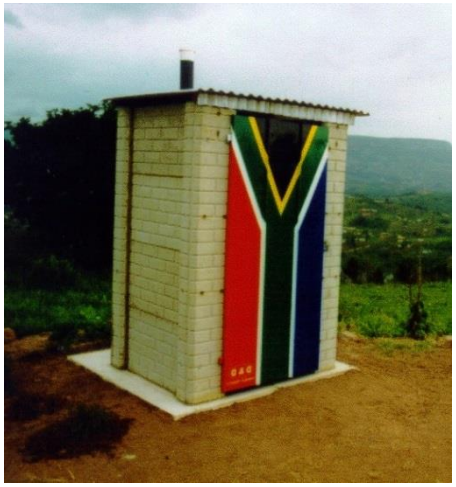
FSM Strategies in Durban

Greatest Medical Advances 1840 to 2009 British Medical Journal

BMJ conducted a survey amongst readers to vote for greatest medical advances:

6. Germ theory – specific diseases are caused by specific "bugs" -1800
5. Discovery of DNA structure – transfer genetic information from one generation to the next – 1953
4. Vaccines-Edward Jenner's smallpox vaccine - 1796; polio, measles
3. Anaesthesia – A Boston dentist used ether during surgery – painless – 1846
2. Antibiotics – Alexander Fleming's discovery of penicillin - 1928

1. Sanitation was voted as the greatest medical advance since 1840:



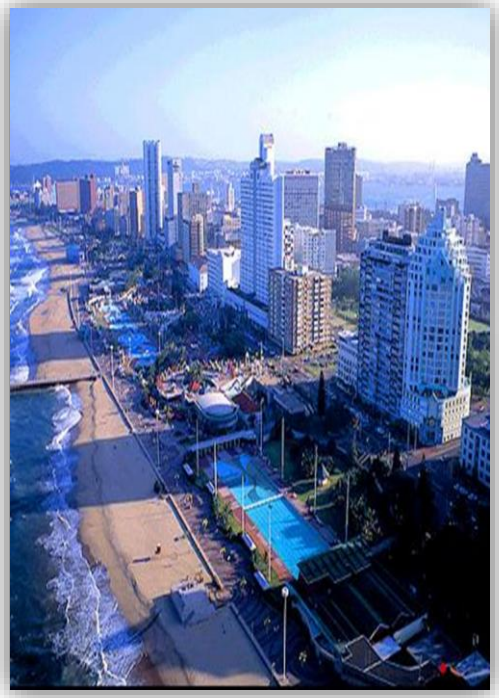
- The importance of clean drinking water and waste disposal was recognised in the late 1800's
- 200 years later 2200 children dying everyday

Vision of EWS

- Integrated use of resources
- Sustainable water & sanitation management
- Provide services that are:
  - Equitable
  - Environmental, socially, financially sustainable
  - Technically excellent

Water & Sanitation Challenges

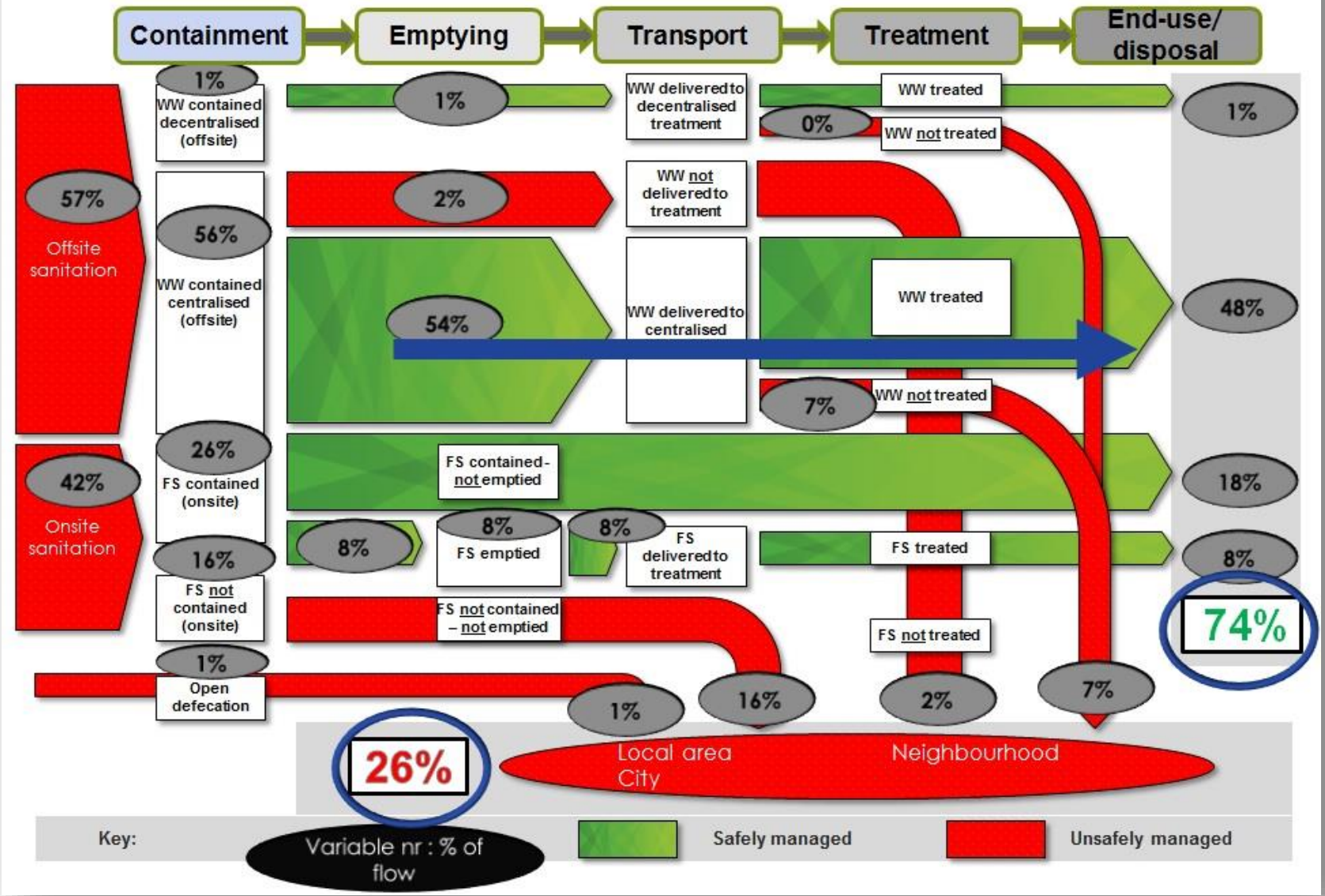
- Access to basic water and sanitation has been a constitutional right since 1994
- Pro-poor transformation agenda
- Clear need for innovative solution
  - Historically unequal service provision, particularly in rural homeland areas
  - Proliferation of informal settlements
  - Perception of ‘inferior technology’
- ‘Learn by doing’ approach
  - Close relationship with University of KwaZulu-Natal
  - Fail-fast



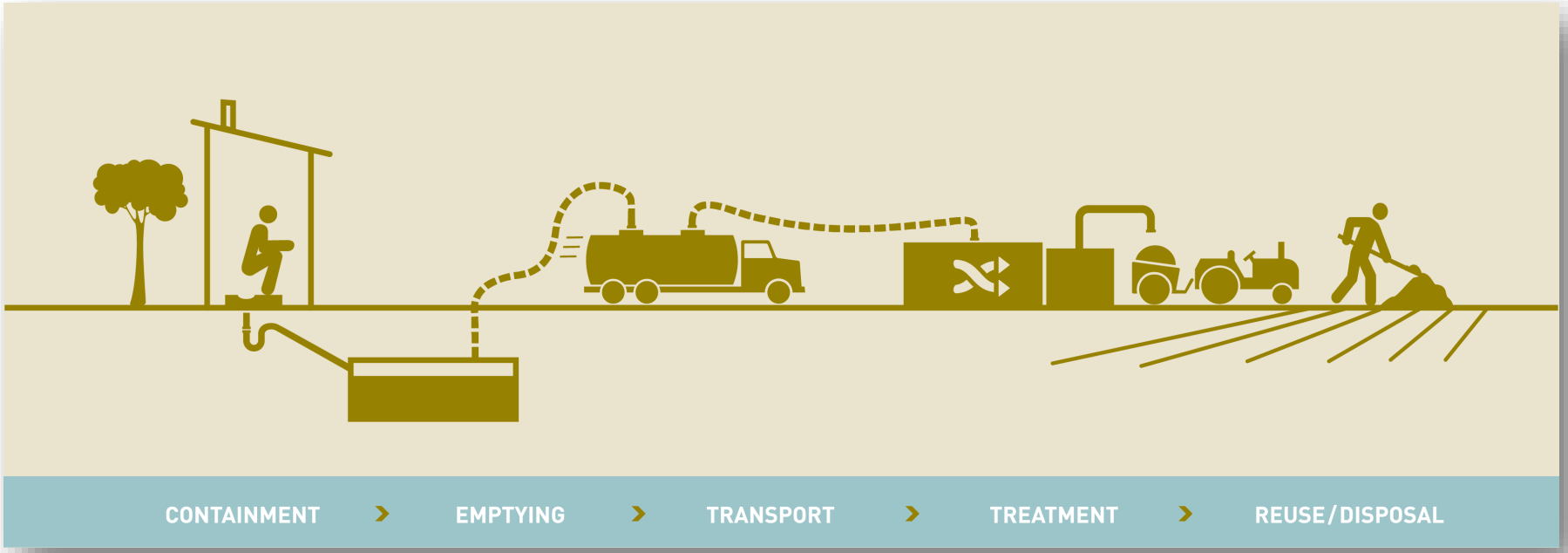
Current Sanitation Services

- URBAN
  - 0.5 million waterborne
  - 30 000 septic tanks
- RURAL
  - 85 000 UD toilets installed
  - Subsidised construction, owner maintained
  - Council one emptying every two years
- URBAN / PERI-URBAN
  - Community Ablution Blocks (CABs)
  - Backlog around 0.5 million
  - VIPs >35 000 to be emptied
  - No further VIP construction
    - ✓ **not sustainable (emptying)**
    - ✓ **free emptying (to user) every 5 y (12 000 per year)**

Shit Flow Diagram (SFD), Durban



FSM: Focus on Entire Value Chain



BMGF

Sanitation Interventions

- Ventilated Pit Latrines (VIPs)
- Urine Diversion Toilets (UDs)
- DEWATS
- Pour/Low Flush toilets
- Community Ablution Blocks (CABs)
- Re-Use / treated wastewater
- Engineering testing of reinvent the toilet prototypes

VIPs:
Peri-Urban FSM Intervention

Containment

- 35 000 ventilated improved pit latrines VIPs built in 90's

VIPs:
Waste to Resources – The Drivers

- Space restrictions and ground contamination preventing further burial onsite
- Process failures at WWTW due to nutrient overload
- High costs of disposal at hazardous waste site

VIPs:
Emptying and Transport

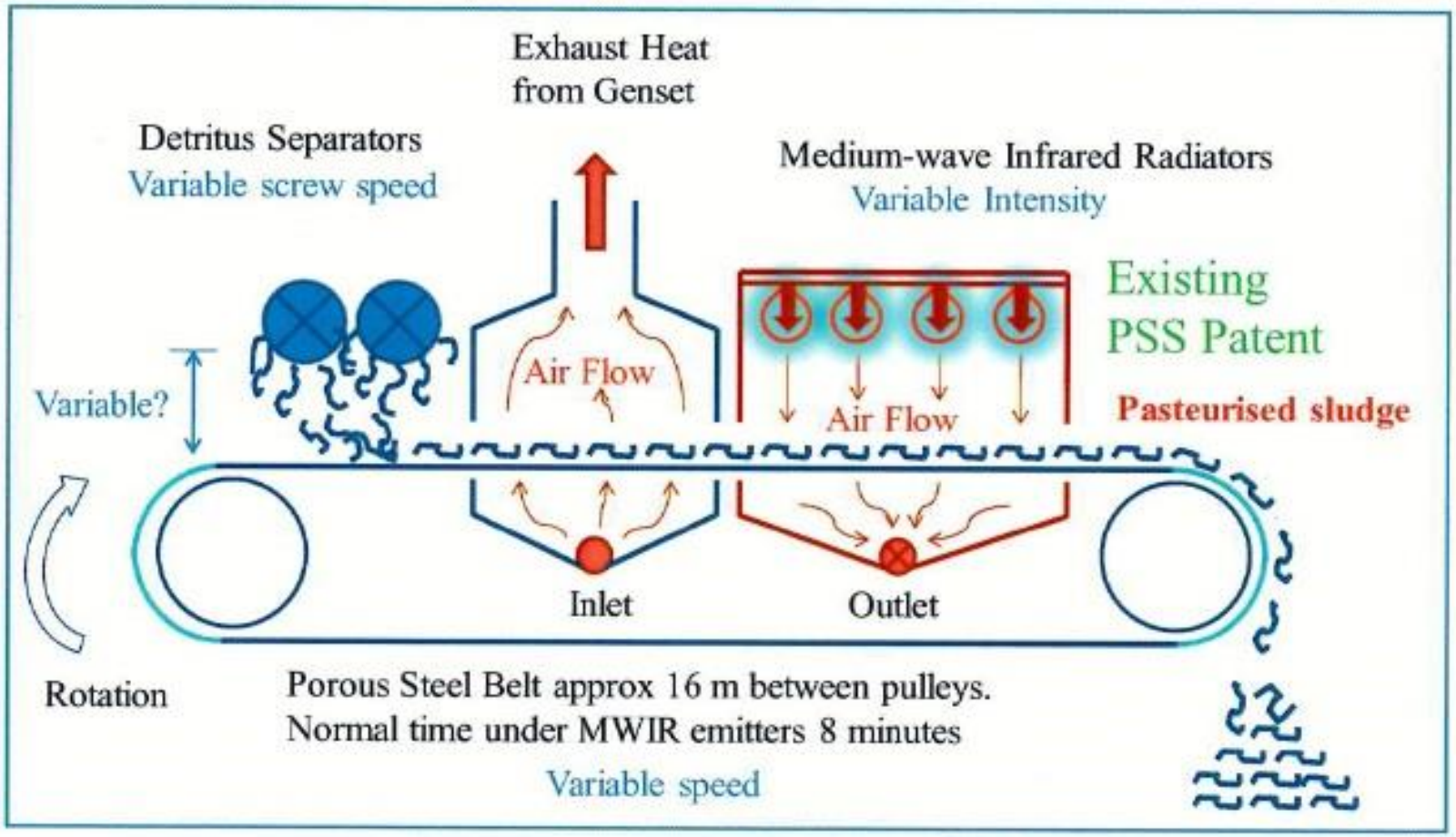
- By 2 000 many full or overflowing
- Pilot emptying service followed by policy development
- Free emptying service every 5-years
- Managing contractor with local sub-contractors
- High levels of health and safety

VIPs:
Treatment, Disposal and End-use

- Burial onsite
- Processing at decentralised pelletiser plant (LaDePa)
  - Remove solid waste / detritus
  - Dehydrates and pasteurisers using infrared technology
  - Pellets produced
  - Soil conditioner/fertiliser




VIPs:
LaDePa Schematic

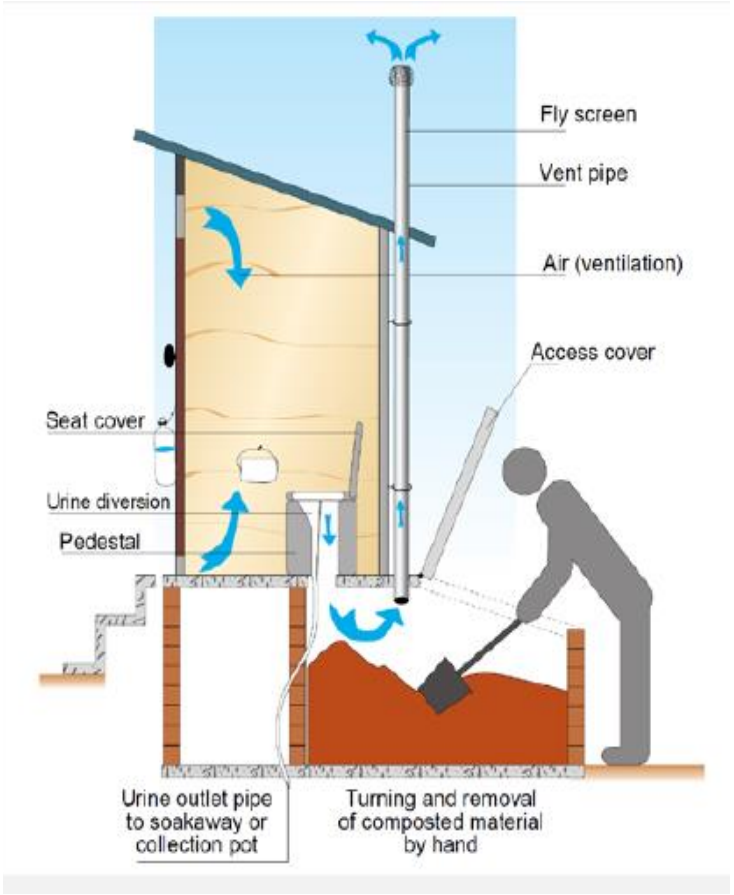


VIPs:
Waste to Resources - Lessons Learned

- Pit emptying and sludge transport are major components of total cost
- Costs can be reduced by optimising operating parameters, e.g. frequency of pit emptying, decentralisation of LaDePa plants.
- Must include environmental savings, food security benefits and job creation
- Security of supply not at level of commercial fertiliser suppliers
- Cost avoided is funding saved

UDs
Rural FSM Intervention
Containment

- Cholera epidemic in 2000 resulted in investigation of new sanitation technologies
- Research – prototype testing
- Urine Diversion Double Vault toilet (UDDT) selected due to:
  - Topography
  - Low density
  - Water availbility
- 85 000 built to date



UDs:
Emptying and Transport

- Resident expected to empty and bury on site
- Some households not emptying
- Pathogens not breaking down – health hazard to household
- Expectation of free emptying service
- Policy of emptying service every 2-years
- Private sector programme to empty, bury or transport to processing site
- Managing contractor with local sub-contractors (small businesses) and local labour
- Detailed health, safety and environmental requirements in contract
- Mentoring local businesses

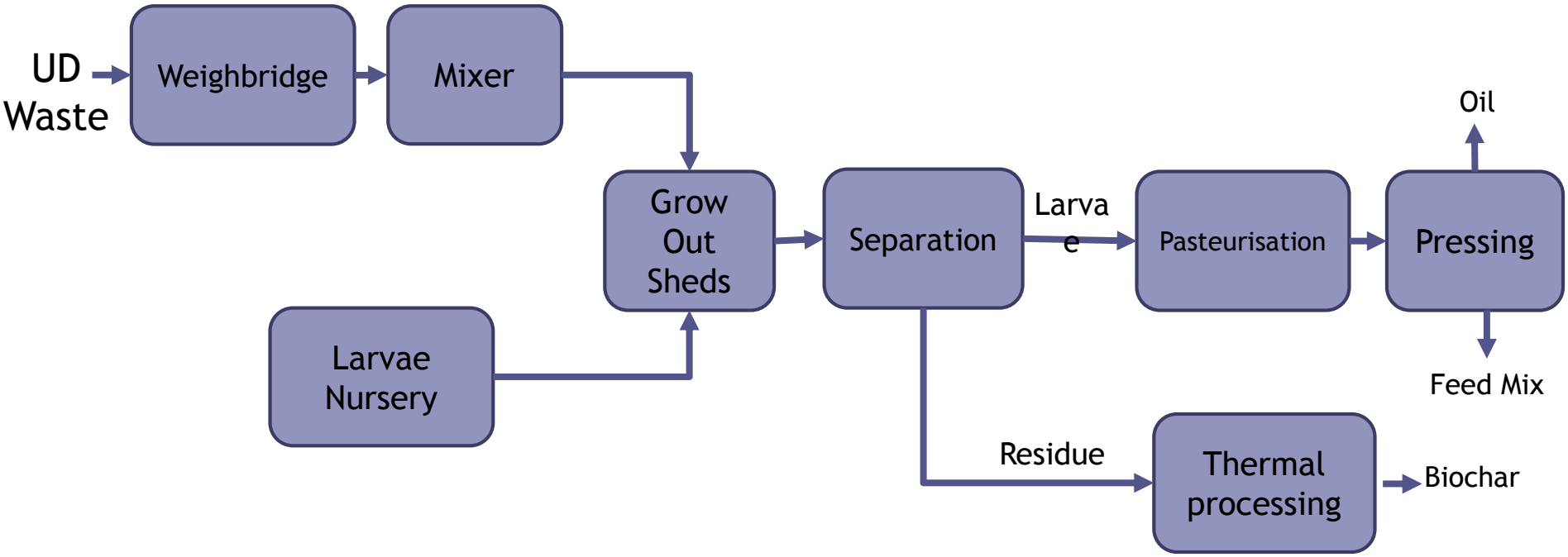
UDs:
Treatment, Disposal and End-use

- Burial onsite with fruit tree planting or
- Processing plant in pilot stage
  - Black soldier fly technology
  - Funding from Bill and Melinda Gates Foundation
  - End products:
    - Oil
    - Animal feed
    - Biochar
  - Operated by private sector specialist with Service Level Agreement (SLA)

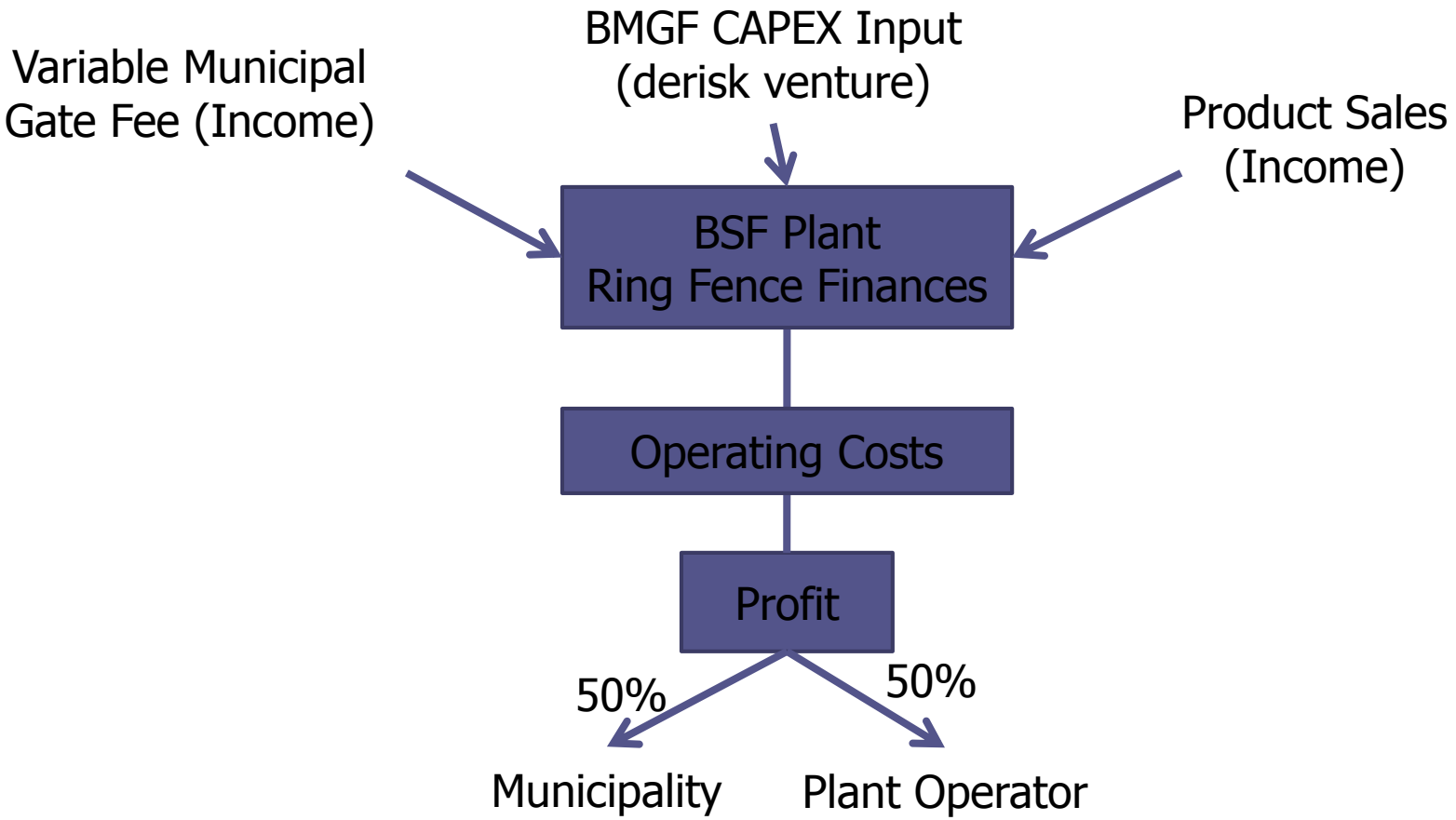
UDs:
Why Black Soldier Fly Processing Technology

- Disposal at WWTW not feasible
- LaDePa not feasible – lower nutrient content
- BSF tested in Stellenbosch
- BSF not pest species
- Potential value from products

UDs:
BSF Plant Input / Output Flowchart



UDs:
BSF Processing Plant: Business Model



UDs:
Waste to Resource - Lessons Learned

- Seed funding needed for start up and to stimulate private sector involvement
- Private sector and municipality have different approval processes
- Plant design requires iterative approach:
  - Technology unknowns
  - Variability of input waste
- External partner to facilitate business process

Per-Urban FSM Intervention - DEWATS

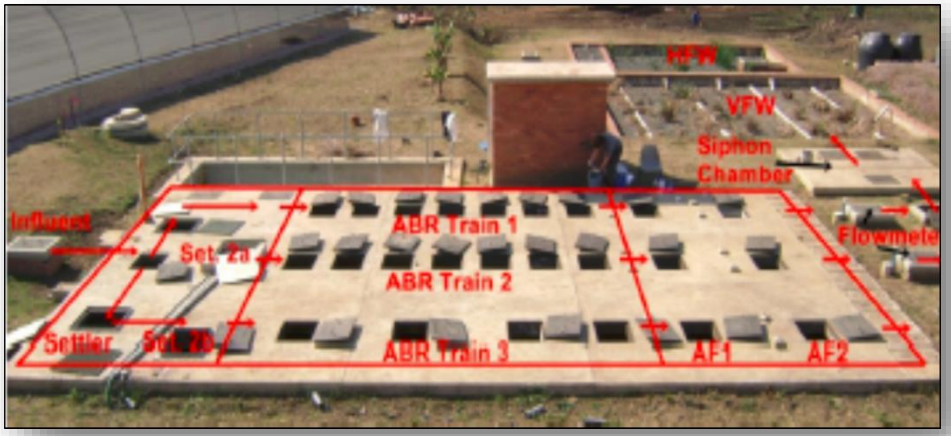
- Wastewater treatment solution for housing outside sewer boundary
- Research partners: BORDA, UKZN
- No electricity input
- Simple to operate and maintain
- Potential for use of treated waste water in agriculture

DEWATS:
Effluent Re-Use in Agriculture

- Irrigation using DEWATS effluent
- Banana and Taro (Amadumbe) and demonstration community garden
- Control and experimental crops
- Analysis of nutrient leaching, nutrient uptake, yield etc.

DEWATS: Pilot Plant Design

- 84 houses with potable water and waterborne sewage
- Design capacity: 42 m^3/day



	Discharge limit	Pilot plant
Suspended Solids [mg/l]	**25**	**7**
COD [mg/l]	**70**	**86**
NH4-N [mg N/l]	**5**	**17**

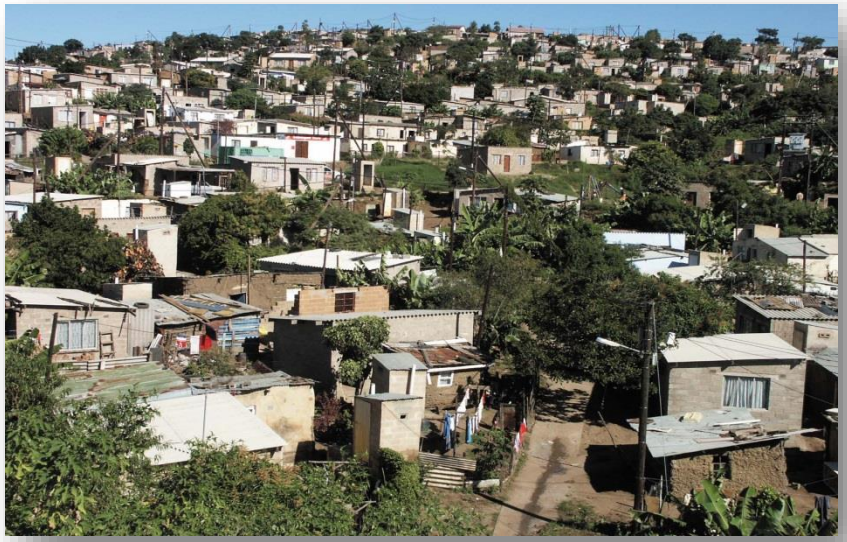
Peri-Urban FSM: Pour / Low flush Toilets

- Partnership between Partners in Development and the WRC
- School Pilot:
  - ➢Technology development by Partners in Development
  - ➢WRC provided R&D costs
  - ➢Ethekwini assisted with O&M
- Pilot 400 RDP houses

Photos by PiD (2014)

Urban – Informal Sanitation Intervention - CABs

- **Challenges**
  - Provide sanitation services to dense informal settlements
  - No space for individual household toilets



CABs:

- Community Ablution Blocks (CABs) provide services to 50 households
- Converted shipping container with caretaker
- Male and female toilets
- Showers
- Laundry
- Lighting

CABs: Emptying, Transport, Treatment and Disposal

- Connects to waterborne sewerage system and treatment works
- Where no waterborne system
- VIPs or
- Decentralised waste water treatment system (DEWATS)

CABs:
O & M Challenges

- O & M presently economically inefficient
- High management and supervision costs
- Maintenance delays result in:
  - High cost of leaks
  - Unhealthy conditions for residents
- Caretakers contracted by EPWP but want to be permanent
- Caretakers work 7 days a week

CABs:
Background to Social Franchising

- Social franchising is "*The application of commercial franchising concepts to achieve socially beneficial ends*" Montagu 2002
- Franchising offers tried and tested business models that entrepreneurs can replicate in order to achieve business success
- Social franchising has less financial risk while achieving rapid social impact

CABs:
The Franchisor

- Established operator
- Business know-how and experience
- Proven track record
- Proven systems and procedures
- Managerial, technical and financial capacity
- Provides quality assurance
- Manages the broader marketing and business strategy
- Provides training and access to finance

CABs:
The Franchisee

- Local operator
- Owner managed
- Freedom to service a number of clients
- Works to defined procedures
- Has access to support
- Benefits from a collective procurement approach

CABs:
Benefits of Proposed Model

- Rapid response to maintenance issues
- Reduced water loss
- Reduced environmental pollution
- Small business opportunities
- Cost savings
- Compliance with basic conditions of employment

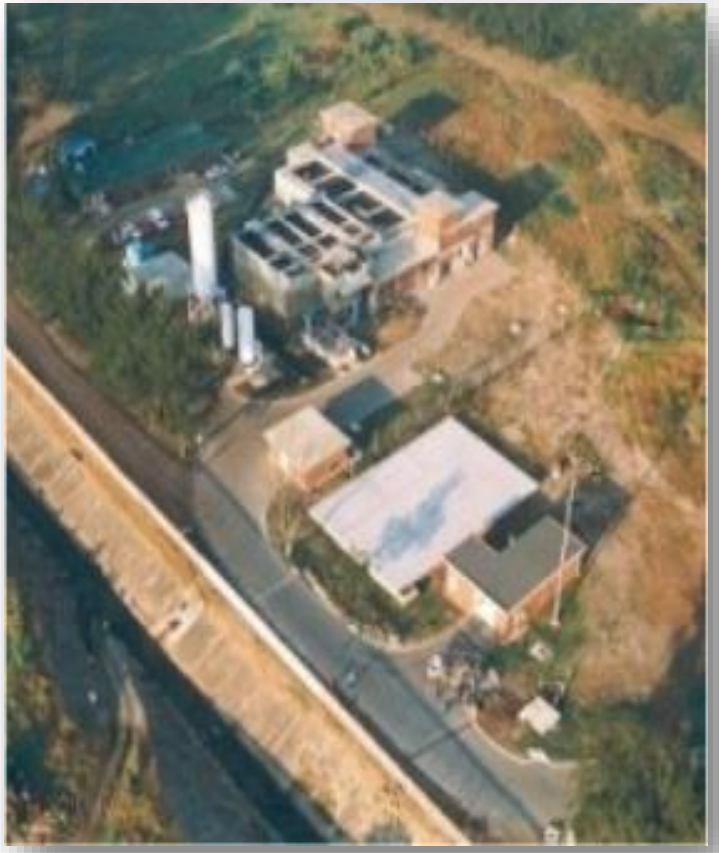
Urban Intervention

Re-Use of Treated Wastewater

- Located at EWS Southern Wastewater Treatment Works
- Public private partnership
- Teats domestic and industrial wastewater to near potable standards
- Treated water is sold to industrial consumers to direct reuse (Mondi and SAPREF)
- 47.5m*l*/d capacity

Re-Use of Treated Wastewater

- The plant reduces city's treated wastewater output by 10%
- The treated water provided to industrial consumers is equivalent to daily potable water to 220 000 households in the city



Re-Use of Treated Wastewater – The Drivers

- SA is a water stressed nation
- Demand for potable water in marginalised areas / rural
- Increased Demand from Industry
- Capital investment increased marine outfall pipeline capacity

Re-Use of Treated Wastewater – Lessons Learned

- Adaptability for market demand
- Requirement for consistent product
- Private sector looks to utility to provide stable and predictable market conditions
- Utility looks to private sector for business acumen
- Creation of long term revenue stream

Bill & Melinda Gates Foundation

- Durban identified (2009) as the leading global municipality for decentralised sanitation innovation
- investment in off-grid solutions
- Durban one of three global test sites for ***Reinvented Toilet*** prototypes
- Durban established as a learning and training centre for Developing Countries
- partnership with UKZN for monitoring and evaluation

The Reinvented Toilet

- Removes germs
- Recovers energy, clean water, and nutrients.
- Operates “off the grid”.
- Costs less than US$.05 cents per user per day.

Field Testing

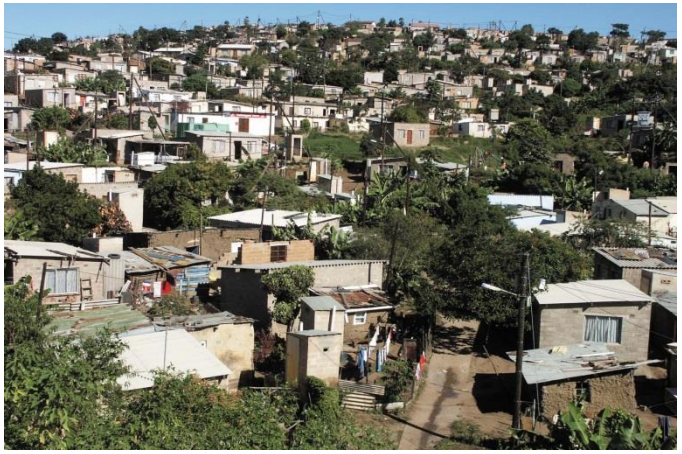
What is the EFT Platform

- Researchers around the world have been working on developing reinvented toilets
- A need has been identified to provide a safe space to test the early engineering concepts under the control of the technology developers
- The Engineering Field Testing Platform therefore aims to:
  - Test reinvented toilets in a real-world environment with many users
  - Monitor and evaluate the performance over an extended period of time
  - Obtain feedback from community members as to the suitability and impact
  - Use the information and data generated to improve sanitation for all

The partnership between eThekwini Water and Sanitation (EWS), Khanyisa Projects and the Pollution Research Group (PRG) at the University of KwaZulu-Ntal (UKZN) has provided the infrastructure for such testing to take place

Why Test in Durban, South Africa?

- South Africa is water constrained country
- EWS has a reputation for innovation in the sanitation field
- Durban has a large number of people that are unserved with regard to sanitation due to inward migration
- EWS aim to improve sanitation service delivery with systems that are:
  - Acceptable to customers
  - Reduced water use
  - Improves health and hygiene
  - Reduced environmental impact
- EWS and PRG have a strong research partnership
- PRG has a well equipped faecal sludge laboratory



Intervention Strengths

- Use of comprehensive long term community engagement strategies
- Focus on safe management of excreta throughout the sanitation chain
- Ability to collect and allocate budget
- In-house technical capacity and excellence
- Use of the private sector and small businesses to enhance delivery and innovation at all stages of sanitation chain (e.g. social franchising)
- Willingness to try new technologies and to innovate

Intervention Weaknesses

- Changing aspirations of communities e.g. flush toilets
- Political changes and changes at City Management level can result in lack of support/understanding of value proposition of FSM and delays
- Sustainability of small scale sanitation service providers
- Distinguishing between more affluent that can afford to pay and poor who cannot

Key Lessons Learned

- No one size fits all
- Without community engagement, support for and understanding of O & M technology will be absent
- Technologies need to be tested and piloted
- Policy development based on the findings of the pilot
- During rollout there must be on-going monitoring and evaluation
- Need to consider O & M strategies and budgets before roll-out of new infrastructure
- Need to encourage calculated risk to continually improve service delivery

THANK YOU