Workshop Septage Treatment Technology

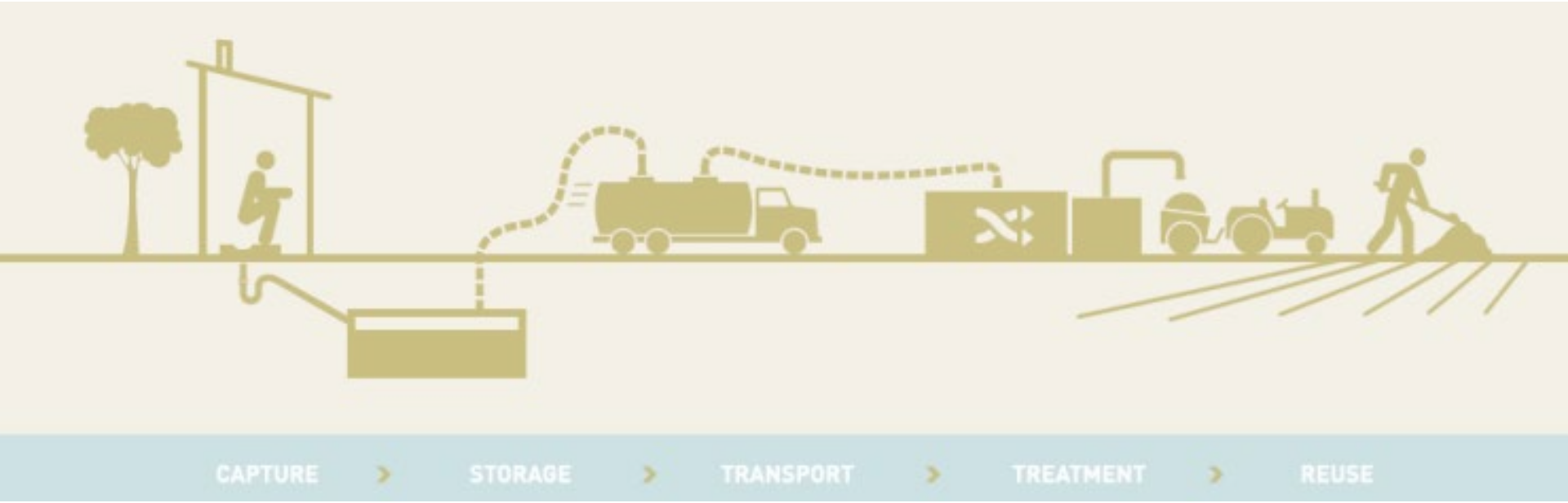
October 20-21st, 2016
Asian Institute of Technology
Bangkok, Thailand

FSM TOOLBOX

for donors, city planners & consultants

The current focus of the FSM practices are only to empty the latrines and disposing of the collected feacal sludge into the environment with minimal treatment or reuse

Realizing the need for FSM interventions, several nations & local governments, investors and communities have increased investments to improve management of faecal sludge

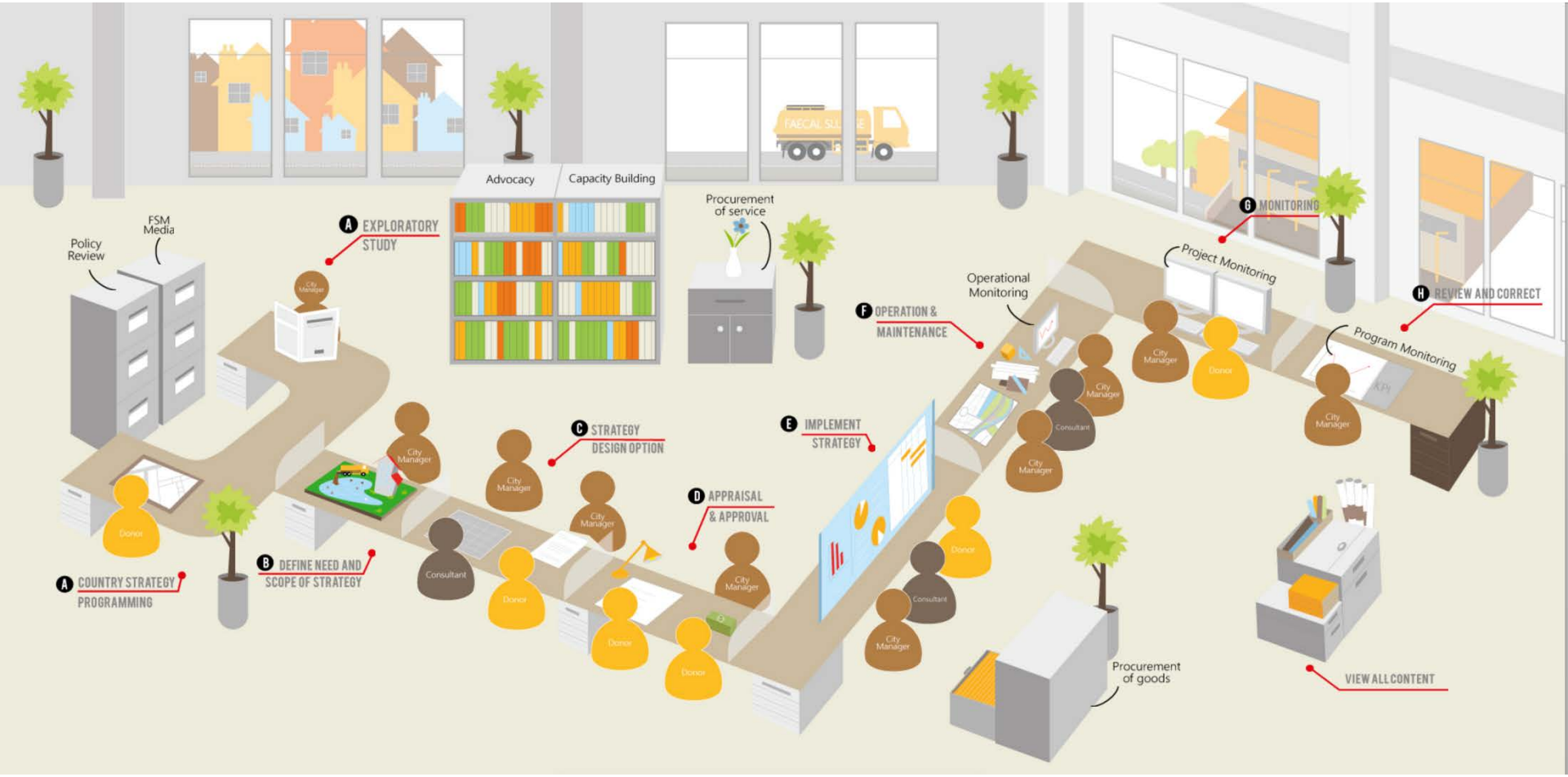


Although investments have increased, challenge still remains in effective planning and implementation of FSM project goals ….

Comprehensive collection + Development and Dissemination
of tools on FSM to enhance the capability of the key players to work towards effective & sustainable implementation (planning) of FSM


FSM TOOLBOX
Faecal Sludge Management Toolbox
ENTER SITE
www.fsmtoolbox.com

FSM PROGRAM



FSM Projects often begins with identifying issues, planning strategies, implementing the set of actions and later followed by evaluation of the project. These series of stages provide a structure which is defined as a FSM program

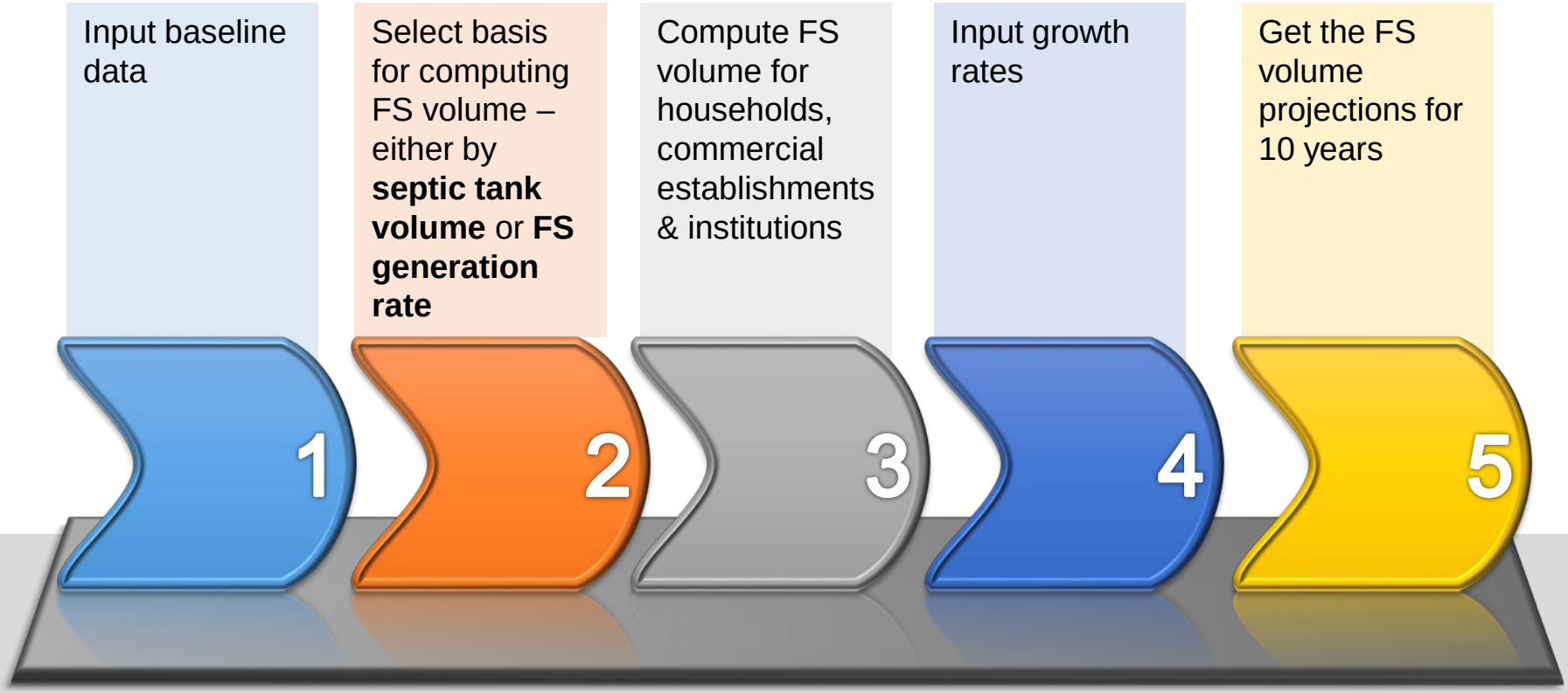
Financial and Technology Assessment Tool

Strategy Design Option

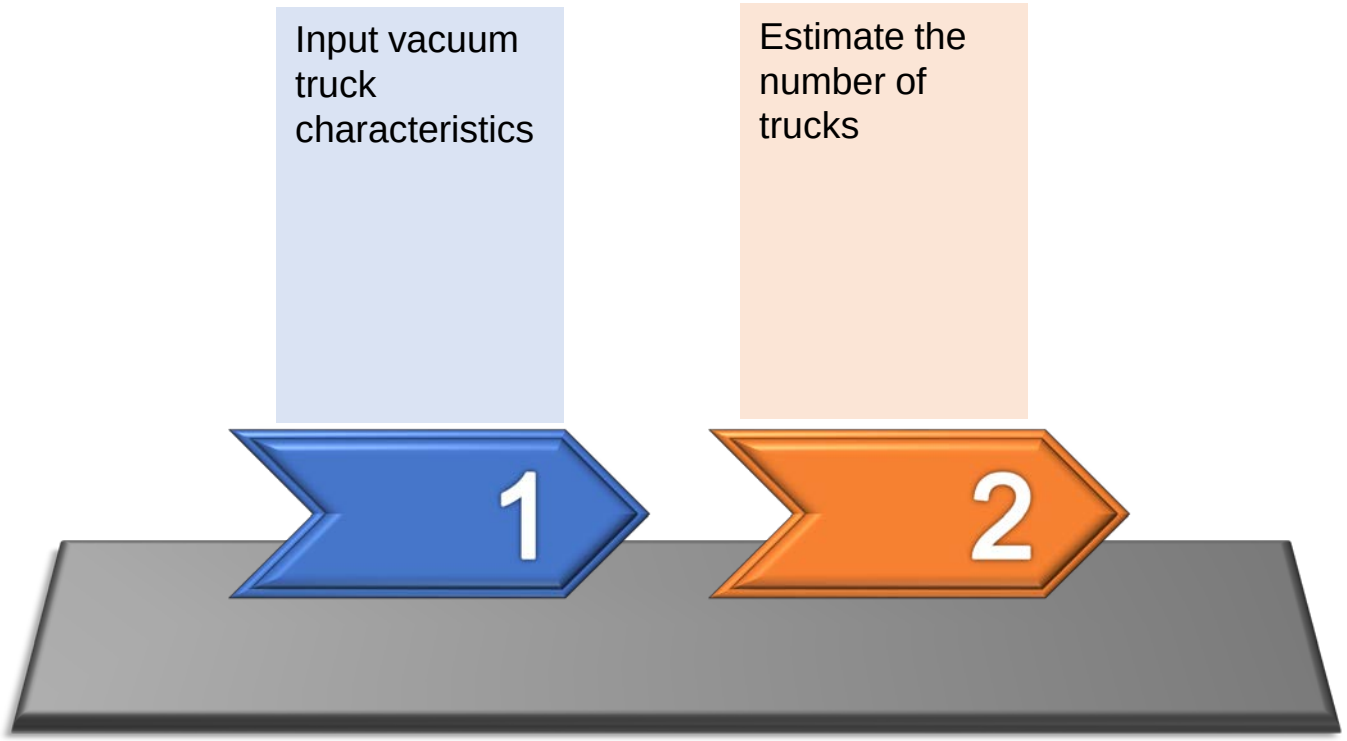
Tool Contents: 8 Sheets

1. FS Volume
2. Number of Trucks
3. Treatment Technology
4. Cost & Financing
5. Debt
6. Revenue
7. CS BS & IS
8. Summary

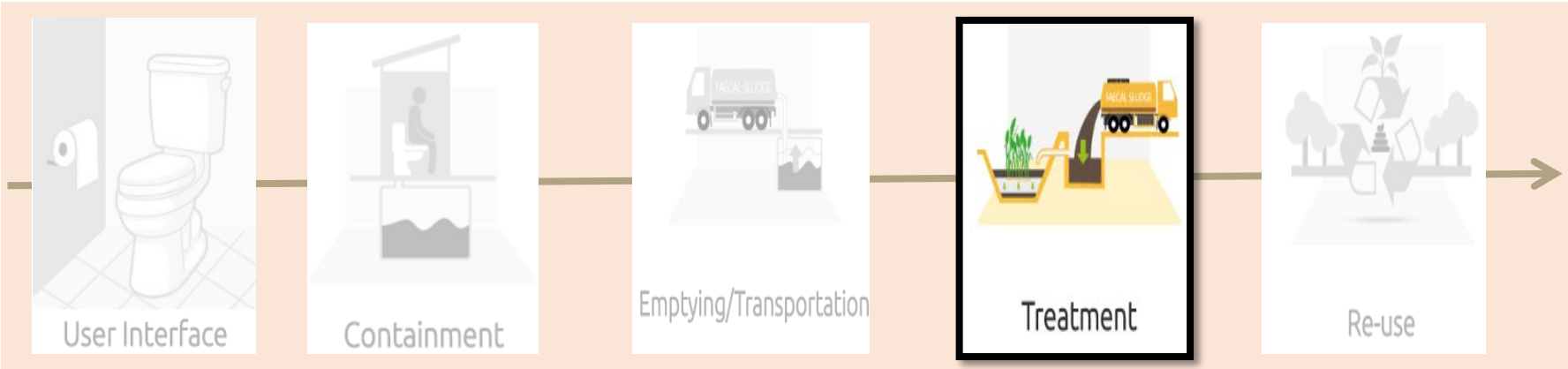
Sheet 1: FS Volume



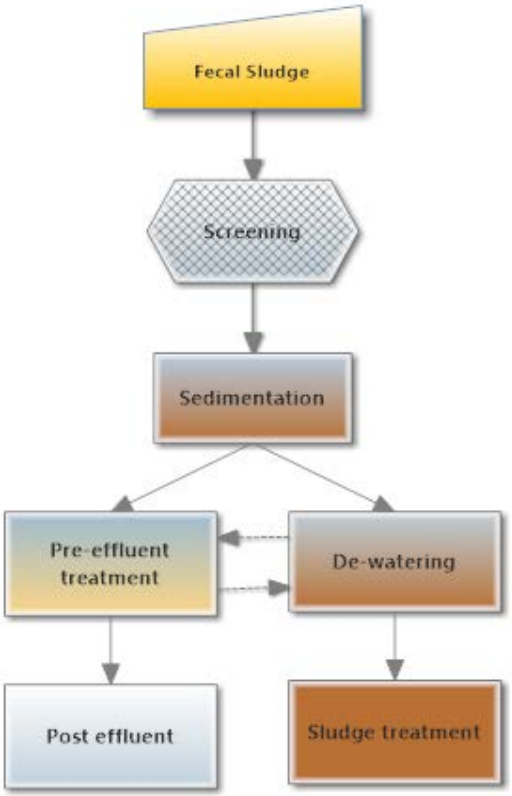
Sheet 2: Number of Trucks



Sheet 3: Treatment Technology



Sheet 3: Treatment Technology

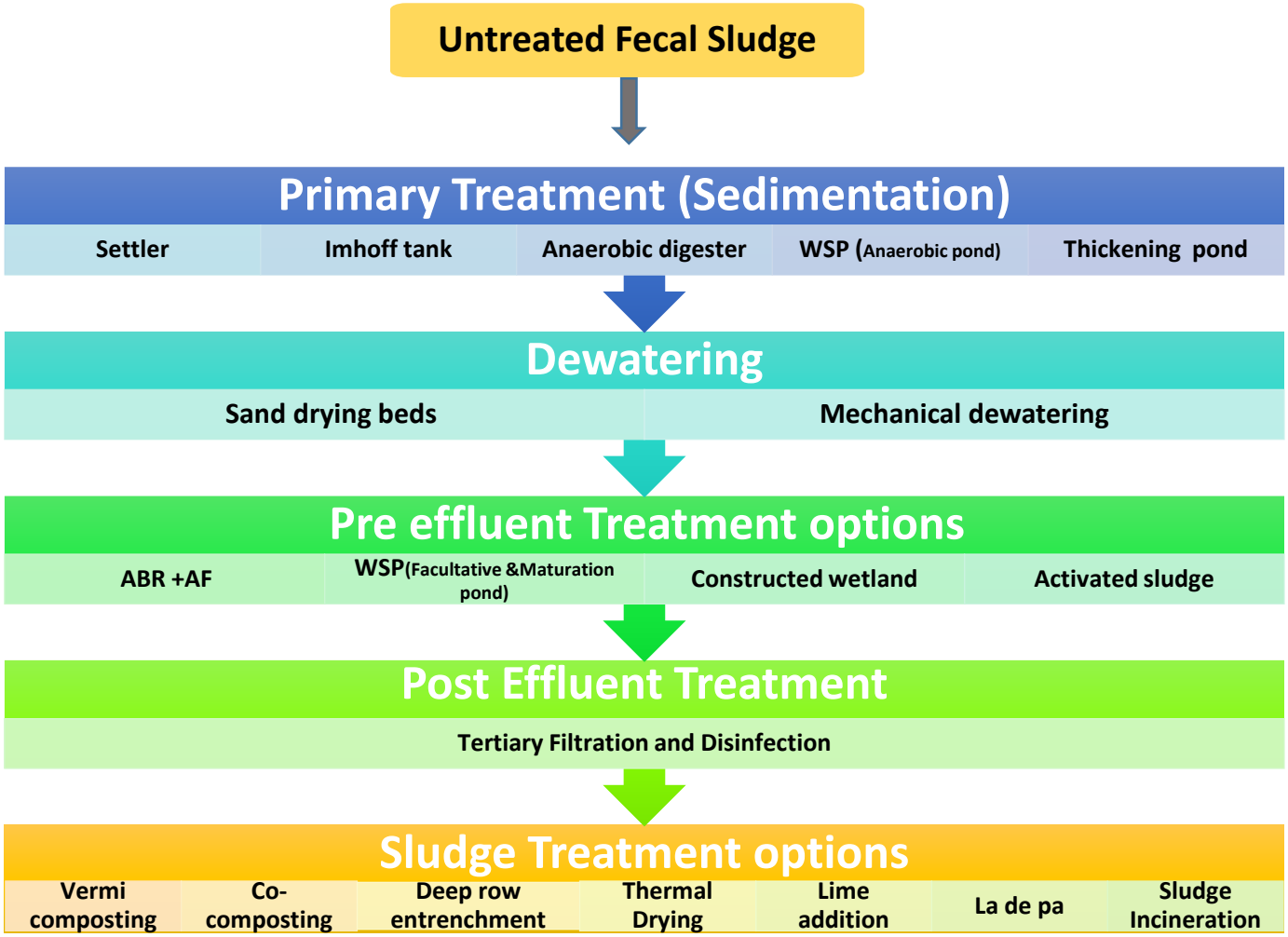


Fecal Sludge Treatment Process Flow in the Tool

Sheet 3: FS Treatment Technology Sheets

3	Input
3.1	Primary Treatment Options
3.2	Dewatering Treatment Options
3.3	Pre- Effluent Treatment Options
3.4	Post- Effluent Treatment Options
3.5	Sludge Treatment Options
3.6	Dashboard

Sheet 3: Treatment Technology



Sheet 3: Treatment Technology

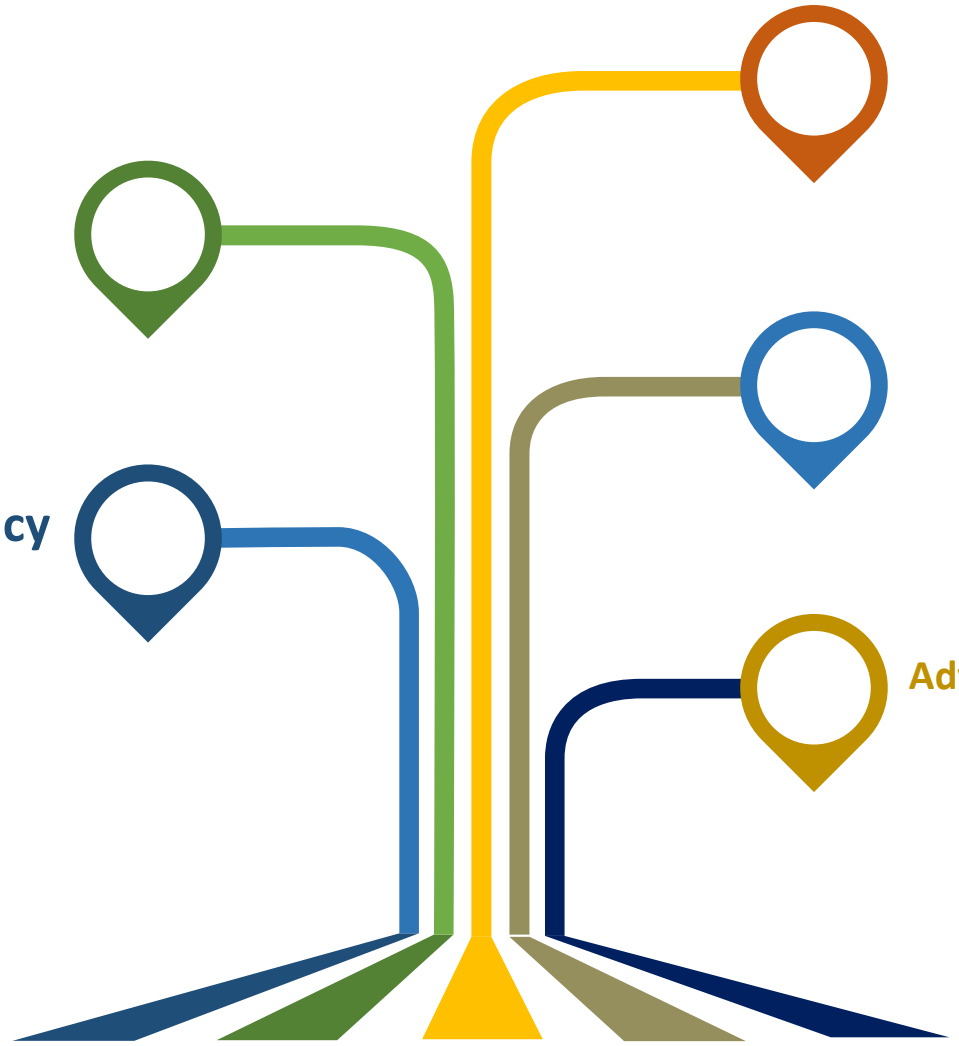
Specification of Each Technology

Land Requirement

Land requirement for individual technology has been calculated in m2/m3, helps user to estimate over all land area requirement for FSTP.

Cost

Capital investment costs include construction cost, design and supervision costs, and management cost.Operation& maintenance costs include personnel, electrical, chemical, maintenance and miscellaneous expenses.



Reuse

Products are ultimately returned to the environment, either as useful resources or reduced- risk materials. Reuse options for each output product has been presented in the toolkit

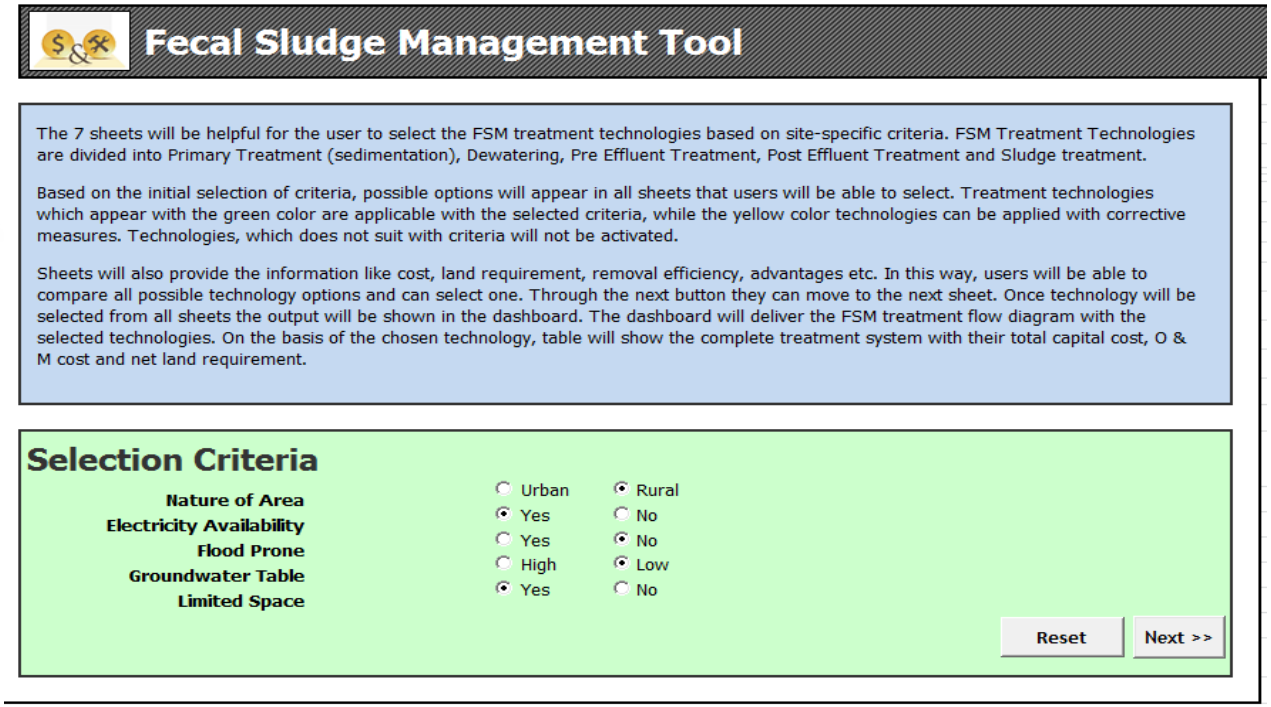
Removal efficiency

Determine the effluent quality in terms of biological oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and pathogen removal after applying various treatment technologies.

Advantages & Disadvantages

The advantages and disadvantages of individual technologies are also presented in the tool to help users in the decision making process.

Sheet 3: Steps for FS Treatment Technology Toolkit



- User has to select the option based on site conditions
- Based on criteria, possible options will appear on the screens; and user is allowed to choose any technology combination.
- Reset button to start the process again & Next button to move to the next sheet

Sheet 3.1: Primary Treatment Options

Primary Treatment Options — Next >>

Option1	Settler	Imhoff tank	Anaerobic Tank	WSP (Anaerobic Pond)	Thickening Pond
Capital Cost (USD/m³/day)	262.00	435.00	2,043.00	282.20	645.00
O&M Cost (USD/m³/year)	114.78	131.35	199.86	99.24	127.15
Land Requirement (m²/m³)	0.4	0.4	10.8	11.46	45.08
Removal Efficiency (%)	BOD 20-40% COD 25-50% TSS 50-70%	BOD 25-40% COD 25-50% TSS 50-70%	BOD 60-70% COD 60-70% TSS 20-50%	BOD 60-70% COD 60-70% TSS 40-60%	BOD 60-70% COD 60-70% TSS 40-60%
Pathogen Removal	Pathogen Removal < 50%	Pathogen Removal < 50%	Pathogen Removal < 50-60%	Pathogen Removal < 50-60%	Pathogen Removal< 50-60%
Reuse	Needs secondary and tertiary treatment	Needs secondary and tertiary treatment	Generate renewable energy	Needs tertiary treatment	Needs secondary and tertiary treatment
Advantages	(+) Simple and robust technology (+) Efficient removal of suspended solids	(+) Solid-liquid separation and sludge stabilization are combined in one single unit (+) Resistant against organic shock loads (+) Small space requirements (+) Suitable for small	(+) The Small land area required (most of the structure can be built underground) (+) Can be built and repaired with locally available materials (+) No electrical energy required	(+) Simple to build. The technology is appropriate for tropical climates, and achieves relatively high pathogen removal in the effluent. (+) Resistant to organic and hydraulic shock loads (+) High reduction of	(+) Thickened sludge is easier to handle and less prone to splashing and spraying (+) Can be built and repaired with locally available materials (+) No electrical energy is required

- **Primary Treatment allows the removal of suspended solids by sedimentation from fecal sludge. Treatment technologies which appear with the green color band are applicable with the selected criteria. Yellow color band technologies can be applicable with corrective measures.**

Sheet 3.2: Dewatering Treatment Options

Dewatering Treatment Options Next >>

Option32	Sand Drying Beds	Mechanical Dewatering
Capital Cost (USD/m³/day)	1,914.00	3,000.00
O&M Cost (USD/m³/year)	560.33	220.00
Land Requirement (m²/m³)	27.38	1.5
Removal Efficiency (%)	Dry solid Level 30-50%	Dry solid level 20-40%
Pathogen Removal		
Reuse	Needs secondary and tertiary treatment	Needs secondary and tertiary treatment
Advantages	(+) Good dewatering efficiency, especially in dry and hot climates (+) Can be built and repaired with locally available materials (+) Simple operation, only infrequent attention required (+) No experts, but trained community	(+) Compact technology (+) Gives speed to the process (+) Good dewatering efficiency

- Dewatering helps separate sludge into liquid and solid portions

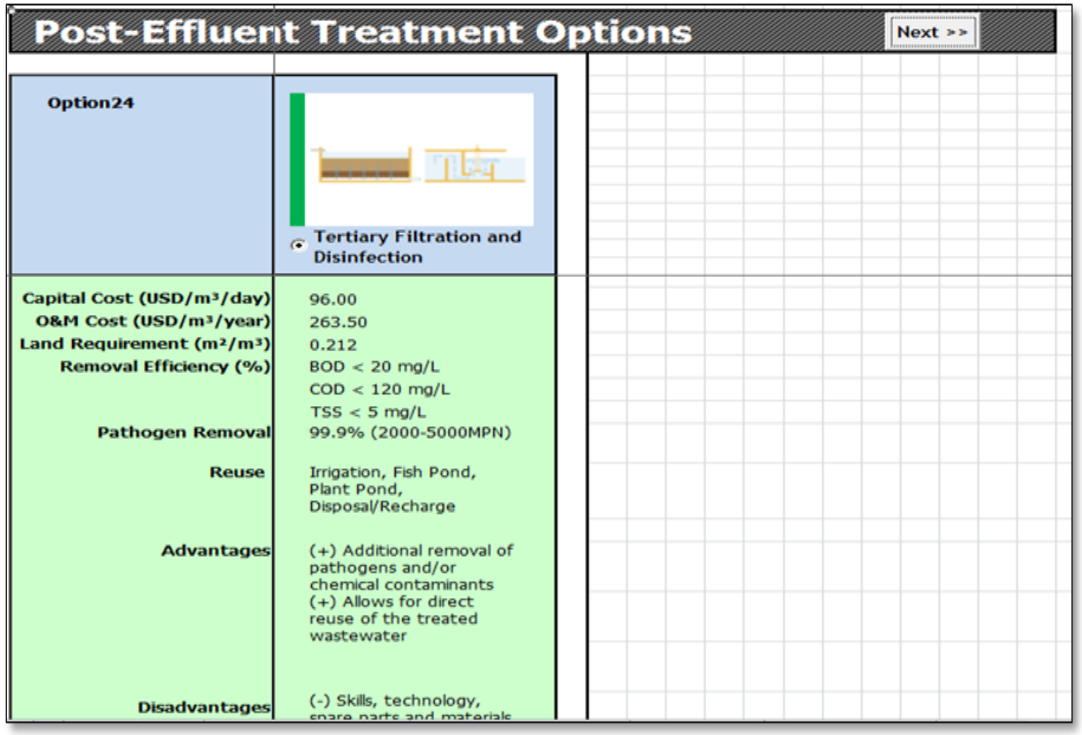
Sheet 3.3: Pre- Effluent Treatment Options

Pre-Effluent Treatment Options — Next >>

Option24	ABR+AF	WSP (Facultative & Maturation pond)	Constructed Wetland	Activated Sludge	Rotating Biological Contactors
Capital Cost (USD/m³/day)	320.00	457.00	1,210.00	1,308.00	2,500.00
O&M Cost (USD/m³/year)	211.64	117.40	156.50	887.40	395.60
Land Requirement (m²/m³)	0.97	21.29	89.46	12.1	5
Removal Efficiency (%)	BOD 70-90% COD 70-90% TSS 80-90%	BOD 80-90% COD 80-90% TSS 60-80%	BOD 80-90% COD 80-90% TSS 60-80%	BOD 80-90% COD 80-90% TSS 80-90%	BOD 80-90% COD 80-90% TSS 80-90%
Pathogen Removal	Pathogen Removal - 99%	Pathogen Removal 99.9%	Pathogen Removal 99.9%	Pathogen Removal < 99%	Pathogen Removal < 99%
Reuse	Needs tertiary treatment	Needs tertiary treatment	Needs tertiary treatment	Needs tertiary treatment	Needs tertiary treatment
Advantages	(+) Resistant to organic and hydraulic shock loads (+) No electrical energy required (+) High BOD reduction (+) Long service life (+) Low sludge production; sludge is stabilized (+) Moderate area requirement (can be built	(+) Resistant to organic and hydraulic shock loads (+) High reduction of solids, BOD and pathogens (+) High nutrient removal if combined with aquaculture (+) No electrical energy required (+) No real problems with	(+) High reduction of BOD, suspended solids and pathogens (+) Ability to nitrify due to good oxygen transfer (+) Does not have the mosquito problems of the Free-Water Surface or Horizontal Wetland (+) Less clogging than in a Horizontal Subsurface	(+) Resistant to organic and hydraulic shock loads (+) High reduction of BOD and pathogens at after secondary treatment (+) High nutrient removal possible (+) High effluent quality (+) Little land required compared to the	(+) High contact time and high effluent quality (both BOD and nutrients) (+) High process stability, resistant to shock hydraulic or organic loading (+) Short contact periods are required because of the large active surface (+) Low space

- **Liquid portion treatment options to remove pathogens, residual suspended solids and / or dissolved constituents**

Sheet 3.4: Post- Effluent Treatment Options



- **Liquid portion further treatment option to remove pathogens, residual suspended solids and / or dissolved constituents, so that the effluents can be reused for different purposes or discharged to water bodies.**

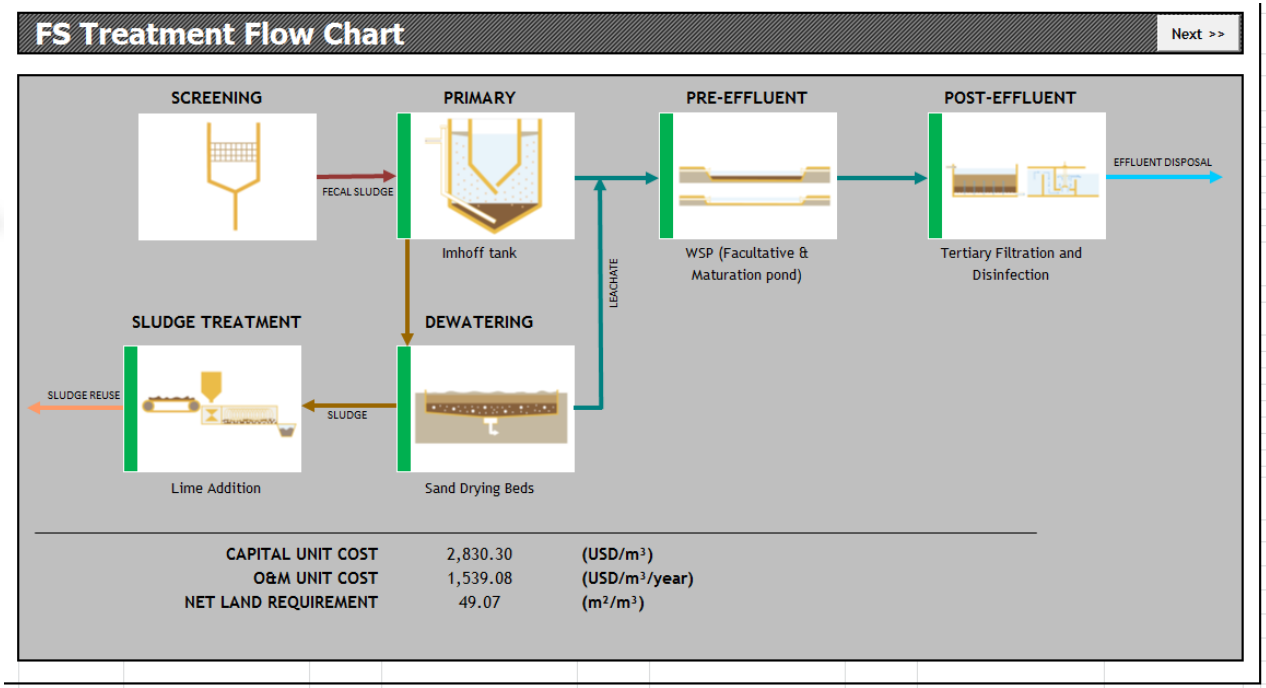
Sheet 3.5: Sludge Treatment Options

Sludge Treatment Options Next >>

Option24	Vermi Composting	Co-Composting	Deep Row Entrenchment	Thermal Drying	Lime Addition	La De Pa	Sludge Incineration
Capital Cost (USD/m³/day)	20,476.60	4,602.00	484.90	62,970.00	24.30	62,970.00	123,943.60
O&M Cost (USD/m³/year)	0.80	33.30	0.10	10,428.00	730.00	10,428.00	20,867.00
Land Requirement (m²/m³)	30	200	7.5	1.5	1.33	1.5	1.5
Removal Efficiency (%)	Dry solid Level 20-30%	Dry Solid Level 20-30%		Dry Solid Level 65%-90% Temp. 80° Energy requirement 725K\	Dry solid Level 30-50% PH of sludge 11-12 Ova reduction 56%-83.8%	Dry solid Level < 10% Temp. 100°	Temp. 750°
Pathogen Removal	Pathogen Removal < 50%	Helminth egg < 1 viable egg/g Ts	Helminth egg < 0.1% viable egg/g Ts	Pathogen removal 100%	Pathogen removal 99%	Pathogen Removal 100%	Pathogen Removal 100%
Reuse	Soil Conditioner	Soil Conditioner	Forestry and Land Rehabilitation Purposes	Energy Source and Soil Conditioner	Energy Source and Soil Conditioner	Energy Source and Soil Conditioner	Energy Source
Advantages	(+) Economic and environment friendly waste management (+) Simple methods available (+) Compost is a valuable resource for gardeners/farmers (+) Selling of worms	(+)Large-scale composting reduces the amount of waste that needs to be transported to final disposal sites (+)Relatively straightforward to set up and maintain with appropriate training (+)Provides a valuable resource that can	(+) No expensive infrastructure or pumps are required (+) Growing trees have many benefits such as extra CO2 fixation, erosion protection, or potential economic benefits	(+) Significant reduction in volume as well as pathogen content (+) Dried sludge easy to handle and market (+) Product can be used for agriculture	(+) Reduction of pathogen (+) Reduction of odour and degradable organic matter (+)Benefit of lime is also that heavy metals can precipitate	(+) Technology is compact, mobile and robust (+) Pellets are free of pathogen, therefore safe for agricultural (+) Pellets can be used as a dry fuel	(+) Significant reduction in volume as well as removed all pathogen content

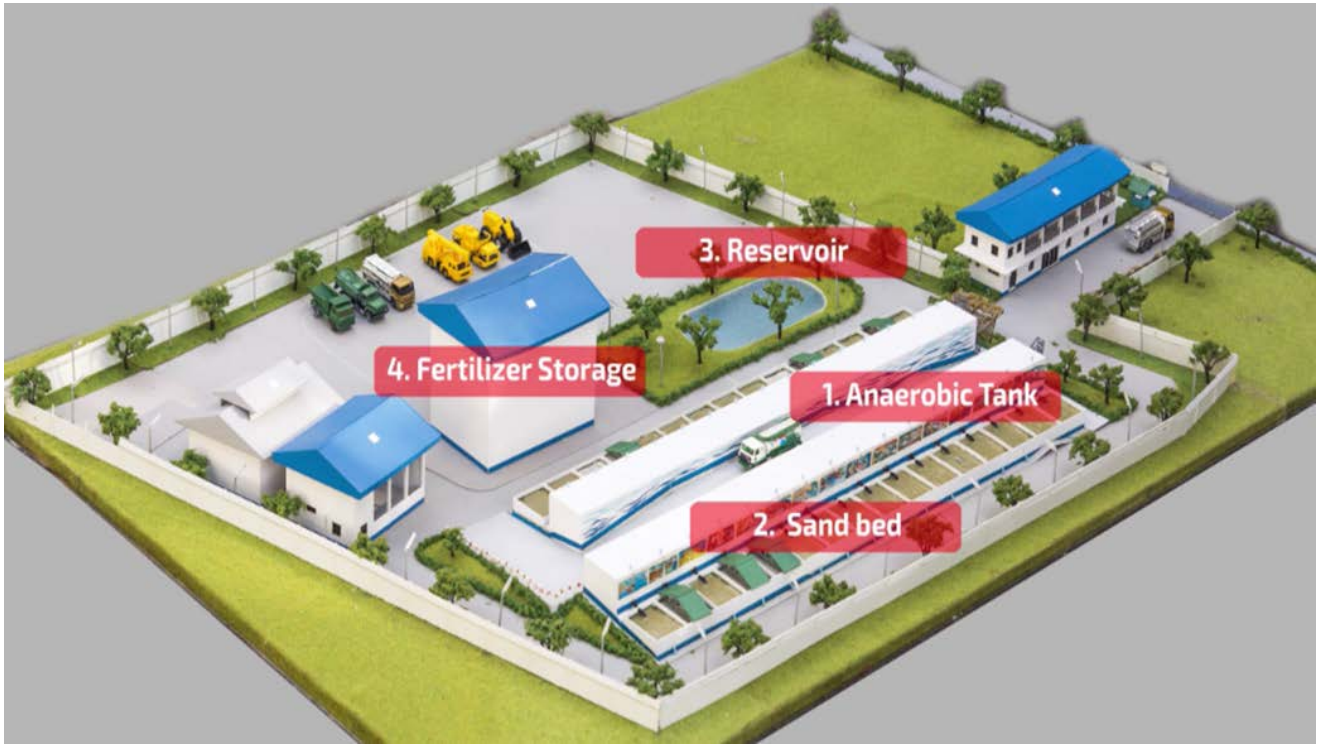
- **Treatment options for the solid portion so that the product can be used for different purposes or safely released into the environment..**

Sheet 3.6: Dashboard



- The dashboard will display the FSM treatment flow diagram with the selected technologies.
- On the basis of the chosen technology combination, a table will be displayed to show the complete treatment system with capital unit cost, unit O & M cost and net land requirement

Similar Case study; Nonthaburi Bio – fertilizer Plant



Nonthaburi Bio – fertilizer Plant

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