



RESEARCH  
PROGRAM ON  
Water, Land and  
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# THE EXCRETA FLOW DIAGRAM: A TOOL FOR ADVOCACY AND A WAKE-UP CALL FOR ALL!

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A water-secure world

**17 November, 2015**

[www.iwmi.org](http://www.iwmi.org)

# OUTLINE

- I. Introduction to IWMI.
- II. The excreta flow diagrams (SFDs) for Greater Accra.
- III. Possible business models to improve sanitation in Ghana.



- IV. Conclusions.

# IWMI



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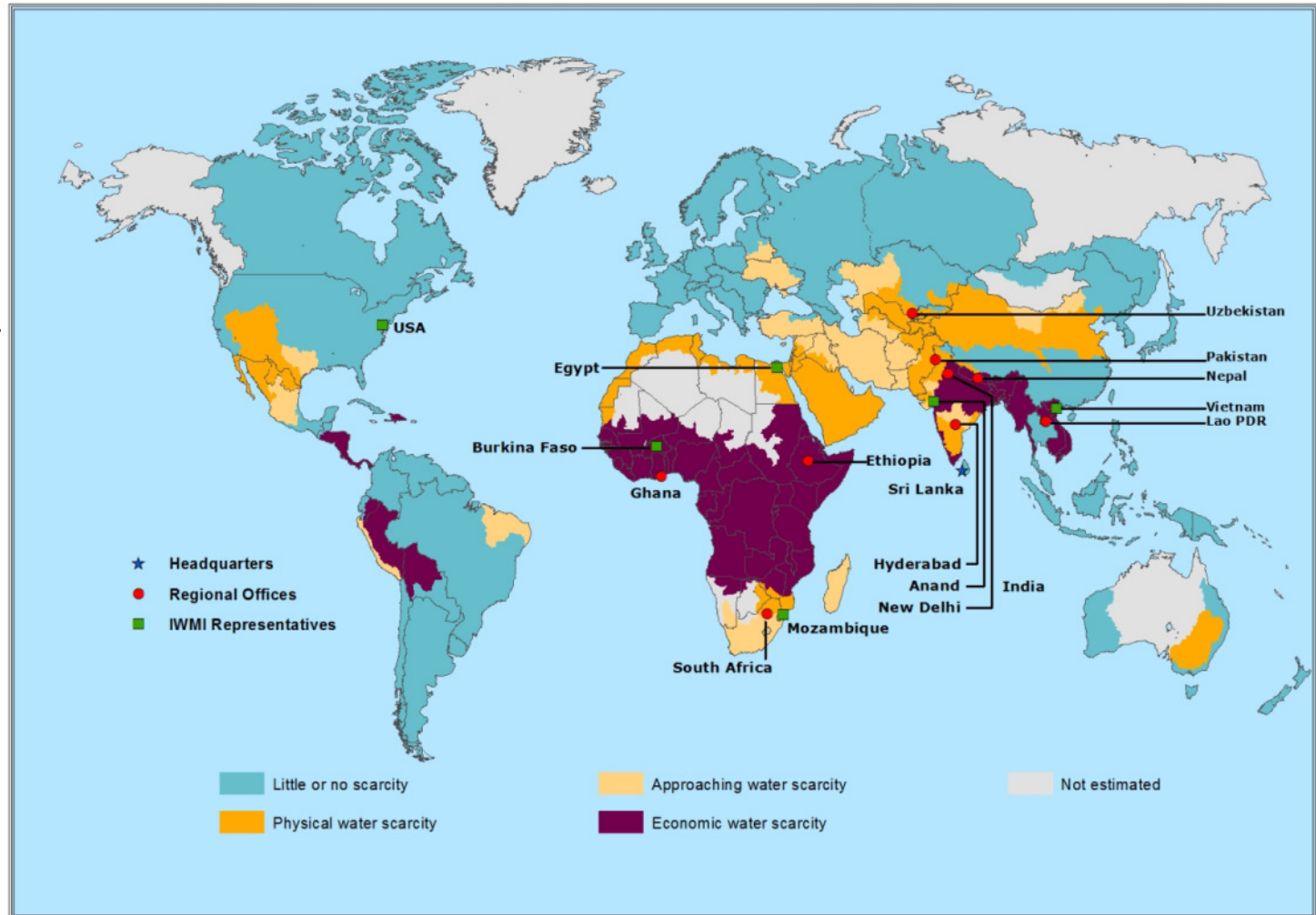
Non-profit, scientific research organization

## IWMI's Vision:

A Water-secure world

## IWMI's Mission:

Provide evidence-based solutions to sustainably manage water and land resources for food security, livelihoods and the environment



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# THE 3 PRIORITY RESEARCH AREAS IN WEST-AFRICA

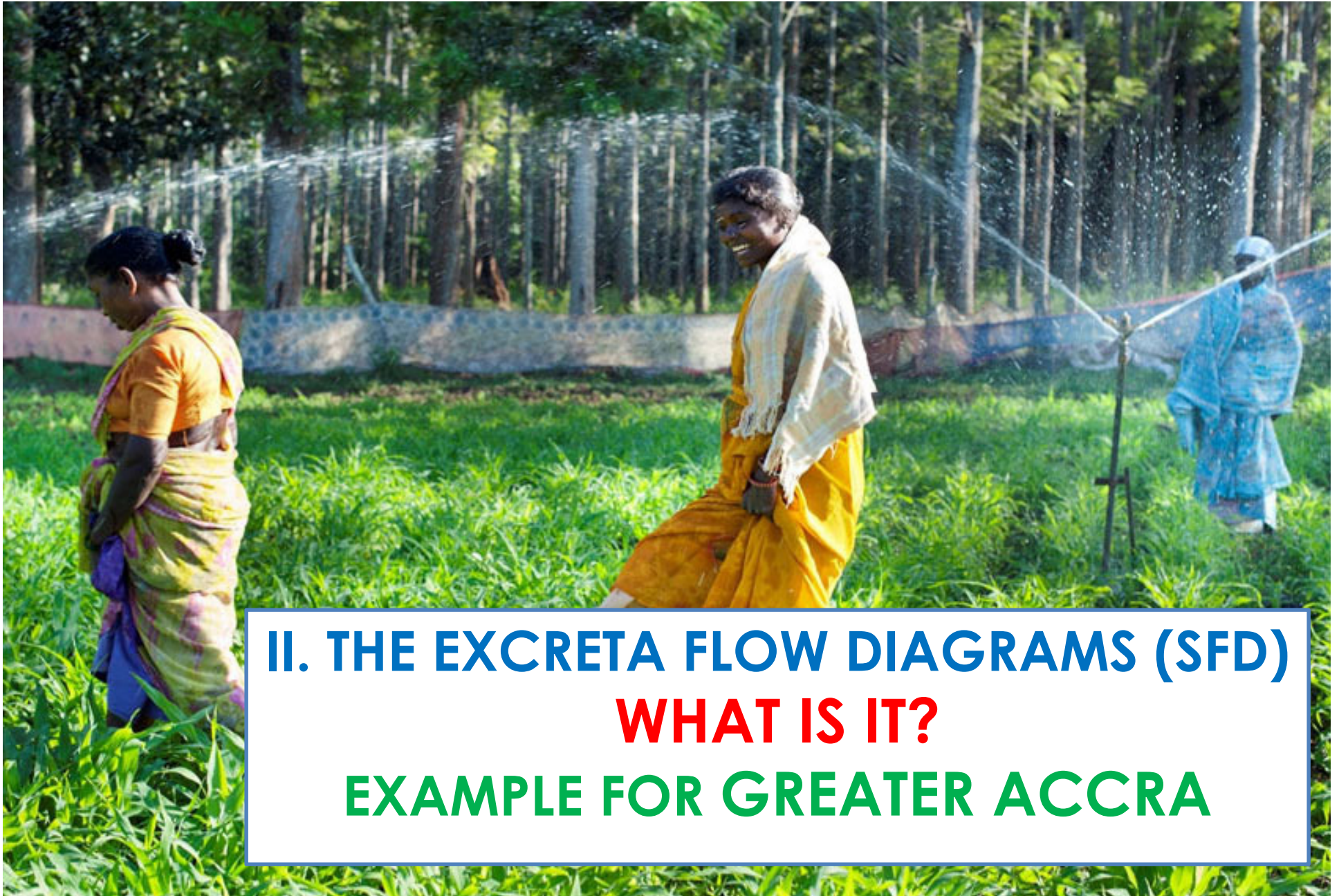
## 1. Intensifying sustainable agricultural production

- Improving smallholder irrigation
- Strengthening rain-fed production systems
- Promoting and improving flood recession agriculture

## 2. Managing water variability and climate change at catchment and basin scales

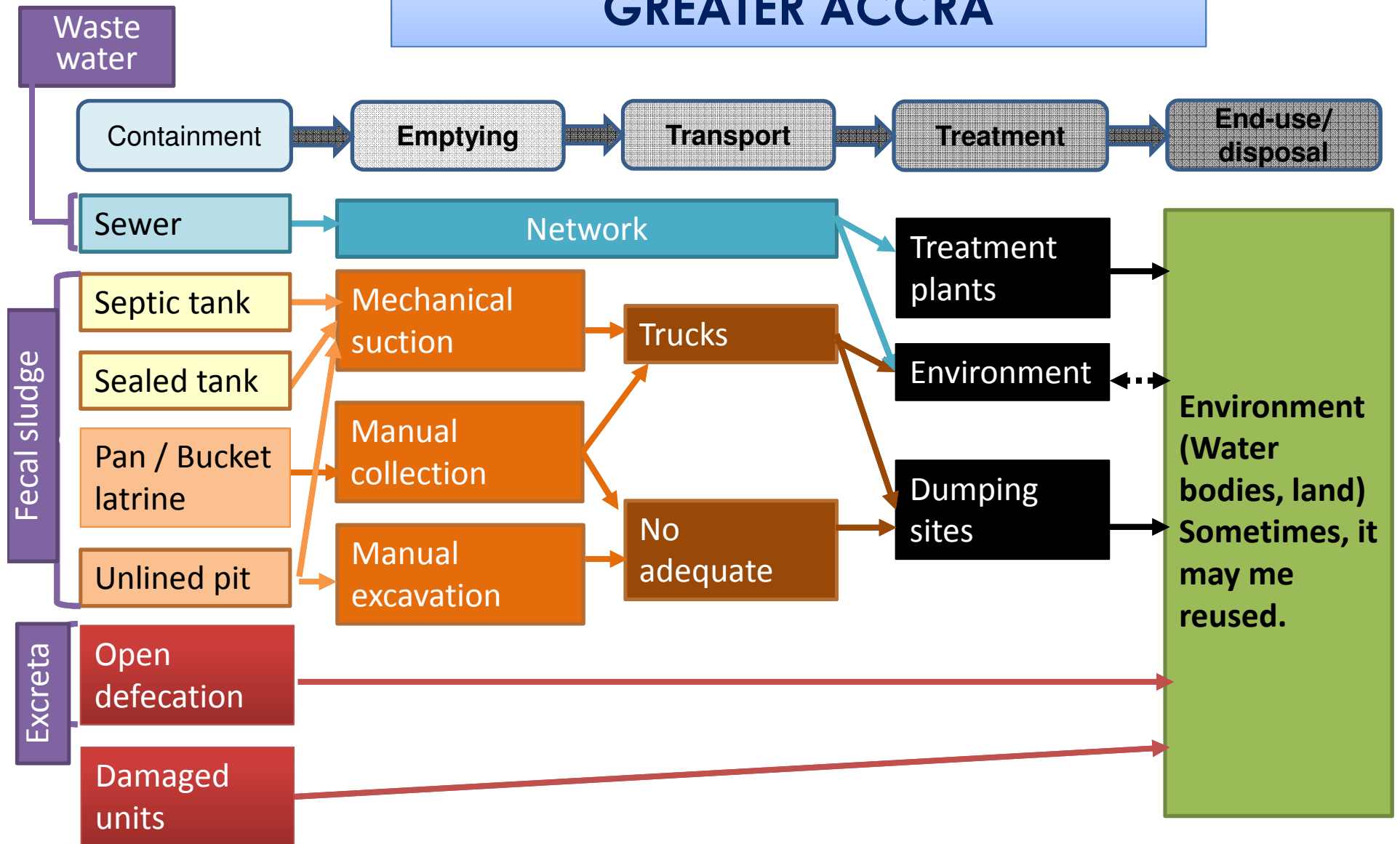
- Enhancing adaptation capacity to climate change and variability
- Enhancing public and private sector investment in agricultural water infrastructure
- Improving the management of trans-boundary water resources
- Generating evidence on water-energy-food nexus to support integrated policy

## 3. PRA 3: Improving resource recovery and reuse of urban wastes and water quality in peri-urban landscapes



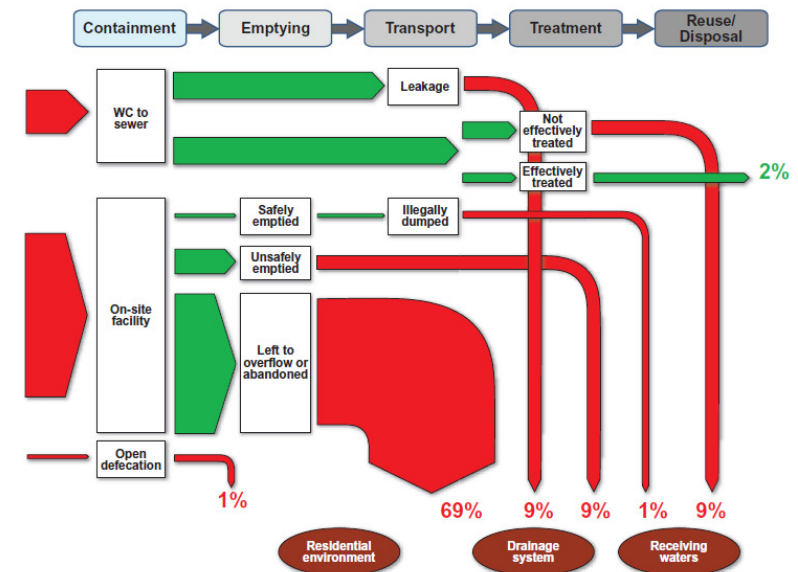
**II. THE EXCRETA FLOW DIAGRAMS (SFD)**  
**WHAT IS IT?**  
**EXAMPLE FOR GREATER ACCRA**

# SANITATION SERVICE CHAIN IN GREATER ACCRA



# HOW DID WE DEVELOP THE SFDs FOR GREATER ACCRA?

1. Collection of appropriate data.
  - Primary data, when available.
  - Best estimates, based on available data.
  - Expert interviews.
2. Generation of drawings.



Source: WSP, 2014

The idea: to allow a visual presentation of the status of sanitation to create awareness and initiate change.

# STEP 1: HOW IS THE CONTAINMENT AT HOUSEHOLD LEVEL?

**Available:** the census data (Ghana Statistical Service Library).

Year 2000		
Toilet facility	No. Household	%
Water closet (WC)	161076	25.7
Pit latrine	81631	13.0
KVIP	73614	11.8
Bucket/Pan	66325	10.6
Public toilet (WC, KVIP, Pit)	168951	27.0
No facility (bush/beach)	71961	11.5
<b>Other</b>	2187	0.3
	<b>Total</b>	625744



# NEXT,

- *Assumptions / estimates required (mostly based on Expert interview).*

Year 2000			
	CONTAINMENT AND DISCHARGE ARRANGEMENT	Number	% OF POP SERVED
	Water closets to sewer	70,000	11
Safe	Septic tank to soak pit	74,425	12
	Septic tank to don't know where	10,632	2
	Fully lined tank sealed - with no outlet or overflow	21,264	3
	Unlined pit latrine - no outlet or overflow	81,631	13
Unsafe	Partially lined pit	143,910	23
	Open defecation	71,961	12
	User interface failed, damaged, collapsed or flooded	68,512	11
	Containment (septic tank or tank or pit latrine) failed, damaged, collapsed or flooded	83,410	13
	<b>TOTAL</b>	<b>625,745</b>	<b>100</b>

## STEP 2. EMPTYING AND TRANSPORT OF EXCRETA

- Estimation of the proportions of excreta for each emptying technique as well as transport mechanism.
  - Status of sewers.
  - Practices for fecal sludge (FS) management.
    - Integration of indiscriminate dumping.
- In 2000, the FS collected and delivered to treatment plants was ~ 58% of all FS generated.

# STEP 3. TREATMENT OF EXCRETA AT OFFICIAL MANAGEMENT SITES

- Data obtained from reports or experts.
- Example: in 2000
  - Amount of FS processed by treatment plants:
    - Teshie: 14,386 m<sup>3</sup> in 1999. This plant was operational in the year 2000.
    - Achimota: 37,835 m<sup>3</sup> in 1999. This plant was partially operational during the year 2000. We estimated that 50% of the FS was treated properly [expert consultation].
    - Korle Gonno (also called Lavender hill): 39,309 m<sup>3</sup> in 1999. This was a dumping site.
  - The treatment level was ~ 36% for the received FS.

# STEP 3. TREATMENT OF EXCRETA AT OFFICIAL MANAGEMENT SITES

- Wastewater treatment plants:
  - The UASB plant was in operation.
    - Coverage: about 1,000 households plus some industries / institutions.
      - Coverage in Tema was ~ 60%, i.e. about 51,400 households plus some industries / institutions.
      - Various mini sewers.
  - We estimated the level of treatment to be up to 60% of wastewater collected.

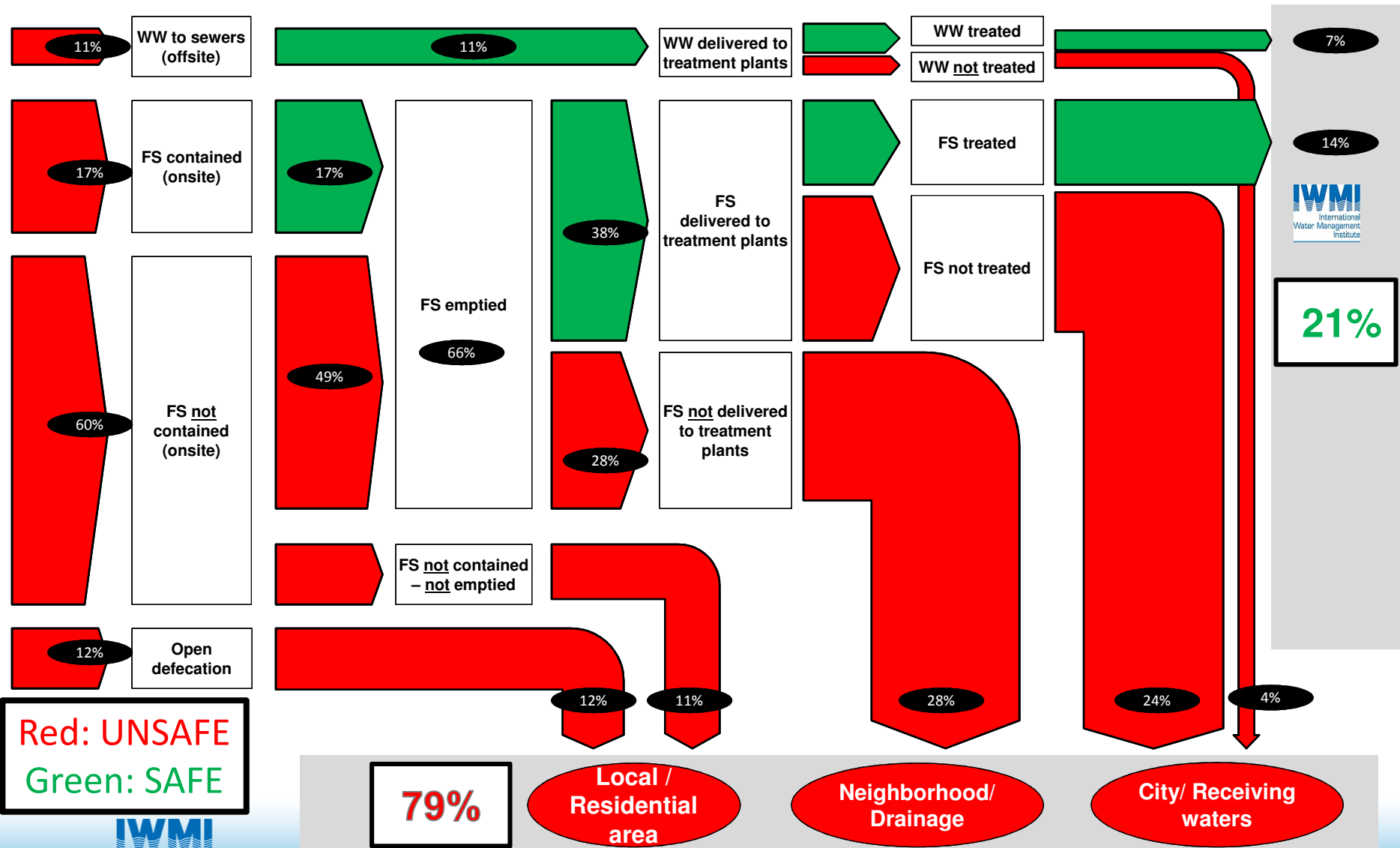
# STEP 4. END-USE/ DISPOSAL

- It does not yet capture reuse or recycling.
- Options:
  - Local / Residential area.
  - Neighborhood/ Drainage.
  - City/ Receiving waters.

Link to the current SFD methodology:

<http://www.susana.org/en/resources/library/details/2357>

# EXCRETA FLOW DIAGRAM: GREATER ACCRA, YEAR 2000



Red: UNSAFE  
Green: SAFE

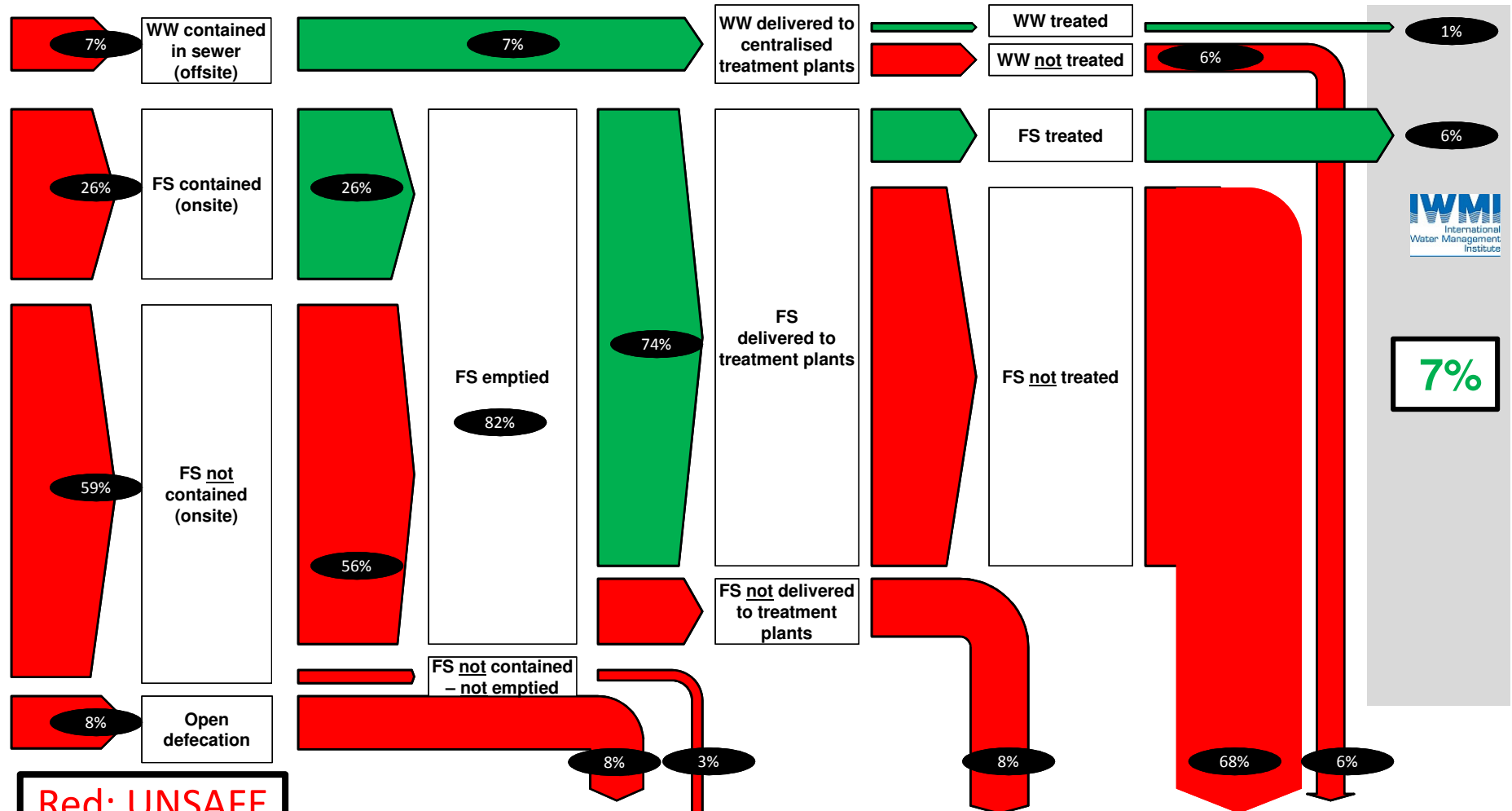


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Source: IWMI, 2015

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# EXCRETA FLOW DIAGRAM: GREATER ACCRA, YEAR 2010



7%

Red: UNSAFE  
Green: SAFE

93%

Local / Residential area

Neighborhood/ Drainage

City/ Receiving waters



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Source: IWMI, 2015

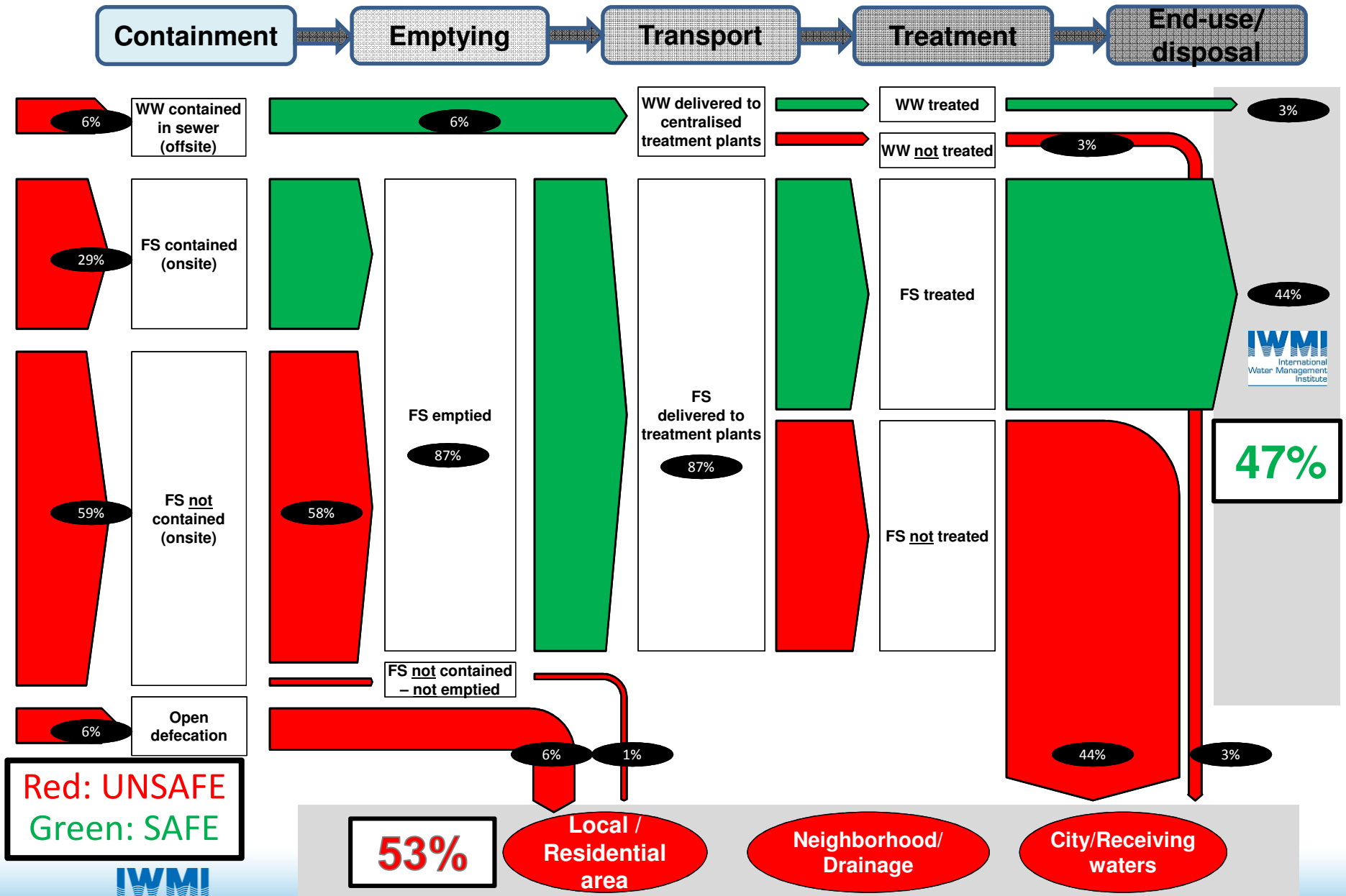
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# FOR THE YEAR 2025,

- Key assumptions.
  - Growth rates to assess population increase
  - Trend between 2000 and 2010 to estimate changes between 2010 and 2025
  - Integration of expected / upcoming projects affecting operation/construction of treatment plants



# EXCRETA FLOW DIAGRAM: GREATER ACCRA, YEAR 2025



**Red: UNSAFE**  
**Green: SAFE**



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Source: IWMI, 2015

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# WHAT DOES IT SHOW?

## Between 2000 and 2010:

- The amount of excreta released untreated into water bodies increased from 28% to 74%.
  - Collection rates for excreta and delivery at designated dumping sites increased.
    - Consequently, the FS contaminating the neighborhood (indiscriminate dumping, manual emptying) reduced, from 28% down to 8%.
  - The local contamination (due to open defecation or inadequate emptying process) also reduced, from 23% to 11%.

### *Why?*

- *Positive impact of enforcement.*
- *Lack of space causes all septic tanks to be emptied and reused.*
- *Strong effort on development of public toilet (private sector contribution).*

# MAJOR ISSUE IS WITH TREATMENT PERFORMANCE

Proportion of excreta safely managed reduced drastically: from 21% down to 7%.

- The treatment plant performance reduced:
  - From 14% of all excreta generated to less than 6% for FS, and
  - From 7% to less than 1% for wastewater.

## *Why?*

- *Reliance on electricity results in technology fragility.*
- *No sustainable revenue stream for operation and maintenance.*
- *Limited enforcement of effluent standards.*

# WHAT CAN WE EXPECT FOR 2025?

- If the same trend is maintained for FS collection rates, then FS contaminating the neighborhood (indiscriminate dumping, manual emptying) could disappear.
  - *Efforts to achieve enforcement of laws must be continued.*
- The local contamination (due to open defecation or inadequate emptying process) should continue to reduce from 11% to 7%, but would not disappear.
  - *More efforts needed to ensure access to toilet facilities and trigger behavior change.*
- Wastewater and fecal sludge treatment performance could increase drastically: from 7% to 47%.
  - *Serious attention required to ensure sustaining the operation of these plants, which has been a major gap in the past.*



### **III. EXCRETA MANAGEMENT THROUGH RECYCLING SOLUTIONS.**

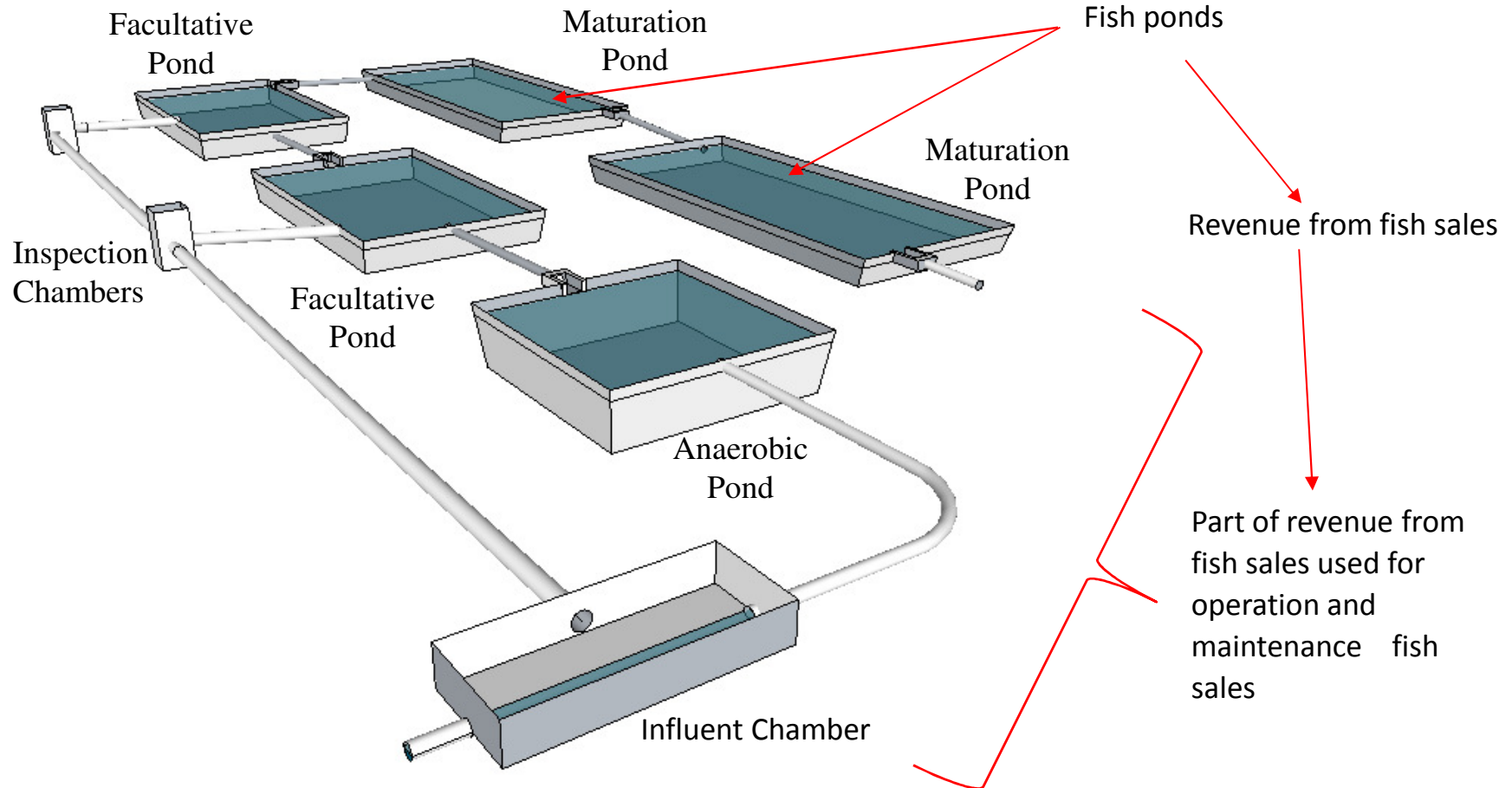
# WHY USE A BUSINESS MODEL APPROACH?

Generation of revenue which could help sustain the operation of the treatment plant.

## What is needed for successful implementation?

- Establishment of market requirements (e.g. demands and user preferences)
- Strong policy support
  - Certifications and permitting
  - Subsidies?
    - The willingness/ ability to pay may be lower for some customer segments
- Ensure continuous quality control for products
  - Properly address health concerns.

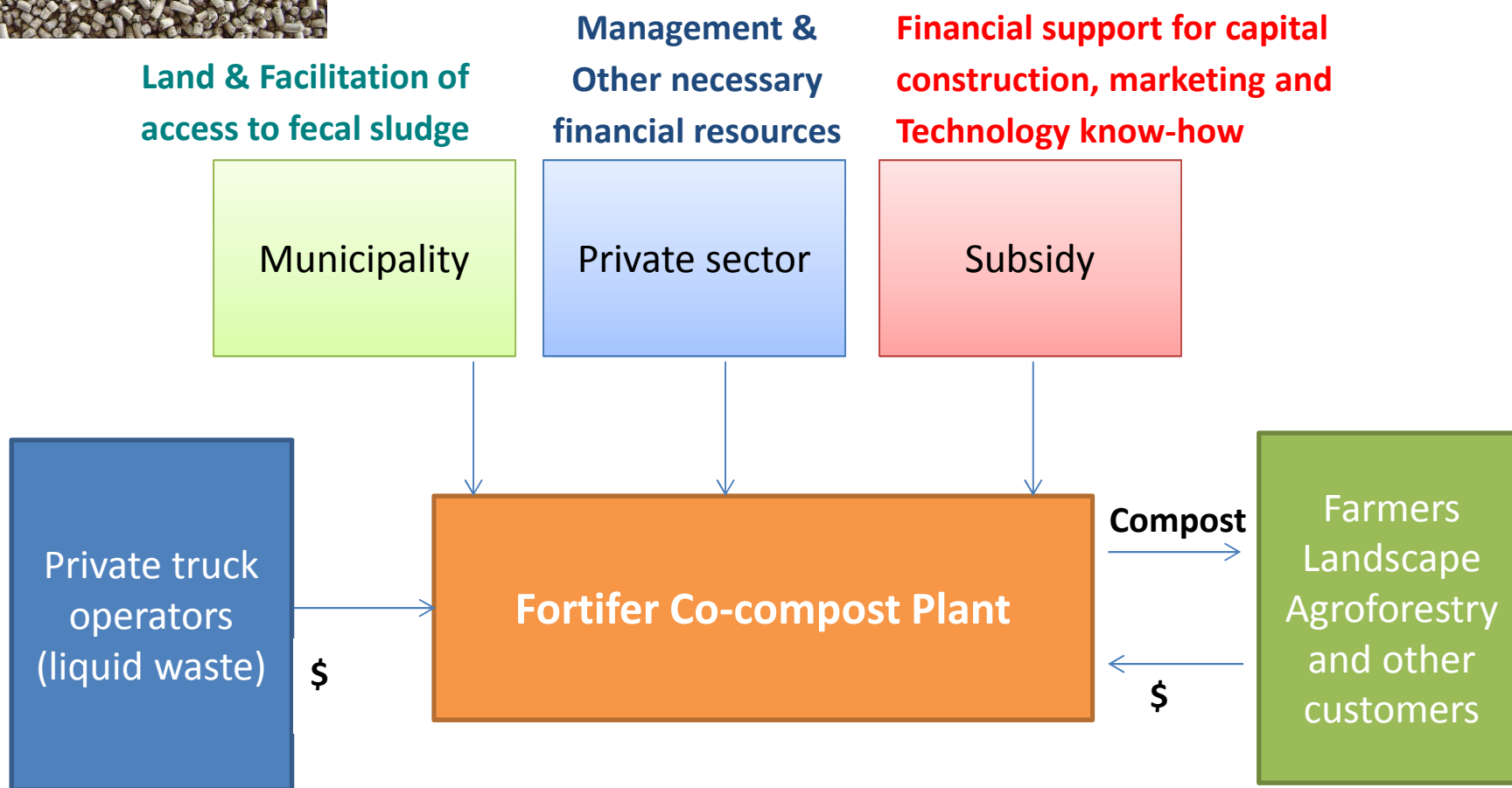
# OPTION 1: USE OF TREATED WASTEWATER E.G. FOR FISH PRODUCTION



Source: Sauchelli Toran, 2015



## Option 2: Production Of Co-compost From Excreta And Municipal Solid Waste



Source: IWMI, 2015



# REAL BENEFITS FOR AGRICULTURE

Fortifer in powder			
Irrigated Site	Dawhenya	Kpong	Okyereko
Year of trial	2011	2010	2012
<b>Yield difference</b>	+50% with Fortifer powder	+24% with Fortifer powder	<ul style="list-style-type: none"> <li>+32% on salt affected soils</li> <li>+38% on normal soils</li> </ul>

Source: Ofosu-Budu, 2010, 2011, 2012



**Rice field (conventional Farmer's practice)**



**Rice field with Fortifer.**

## Farmers' practice

200 kg of NPK 15-15-15 and 100 kg of AS. Top dressed with 50 kg of urea

1,000 kg of enriched co-compost (3% N).  
Top dressed with 30 kg of ammonium sulfate (AS)

# Option 3: Production Of solid Fuel (Briquettes) From Municipal Wastes And Excreta



Source: IWMI, 2015

# IV. CONCLUSIONS



# WHAT APPLICATION FOR THE SFD ?

- It could allow to monitor development in sanitation and waste (i.e. sewage/septage) management:
  - SDG 6.2: By 2030, achieve **access to adequate and equitable sanitation and hygiene** for all and end **open defecation**, paying special attention to the needs of women and girls and those in vulnerable situations.
  - SDG 6.3: By 2030, improve **water quality** by **reducing pollution, eliminating dumping** and minimizing release of hazardous chemicals and materials, **halving the proportion of untreated wastewater** and substantially increasing recycling and safe reuse globally.



- It could allow to compare cities once standard method is applied.

# SFDs Are Still In Development!

- But SFDs could give opportunity to policy makers to discuss the sanitation issue, with the aim of improving its status in the country.
  - It also gives direction concerning the best applicable solutions.
- SFDs have some gaps.
  - We should bear in mind that estimations are made (due to lack of adequate data) at different levels.
  - Do not capture heterogeneity.
  - Do not capture reuse.

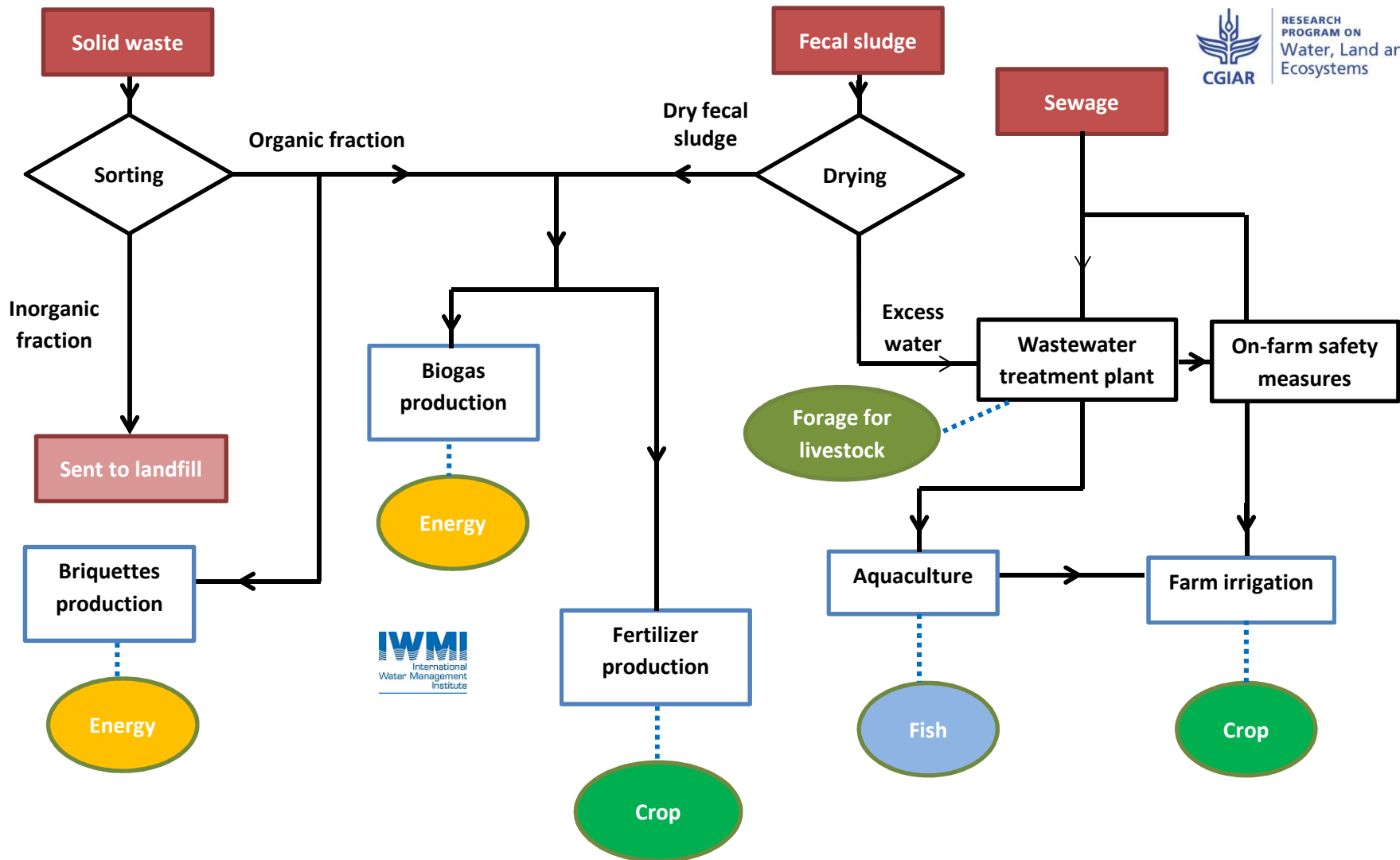
# SUMMARY FOR GREATER ACCRA



- The SFDs time series for Greater Accra shows that:
  - Progress is already made in some areas, such as:
    - Collection and transport of the fecal sludge.
    - Open defecation.
    - Construction of new waste treatment facilities.
  - There are also areas of concern:
    - Continuously ensure adequate enforcement and relevant policy.
    - Pursue efforts for awareness raising.
    - Improve the sustainability of treatment plants.
- There are business solutions that are currently being tested in Ghana and are showing promising results.



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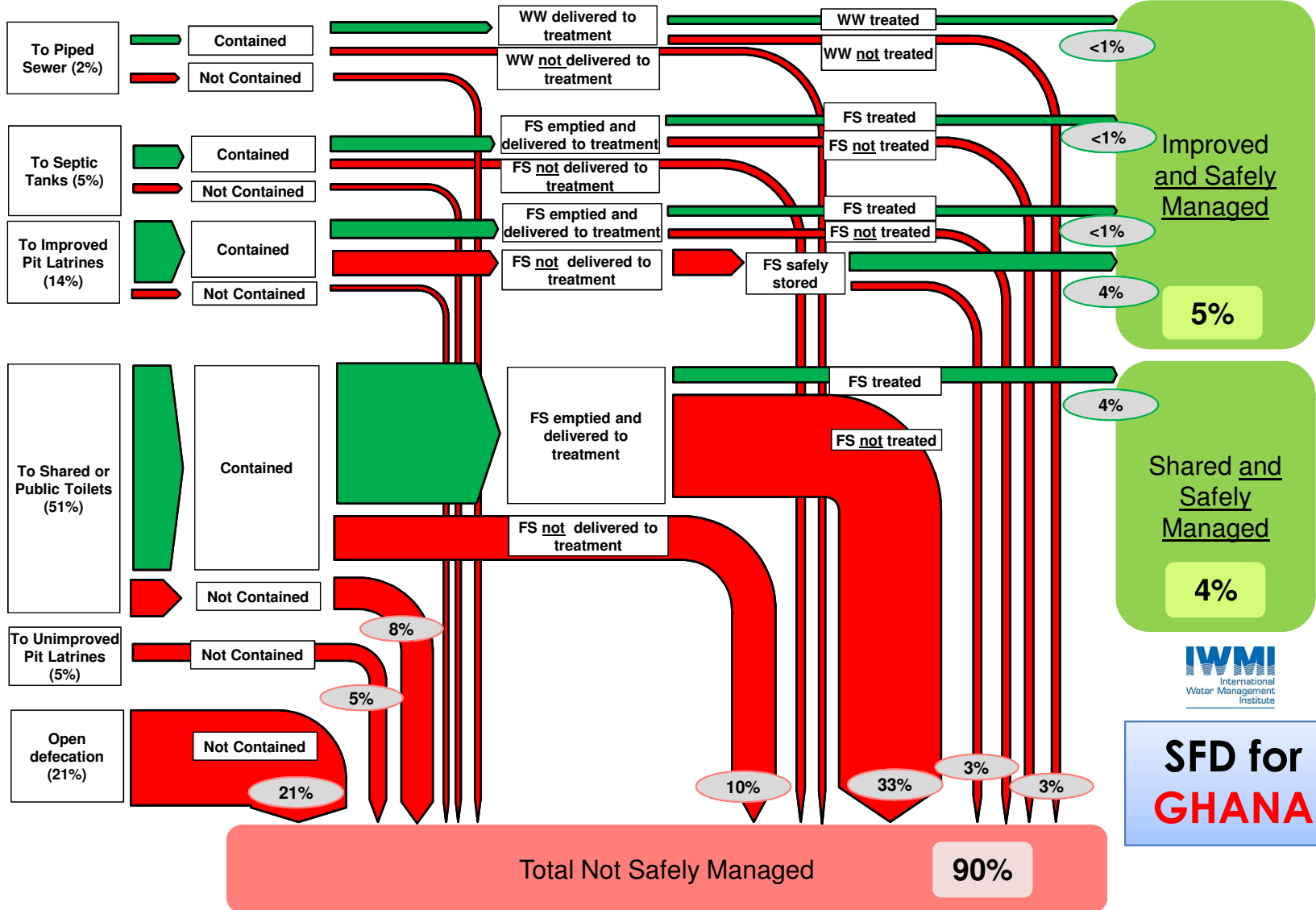
All these innovations will contribute to sustaining the operation of treatment plants as well as achieving productive use of resources.

15\*-21%

Improved Sanitation

Unimproved Sanitation

79-85\*%



Improved and Safely Managed  
5%

Shared and Safely Managed  
4%

IWMI International Water Management Institute  
**SFD for GHANA**

. Di Mario L, Peal A, Nikiema J, Drechsel P (work in progress, unpublished)  
 . Peal A; Evans B; Blackett I; Hawkins P; Heymans C (2013) J. Wat., Sanitation & Hygiene for Dev., 4 (3), 371-383;



# KEY MESSAGES!



- We therefore need:
  - To design treatment plans in a way that allows reuse or recycling as much as possible.
  - To be strategic in selection of models to be implemented (taking into account demands for products and costs).
  - Coordinated efforts to ensure safe management of waste.
  - Adequate quality control for waste based products to safeguard public health.
  - To ensure public support through awareness raising.
- SFDs can help us monitor the progress we are achieving.

# SPECIAL THANKS TO:

## Donors:

- ✓ International Development Research Centre (IDRC)
- ✓ CGIAR Challenge Program on Water and Food (CPWF)
- ✓ Information and Communications Technology (ICT), Knowledge Management (KM), Urban Harvest; CGIAR
- ✓ European Commission (EC) / International Fund for Agricultural Development (IFAD) CGIAR Programme
- ✓ World Health Organization (WHO)
- ✓ Food and Agriculture Organization of the United Nations (FAO)
- ✓ Google.org
- ✓ Bill and Melinda Gates Foundation (BMGF)
- ✓ Department for International Development (DFID)
- ✓ Grand Challenges Canada (GCC);



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  - ✓ Jekora Ventures Ltd.
  - ✓ Volta Ghana Investment Co. Ltd.
  - ✓ Tema Metropolitan Assembly (TMA)
  - ✓ Many more.

***And also to you!***