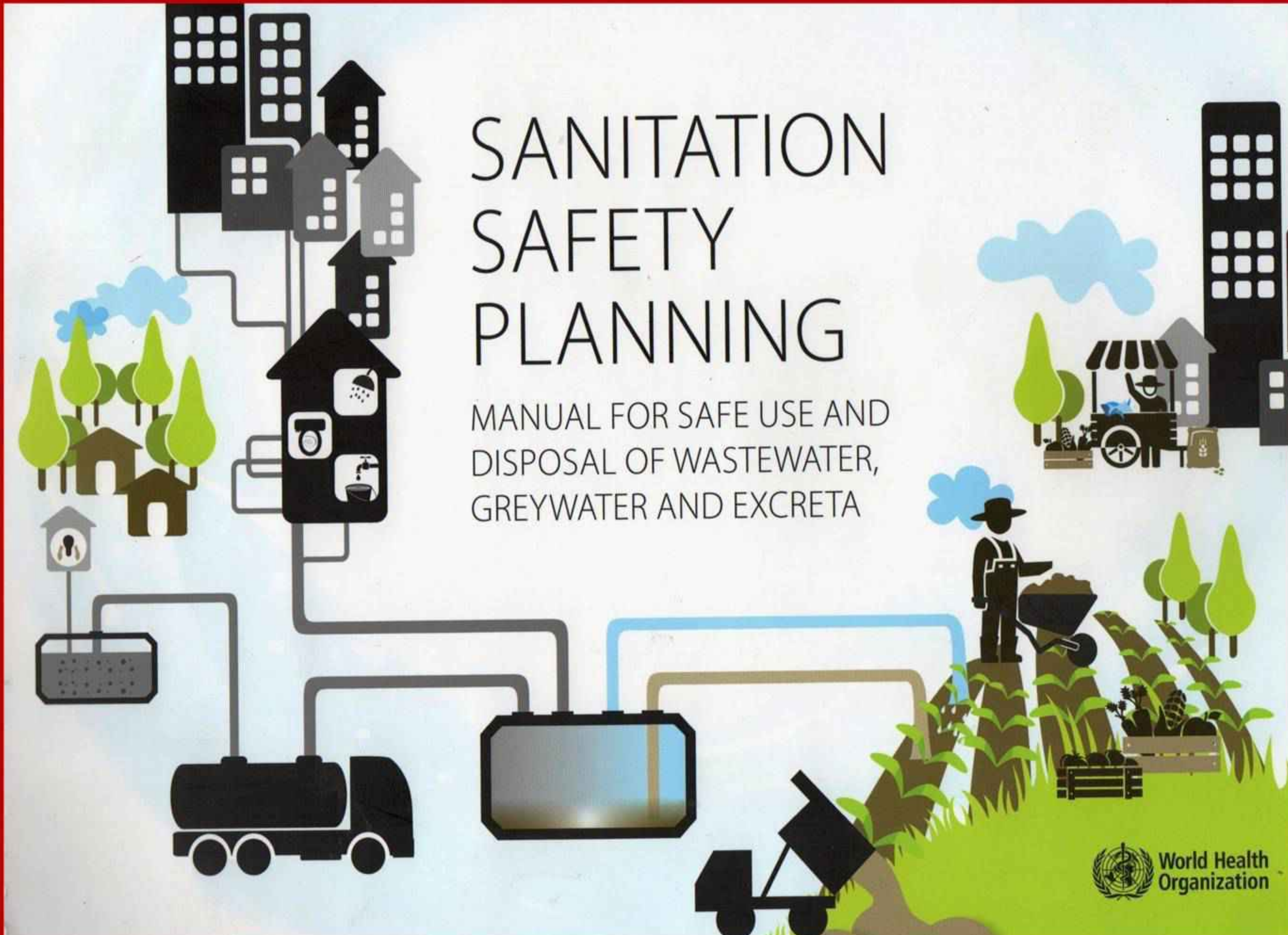
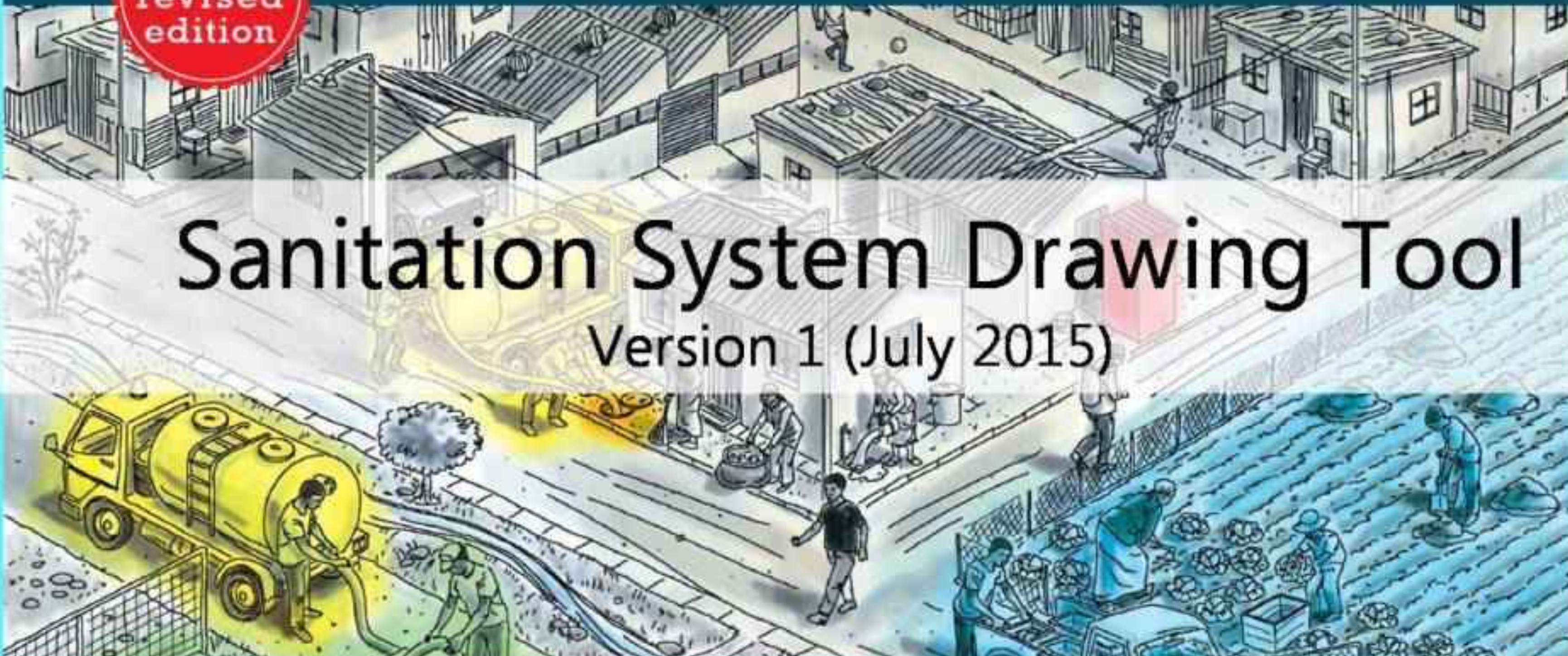
What Waste, Resource and Management Systems Are We Dealing With?


SANITATION
SAFETY
PLANNING
MANUAL FOR SAFE USE AND
DISPOSAL OF WASTEWATER,
GREYWATER AND EXCRETA
World Health
Organization

Compendium of Sanitation Systems and Technologies

2nd revised edition



Sanitation System Drawing Tool

Version 1 (July 2015)

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MODULE 1
PREPARE FOR SSP

MODULES

1.1 Establish priority areas or activities

1.2 Set objectives

1.3 Define the system boundary and lead organization

1.4 Assemble the team

OUTPUTS

- Agreed priority areas, purpose, scope, boundaries and leadership for SSP
- A multidisciplinary team representing the sanitation chain for development and implementation of SSP

MODULE 2

DESCRIBE THE SANITATION SYSTEM

MODULES

2.1 Map the system
2.2 Characterize the waste fractions
2.3 Identify potential exposure groups
2.4 Gather compliance and contextual information
2.5 Validate the system description

OUTPUTS

- **A validated map and description of the system**
- **Potential exposure groups**
- **An understanding of the waste stream constituents and waste related health hazards**
- **An understanding of the factors affecting the performance and vulnerability of the system**
- **A compilation of all other relevant technical, legal and regulatory information**

MODULE 3

IDENTIFY HAZARDOUS EVENTS, ASSESS EXISTING CONTROL MEASURES AND EXPOSURE RISKS

MODULES

3.1 Identify hazards and hazardous events

3.2 Refine exposure groups and exposure routes

3.3 Identify and assess existing control measures

3.4 Assess and prioritize the exposure risk

OUTPUTS

- **A risk assessment table which includes a comprehensive list of hazards, and summarizes hazardous events, exposure groups and routes, existing control measures and their effectiveness**
- **A prioritized list of hazardous events to guide system improvements**

MODULE 4

DEVELOP AND IMPLEMENT AN INCREMENTAL IMPROVEMENT PLAN

MODULES

4.1 Consider options to control identified risks

4.2 Use selected options to develop an incremental improvement plan

4.3 Implement the improvement plan

OUTPUTS

- An implemented plan with incremental improvements which protects all exposure groups along the sanitation chain

MODULE 5

MONITOR CONTROL MEASURES AND VERIFY PERFORMANCE

MODULES

5.1 Define and implement operational monitoring

5.2 Verify system performance

5.3 Audit the system

OUTPUTS

- An operational monitoring plan
- A verification monitoring plan
- Independent assessment

MODULE 6
DEVELOP SUPPORTING PROGRAMMES AND REVIEW PLANS

MODULES

6.1 dentify and implement supporting programmes and management procedures

6.2 Periodically review and update the SSP outputs

OUTPUTS

- **Supporting programmes and management procedures that improve implementation of the SSP outputs**
- **Up to date SSP outputs responding to internal and external changes**

Ammonia & Nitrate Pollution

- **Nitrogen Cycle & pollution**

$2\ NH^{4+} + 4O_2 = 2NO_3 + 4H^+ + 2H_2O$

$1\ mg\ NH_4 = 3.6\ mg\ O_2$

$1\ mg\ NH4^+ = 3.44\ mg\ NO3^-$

- **Iron & Manganese Removal**

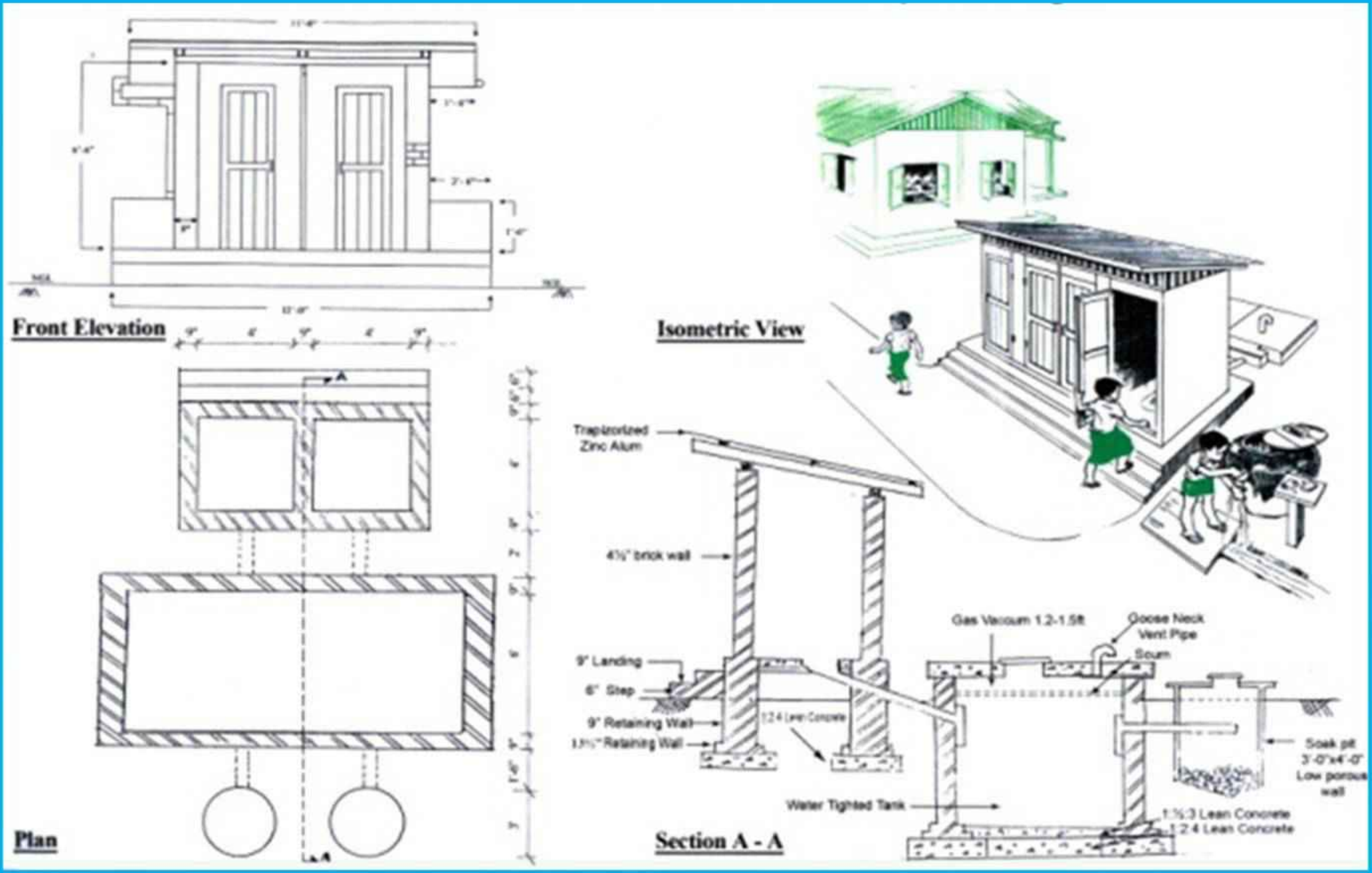
$4\ Fe^{2+} + O_2 + 10\ H_2O = 4\ Fe\ (OH)_3 + 8H^+$

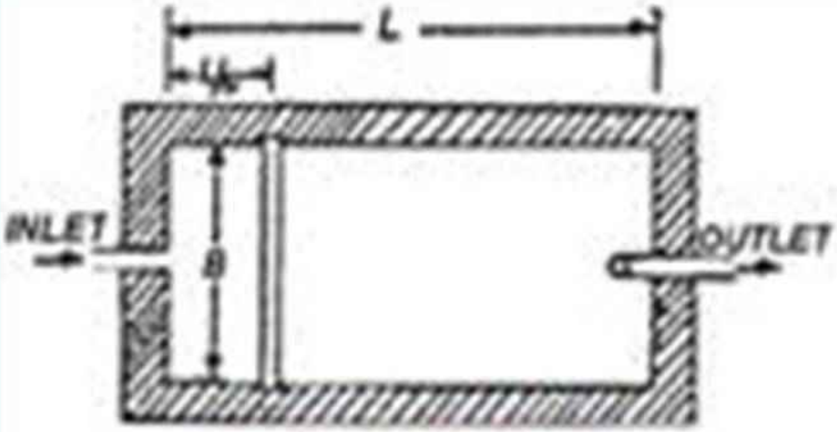
$1\ mg\ Fe^{2+} = 0.14\ mg\ O_2$

- **$6\ Mn^{2+} + 3\ O_2 + 6\ H_20 = 6\ Mn\ O_2 + 12\ H^+$**

$1\ mg\ Mn^{2+} = 0.29\ mg\ O_2$

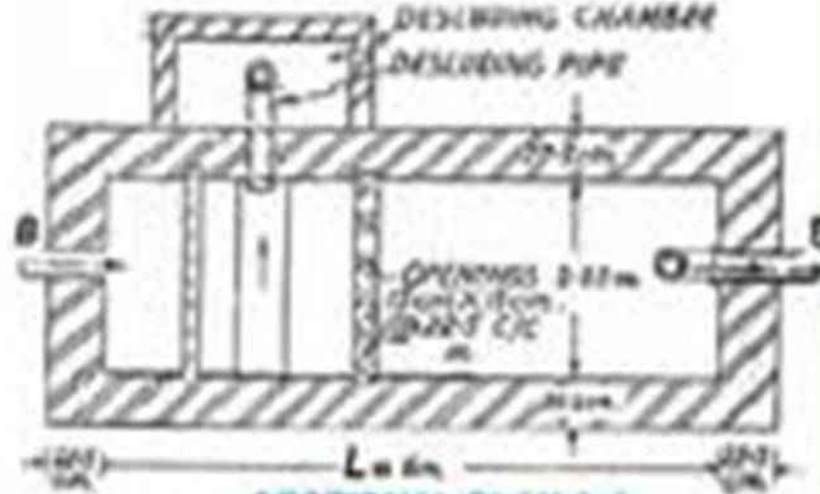
PRIMARY - SEPTIC TANK



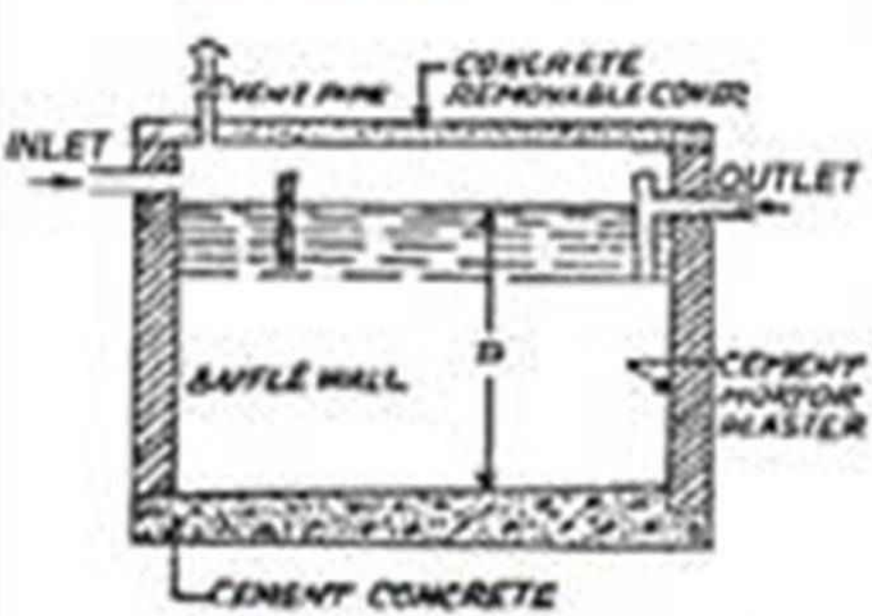


SECTIONAL PLAN

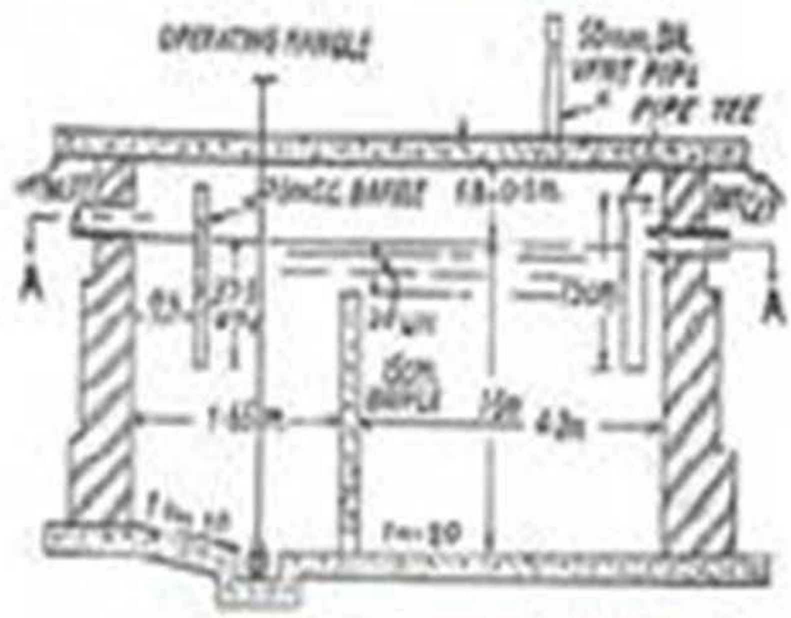
SECTIONAL ELEVATION



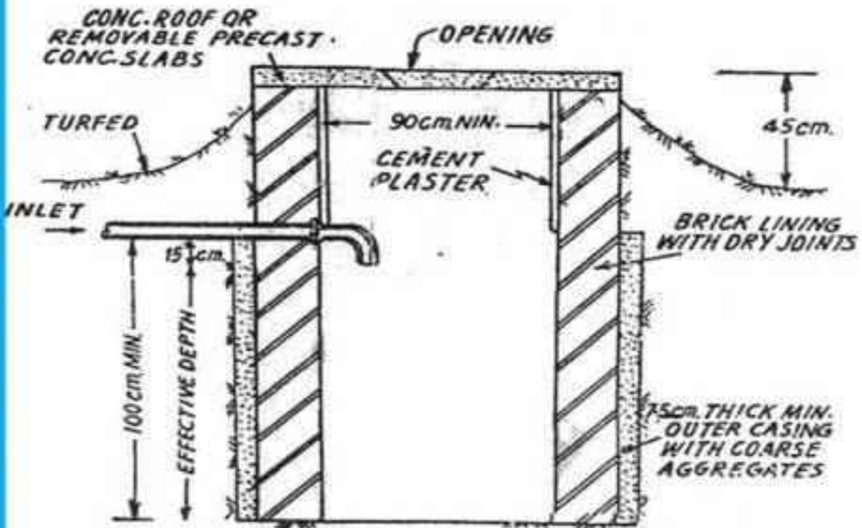
SECTIONAL PLAN A-A



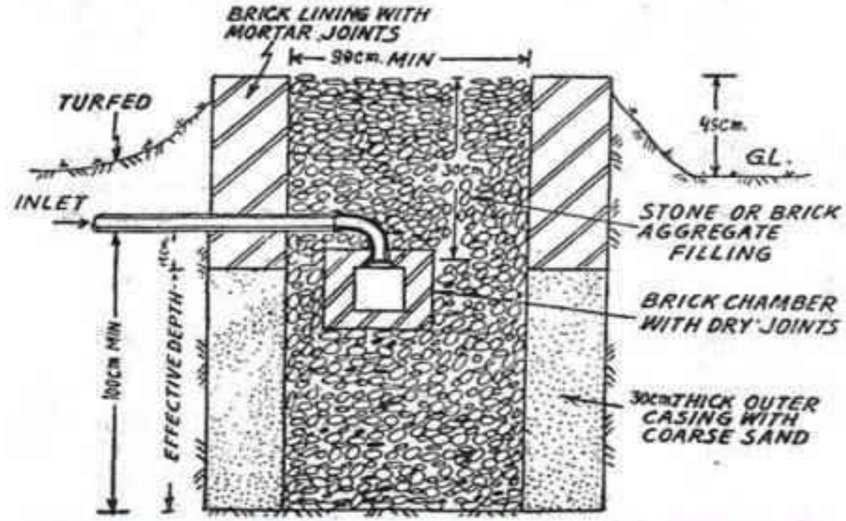
SECTIONAL ELEVATION



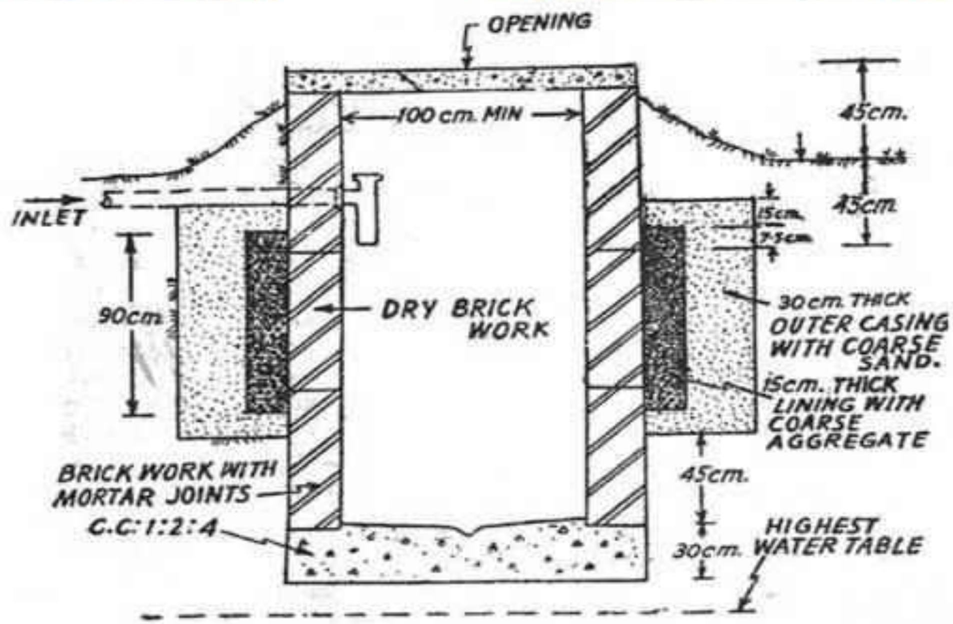
SECTIONAL ELEVATION B-B



Soak or Seepage Pit when empty



Soak Pit when filled with stone or Brick Aggregates



Leaching Cess pool

SEPTIC TANK DESIGN

Table The dimensions of septic tanks as per I.S. 2470

No. of users	Length L metres	Breadth B metre	Liquid depth D	Liquid capacity m^3.	Free Board cm.	Sludge to be removed m^3.	Cleaning intervals
5	1·5	0·75	1·0	1·12	30	0·18	6 months
			1·0	1·12	30	0·36	1 year
			1 05	1·18	30	0·72	2 years
10	2	0·9	1·0	1·8	30	0·36	6 months
			1·0	1·8	30	0·72	1 year
			1·4	2·52	30	1·44	2 years
15	2	0·9	1·0	1·8	30	0·54	6 months
			1·3	2·34	30	1 08	1 year
			2·0	3·6	30	2 16	2 years
20	2·3	1·1	1·0	2·53	30	0·72	6 months
			1·3	3·3	30	1·44	1 year
			1·8	4·55	30	2·88	2 years
50	4	1·4	1·0	5·6	30	1·8	6 months
			1·3	7·28	30	3·6	1 year
			2·0	11·2	30	7 2	2 years

DESIGN CALCULATIONS FOR ANAEROBIC TANK

- ❖SEWAGE FLOWS METHOD
- ❖RATIONAL METHOD
- ❖SLUDGE ACCUMATION METHOD

Septic Tank Design

I. Sewage Flow Method

Water tight, inlet 1 dia > out let dia D = 1.2 – 1.7 m, L/B = 2-4,

Free Board=1-1.5 ft (Min 30 cm)

Sewage Flow = 20 gpcd Users =50 Q = 20 gpcg x 50 capita = 1000 gals/day

Detension time 24 hours = 24 h/24 hour/day = 1day

Q = 1000 gallon/ day x 1 day = 1000 gallons V = 1000 gal / 6.24 gal/ ft^3

$=160.3\ ft^3$

Assume D= 1.2 m = 1.2 x 3.28 ft = 4 ft A = 160.3 ft^3 / 4 ft = 40.8 ft^2

Assume L/B = 2

A = 2B x B = 2 B^2 = 40.8 ft^2 B^2=20.4 B= 4.52 ft, L = 9 ft

Tank Dimension 9' x 4.5' x 4'+ 1'

II. Rational Method

135 lpcd x 100c= 13500 l/day= 13.5 m^3/day

- Detention Time 24 hours = 1 day
- Need ထုထည် 13.5 m^3/day x 1day= **13.5 m^3**

(1)အနည်ထိုင်ဖို့ 1m^2/10c x 100 c = 10m^2 10m^2 x 0.3 m = 3 m^3

(2)မစင်ချေဖြတ်ဖို့ =0.033 m^3 x100 capita x1 year= 3.3 m^3 capita year

(3)သိုလှောင်ထုထည V = 0.00021 m^3/c/day x 100 c x 365 days = 7.7 m^3

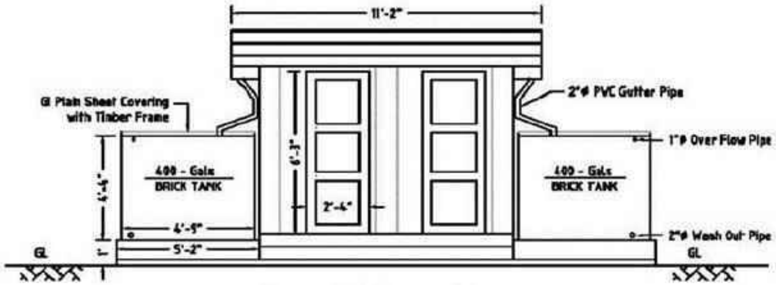
စုစုပေါင်း V = 3 + 3.3 + 7.7 = **14 m^3**

ကန်အတိုင်းအတာ Depth (H) = 1.4 + 0.3 = 1.7m ,

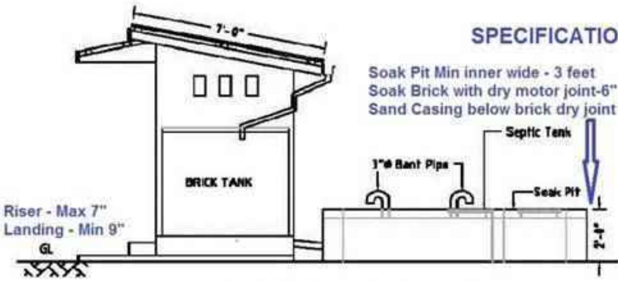
Breath= 1.4m , Length=5.6m

➢ မှန်မမှန်စစ်ဆေးခြင်း ရွေးတား V 14 m3 > 13.5 OK

2 SEATED SCHOOL LATRINE



Front Elevation



Right Side Elevation

SPECIFICATIONS

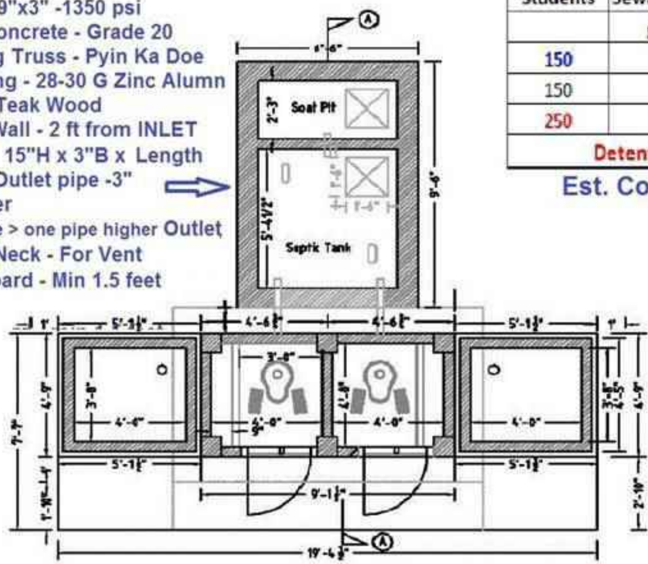
Soak Pit Min inner wide - 3 feet
Soak Brick with dry motor joint-6" below outlet pipe
Sand Casing below brick dry joint - 12" Coarse Sand

2 Seated	5' 6"x5'x6'	Gallons	Remark
Vol. ft³	168 ft³	1260	
Students	Sewage Flow	Volume	Clean Interval
	gpcd	Gals	years
150	3	450	3
150	5	750	2
250	3	750	2
Detention Time - 24 Hours			

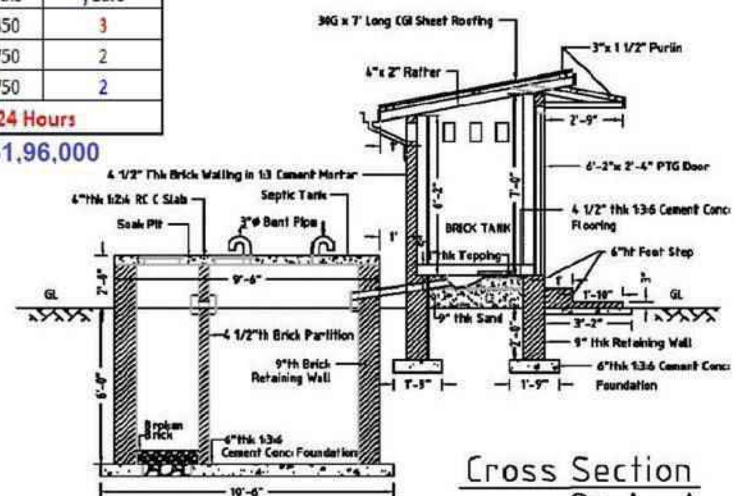
Est. Cost = Ks 31,96,000

SPECIFICATIONS

Brick - 9"x3" -1350 psi
Lean Concrete - Grade 20
Roofing Truss - Pyin Ka Doe
Roogfing - 28-30 G Zinc Alumn
Door - Teak Wood
Baffle Wall - 2 ft from INLET
15"H x 3"B x Length
Inlet & Outlet pipe -3" Diameter
Inlet pipe > one pipe higher Outlet
Goose Neck - For Vent
Free Board - Min 1.5 feet



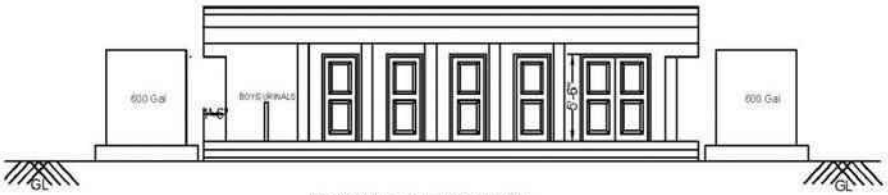
PLAN



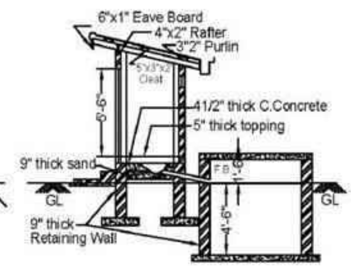
Cross Section On A- A

Note: Responsible Engineer's specific instruction is needed for tank construction to get "Septic Function well of tank"

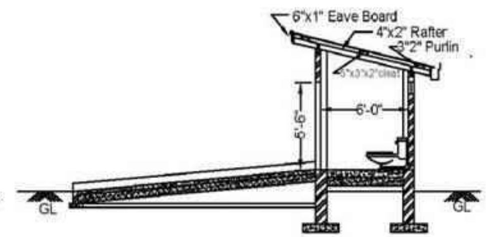
4 SEATED SCHOOL LATRINE WITH DISABLED TOILET



FRONT ELEVATION



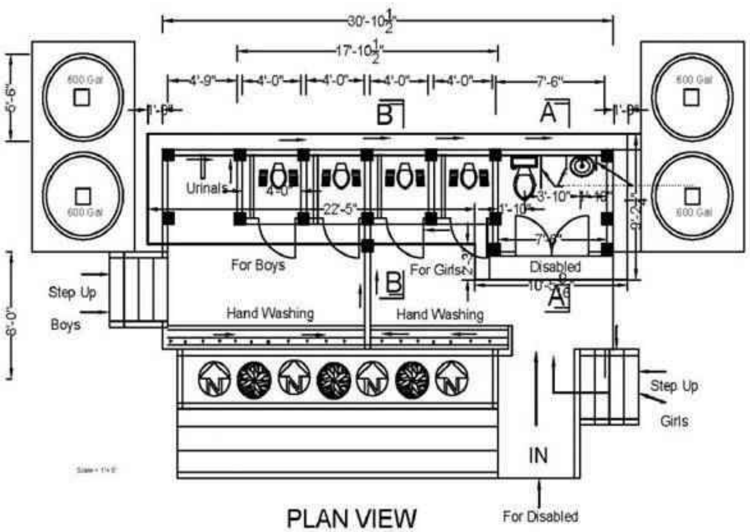
SECTION B-B



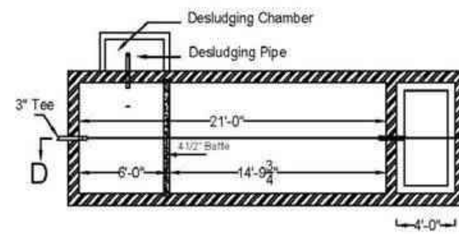
SECTION A-A

Estimation Cost = Ks 59,89548

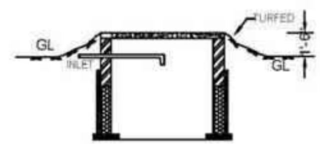
Target for 300 Students, 10 gpcd, detension time-1day
For Middle School & above, cleaning interval - 1 year



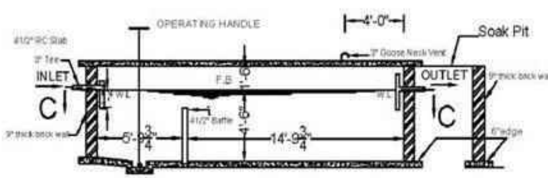
PLAN VIEW



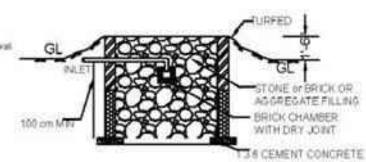
SECTIONAL PLAN C-C



Soak Pit when empty



SECTIONAL ELEVATION D-D

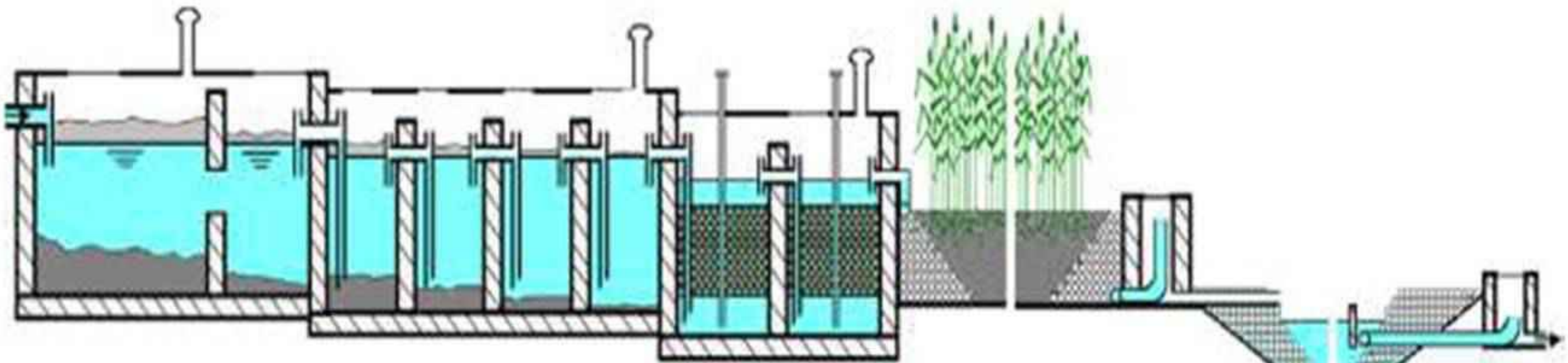


Soak Pit when filled with broken bricks & aggregates

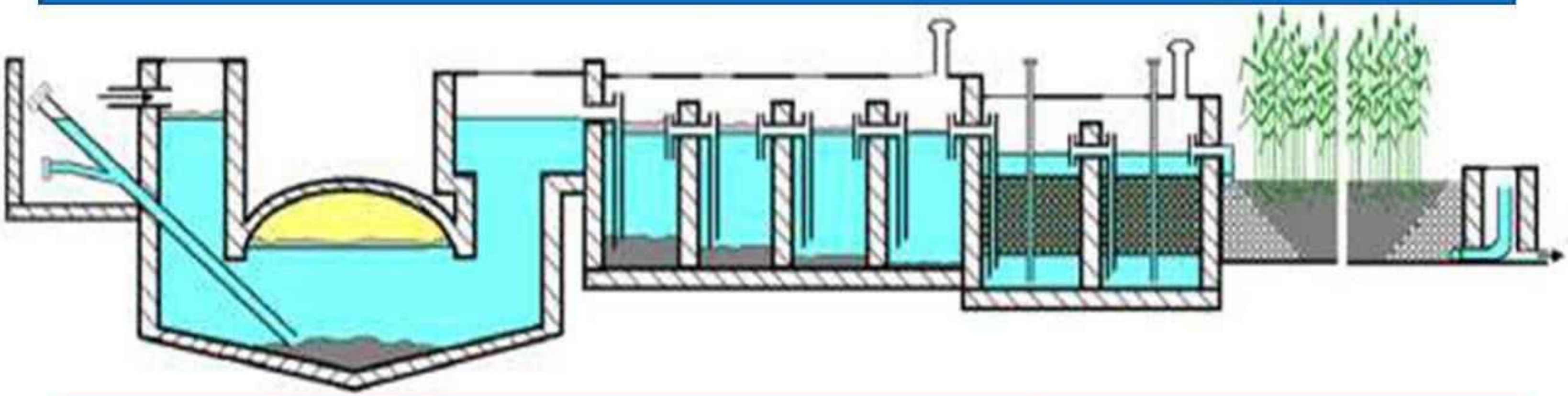
NOTE: Responsible Engineer or Skill Contractor's specific instruction is needed to get "Septic Function of tank"

CDD- Consortium DEWATS Disemination

Decentralized Wastewater Treatment System



Settler – ABR – AF – PGF – polishing pond (not true to scale)



fixed dome biogas settler – ABR – AF – PGF (not true to scale)

Thumb Rules (Settler)	Thumb Rules (ABR)	Thumb Rules (AF)	Thumb Rules (HPGF)	No Thumb Rules (Polishing Pond)
1. Sludge volume l/g BODrem=0.005 BODr 2. SS/COD = 0.35 - 0.55 – 0.42 3.Surface load =0.6 m3/m2 w/w peak flow 4. CH4 produced /kg COD rem=0.35 m3/kg 5. Height(scum) = 0.2 – 0.3 m 6. Hydraulic RT = 1.5 – 2.0 hrs **7.L/B ratio = 2.1 – 3.1** **8. Outlet Liq depth=1.8–2.2 m** 9. 1st & 2nd Chamber ratio If 2 Chams, 1st Cham = 2/3 of total length If 3 Chams, 1st Cham = 1/2 total length. 11. Assure wall opening bet. under scum & sludge top, have MH, Water tight, Vent 12. Desludg interval = 18–24 m	1.SS/COD–Dom. =.35–.55–.42 2. Sludge Volume –5-10% of volume of ABR 3. CH4–produced /KgCODrem – 0.35 m3/kg 4. Scum volume 10 l/cap 5. HRT– not <8 hrs, better 16-20 hrs, if > 20 hrs, pollution removal is very minimum **6. B/H ratio – 0.4** 7. Distance bet: pipes - not exceed 0.30 m 8. Nos of Chambers – At least 4 chambers 9. **Outlet water depth- 1.8 m- 2.2 m** 10. Up-flow vel: – 0.9 – 1.2 m/h 11. Organic load - < 6 kg/m3* day BOD	**1. SS/COD - Domestic: 0.35–0.45–0.42** **2. HRT – 24-48 hrs** **3. Filter height – 0,75 – 1 m** **4. Specific surface of filter medium 80 -120 m2/ m3** **5. Voids in the filter mass 30-45%** **6. Size of filter 8-14 cm dia,cinder** **7. Up-flow velocity Max 2m/h** **8. Organic load <4 kg/m3 *day COD** **9. Outlet water depth – 1.8- 2.2 m** 10. CH4–produced /Kg CODrem – - 0.35 m3/kg	**1. Void of gravel – 35%- 45%** **2. Max BOD on X sectional area- 150 g/m3 s** **3. Max organic on chosen surface (Organic load limit) – 10 g//m2 BOD** **4. Gravel size– 5-7mm, 10- 12 mm, 50-70mm dia., bigger size at inlet & outlet** **5. Slope 1%** **6. Height of filter 50 - 60 cm** **7. Construction – Swivel at inlet & outlet to adjust water level**	**V = 12 m3/d*2d=24m3** **Sur. Area= .24m3/1m= 24 m3** **Dimensions:** **W= 4 m, L=6m** **Diameter 5.5 m**

Reutilizing Wastewater for Plants



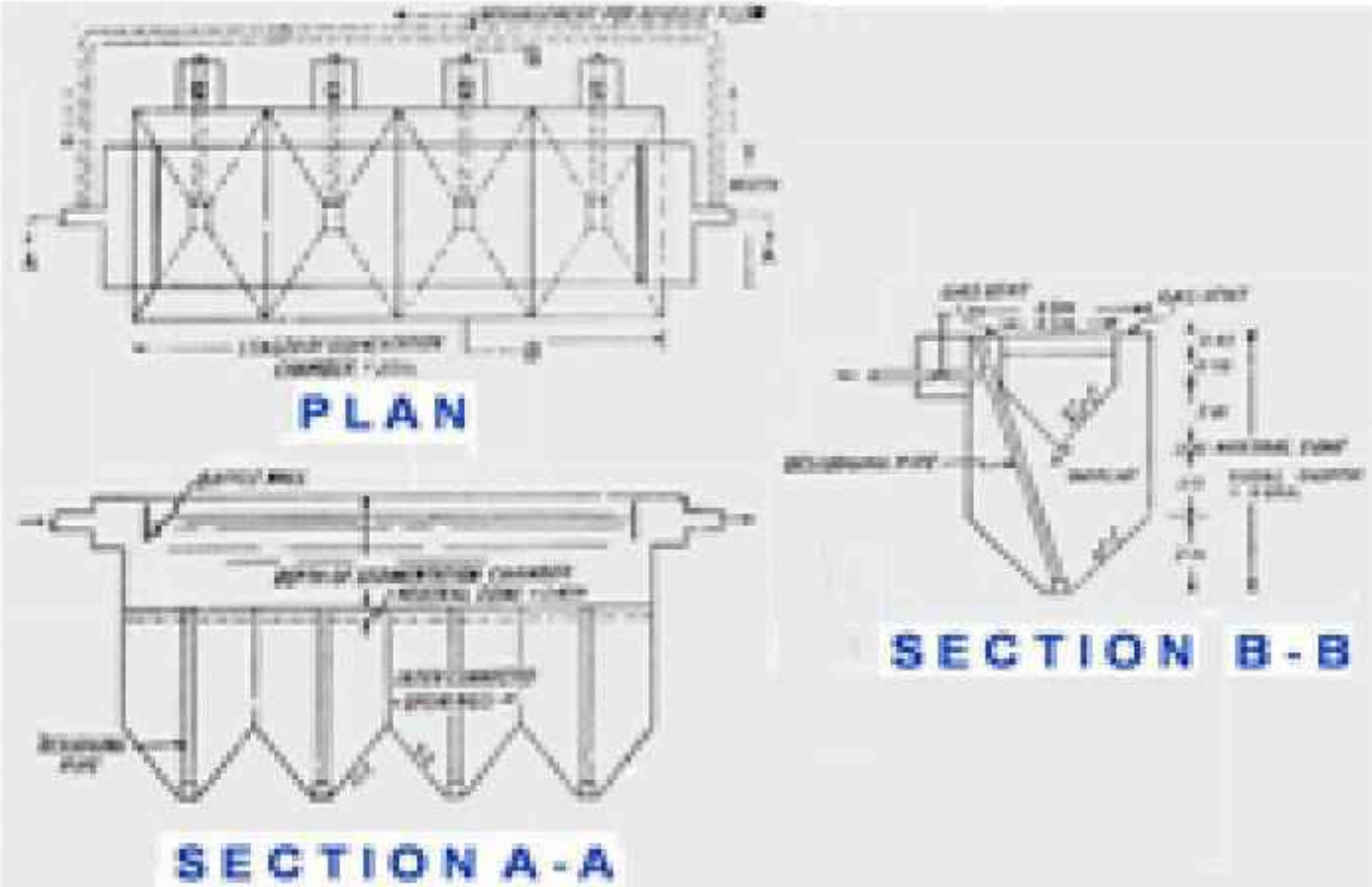



Reutilizing Wastewater for Plants

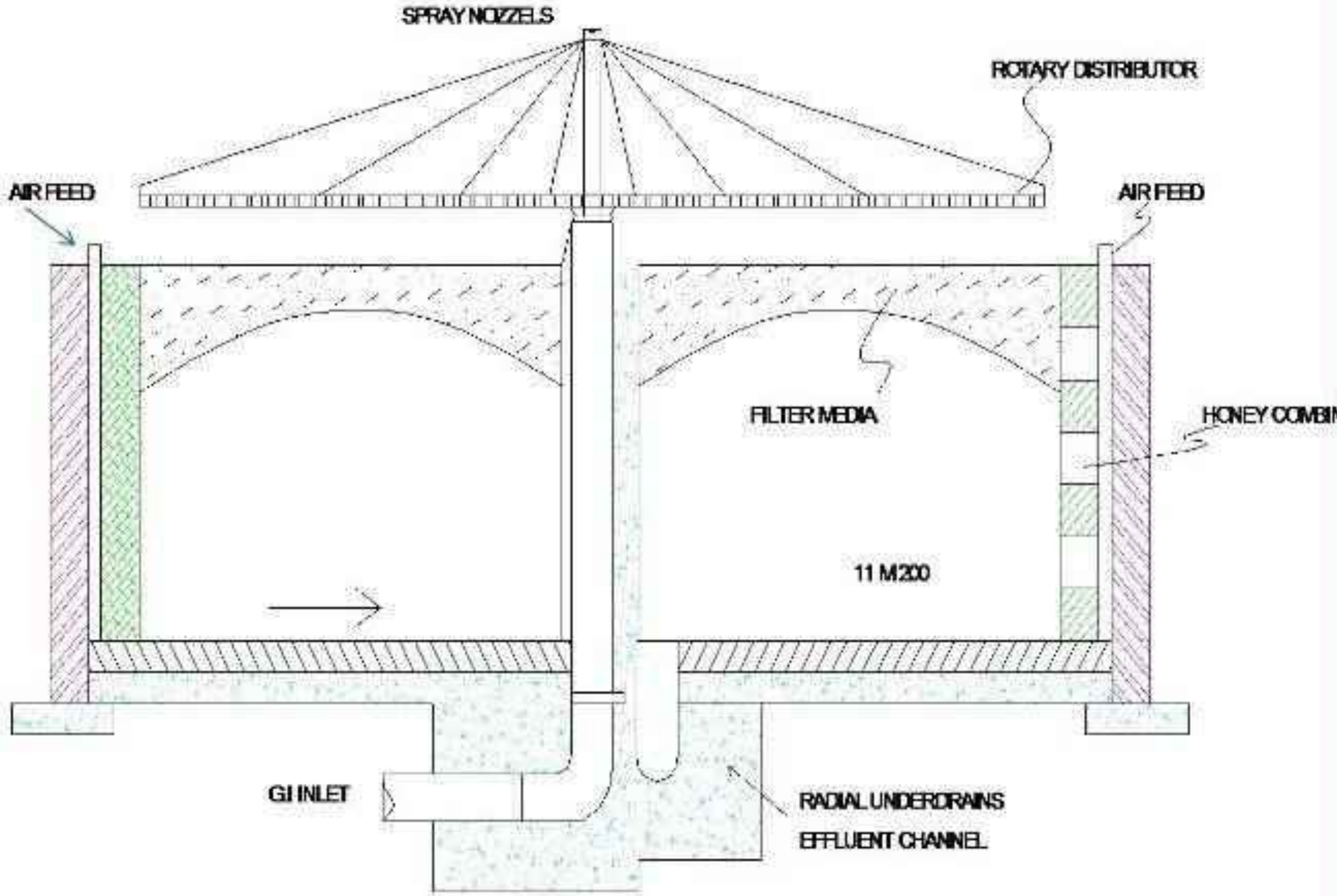




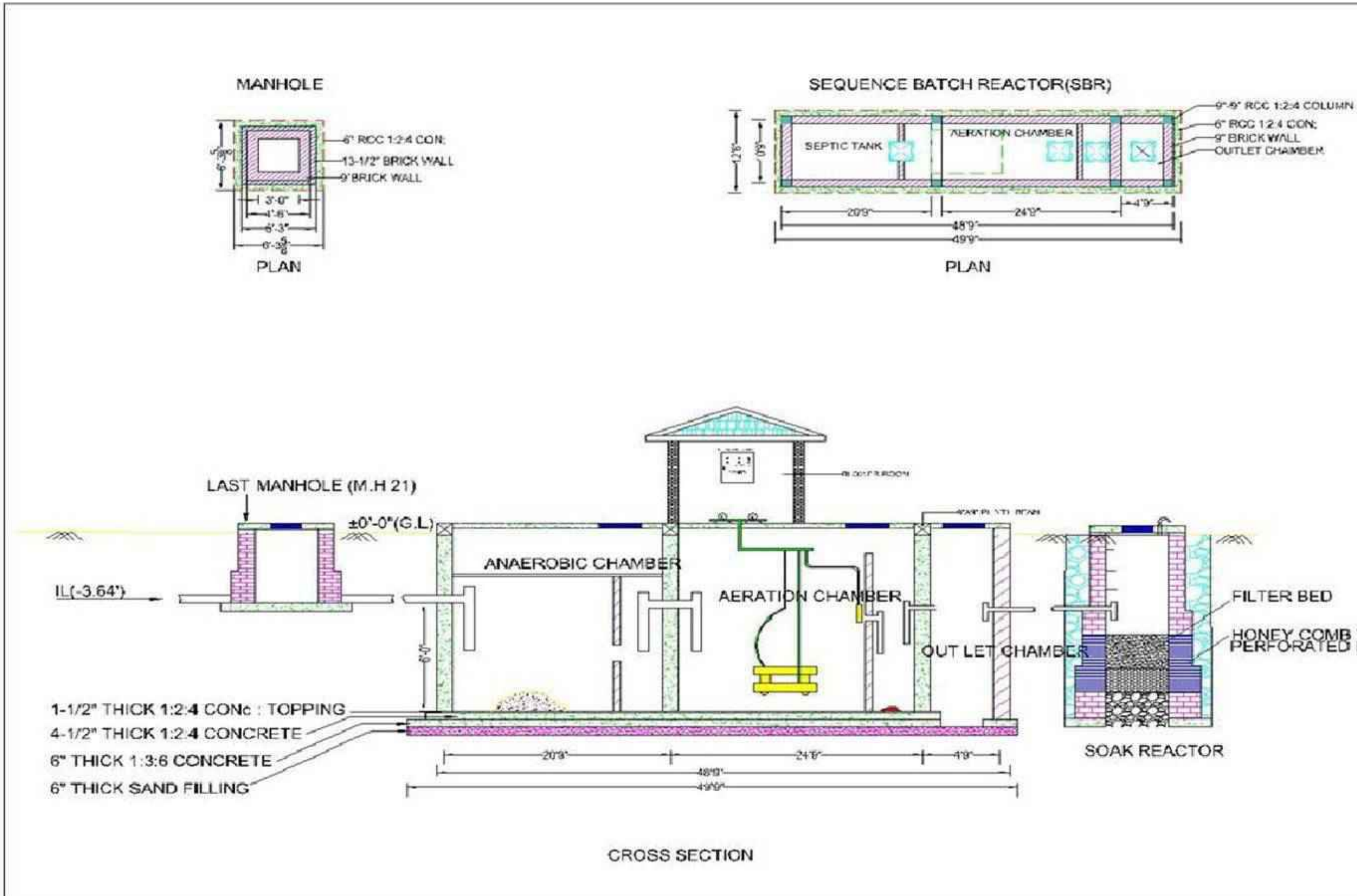

IMHOFF TANK



SECONARY - TRICKLING FILTER

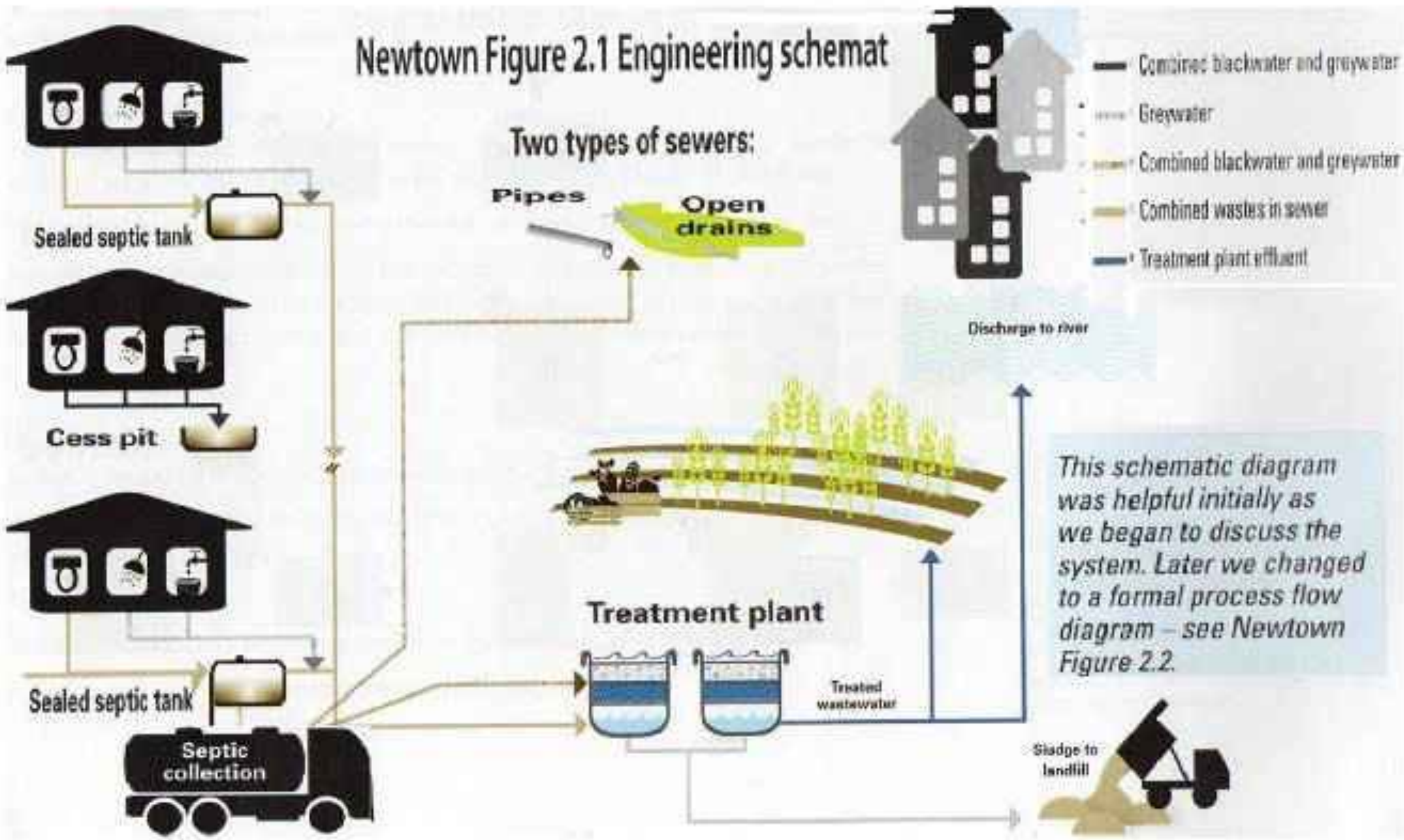


SECONARY - ACTIVATED SLUDGE or SBR



Module 2.1 Map the system

An initial engineering diagram was used to aid in understanding the syster



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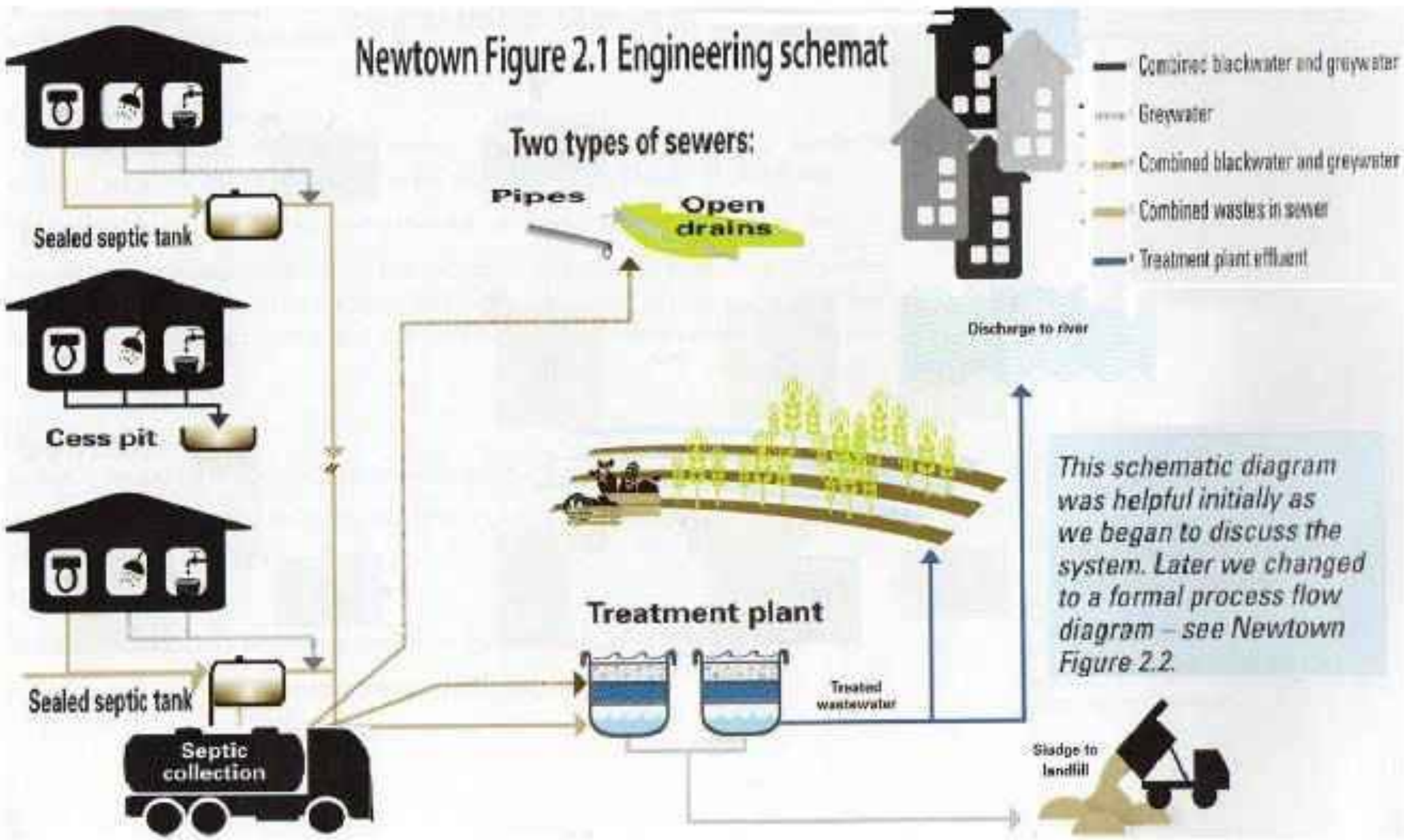


Nytrogen Cycle & Effects

- $NH^{4+} + 2O_2 = NO_3 + 2H^+ + H_2O$

- 1 mg NH_4^+ = 3.6 mg O_2

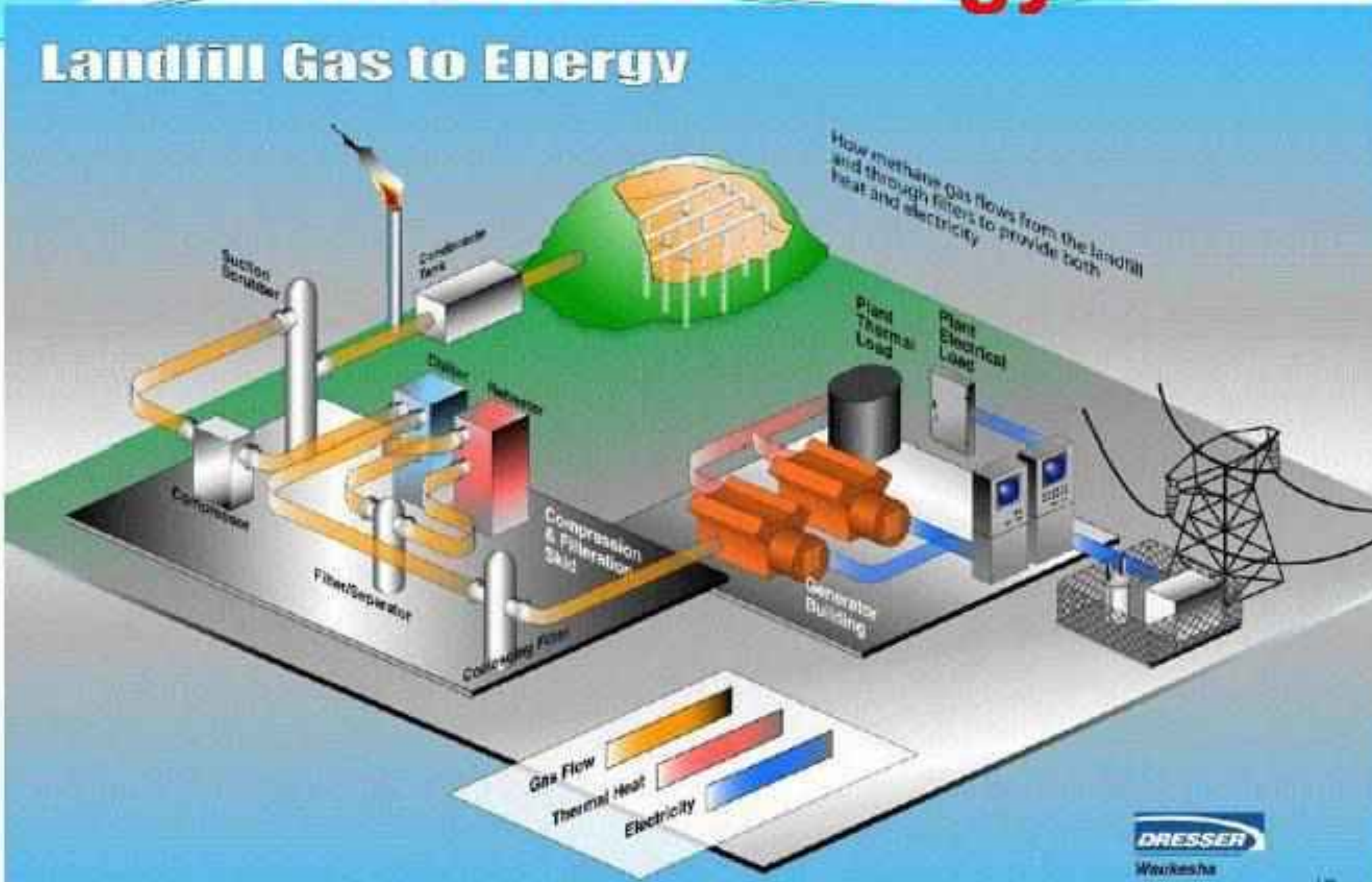
- 1 mg NH_4^+ = 3.44 mg $NO3^-$

In Water Quality

If $NO3^-$ is > 50 mg/l→Cause Blue Baby disease

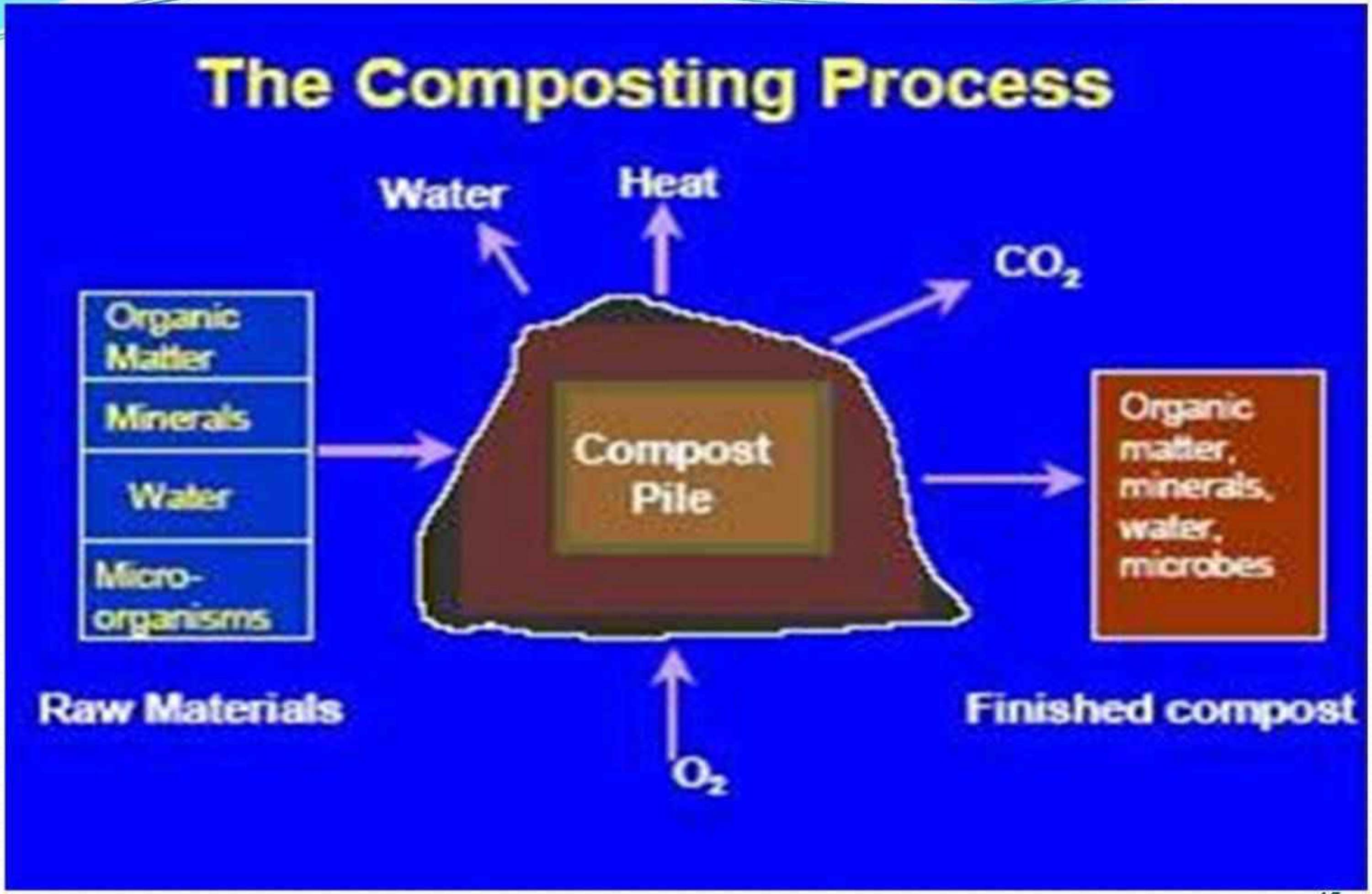
Waste Collection

Waste-to-Energy



Waste Reduction & Recycle

Waste Composting



SEAMEO SEARCA

ISSN [illegible]

Policy Brief Series

2006 - 1

Solid Waste Management Badly Needed in Myanmar[1]

Asia's urbanized areas produce about 760,000 tons of solid waste daily and are expected to be more than double by year 2025. And that is not even the worst case scenario.

According to the World Bank, municipalities in developing countries spend 20-50% of their budget on solid waste management. Sadly though, 30-60% of urban solid wastes in Asian countries remain uncollected and less than 50% of the population served. In some cases, as much as 80% of the trash collection and transport equipment is non-functional.

Despite the palpable urgency to solve this issue, local governments in third world countries are stumped in the achievement of an effective solid waste management system (SWMS) in urban areas for several factors. These factors include lack of funds and resources; community involvement; collective and participatory planning, technical know-how of staff, discipline on the part of waste producers, and updated policies.

A Microcosm of the Waste Management Concern

Yangon City, the capital of the Union of Myanmar, exemplifies an alarming neglect of this waste management issue. Currently, the City has a population of 5.5 million with an annual growth rate of about 2%. More people mean more waste. Rapid urbanization and population growth renders the City's human health and environment vulnerable to the effects of inefficient waste management system.

Seinn Lei Aye, in her dissertation titled "Strategic Solid Waste Management Planning for Yangon City, Myanmar", defined solid waste management (SWM) as the "generation, storage, collection, transfer, and transport, processing, and disposal" of solid waste, according to social and economic needs and environmental standards.

In the case of Yangon City, the municipal area generates approximately 2,900 tons of solid waste daily, with a daily collection efficiency of 54%. The average waste generation of public sector is about 0.53 kilogram per capita per day.

Yangon City's SWMS is "centrally implemented, labor-intensive, and uncontrolled." The Pollution Control and Cleansing Department (PCCD), under the Yangon City Development Committee (YCDC), administers and performs the municipal SWMS. The 33 Townships in the City are classified into 4 Districts - North, South, East and West. PCCD maintains offices in each township, and each township also executes waste collection, street sweeping, and transportation practices.

The current system, however, proves inadequate. This lack of an adequate SWMS in terms of planning, legislation, capacity building, and low level of awareness on environmental management, obsolete equipment, and insufficient budget, among other limitations, is quite alarming.

High Cost. In the 2003-2004 Financial Year, the Yangon City SWMS incurred a total expense of 1.2 million US dollars to collect a total waste volume of 245,098 tons. Meanwhile, the system recovered a mere total of 0.08 million US dollars.

Lack of Technical Know-how. Aside from the high cost of the overall SWMS, waste management officials and staff lack the proper know-how on waste management technologies and have not yet fully grasped its social, economical, and ecological implications.

Outdated policies and legislations. For an SWMS to be adequate and effective in a rapidly growing city such as Yangon, there has to be a strategic plan. Unfortunately, legislation on Yangon City's SWM was formulated way back in 1922, and nothing else followed ever since. This legislation is contained in Sections 111 and 112 of the City of Rangoon Municipal Act of 1922 entitled "Scavenging and Cleansing Acts". This empowers YCDC to act on waste management within their jurisdiction and to adopt regulations and standards for the storage, collection, and disposal of solid waste. However, implementing rules and regulations have yet to be put in place, and the existing ones updated.

Policy Recommendations

Based on Aye's study, the SWMP will be rendered effective if supported by policies in the form of legislation, regulations, and administrative orders issued by YCDC and the Mayor. The recommended policies and ordinances that need to be drawn are:

1. An ordinance to support the ecologically sound practices on SWM such as the requirement for environmental impact assessment (EIA) for the industries and waste segregation programs for residential, commercial, and other establishments;
2. An ordinance to support the collection of waste management charges in the form of direct-user charges (which depend on volume of waste generated) and monthly charges from households, institutions, commercial establishments, and industries;
3. An anti-littering ordinance that penalizes illegal dumping of wastes.

Other recommendations toward an effective SWMS are:

- Active community involvement and participation through appropriate information dissemination and knowledge proliferation on proper SWM;
- Waste minimization;
- Efficient and effective solid waste collection and transportation system; and
- Effective cost recovery program essential in developing waste management practices. *(Maria Piel I. Manansan)*

[1] *Seinn Lei Aye, PhD. Strategic Solid Waste Management Planning for Yangon City, Myanmar. University of the Philippines Los Baños (UPLB), December 2005.*

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Yangon City's SWMS

"centrally implemented, labor-intensive, and uncontrolled."

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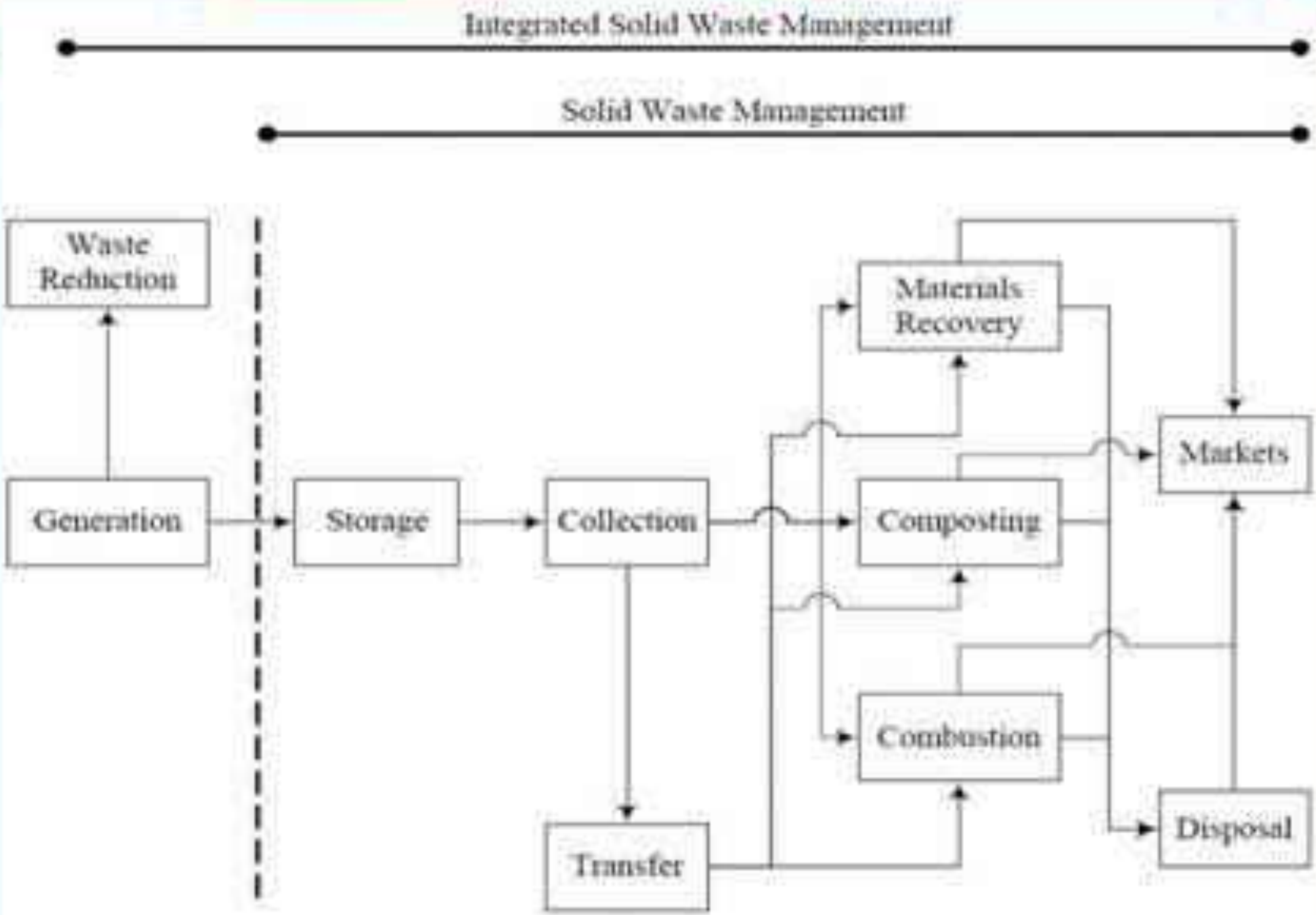
- The current system, however, proves inadequate.
- Lack of an adequate SWMS in terms of
  - planning,
  - legislation,
  - capacity building,
- Low level of awareness on environmental management,
- Obsolete equipment, and insufficient budget,
- Other limitations



Source: Hickman

Processing and Disposal of MSW

- *Landfill*
- *Composting*
- *Recycling and recovery*
- *Incineration*

Landfill

- The most preferred method for the final disposal of solid waste.
- Most of these sites practice open dumping.
- Landfill Gas
- Waste-to -Energy

Sanitary Landfill

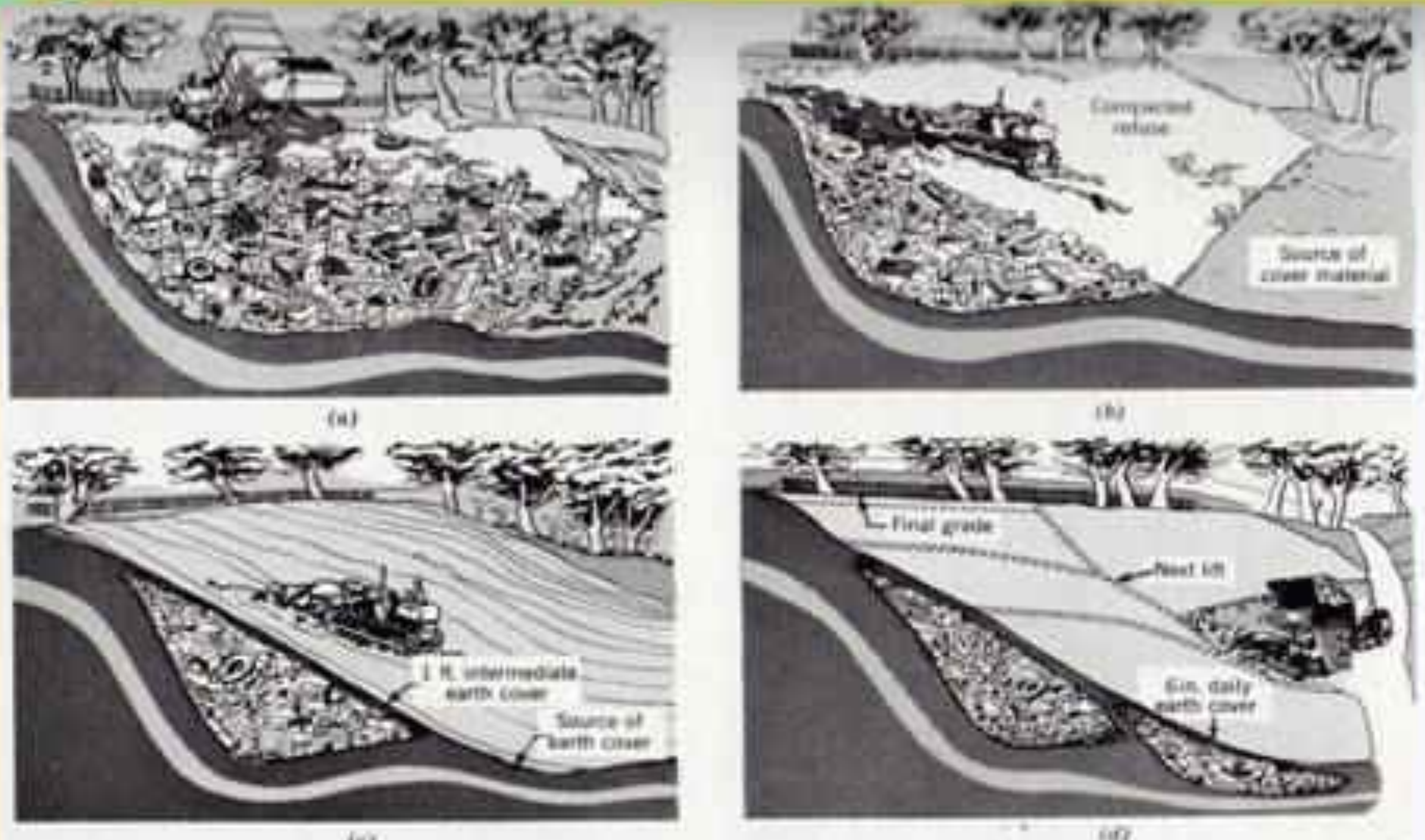


Figure 5-13 Conversion of an open dump to a sanitary landfill. (a) Existing open dump. (b) Steep slope reduced to less than 2:1 to allow safe operation of equipment. (c) Refuse compacted and covered. (d) Refuse area operated as a sanitary landfill. (From *Sanitary Landfill*, New York State Dept. of Health, Albany, 1960).

Composting

- The second preferred method of solid waste disposal,
- Due to the high % of organic materials.
- Compost
- Biofertilizer
- Organic Farming

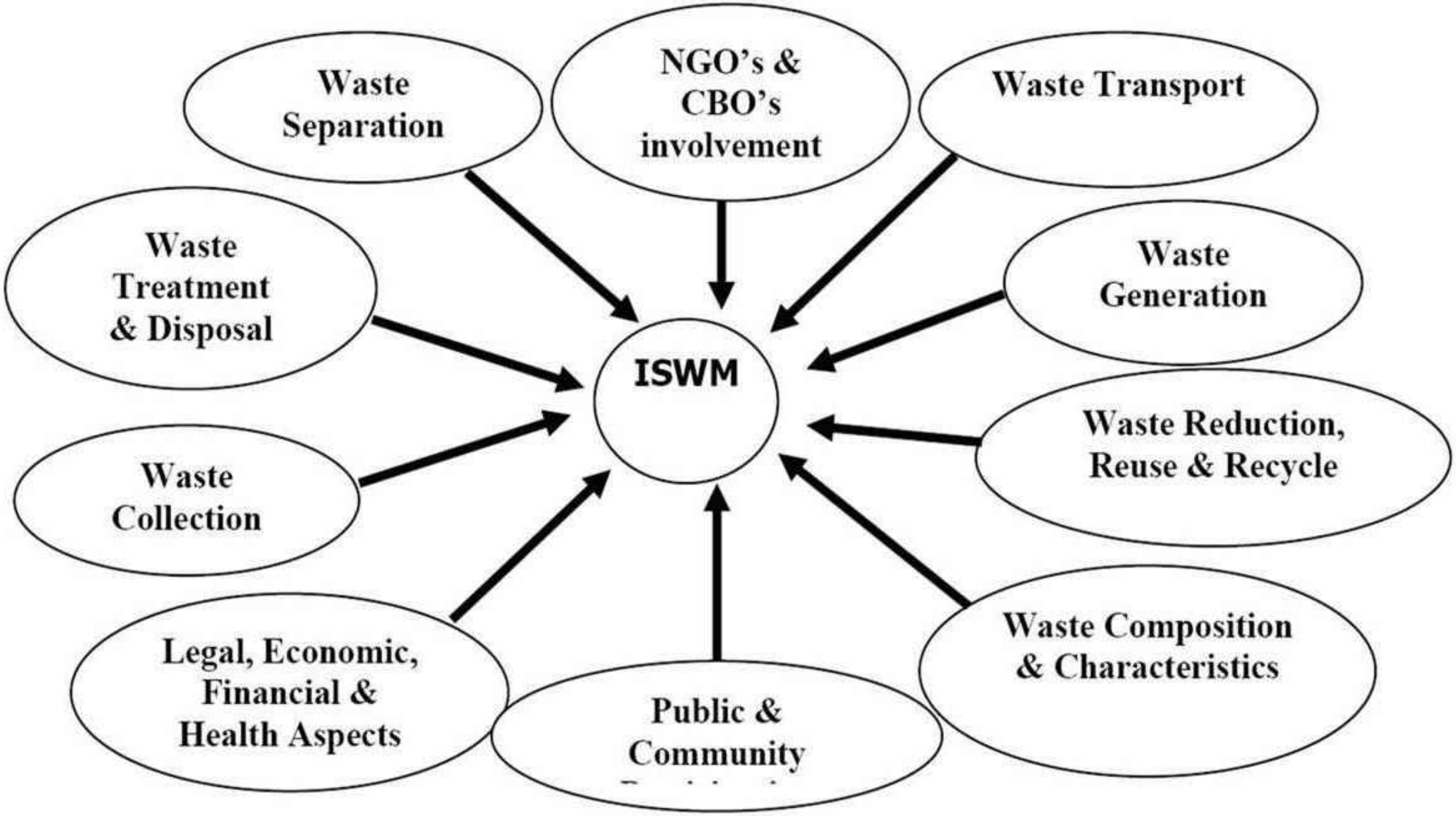
Recycling and recovery

- Generally carried out by the informal sector.
- Collection of recyclable waste is done in several steps such as
  - door to door collection,
  - collection at secondary and primary transfer stations
  - even in the disposal sites.
- Due to the collection systems
  - the low quality of scrap,
  - the recycling rate is low
  - high number of waste pickers working.

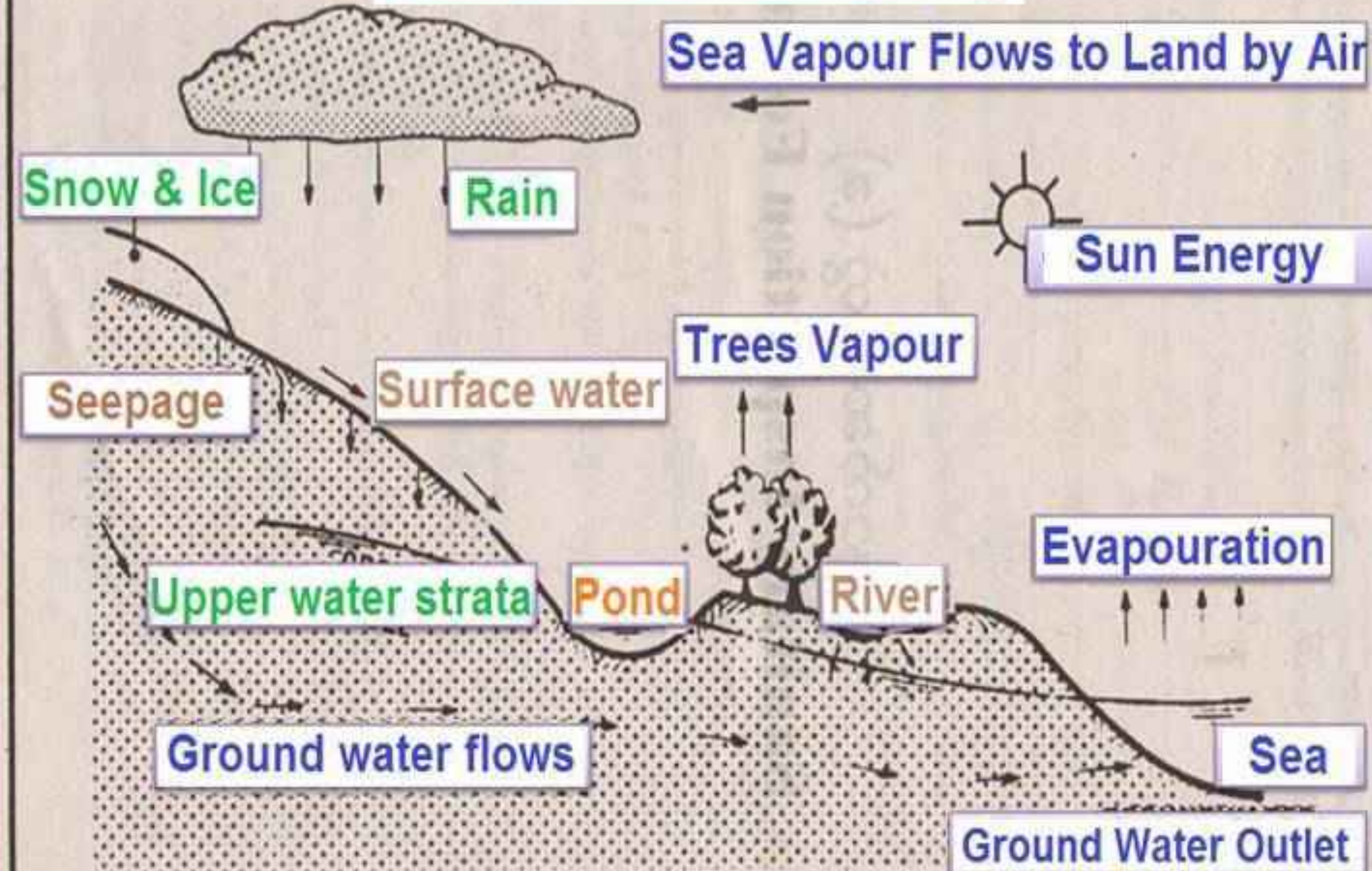
Incineration

- Due to the high capital, operation and maintenance costs involved for the installation of incineration plants,
  - incineration is not popular as a waste disposal system.
- the major portion of the MSW is organic with relatively high moisture content
  - leads to a low calorific value

Integrated Solid Waste Management



Water Sources Recycling



WATER RESOURCES & USAGE

Global water

97.5%

Salt water

2.5%

Fresh water

↓

< 1%

technologically and economically accessible for human use.

Water Scarcity in Africa

Darfur, Sudan

Droughts

Water Pollution

PROBLEM MAGNITUDE

- Densely populated area & severe water shortage
- In 2016, nearly 2 billion people live in parts of world running out of water
- By 2025, two thirds of the world may suffer from water shortages

↑ 150% U-Population

- 2018 World water Day

Slogan “Nature For Water”

World Water Day 2018

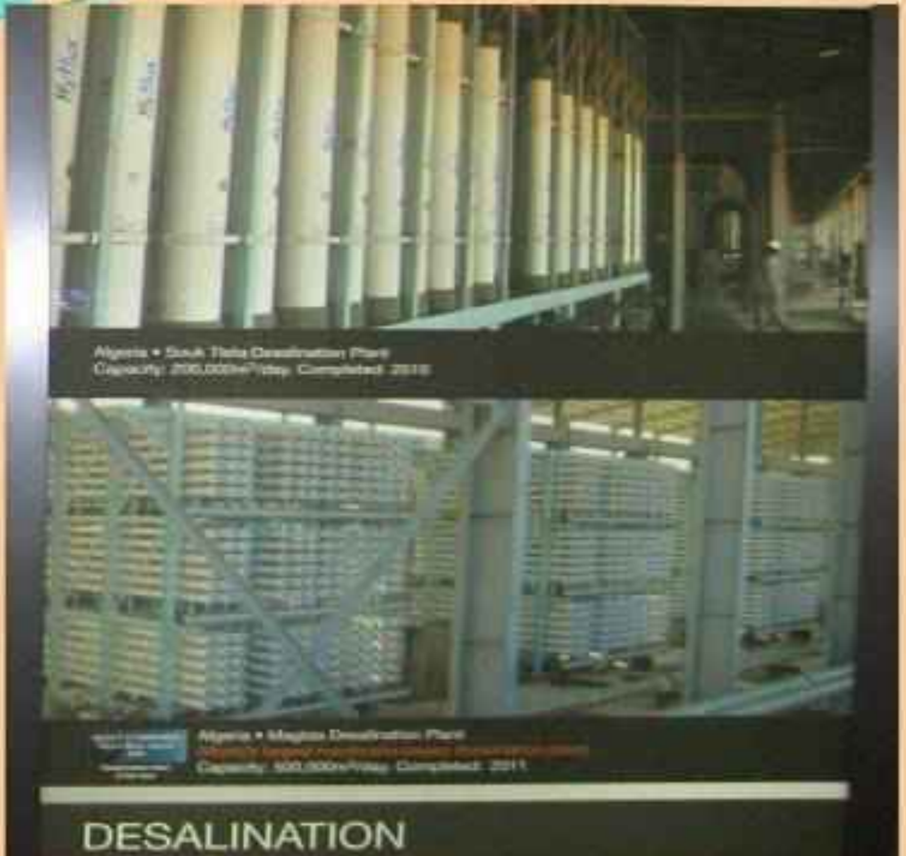
Seven Billion Dreams.
One Planet.
Consume with Care.

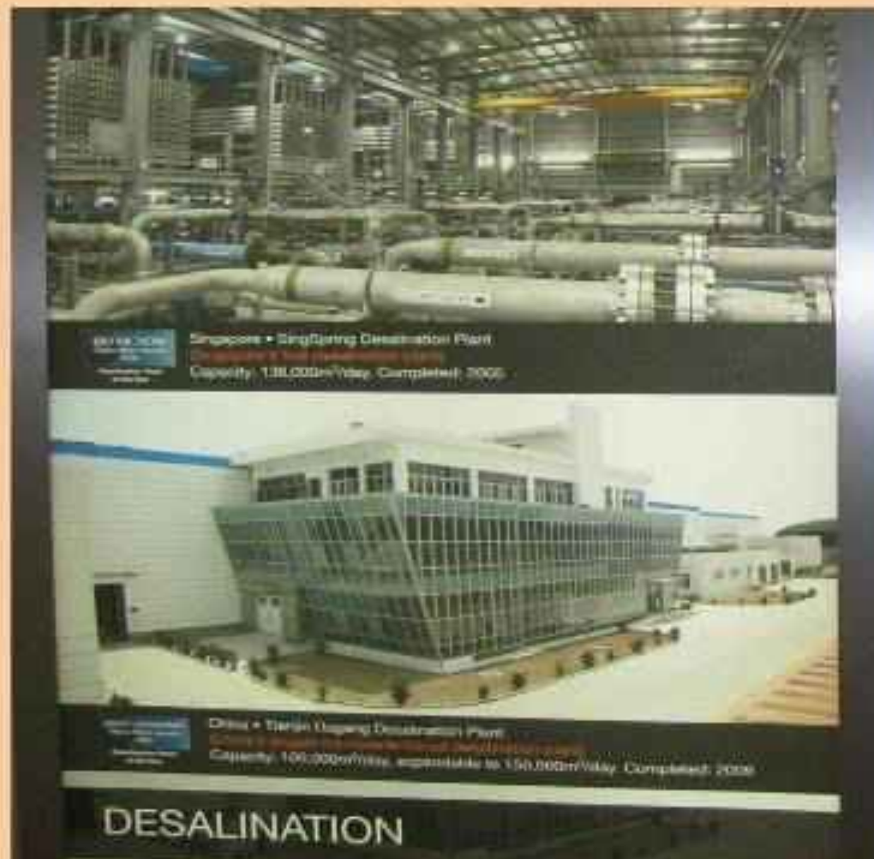
22 March every year

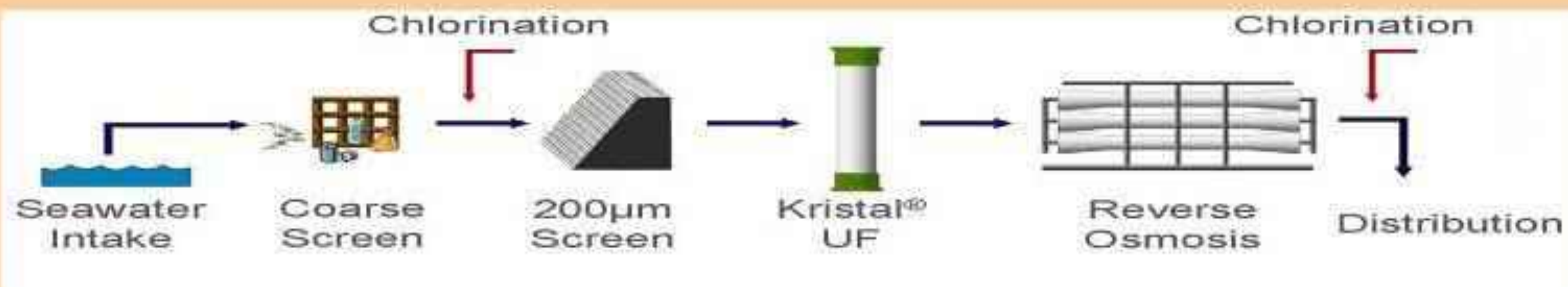
REUSE REDUCE RECYCLE

Innovating Life

DESALINATION

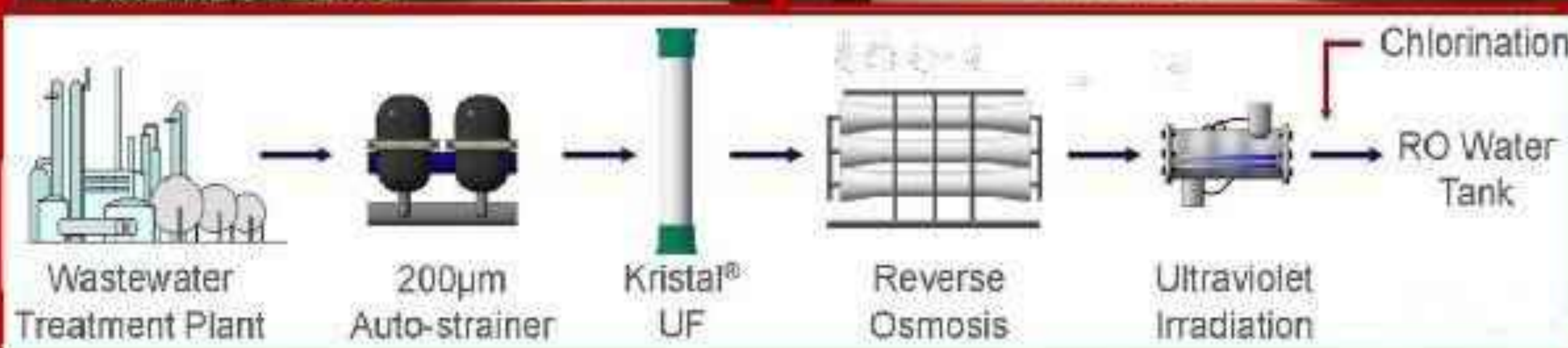






WASTE WATER


WASTEWATER TREATMENT AND RECYCLING
WASTEWATER TREATMENT AND RECYCLING

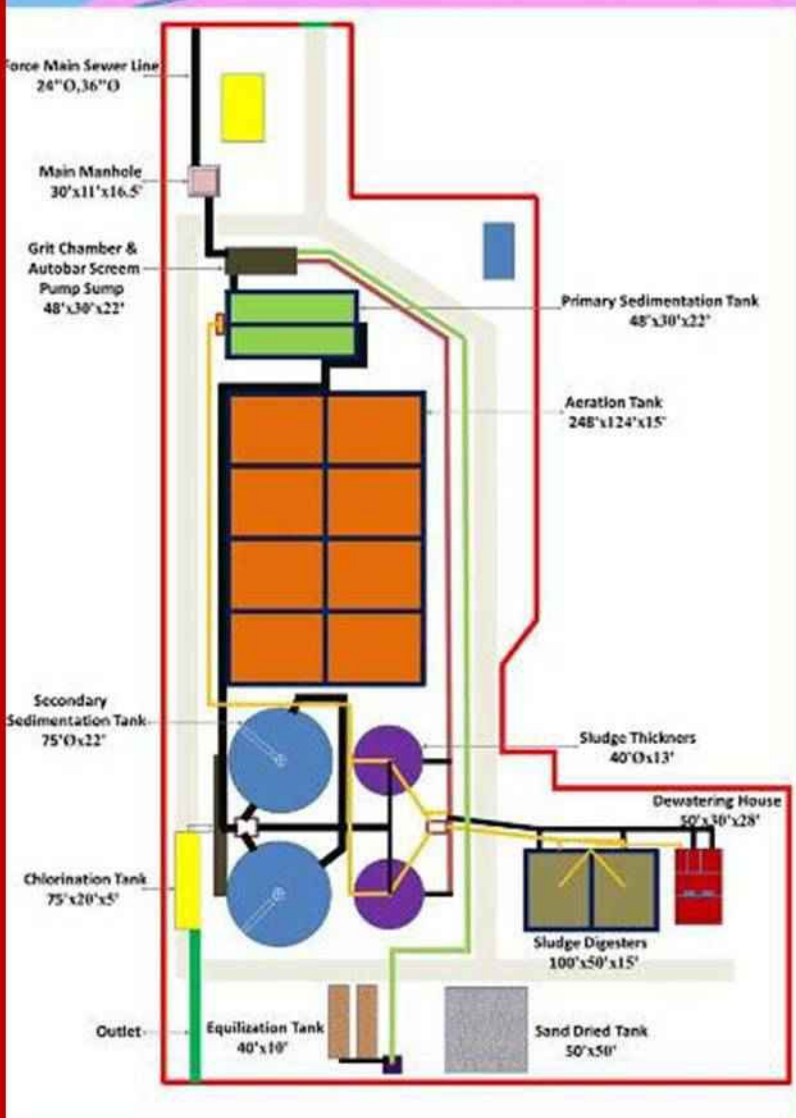

Chlorination
RO Water Tank
Wastewater Treatment Plant
200µm Auto-strainer
Kristal® UF
Reverse Osmosis
Ultraviolet Irradiation

Main Air Compressor in Botadaung Township, Sewage are driven by air compressing to Treatment Plant

- Year of Establishment -1888 year
- (6) Steam Turbine Engines
- Change of year to electrical driven -(1962-1963)
- (2) Electrical Air Compressors of 200 Horse power were reinstalled
- (2) Electrical Air Compressors of 120 Horse power were reinstalled
- Total land areas - 2.75 acres

Layout plan of Treatment plant

Establishment of Sewage Treatment Plant



Programme for Sewage Treatment Project

- ❑ Detail Design
- ❑ Implementation
- ❑ Installation
- ❑ Commissioning
- ❑ Installation
- ❑ Training

Design Criteria:

- ➢ Area of Plant - 5.56 acres
- ➢ **Design population - 300,000**
- ➢ Daily wastewater discharge- - 14775 m3/day
- ➢ **BOD influent - 600mg / l**
- ➢ **BOD effluent - 20 mg / l**
- ➢ **Suspended solid influent- 700 mg / l**
- ➢ **Suspended solid effluent- 40 mg / l**

Microscope


Types of bacteria occured in activated sludge
Amoeba
Rotifer
Single stalked ciliate
Nematode
Flagellate
Free swimming cillate
Crawling ciliate
Euglena

Sewerage System of YCDC

Estimated population with sewer(conventional sewer system) is 300,000 people . Main content of system are

1) Air Compressor Station(2) Pneumatic Ejectors(3) Air Pipeline

4) Gravity sewer pipeline(5) Wastewater Treatment Plant

Wastewater treatment plant

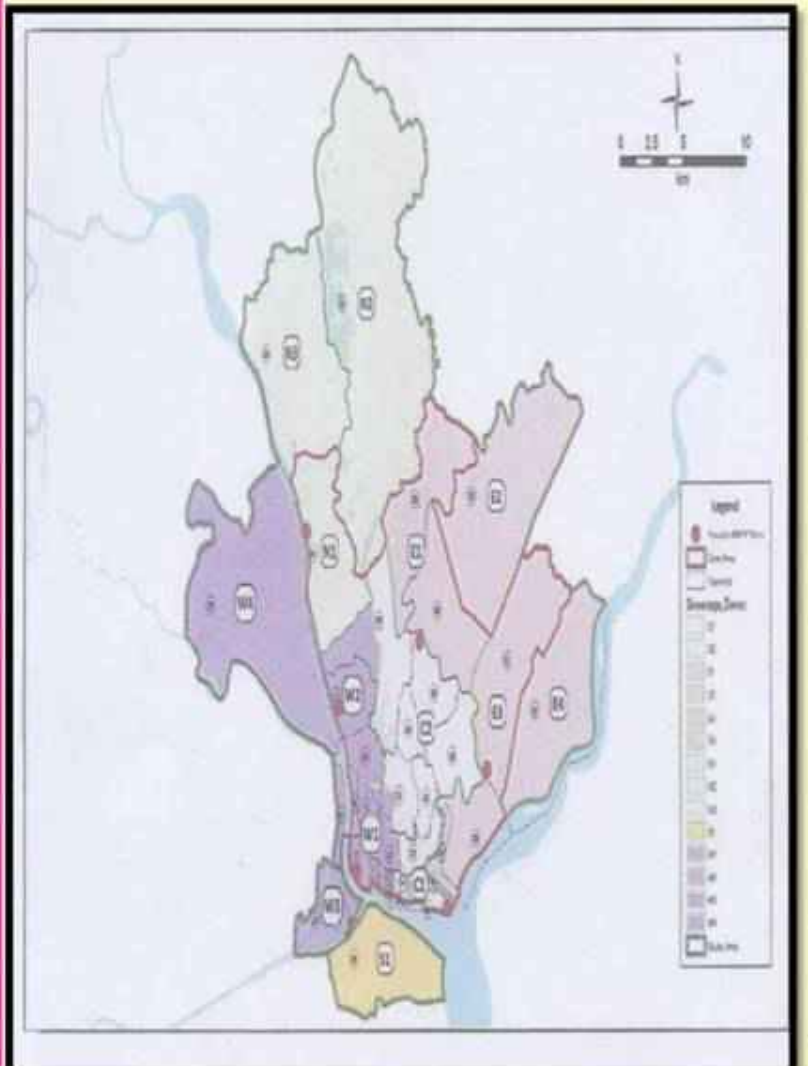
Air compressor station

Total length of sewer pipe line - (10.75) km(12"CI to 36"CI Pipe)

Sewage ejector - (35) Nos

Manholes - 2114 Nos

SEWERAGE ZONES AREA (13 ZONES)



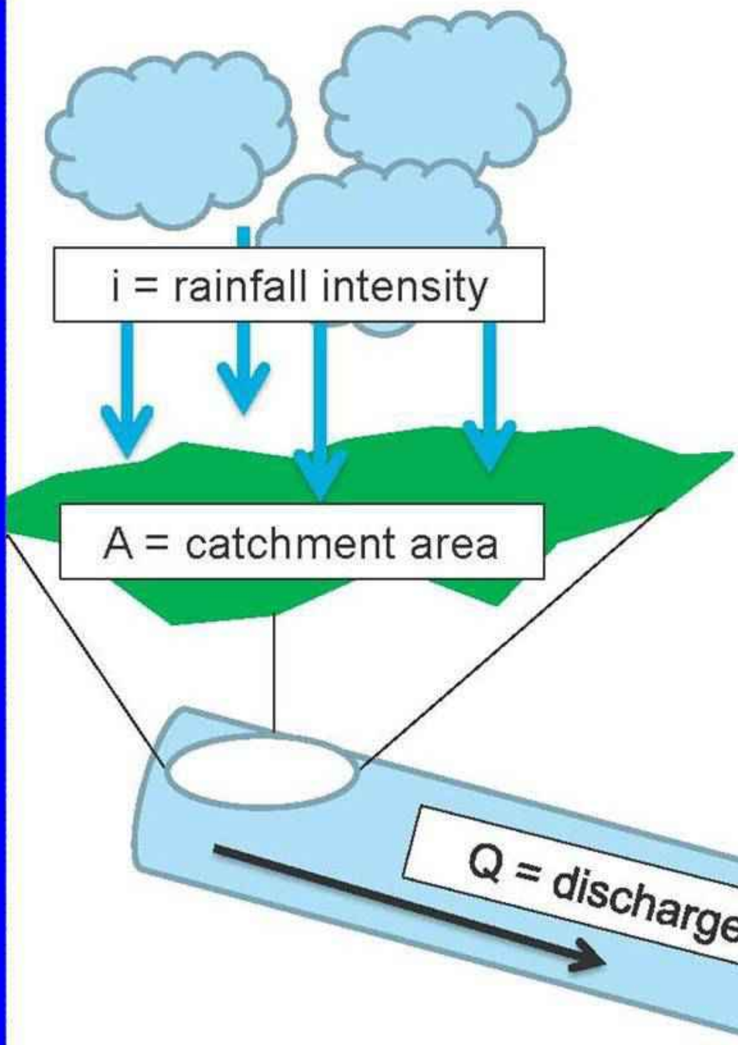
Zone	Township
C1	Botahtaung,Puzundaung,Kyauktada,Pebedam,
W1	Lanmadaw,Latha,Alone,a part of Kyeemyintdaing,Dagon,a part of Bahan,a part of Kamaryut,Sanchaung
C2+E1	a part of Bahan,Mingalartaungnyunt,Yankin,Thingangyun,Tamwe, S-Okkalapa,a part of Mayangone,N-Okkalapa,N-Dagon
W2	a part of Kamaryut,Hlaing,a part of Mayangone
E3	Taketa,Dawbon,S-Dagon
N1	Insein
E4	Dagon Seikkan
E2	East Dagon
N2	Mingalardon
N3	Shwepyithar
S1	Dala
W3	a part of Kyeemyintdaing,Seikgyi khanaungto,Seikkan
W4	Hlaing Tharyar

DRAINAGE WITH CONTOUR MAPPING

Contour Mapping & should be disposed to Agriculture & Low Lying Area

Drip-Irrigation

Relation Between Drain Discharge and Rainfall Intensity



Rational method (Lloyd-Davies)

Q **Q =2.78CiA** [L/s]

2.78 dimensional term for unit conversion

C runoff coefficient between 0 and 1 describing the permeability of the ground

i rainfall intensity [mm/h]

A catchment area [hectares]

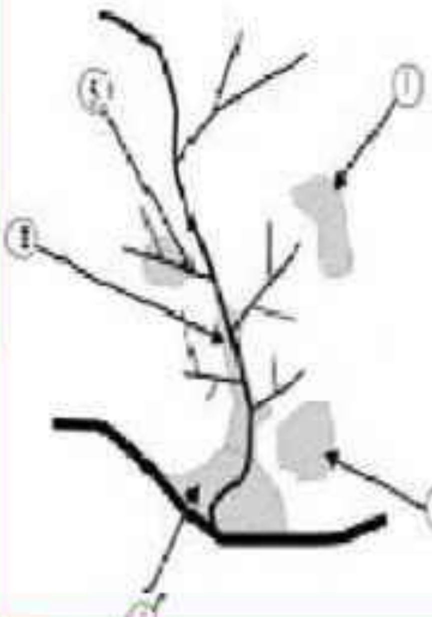
Findings

Drip irrigation

- Drip irrigation and mulch trench systems are most appropriate (sub-surface or close to surface
- Alternative where greywater volumes are small and soils are inappropriate for agriculture: Tower gardens

The Problem

- Causes and Types of Urban Flooding



(1) Lack of drainage infrastructure

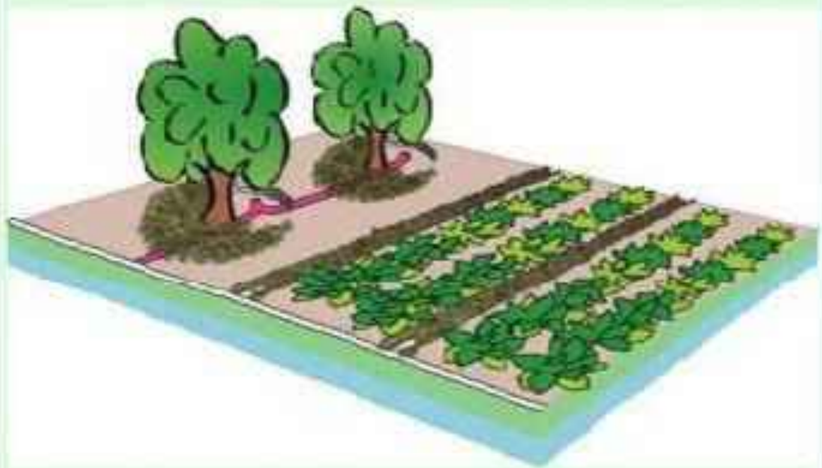
(2) Backup due to elevated downstream water levels

(3) Flooding in low-lying areas

(4) Inundation caused by high river water levels

(5) Blockage of the drainage system

Mulch trench system



Mulch: mixture of leafs, wood, straw, ...

Enables even distribution of greywater in trenches or around trees

Requires only primary treatment*

ENVIRONMENTAL MITIGATION

Water related diseases

I. Water-borne
Pathogens carried by water
Faecal-oral transmission

- ကာလဝမ်းရောဂါ   တိုက်ဖွိုက်ရောဂါ
- ဝမ်းကိုက်ရောဂါ
- အသည်းရောင်အသားဝါရောဂါ
- ကျောက်ကပ်ပျက်အသည်းရောင်ရောဂါ
- အထက်လှန်အောက်လျှောရောဂါ

II. Water-washed
(Water- scarce)
water quantity problem

- ဝဲရောဂါ ၊ အရေပြားပြည်တည်နာ
- မျက်ခမ်းစပ်ရောဂါ၊ ဝမ်းပျက်ဝမ်းလျှေ
- မျက်စိရောင်ရမ်းရောဂါ၊
အနာကြီးရောဂါ

transmitted infectious disease

III. Water-based
Pathogen depe
on water
animal/plant

- ဆီးလမ်းကြောင်းနှင့်
အစာဟောင်းအိမ်ပိုးဝင်ခြင်းရောဂါ
(Urinary and rectal schistomiasis)
- သံကောင်ရောဂါများ
(Guinea worm, Threadworm)

IV. Water-related
Pathogen transmitted close/near water
Mosquito-borne

သွေးလွန်တုပ်ကွေး၊
ငှက်ဖျား၊
ဆင်ခြေ ထောက်၊
ဂျပန်ဦးနှောက်ရော

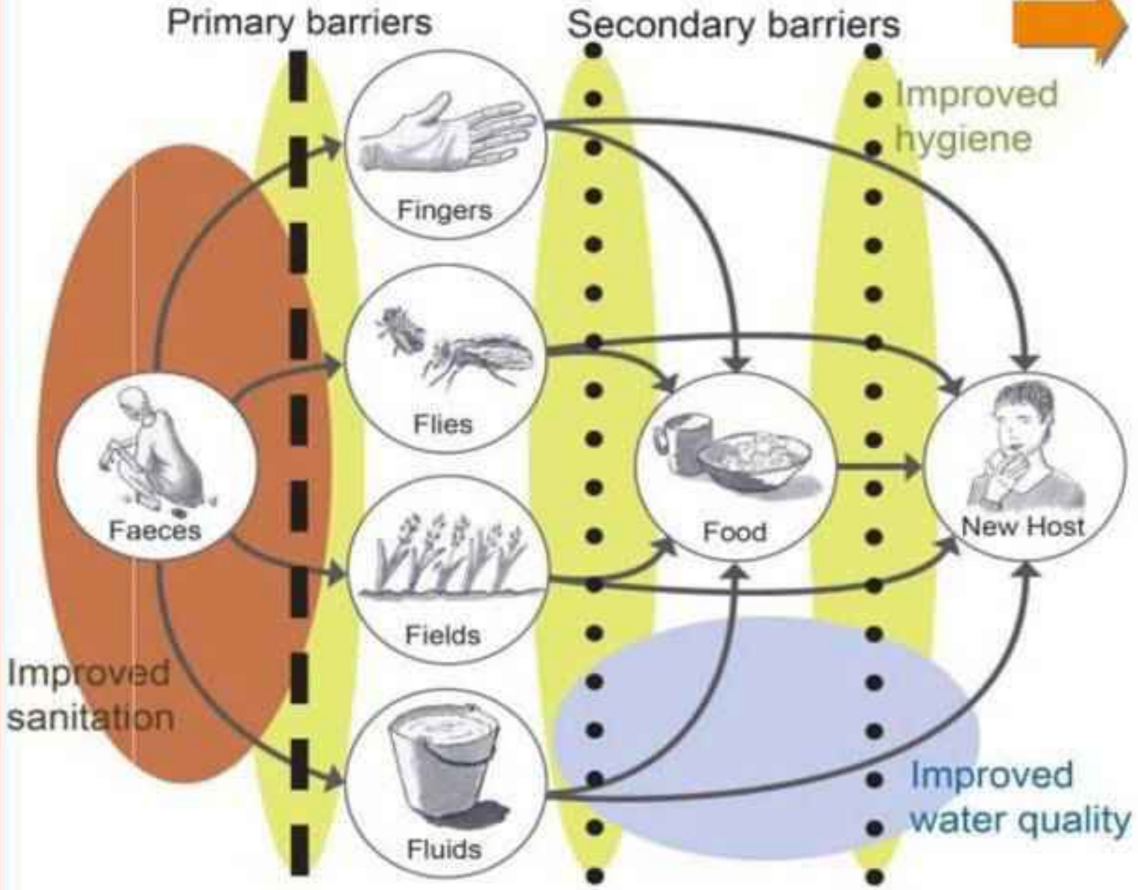
Source : WHO

IMR, U 5 MR & Life Expentency of 8 ASEAN countries, 1990 - 2009

Country	U 5 MR	* U 5 MR		* IMR (<1)		N Natal R	Life Expacta^cy	Improved Sanitation %		
	Rank	1990	2009	1990	2009	2009	2009	Total	urban	rural
Malaysia	157	18	6	16	6	3	75	96	96	95
Thailand	125	32	14	27	12	8	69	89	92	82
Vietnam	93	55	24	39	20	12	75	75	94	67
Phillipines	77	59	33	41	26	16	72	76	80	69
Indonesia	66	86	39	56	30	19	71	52	67	36
Myanmar	44	118	71	84	54	33	62*	81	86	79
Cambodia	36	117	88	85	68	30	62	29	67	18
Laos	32	157	59	108	46	22	65	53	86	38
Singapore	184	8	3	6	2	1	81*	100*	100*	

Source: State of the World Children UNICEF (2011)

Where can we disrupt the transmission routes?



Washing hands after defecation or constructing safe sanitation facilities are **primary barriers** which prevent pathogens from entering the environment.

Washing hands before eating or protecting food from flies are **secondary barriers** which prevent pathogens from infecting a new host or contaminating food.

adapted from WHO 2005

Wash Your Hands Clean with Soap on 5 Occasions

1-3. Before Eating, Cooking & Breast Feeding

4-5. After Defecating & Child Bottom Cleaning

YOUR HAND IS YOUR CLINIC

Remedies for water crisis

- **technologies** such as

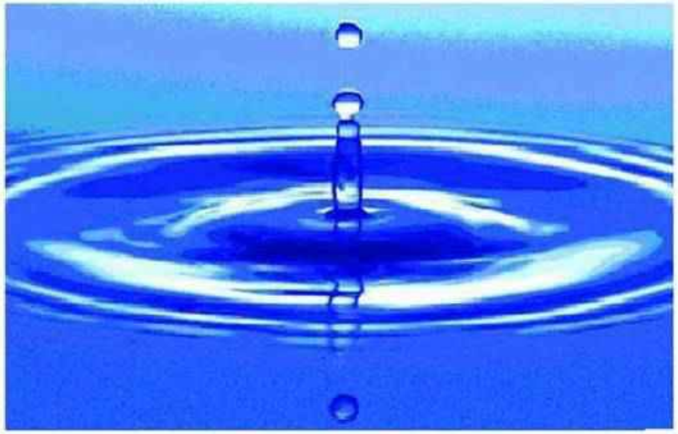
- drought-resistant crops
- drip-irrigation
- waste water treatment
- regulation to protect aquifers

Love trees → love nature

Working
for
Wetlands

BEST WISHES

Water for Life



Thank You

Innovating Life