Urban Sanitation Lab'2010

City Sanitation Plan for Kalol Nagarpalika

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Background

'*Kalol*' needs immediate attention for provision of better *Sanitation*

AIM

*"To prepare City Sanitation Plan of Kalol City for providing **Sustainable** Sanitation Solutions in an **Equitable** & **Integrated** manner"*

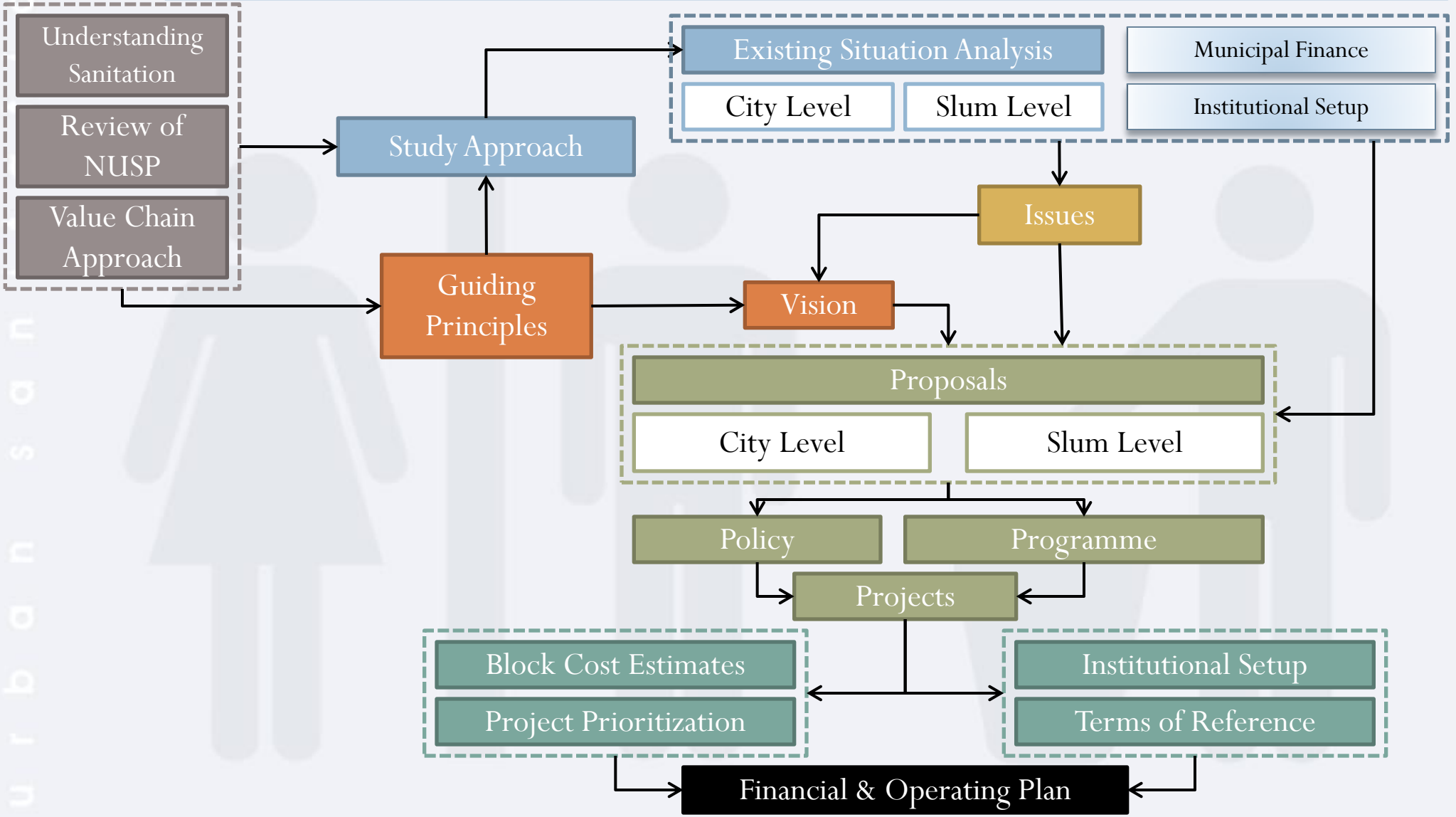
OBJECTIVES

- *To ensure sanitation measures for all*
- *To integrate the sanitation value chain*
- *To provide sustainable financial and institutional arrangements for sanitation*

Methodology

Aim

"To prepare City Sanitation Plan of Kalol City for providing Sustainable Sanitation Solutions in an Equitable & Integrated manner "



What do we mean by *Sanitation?*

'Sanitation' is the hygienic means of promoting health through *prevention of human contact with the hazards of wastes* (solid & liquid) (WHO)

'Sanitation' generally refers to the *provision of facilities and services* for the safe disposal of human urine and faeces. (WHO)

'Sanitation' is defined as safe management of human excreta, including its *safe confinement treatment, disposal* and associated hygiene-related practices. (NUSP)

'Sanitation' refers to the *safe management and disposal* of human excreta. (WATER AID)

The methods for the safe and **sustainable management of human excreta**, including the **collection, storage, treatment and disposal of faeces and urine**. (MoUD, GoI)

SANITATION

SAFE MANEGEMENT & DISPOSAL OF **'HUMAN WASTE'**

- *Waste Water*
- *Storm Water*
- *Solid Waste*

National Urban Sanitation Policy, 2008

National Urban Sanitation Policy (NUSP) was introduced by MoUD to address issues like:

- Poor Awareness
- Social and Occupational aspects of Sanitation
- Fragmented Institutional Roles and Responsibilities
- Lack of an Integrated City-wide Approach
- Limited Technology Choices
- Lack of Demand Responsiveness

VISION OF NUSP:

*'All Indian cities and towns become **totally sanitized**, healthy and liveable and ensure and **sustain good public health and environmental** outcomes for all their citizens with a special focus on hygienic and **affordable sanitation** facilities for the **urban poor and women**'.*

Why City Sanitation Plan (CSP)?

- City Sanitation Plan provides an ***Integrated Holistic Approach keeping in view ULB's affordability & finances*** to address the Sanitation issues of a city.:

  - ❑ **Waste Water Management**
  - ❑ **Storm Water Drainage**
  - ❑ **Solid Waste Management**

Components of CSP

How should we address *Sanitation?*

Components of CSP

POLICY

- Institutional Roles & Responsibilities
- City-wide Approach
- Client focus and Generation of Demand
- Sustained Improvements
- Reaching the un-served and poor
- Technology Choice
- Awareness Generation for changing mindsets

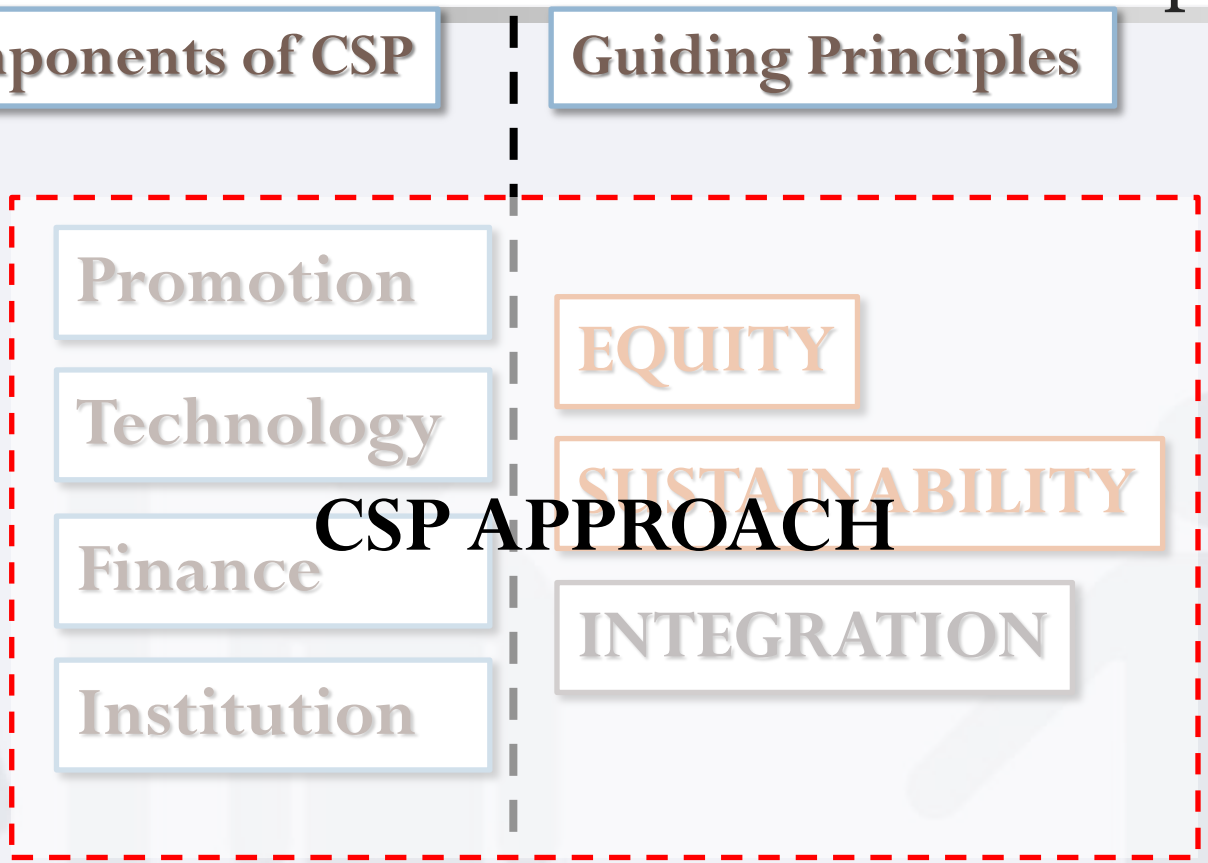
INSTITUTIONAL

FINANCE

TECHNOLOGY

PROMOTION

Components of CSP	Guiding Principles
Promotion	EQUITY
Technology	SUSTAINABILITY
Finance	INTEGRATION
Institution	


Components of CSP
Guiding Principles
Promotion
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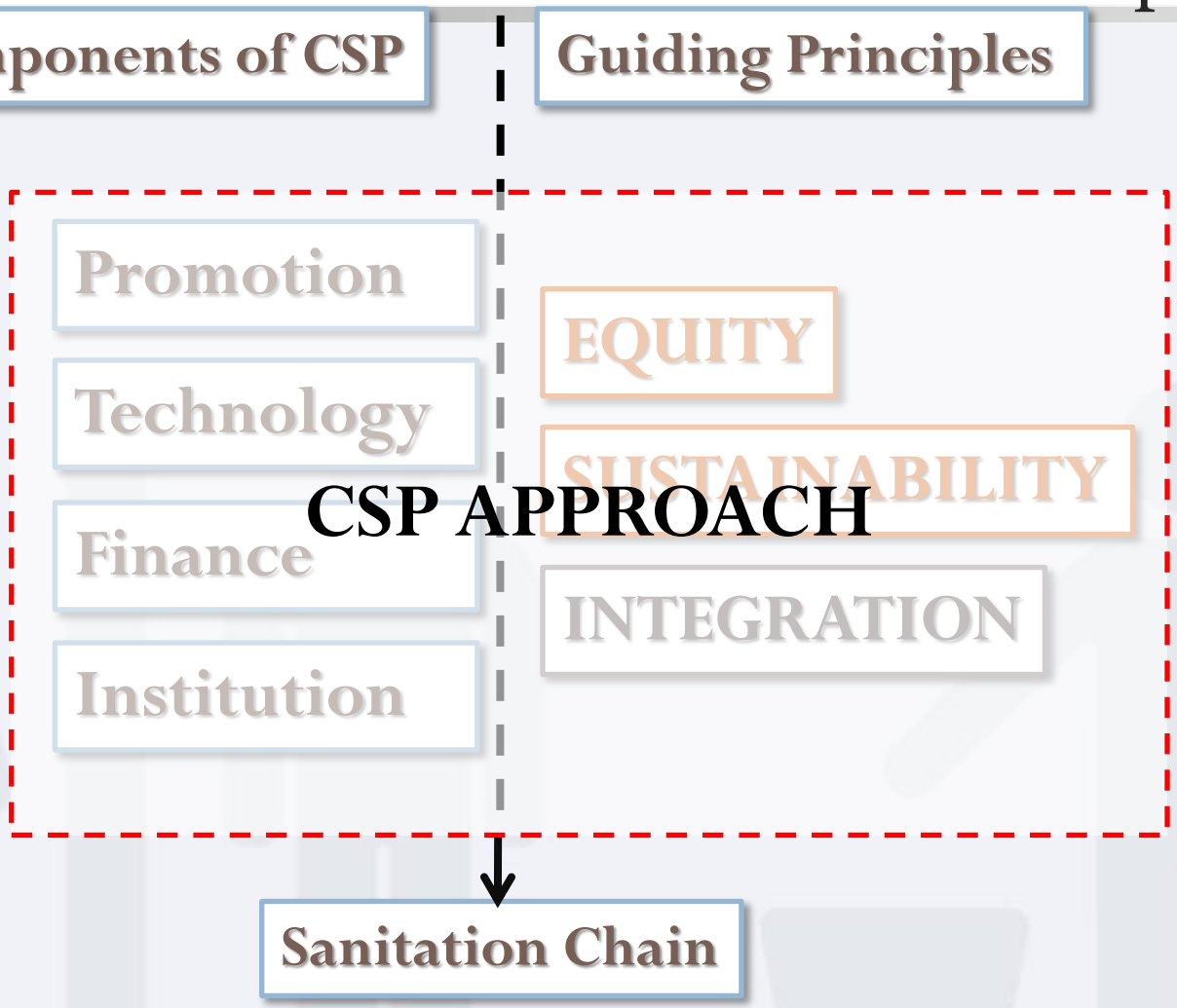
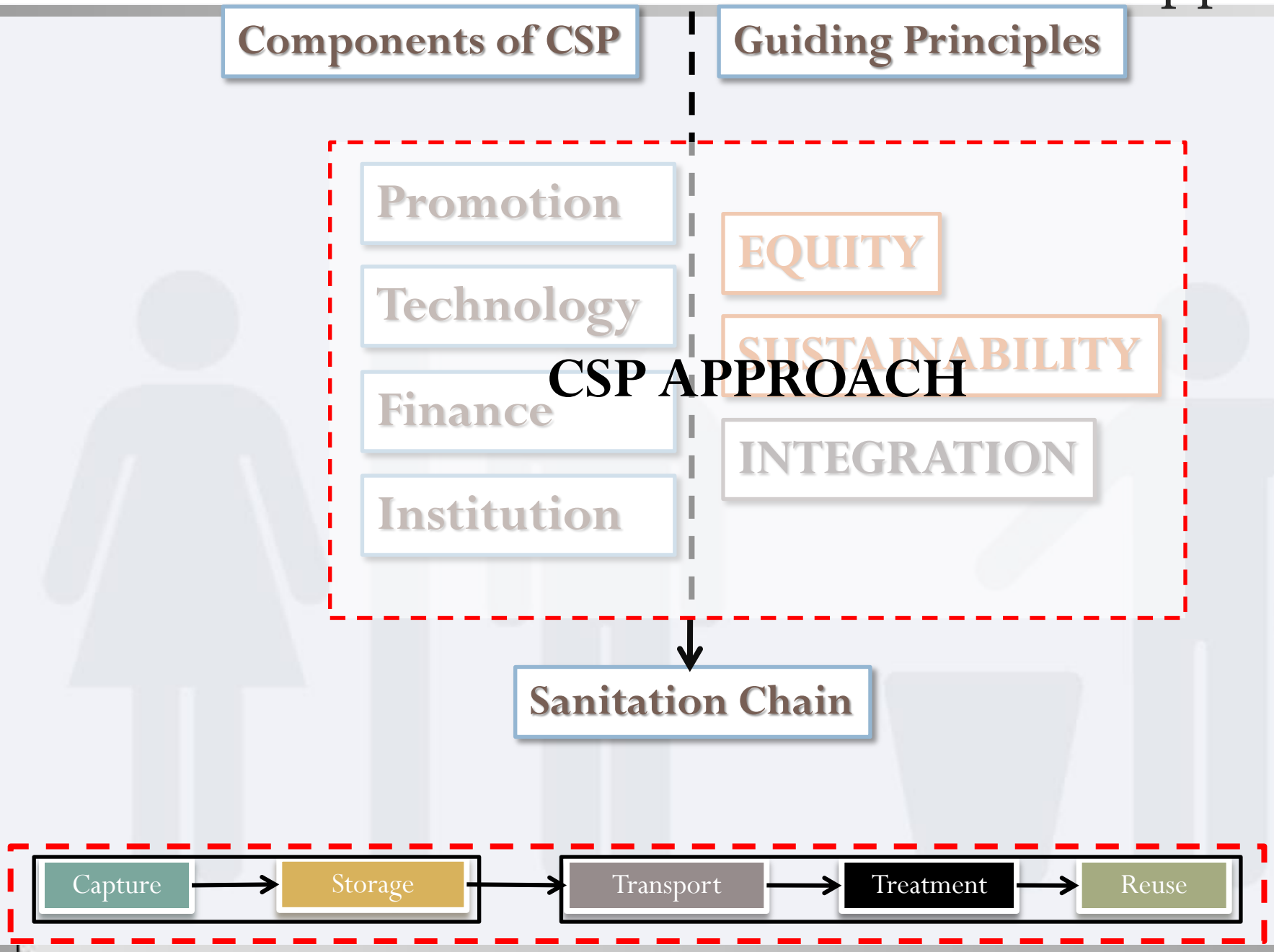
Institution
EQUITY
SUSTAINABILITY
INTEGRATION
CSP APPROACH



Sanitation Chain takes the Total processes starting from Capture to the Disposal and Reuse for SWM,WW & SWD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Guiding Principles
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EQUITY
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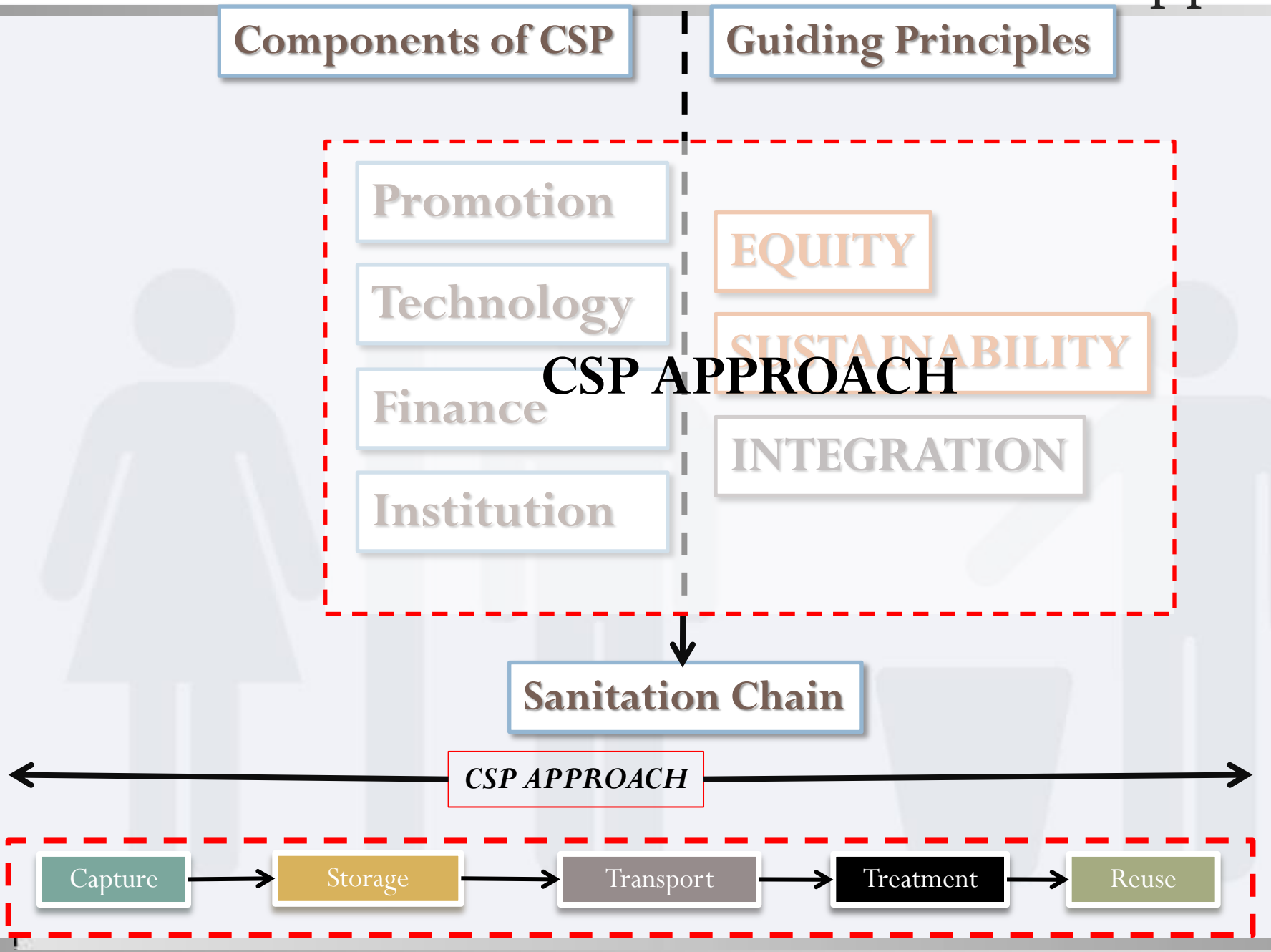
CSP APPROACH
Sanitation Chain
Capture
Storage
Transport
Treatment
Reuse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Sanitation Chain
CSP APPROACH
Capture
Storage
Transport
Treatment
Reuse

CSP Approach

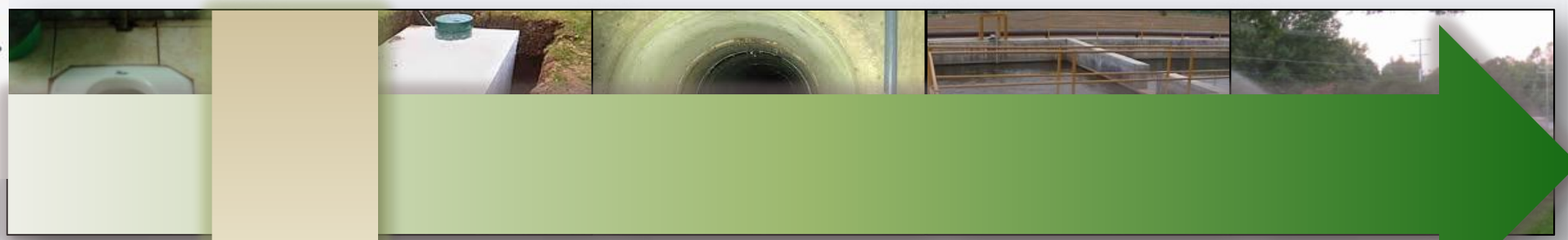
Capture → Storage → Transport → Treatment → Reuse

Institution

Finance

Technology

Promotion



WASTE WATER MANAGEMENT

SOLID WASTE MANAGEMENT

STORM WATER MANAGEMENT

CSP Approach

METHODOLOGY

3 WEEKS	5 WEEKS	3 WEEKS	5 WEEKS
Preparatory Phase	**Existing Situation Analysis**	**Draft Proposals**	**Final Proposals**
Study of Project Development Process	**Secondary Data Collection:** ULB, PAS		
Study of procurement cycle ▪ **EOI** ▪ **RFQ** ▪ **RFP** ▪ **TOR**	**Primary Surveys:** ULB Officials , Workers, Slum Dwellers, Rotary Club, Hospitals, APMC, Syntex, Local Contractors, Anaganwadi		
Review of NUSP Concepts of: ▪ **CSP** ▪ **DPRs**			
Review of DPR's	**Physical Surveys:** - Marking Manholes, Bins, Community Toilets		
Study of: ▪ **Project Dev. Process** ▪ **EAI & SIA** ▪ **Institutional Framework** ▪ **Financial Mechanism**	**Perception & reconnaissance survey**		

CSP Approach

METHODOLOGY

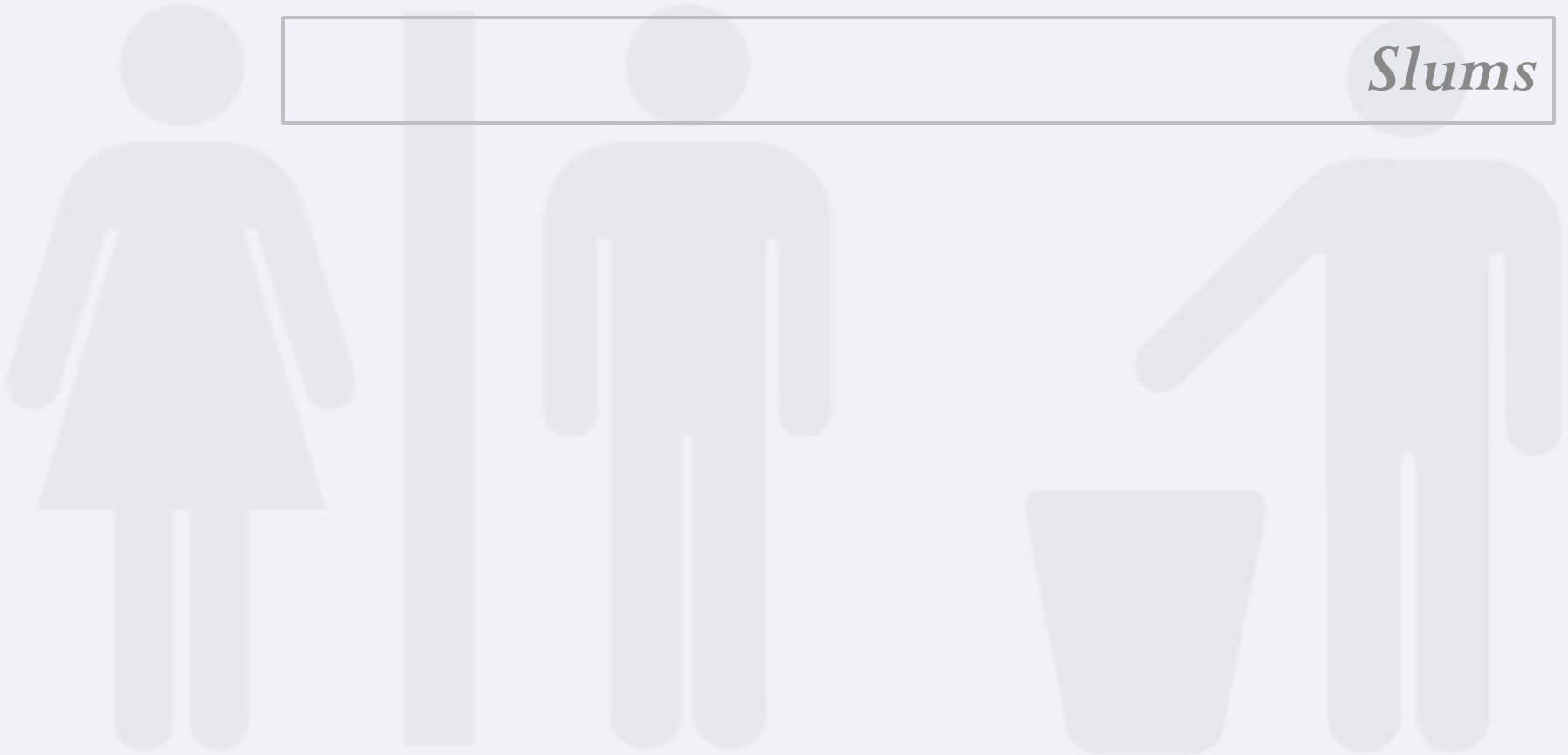
3 WEEKS	5 WEEKS	3 WEEKS	5 WEEKS
Preparatory Phase	Existing Situation Analysis	Draft Proposals	Final Proposals
	Hot Spot Identification	Sector wise Proposals	Identification of Projects
	Zonal Level Analysis		Prioritization of Projects
	City Level Analysis	City Level Proposals	Phasing
			Financial Assessments

APPROACH

Study Area Profile

City Level

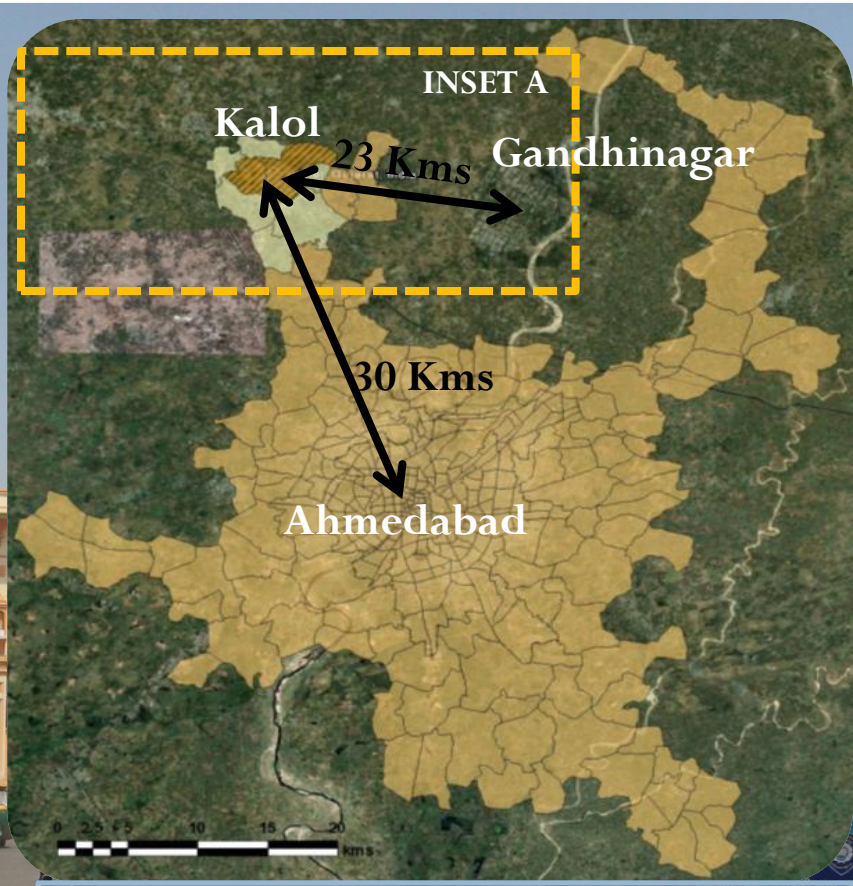
Slums



City Level

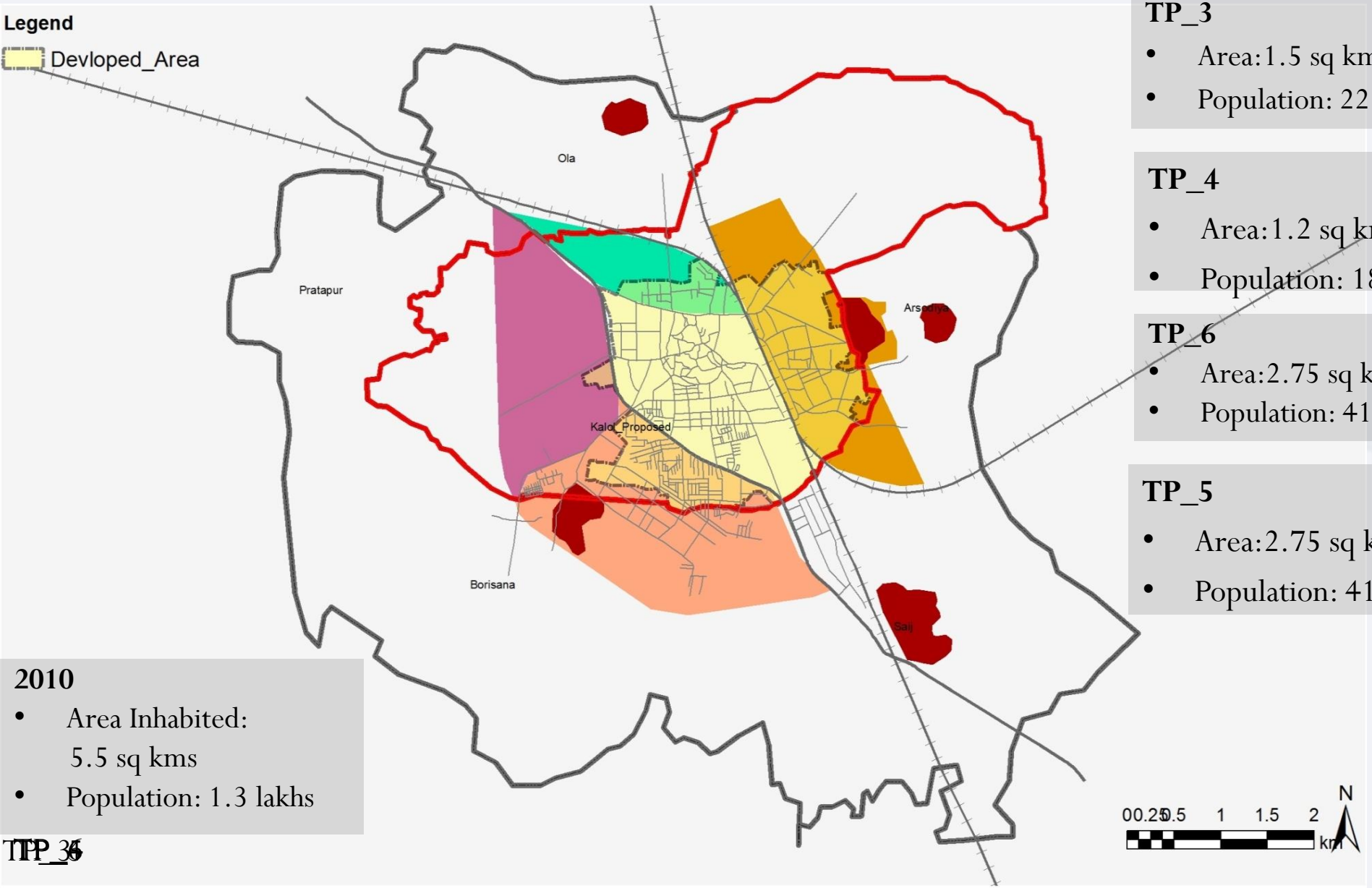
BACKGROUND:

Area	17.24 Sq Kms
Population (2001)	100,008 (Class A Town)
Estimated Population (2041)	235,000
Slum Population	30,318
Population growth	4.0% Annually
Floating population (Est.)	10,000 daily
Road Length	97 Km (Pucca), 49 km (Kutcha)



1) 2nd largest town of the District
2) 87% Urban Population of Taluka Resides in Kalol City
3) Part of Auda

Development Profile



TP_3

- Area:1.5 sq kms
- Population: 22,500

TP_4

- Area:1.2 sq kms
- Population: 18,00

TP_6

- Area:2.75 sq kms
- Population: 41,250

TP_5

- Area:2.75 sq kms
- Population: 41,250

2010

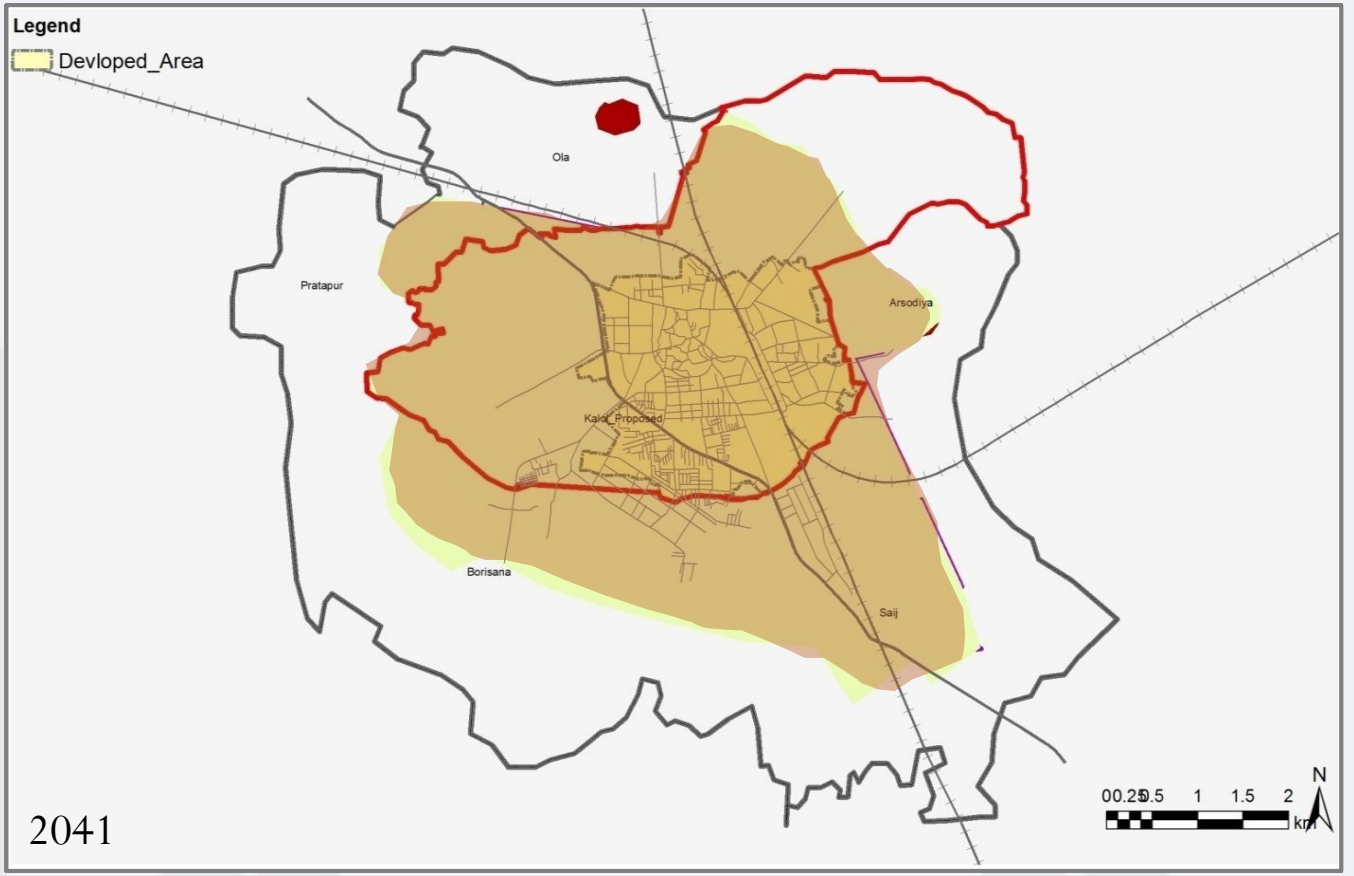
- Area Inhabited: 5.5 sq kms
- Population: 1.3 lakhs

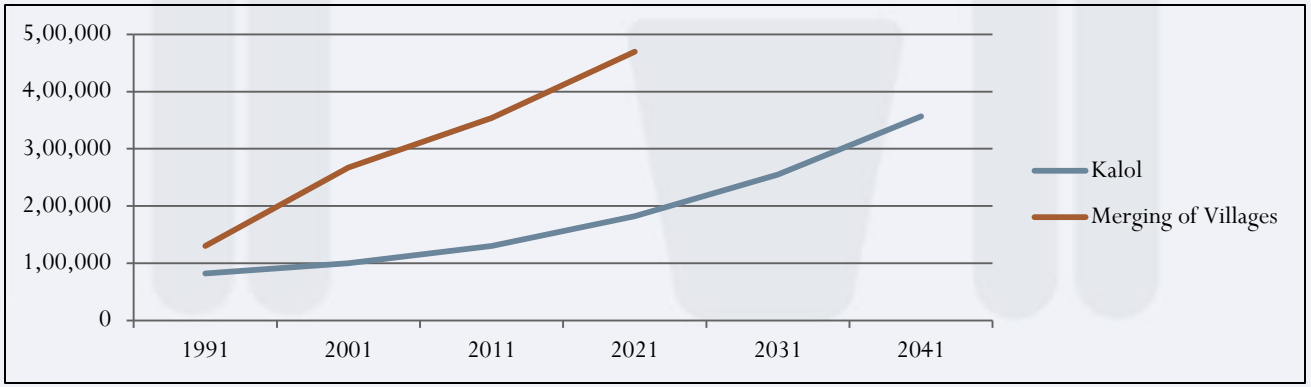
TP_36

2010

- Area Inhabited: 5.5 sq kms
- Population: 1.3 lac

Year	Population	Area
2011	1,30,000	8.7
2021	2,66,998	17.8
2031	3,54,039	23.6
2041	4,69,456	31.3



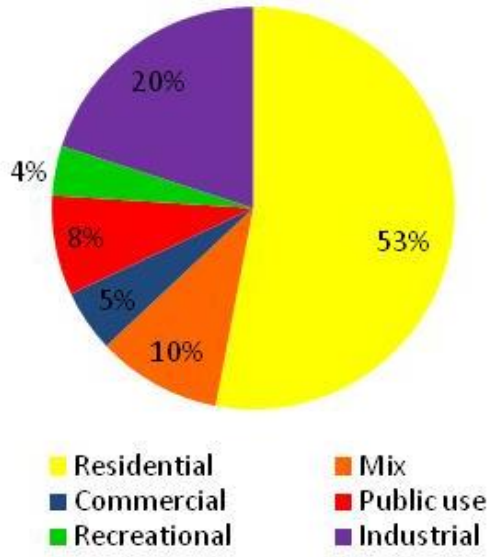


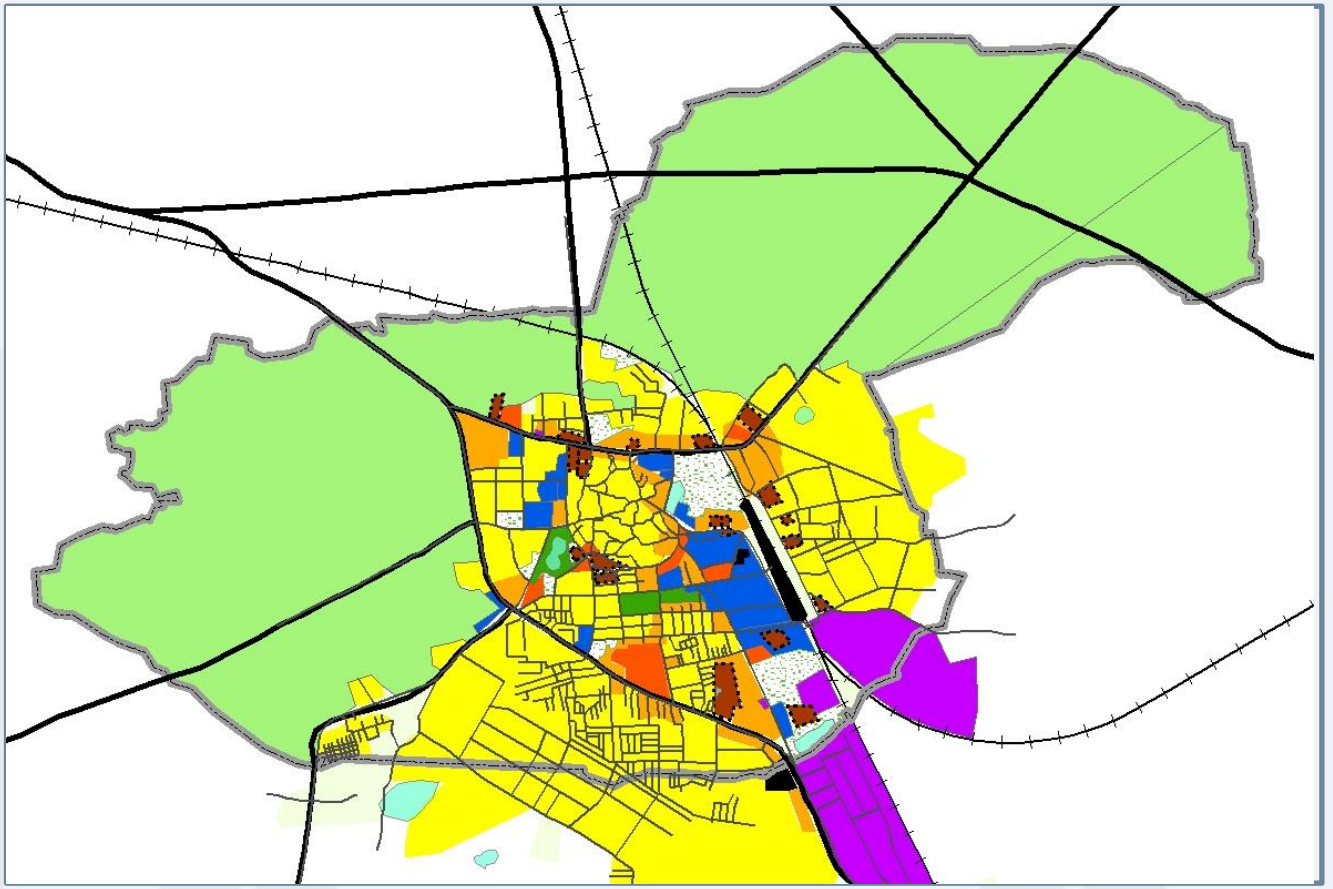
Landuse

17.24 sq kms Area

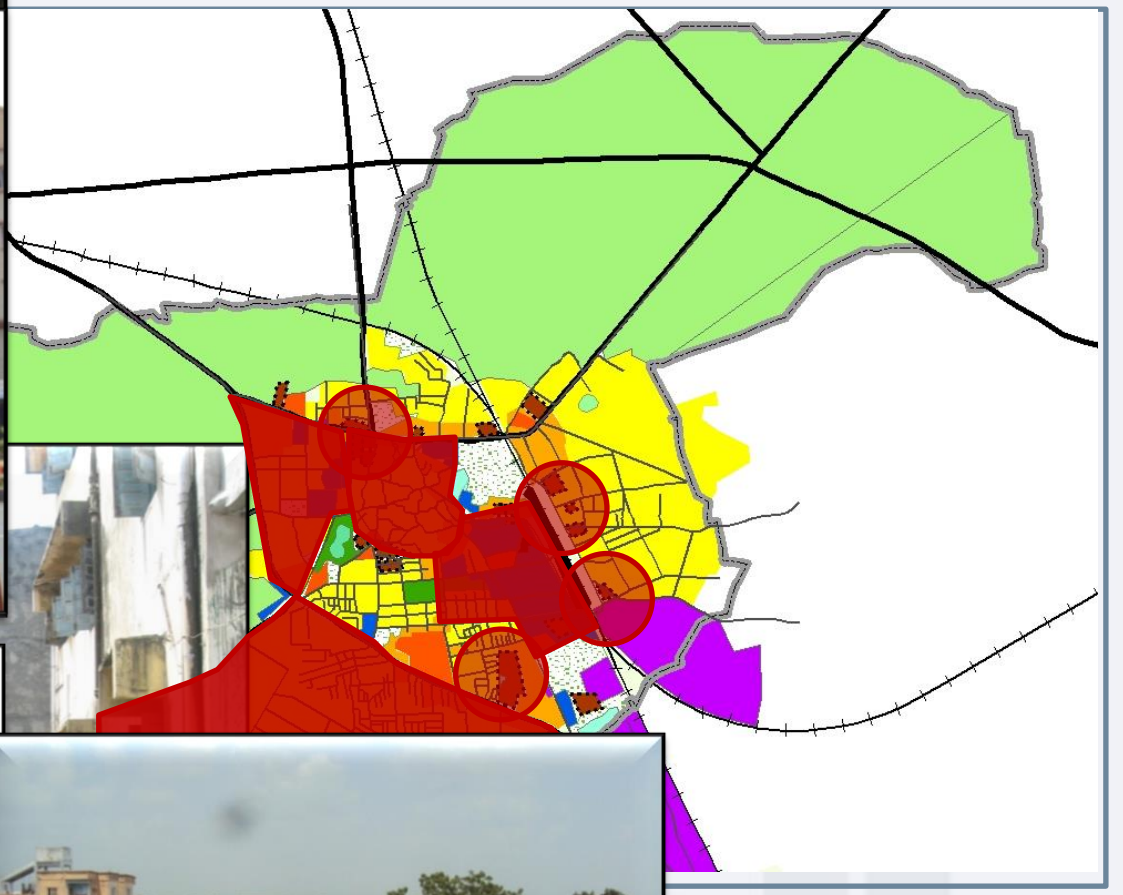
5.5 sq kms inhabited area

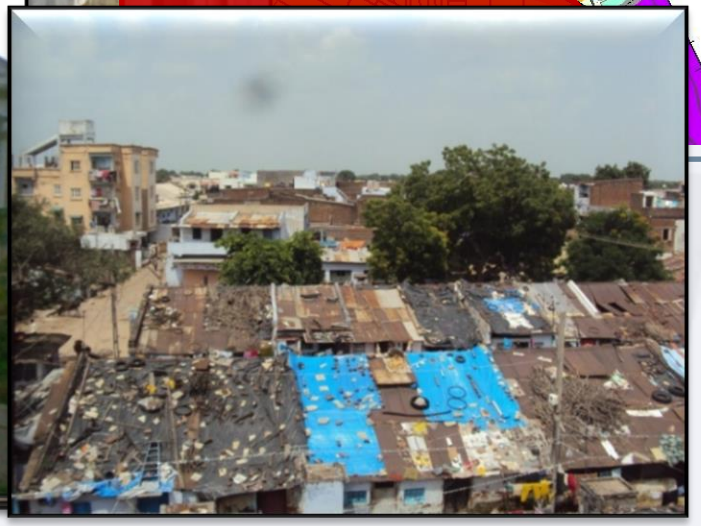
Inhabited Area Landuse breakup



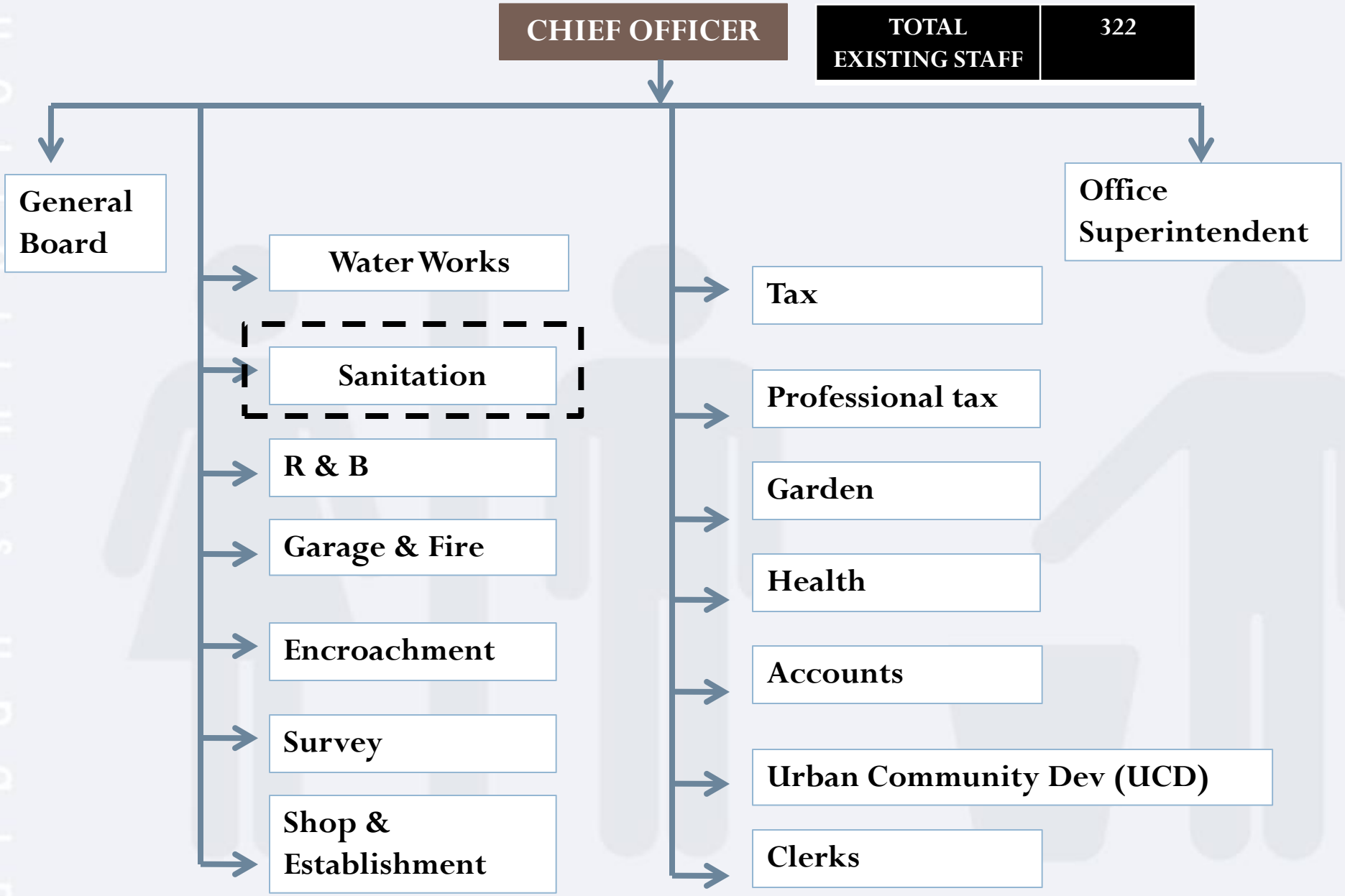


Character of the City



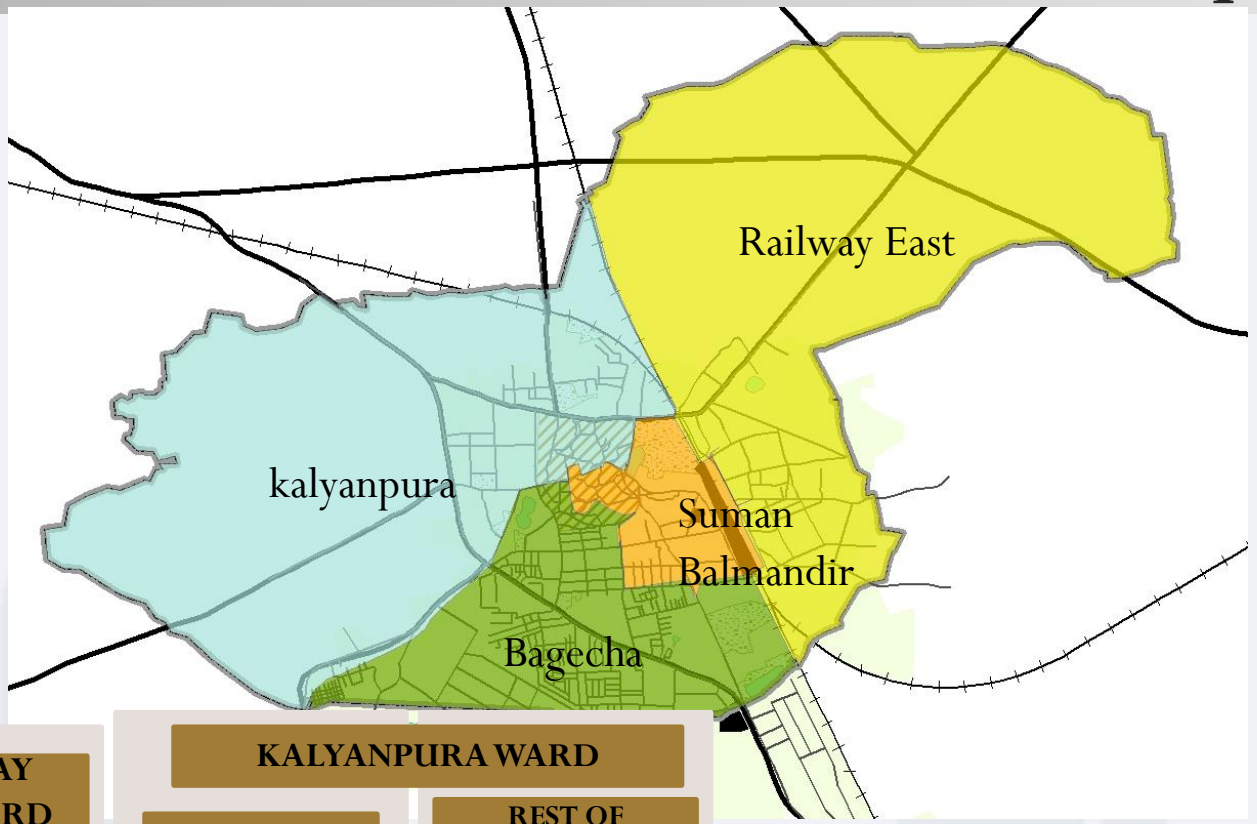


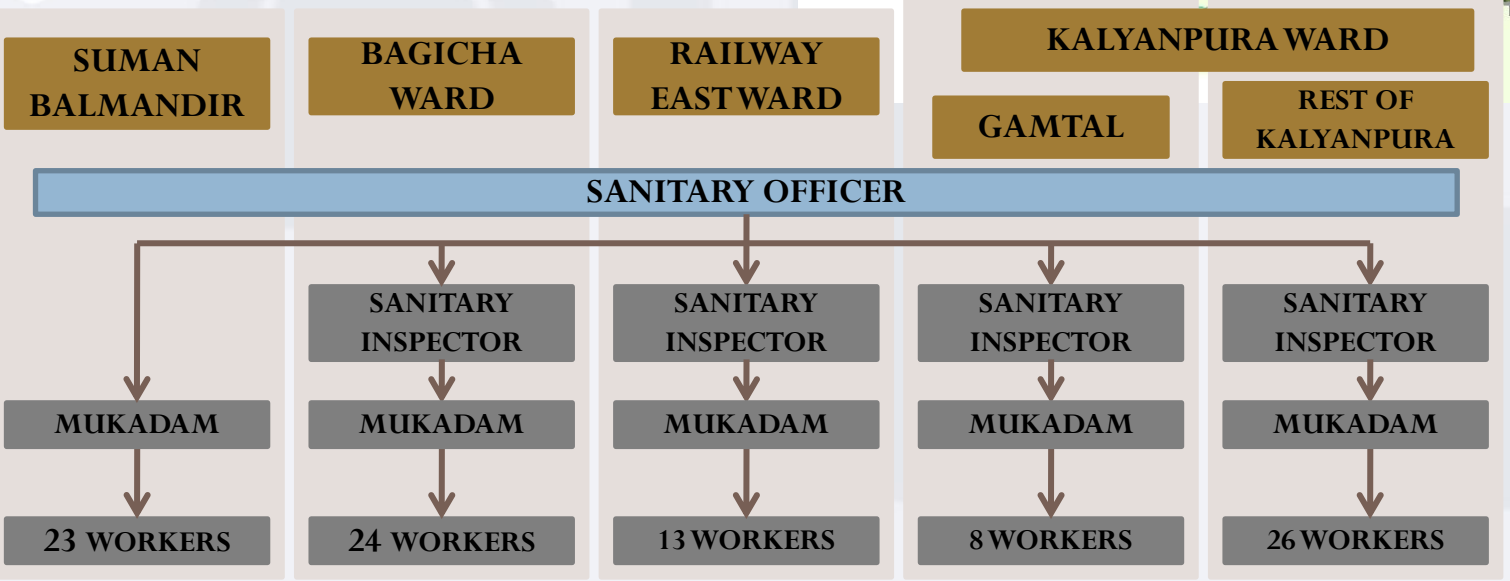
Institutional Set-up



Institutional Set-up

HEAD	EXISTING NUMBERS	RECOMMENDED (CPHEEO)
Asst. Engineer	0	1
Sanitary Officer	1	2 (EVERY 1 LAC POP)
Sanitary Inspector	4	3 (EVERY 50,000 POP)
Sanitary Sub Inspector	0	12 (EVERY 25,000 POP)
Mukadam	5	8 (EVERY 12,500 POP)
Workers	94 + 30	136





Slums

Karjisan ni Chali

Gas lines

Water storage

Location: Ward no. 14
Land Ownership: Bharat Mill
Area: 3.76 Ha
No of HH: 1000 HH
Population: 4,500
Density: 1,216 PpHa
Residents: Mill workers

Sevices:

- No CBO/NGO working
- Light connection available
- Street Lights in 2 chawks
- Paved pathways with stone and concrete
- Gas lines from Sabarmati Gas line (Rs. 400/month)
- Harikrupa Hospital nearby

Water Supply:

- Individual Connection since last 50 yr
- Tax of Rs. 600/annually
- Water fetched from Railway station due to poor quality of water

Back flushing of lines

Toilets built under scheme

Flood points

- Nearest sewer line: 200 mtrs.

No. of HH	550 HH	
No. of HH with Individual Toilets	440 HH	80%

Vgaktigat Shauchalya Scheme:

- Rs 2000/Toilet paid

Toilets built under VS scheme	308 HH	70%

Toilets:

- No. community toilets within slum
- Nearest toilet at 200 mtr. distance
- Unused due to poor maintenance
- No open defecation found
- No soakpits found

Door to Door collection:

- Waste collected once in two days
- Collected in Tractor
- No segregation of waste done

Street sweeping:

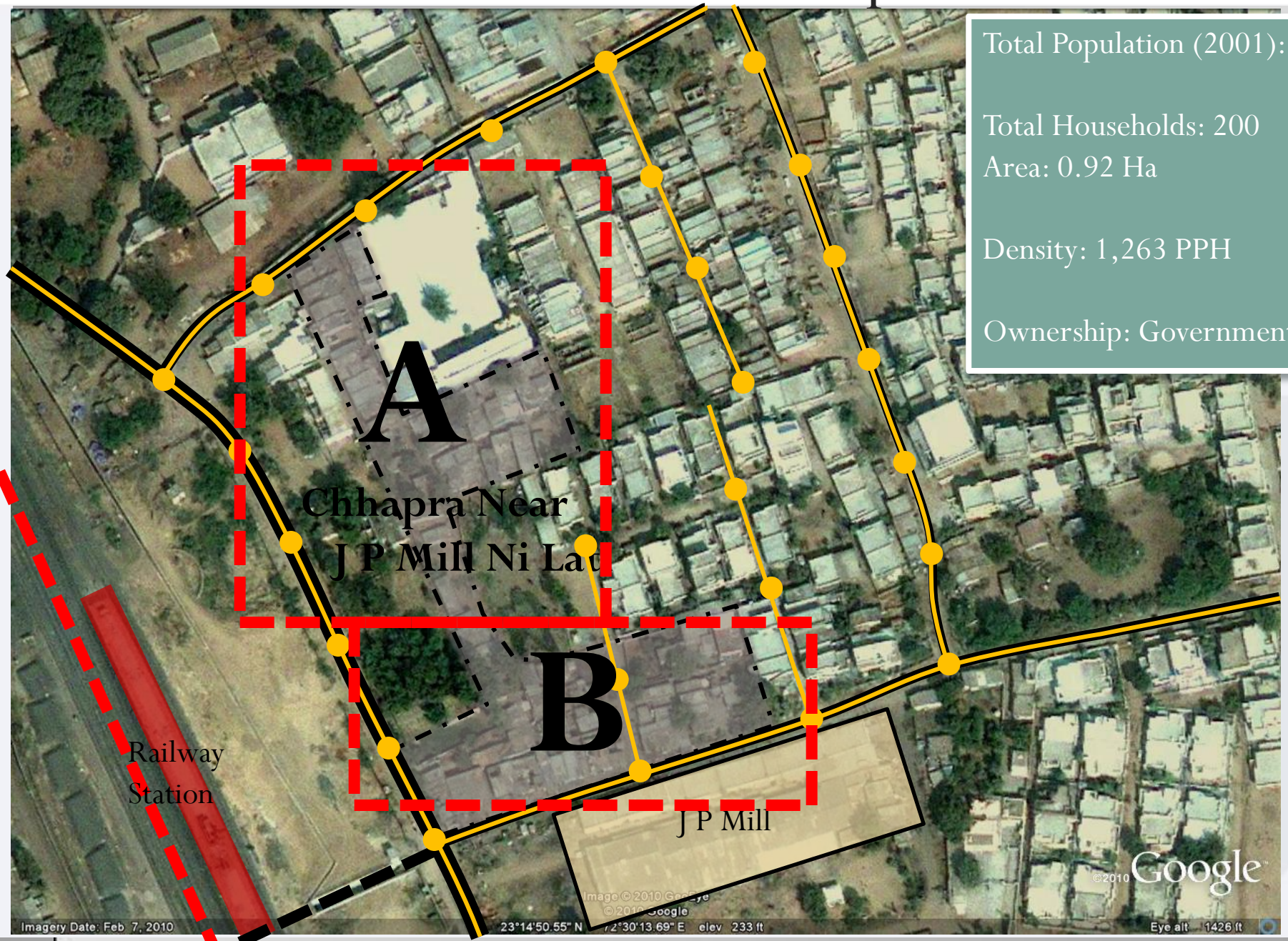
- Aprrox. 1 sq. km of Road length
- Swept daily by 1 worker

- Secondary storage bin outside slum
- Collection of waste from bins once a week

Summary

- Piped Water Supply- but low pressure
- Mixing of drinking water with waste water
- 80% of HH have toilets build under VS
- Overflowing of Sewerage once a week
- D-D collection done
- Paved Road
- Slums on private land- mill land

Chapra Near JP ni Lati



Total Population (2001): 1,162

Total Households: 200
Area: 0.92 Ha

Density: 1,263 PPH

Ownership: Government Land

Chapra Near JP ni Lati

- Narrow Streets
- Kutcha Internal Roads
- Housing Typology: Kutcha / Semi-Pucca
- Domestic Fuel for Kitchen
- No Piped Water Supply
- No Solid Waste Collection
- No Street Sweeping
- Water Logging Problem

ZONE 'A' **Individual HH Toilet**
- With Soak Pits

ZONE 'B' **No Individual Toilet**

Indiranagar na Chapra

Area: 0.026 sq km.

DEMOGRAPHY

TOTAL POPULATION: 1636
TOTAL HH : 330
TOTAL MALE POP. : 786
TOTAL FEMALE POP. : 850
BPL CARD HOLDERS : 60-65 HH

The slum is divided into 3 zones, managed by 3 Anganwadis

TENURE

Land belongs to Nagarpalika

85% of the HH (1390 HH) are owned

15% of the HH (246 HH) are rented

Indiranagar na Chapra

ROAD WIDTHS : 2MT or less than 2MT

WATER SUPPLY

Water supply line passing through the slums
Water supply in the morning from 8.00 – 8. 30

Connections in the slum are illegal

Water supply is irregular

Other sources of water : GEB premises (across the road- 500 mt.)
: GIDC (approx. 2km)

Water connections

Willingness to pay for water

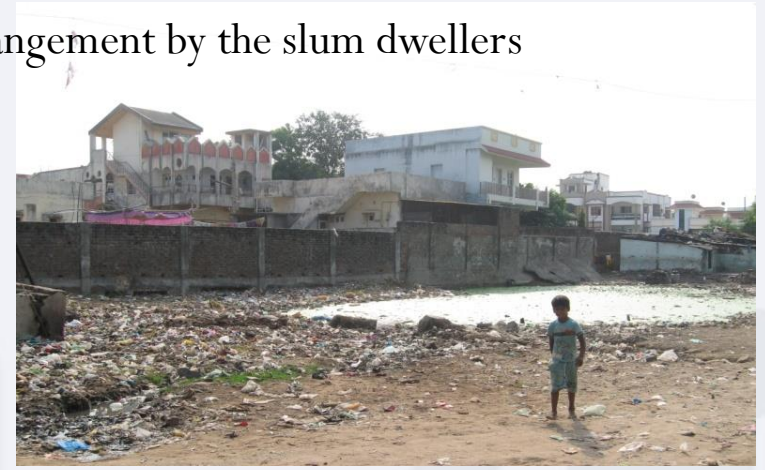
SOLID WASTE

No solid waste collection
No street sweeping

Sweepers clear the dump site every 15 days
Cost- Rs. 5/HH

Tractor clears the dump site every 6 months
Cost- Rs. 20/HH

Arrangement by the slum dwellers



Dump sites

WASTE WATER

TOILETS:

Individual toilets:

25 HH had individual toilets : 7%

About 230-240 toilets were built under Vyaktigat Sauchalya Scheme

80% of HH have individual toilets

ISSUES:

- No sewerage connections
- 30% only have soak pits
- Overflowing of waste water pits
- Open defecation
- Middle man

Indiranagar na Chapra

TOILETS:

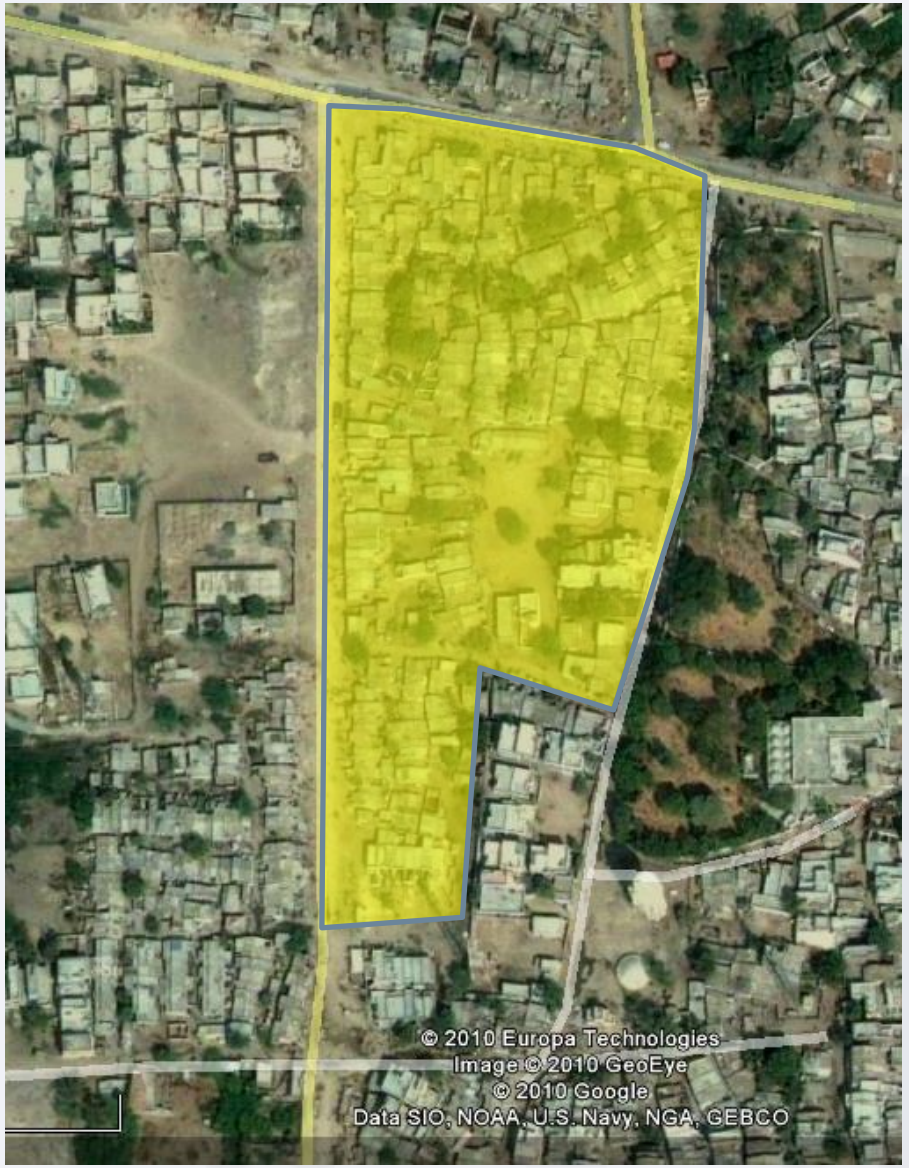
Community toilets: 2 in no. each with 15 seats

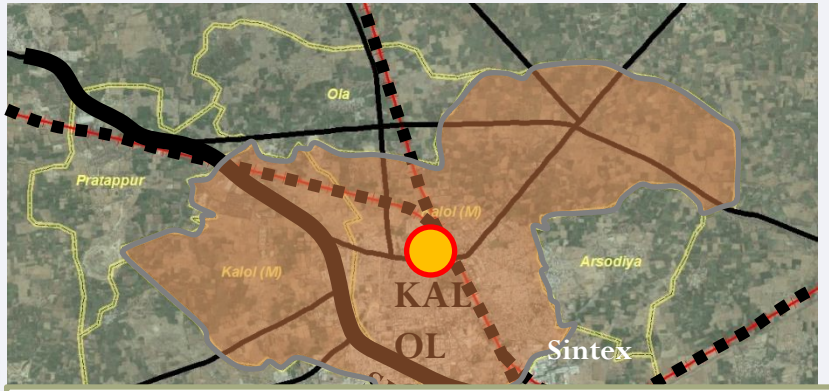
20% of the population does not have toilets

Community toilets: 20 persons/seat

ISSUES:

- No water connection to toilets
- No sewerage connections
- Open defecation





DEMOGRAPHIC DETAILS:

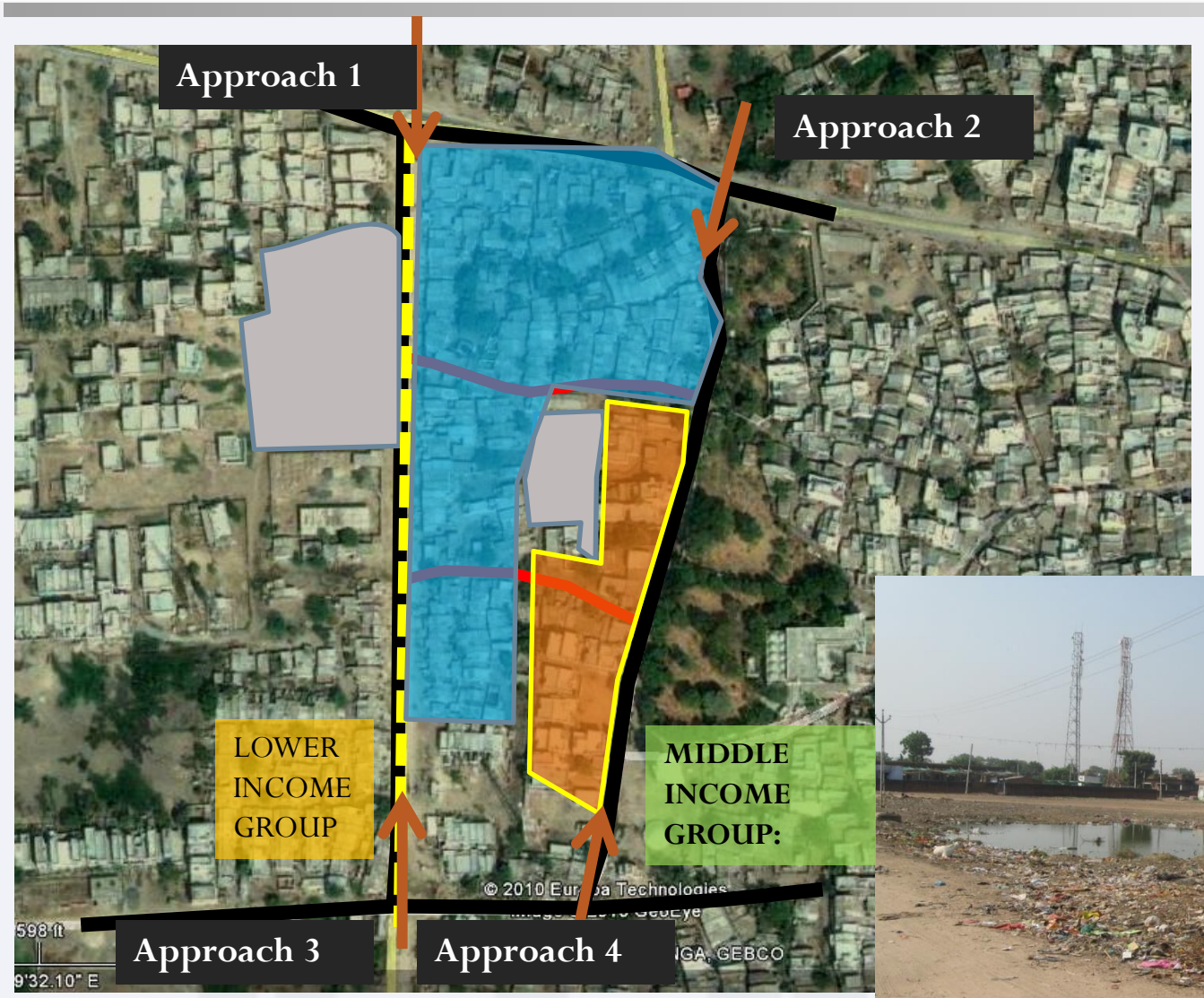
- AREA: 1.5 ACRES
- POPULATION: 3258
- NO. OF HH: 650
- NO OF MALES: 1689
- NO. OF FEMALES: 1569

TENURE DETAILS:

The land belongs to the municipality except from some tracts which are privately owned

There are four Aanganwadis currently active in the slum

Rahimpura


Approach 1
Approach 2
LOWER INCOME GROUP
MIDDLE INCOME GROUP:
Approach 3
Approach 4
© 2010 Eur ba Technologies
598 ft
9'32.10" E

WATER SUPPLY

•Most of the houses do not have water connections

•Illegal water connections

•Water quality :
•Many times non-potable
•Grey in colour with bad odour

•Frequency: Not regular
Ladies bring water from their relatives' places which takes an hour

•Pressure is not adequate

•No charges/ taxes are paid as connections are illegal

•Complaints are not addressed by ULB

SEWERAGE

Houses are situated along an open drain

Existing underground sewerage drain - Illegal connections
Drainage line was replaced by a new sewerage drain last year

No drainage connections
Sewage is let out in the open drain

Most of the houses do not have individual toilets
Open defecation in the open ground/ relatives' houses

SOLID WASTE

- No D-T-D collection
- Only 1 bin in entire slum
- Waste is thrown in the open plots
- Wet waste is thrown outside to let animals eat
- Waste is thrown in the open drain
- Dead animals are dumped in open plot near the slum
  Lead to bad odour and hygiene problems





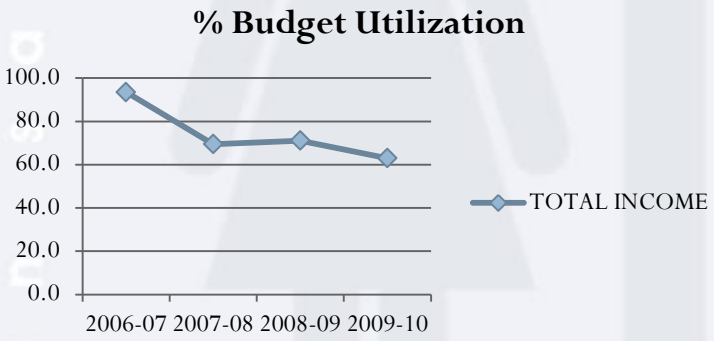

ULB's Finance

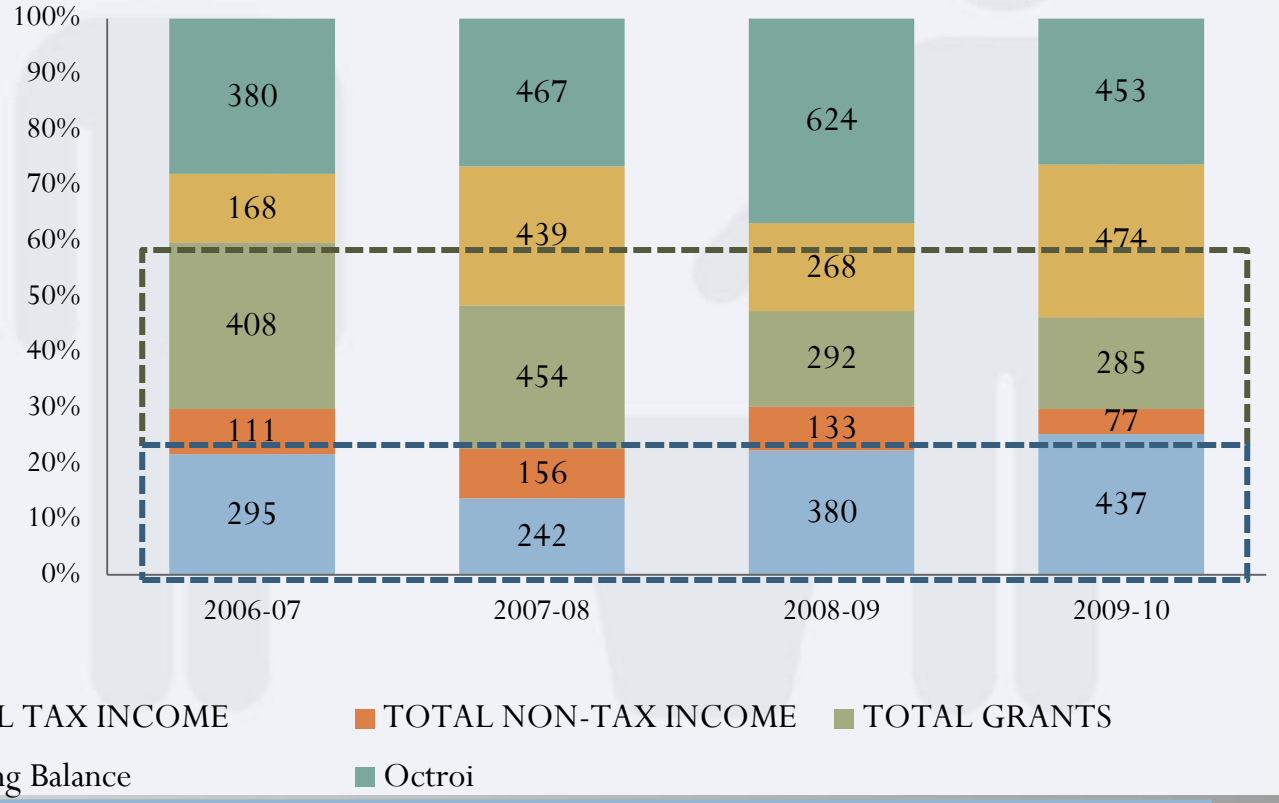
TOTAL OUTLAY IN RS. LAKHS

	2006-07	2007-08	2008-09	2009-10
TOTAL INCOME	1361.00	1758.00	1696.00	1727
TOTAL EXPENDITURE	1709	1279	1397	1341
SURPLUS/DEFICIT	-347.64	479.37	299.09	386.14
OPERATING RATIO	1.24	0.7	0.82	0.77
GRANTS RECEIVED	408	454	292	285
OWNS SOURCES	406	398	513	514

Revenue Income

- Octroi compensation,
- Opening Balance
- Total Tax Income
- Other Non-Tax Income
- Grants from state governments

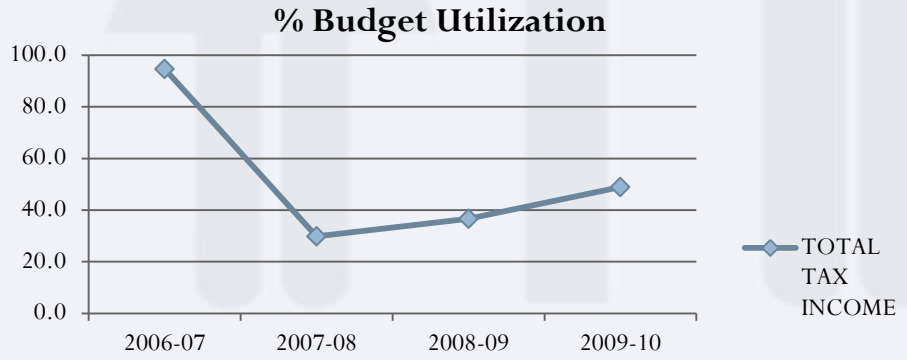




Revenue Income

TAX INCOME	2006-07	2007-08	2008-09	2009-10
TAX INCOME PROPERTY RELATED				
Property Tax	0	132	162	169
Drainage Tax	72	67	59	56
Water Tax (General & Special)	52	42	66	81
Lighting Tax	0	0	19	31
Conservancy Tax (General & Special)	0	0	26	38
Consolidated Tax	171	0	0	0
TOTAL PROPERTY RELATED TAX	295	242	332	375
TOTAL OTHER TAXES	0.26	0.19	47.36	62.40

Growth Rate	2006-07	2007-08	2008-09	2009-10
Property Tax			22	4
Water Tax (General & Special)		-19	56	24
Other Taxes		-29	25370	32

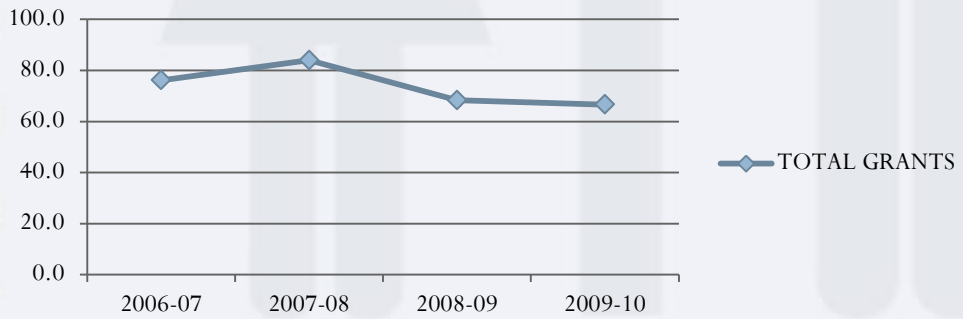


% Utilization	2006-07	2007-08	2008-09	2009-10
TOTAL TAX INCOME	94.6	29.8	36.7	48.9

Revenue Income

GRANTS	2006-07	2007-08	2008-09	2009-10
UC GRANTS	2	1	0.3	68
SANITATION RELATED GRANTS (Swachhta Abhiyan Grant)	2	2	2	1
OTHER GRANTS	404	451	290	216

UC	2006-07	2007-08	2008-09	2009-10
UC Grant	1.80	1.22	0.32	1.8
Ganda wasavat Sudharna Grant	0.00	0.00	0.00	**66**

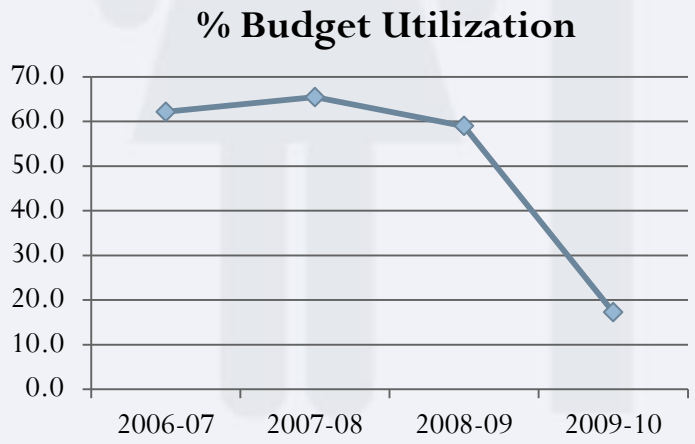


% Utilization	2006-07	2007-08	2008-09	2009-10
TOTAL GRANTS	76.1	84.0	68.3	66.6

Revenue Income

NON-TAX INCOME	2006-07	2007-08	2008-09	2009-10
TOTAL SANITATION RELATED NON-TAX INCOME	1	0.26	6	1
TOTAL OTHER NON-TAX INCOME	110	156	127	77

NON-TAX INCOME	2006-07	2007-08	2008-09	2009-10
Water Connection charges	0.5	0.2	1.3	0.1
Plumber fee	0.01	0.01	0.0	0.0
Sewage farm Income	0.0	0.0	0.0	0.1
Society Drainage facility fee	0.0	0.0	0.2	0.0
GIDC drainage connection income	0.1	0.0	4.9	0.5

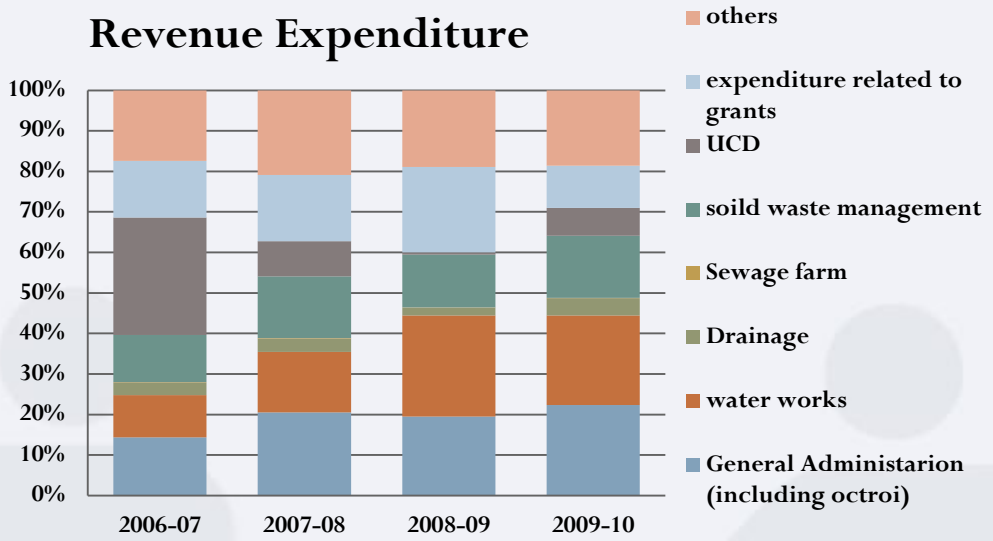


% Utilization	2006-07	2007-08	2008-09	2009-10
TOTAL NON-TAX INCOME	62.1	65.5	59.0	17.3

REVENUE EXPENDITURE

Major Categories:

- General administration
- Water works
- Drainage
- Sewage farm
- SWM
- Public works
- UCD
- Expenditure related to Grants



REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

The expenditure for

- General administration
- Sewage farm
- Solid waste management

Have been constant/similar over the years

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

The expenditure on water works have increased over the years with the levy of Narmada water charge from 2008

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

The expenditure on drainage reduced due to reduction in use of electricity

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
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7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

The expenditure related to nanapanch grants reduced in the year 2009-10

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

Loan in 2008-09 from vajpai shehri vikas yojna

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

Expenditure related to ganda vasvat sudharna grant reduced

REVENUE EXPENDITURE

		2006-07	2007-08	2008-09	2009-10
		ACUTALS (RS. LAKHS)			
1	General Administarion (including octroi)	242	252	271	295
2	water works	176	182	348	292
3	Drainage	53	40	26	57
4	Sewage farm	2	2	1	2
5	soild waste management	196	187	182	202
6	UCD	490	106	8	91
7	expenditure related to grants	236	201	212	139
8	others	293	256	346	246
		1687	1227	1394	1323

Budget Utilization

	2006-07	2007-08	2008-09	2009-10	2010-11
	(Rs. Lakhs)				
Budget	1766	1581	1759	3632	5617
Actual	1687	1227	1394	1323	
% Utilization	**96**	**78**	**79**	**36**	

Actual expenditure is in the range of 1300-1700 lakhs.

REVENUE EXPENDITURE

Growth Rates

	MAJOR CATEGORIES	2007-08	2008-09	2009-10
1	General Administarion (including octroi)	4.0	7.7	8.8
2	water works	3.8	90.7	-16.0
3	Drainage	-23.1	-35.5	117.0
4	Sewage farm	-17.7	-40.2	67.3
5	soild waste management	-4.4	-2.9	11.4
6	UCD	-78.3	-92.5	1044.6
7	others	-8.7	5.6	-46.6

Avg. Growth Rate	Normal Increase	Plan
7	Taking 7% (inflation rate)	New/ improved activities
26		
19		
3		
1		
291		
-17		

Projections for FOP

REVENUE EXPENDITURE

Budget Utilization

	2006-07	2007-08	2008-09	2009-10	2010-11
	(Rs. Lakhs)				
Budget	1766	1581	1759	3632	5617
Actual	1687	1227	1394	1323	
% Utilization	96	78	79	36	

Actual expenditure is in the range of 1300-1700 lakhs.

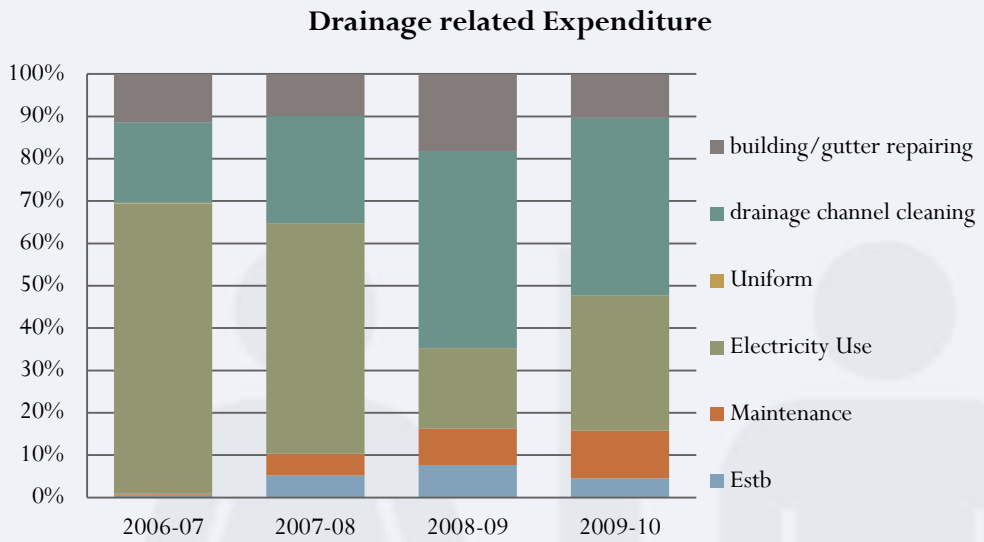
		2006-07	2007-08	2008-09	2009-10
		(% BUDGET UTILISATION)			
1	General Administration	39	104	97	93
2	water works	110	128	187	53
3	Drainage	140	106	43	199
4	Sewage farm	117	94	49	162
5	soild waste management	118	116	81	111
6	UCD	169	22	2	8
7	expenditure related to grants	100	91	123	26
8	others	113	88	74	28

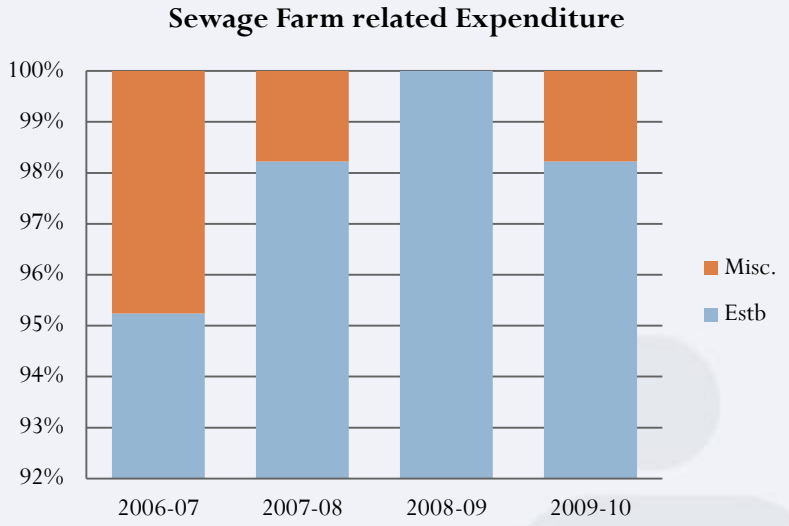
Grant Utilization

	2006-07	2007-08	2008-09	2009-10
Grants Received	408	454	292	285
expenditure related to grants	236	201	295	139
% utilisation	58	44	101	49

Loan related to Vajpai shehri vikas yojana was repaid in the year 2008-09

REVENUE EXPENDITURE- Sewerage





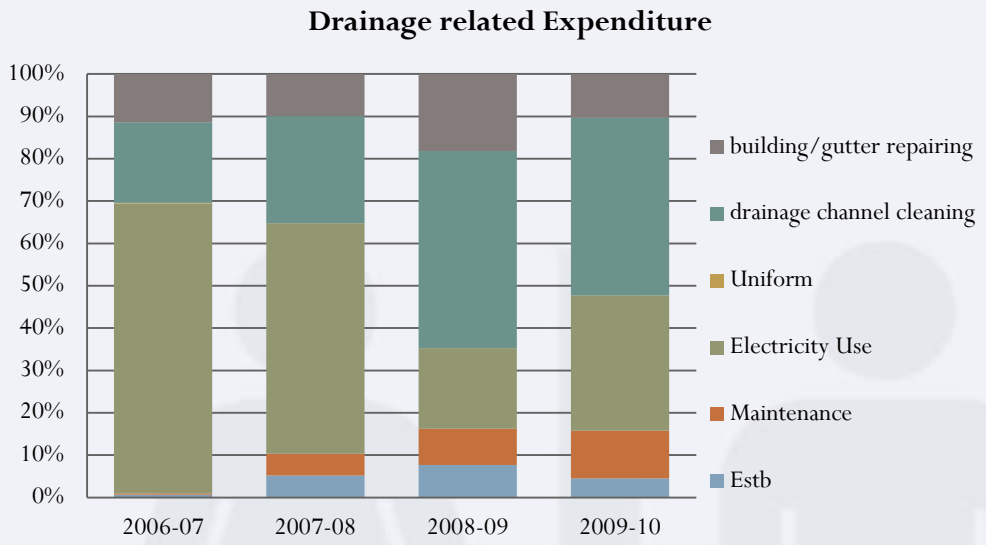
Total Expenditure (Rs. Lakshs)

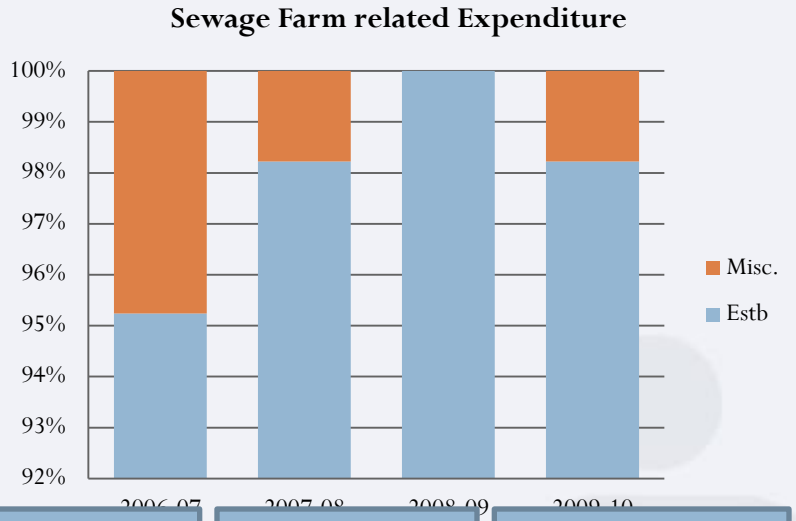
	2006-07	2007-08	2008-09	2009-10
Drainage	53	40	26	57

Total Expenditure (Rs. Lakshs)

	2006-07	2007-08	2008-09	2009-10
Sewage Farm	2	2	1	2

REVENUE EXPENDITURE- Sewerage





	2007-08	2008-09	2009-10
Estb	496	-4	28
Maintenance	1296	6	185
Electricity Use	-39	-77	264
drainage channel cleaning	2	19	95
building/gutter repairing	-33	17	23
Sewage Farm Estb.	-15	-39	64
Misc.	-69	-100	

Avg. Growth Rate	Normal Increase	Plan
440	Taking 7% (inflation rate)	New/ improved activities
51		
63		
27		
9		
-15		
440		

Projections for FOP

REVENUE EXPENDITURE- Solid Waste Management

Major Categories

Estb	Estb.
Daily Labour	
Uniform	
Misc. Promotion Exp.	Promotion
Best ward award	
solid waste tractor estb	Collection &Transport
solid waste tractor repairing	
Wheel Barrow purchase & Maintenance	
Solid Waste equipment purchase	
Fabrication/Repairing	
Gen. Conservancy	
Solid waste management & disposal	Sweeping
Compost plant maintenance	
Medicines	Treatment
Emergency Exp.	
	Misc.

Total Expenditure (Rs. Lakshs)

	2006-07	2007-08	2008-09	2009-10
Establishment	27	42	41	44
Promotion	2	2	2	1
Collection and Transport	15	12	19	15
Sweeping	120	90	88	97
Treatment & disposal	27	38	28	42
Misc	5	4	3	3
Total	196	187	182	202

REVENUE EXPENDITURE

Growth Rates

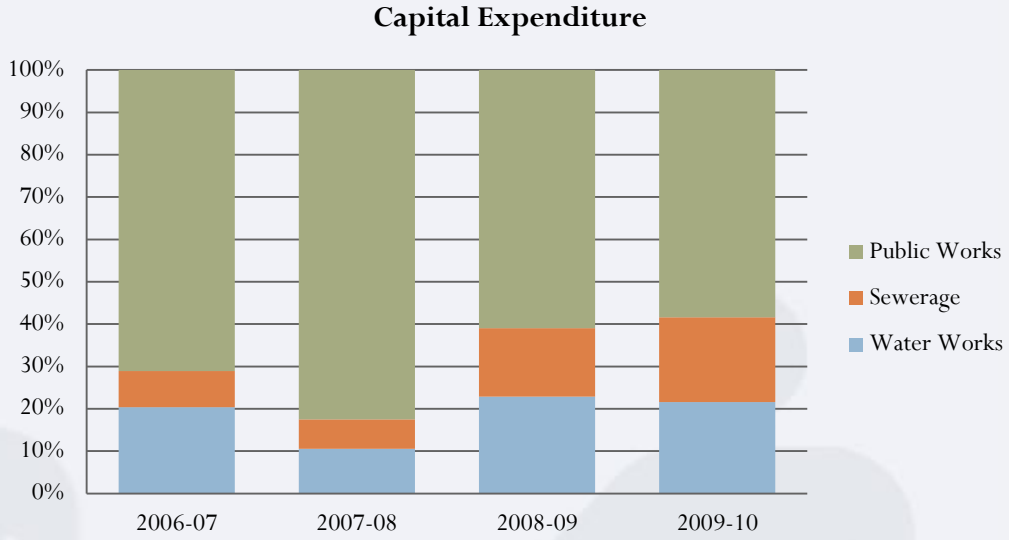
	2007-08	2008-09	2009-10
	56	-3	7
Establishment	-20	2	-18
Promotion	-18	59	-20
Collection and Transport	-25	-2	10
Sweeping	40	-25	46
Treatment & disposal	-20	-13	0
Misc	-4	-3	11

Avg. Growth Rate	Normal Increase	Plan
20	Taking 7% (inflation rate)	New/ improved activities
-12		
7		
-6		
21		
-11		
1		

Projections for FOP

CAPITAL EXPENDITURE

Water Supply pipelines New bore New machinary OH tanks & Sump Room Rising Line repairing OH Tank reapairing	**Water Works**
Drainage mchinary toilet repairing Dranage sub-lines East Kalol Drainage loan &Inerest	**Sewerage**
Roads road repairing shoping center Paving Compound Wall fencing Office Building CC Road underbridge	**Public Works**



Total Expenditure (Rs. Lakshs)

	2006-07	2007-08	2008-09	2009-10
Budget	152	246	105	125
Actual	21	52	3	17

Literature Review

Planning

Implementation

Financing

Evaluation

Planning

ROLE OF NATIONAL POLICIES

- can serve as a key stimulus for local action
- set priorities
- provide the basis for translating needs into action, creating conditions in which sanitation can be improved.

The recent Global Water Supply and Sanitation Assessment 2000 Report pointed out More than 2.4 billion people still lack access to improved sanitation.
The majority of these people live in Africa and Asia.

Case-study:
IRC International Water and Sanitation Centre and EH project (guidelines for assessment of national sanitation policy) states that following are the countries have made substantial progress in developing national sanitation policies

- **South Africa**
- **Uganda**
- **Nepal**
- **India**

SAITATION STATUS

The Millennium Development Goals (MDGs) enjoin upon the signatory nations to extend access to improved sanitation to at least half the urban population by 2015

Coverage Indicator (URBAN)	MGD TARGETS	NEPAL	SOUTH AFRICA	INDIA
		10th plan achieved 2002-2007	2004	2008
% population with access to improved drinking water	73	76.6	87.7	91
% population with access to basic sanitation services	53	46	76.9	83
Target year to achieve 100% sanitation		2017	2025	2025

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
EVOLUTION OF SANITATION POLICY	➢ National sanitation policy-1994 ➢ GoN's Local Self Government Act (1999) ➢ National Urban Policy 2007 ➢ Government's 3 Year Interim Plan (2007-2010) ➢ National Urban Water Supply and Sanitation Sector Policy 2008 (draft)	➢ Water supply and sanitation policy 1994 ➢ National Sanitation Task Team in 1996 ➢ Basic Household sanitation policy-2001	➢ International Drinking Water and Sanitation Decade in 1981 ➢ Total sanitation campaign 1999 ➢ NUSP -2008
DEFINATION OF SANITATION	Sanitation is defined as the **safe management of human excreta, including the hardware (latrines, etc.) and software (regulation, hygiene promotion, etc.)** needed to reduce fecal-oral disease transmission	"Sanitation" refers to the **principles and practices relating to the collection, removal or disposal of human excreta, household waste water and refuse** as they impact upon people and the environment. Good sanitation includes appropriate health and hygiene awareness and behaviour, and acceptable, affordable and sustainable sanitation services.	Sanitation is defined as **safe management of human excreta, including its safe confinement treatment, disposal and associated hygiene-related practices**. solutions need to take account of other elements of environmental sanitation, i.e. solid waste management; generation of industrial and other specialized / hazardous wastes; drainage; as also the management of drinking water supply

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008-NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001-SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
OBJECTIVES	1. To **ensure the availability of basic safe, accessible and adequate water supply and sanitation services** to all urban populations by 2017. 2. To **reduce the incidence of** water, hygiene and sanitation related **diseased** in urban areas 3. To **stimulate socio-economic development** in urban centres through the productive use of urban water supplies and the responsible management of all wastes 4. To ensure that the **basic service needs of poor and marginalized communities** are met and that these groups, and especially women, are involved in all decision making that affects their service interests at all levels.	The objectives of the policy are to alleviate the following • Public health problems • Reduce environmental impact & contamination • Economic impact of poor sanitation • social and psychological problems	1. Awareness Generation and Behaviour Change 2. Open Defecation Free Cities 3. Integrated City-Wide Sanitation • Re-Orienting Institutions and Mainstreaming Sanitation • Sanitary and Safe Disposal • Proper Operation & Maintenance of all Sanitary Installations

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
OBJECTIVES	5. To **build sufficient institutional and operational capaci**ty to ensure that new and existing schemes are efficiently and transparently managed and maintained in order to operate at required service levels for their full design periods 6. To harness, **develop and manage surface and ground water sources serving urban centres in an efficient and equitable manner** and ensure their protection and that of surrounding ecosystems 7. To clearly **define the roles and responsibilities of central and local government bodies, external development partners, the private sector - including NGOs - and user groups** in scheme implementation, regulation and performance management in accordance with national decentralization policy 8. To recognize the **role of a broad range of providers in the sector** and provide a supportive policy framework that encourages alternate options through private provision, public private partnerships, NGO and community involvement		

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
STRATEGY / ACTION PLAN			
PUBLIC HEALTH	• provision and management of wastewater and solid wastes at household, commercial facility and institutional levels • Centralized sewer treatment for the city and decentralized or on-site in case of outgrowths • basic service level to all residents • Hygiene promotion • Flexible financial mechanisms, including cross-subsidies, and the use of appropriate and affordable technologies	• Influencing hygiene behavior – personal, household and community hygiene • Having a Dialogue with the community • Educational programmes • Linking with other programmes	• Education and Communication (IEC) Strategy

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
STRATEGY / ACTION PLAN			
COMMUNITY PARTICIPATION/ SOCIAL INCLUSION	• Provision of access to sustainable basic services at affordable prices to the marginalized group **This is regardless of whether or not such residents have legal citizenship and land tenure rights.** • Criteria for the identification of target groups, including social mapping, and the award of subsidies will be developed • The total scheme cost will include the connection cost but Consumers seeking connections after scheme designs and costing have been finalized will be required to pay a separate connection fee. • Tariff charges will be cross-subsidized	• Community members have a strong interest in choosing a level of service for which they are willing and able to pay and in understanding the benefits of such a decision • community participation is a key requirement in the conceptualization, selection, planning, design, implementation, operation and maintenance of all projects • Local community member's skills will be developed so that they can build the sanitation infrastructure and facilitate the health and hygiene promotion	• city-wide, demand-based participatory approach to individual • special slum and community sanitation plans • provisioning of basic sanitation should be de-linked from the issues of land tenure

POLICY REVIEW

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STRATEGY / ACTION PLAN			
ENVIRONMENT	• Government will review, develop, **update and implement effluent standards for the treatment and disposal** of raw sewage, hazardous chemicals, industrial and hospital wastes prior to their discharge into local water bodies • technologies such as **rainwater harvesting and solid waste management** will be promoted • **Environmental Impact Assessment (EIA**) under Environment Protection Rules and Environment Protection Act-and Rules (1997).	• National Environmental Management Act of 1998 (NEMA), environmental plans, policies and programmes of government departments in all spheres must be co-ordinated and harmonized. • communities must be encouraged to become involved in monitoring the quality of their own water resources in order to heighten awareness of pollution. • **Polluter pays-** charged for costs incurred in cleaning up or removing pollution or for repairing associated damage, for poor , steps should be taken to prevent further cases of pollution or contamination	• Education and Communication (IEC) Strategy • Setting standards at state level- e.g. State Pollution Control Board standards on effluent parameters, diminishing water resources, impact of climate change, use of low energy intensive onsite/decentralised wastewater treatment technologies

POLICY REVIEW

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STRATEGY / ACTION PLAN			
FINANCING	• costs for the construction of surface water drainage and sewerage systems will primarily be met through central government and municipality grants • connection charges and a proportion of total capital, operation and maintenance costs met by the consumers served- 10-30% of capital costs, 30% of operation and maintenance costs. • On site sanitation will be the responsibility of individual households but with subsidies and technical guidance available from municipalities for poor and marginalized settlement	**Municipal Infrastructure Investment Grant** provision of grant finance to cover the capital cost of basic infrastructure for the poor. • phased introduction of these reforms will be managed through the annual Division of Revenue Act • Existing financial obligations (projects in process) will be given a period of at least three years to complete the on going municipal infrastructure projects. • Low cost sanitation subsidy by DWAF -R600 for community development and R600 for the basic toilet structure • Tariff collection	• Funding from center under the schemes of JNNURM and UIDSSMT. • for Integrated Low Cost Sanitation (ILCS) scheme, central subsidy to the • extent of 75%, state subsidy to the extent of 15% and beneficiary contribution to the extent of 10% • At least 20% of the funds under the sanitation sector should be earmarked for the urban poor

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
INSTITUTIONAL RESPONSIBILITIES			
CENTER	policy makers, regulators, facilitators, technical support agencies and monitoring and evaluation agents.	establish legislation, policies, norms and standards , co-ordinate and monitor national programmes , regulate provide advocacy and guidance	Assess in setting standards, planning and financing, implementation, knowledge development, capacity building and training, Monitoring & Evaluation (M&E), and regulatory arrangements
PROVINCIAL GOV/STATES	-	•co-ordinate regional planning •ensure compliance with national policy and norms and standards •provide support to municipalities in a number of areas, including financial, human resource and technical promote health and hygiene awareness •Monitor Progress	•provide support to municipalities in a number of areas, including financial, human resource and technical promote health and hygiene awareness • issue guidelines to support cities in adopting participatory approaches to community sanitation, rational planning, O&M
ULB/BOARDS	Implementation and management of the project	the provision of sanitation services . Implement. Monitor. promote health and hygiene	planning and financing public infrastructure. responsible for asset-creation and managing systems including service delivery

POLICY REVIEW

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INSTITUTIONAL RESPONSIBILITIES			
PRIVATE ORGANISATION	Implement and monitor the project	• planning, design and construction of sanitation infrastructure • the water services provider or municipal services partner function • manufacturing and supplying toilets • financing higher levels of infrastructure than government is prepared to fund	Implement and monitor the project
NGO	community awareness raising and public auditing	• health and hygiene awareness promotion and education • facilitating community participation • implementing community based sanitation improvement projects	Community awareness monitoring

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
INTEGRATION	THE POLICY DOES NOT DISCUSS ABOUT INTEGRATION BUT THE **GOVERNMENT'S 3 YEAR INTERIM PLAN (2007-2010)** It proposes the full integration of sewerage, on-site sanitation and solid waste management in all urban schemes	**INTEGRATED DEVELOPMENT PLAN** There are critical linkages between the provision of health and hygiene education and sanitation services, water supply services, solid waste management and housing. **Package of service approach-** The focal mechanism for achieving integrated planning is the municipality driven **Integrated Development Planning (IDP) process.** **Infrastructure Investment Plan**	Formation of state level sanitation strategy Formation of multi-stakeholder City Sanitation Task Force City sanitation plan

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
MONITORING AND EVALUATION	-	**Key performance indicators will be developed**. Data collection and measurement will take place at the municipality, the Regional Office of the Department of Water Affairs and Forestry or the Provincial Departments of Education, Housing, Health. 30 days for municipal to provincial reporting further 30 days for provincial to national reporting. **Crisis reporting** by the municipality to the national department Computer systems	National Annual Award will be instituted on the basis of rating by GOI. collection and reportage systems using outcome indicators Cross-city monitoring with participation of State level and other-city stakeholders knowledge on institutional development, technology choices and management regimes, planning new developments and upgradation Capacity building

POLICY REVIEW

PARAMETERS	NATIONAL WATER SUPPLY AND SANITATION POLICY 2008- NEPAL	BASIC HOUSEHOLD SANITATION POLICY 2001- SOUTH AFRICA	NATIONAL URBAN SANITATION POLICY-2008, INDIA
PROGRAMMES	CLTS PROGRAMME Focuses of alleviating open defecation than building toilets Assisting communities to build latrines without subsidies Agencies involved • WaterAid Nepal • Plan Nepal • NEWAH • Environmental, Cultural, Agricultural Research and Development Society (ECARDS) Nepal Rural Water And Sanitation Awareness Promotion Society (RUWSAPS) • Rural Awareness and Development Organisation (RADO) Nepal • Integrated Development Society (IDS) • Nepal and Rural Reconstruction Nepal (RRN) Coverage-18 villages spread across 7 districts	NATIONAL WATER AND SANITATION PROGRAMME Under taken by department of water affairs and forestry DWAF There has been substantial progress on water, it has not yet developed an effective programme to address the sanitation problems of individual households and to promote health and hygiene awareness	

Implementation

BEST PRACTICES : Implementation Strategies

Urban Sanitation

Development of community based sanitation infrastructure in Hasanpura, Faisalabad

- Overall development of the project and
- The steps followed to implement the project effectively

Hygiene Promotion

Evolution of hygiene education in Bangladesh

- Various approaches followed in various programmes to promote hygiene

Development of community based sanitation

Tasks		Actor
Selection of project area and baseline data gathering Initial project work	**•Socio-economic survey •Willingness to pay & accept intervention •developed a rapport with municipal planners**	**by ASB**
Community mobilisation	**Selection of respectable community leaders**	**by ASB**
Adopt the development mode & work with community at large to develop a consensus		**Task of leaders**
Community was organized into lane committees headed by lane managers		
MoUs were signed between lane committees & ASB to provide labour & financial resources		
ASB committed to offer guidance & technical support		
series of motivational meetings and slide shows to educate the masses about the steps needed for the implementation		**by ASB**

Development of community based sanitation infrastructure in Hasanpura, Faisalabad

Other Characteristics:

Promoting sanitation awareness

ASB first identified approximately 50 **influential people** & selected 4 from them as community motivators

Gender-based awareness campaigns

- Staff for D-T-D survey comprised of a Lady Health Visitor (LHV), a trained midwife and two female field workers who spoke to women
- *ASB organized women at street level & held weekly meetings,* Provided paramedical health services
- ASB also organised hygiene and cleanliness competitions such as a clean kitchen etc

Technological choices

Affordability & the community's willingness and its ability to pay for the proposed infrastructure were the main deciding factor

Pro-poor provisions

Provision of interest free loans for the poor households with the lane committee responsible for repayment.

SARAR *(Self-esteem, Associative strengths, Resourcefulness, Action-planning, and Responsibility)*

A methodology of participatory learning, which builds on **people's innate ability to address and resolve their own problems.**

Aim:

•To help people recognize the talents within themselves and to use them

Principles:

•People will solve their own problems best in a participatory group process.

•The group collectively will have enough information and experience to begin to address its own problems.

PHAST *(Participatory Hygiene and Sanitation Transformation)*

An adaptation of 'SARAR' methodology

Aim:

•To empower communities to manage their water and to control sanitation-related diseases

•To promote health awareness & understanding leading to environmental and behavioural improvements.

Principles:

•Any sustainable improvement in hygiene and sanitation must be based on an **interaction between behavioural and technological elements.**

•The best way to achieve sustainable improvement is to take **an incremental approach, starting with the existing situation in a community and building up a series of changes**

•*Methods and materials that stimulate the participation of women, men and children in the development process*

•*Relies on training of extension workers and on the development of graphic materials*

Models used:

(1) "single-channel" (SAFE): a particular group of people was targeted for hygiene promotion.

(2) "multi-channel" (SAFER (Sanitation and Family Education Resource) communication model):

The model is based on recognition that ***each situation is different and requires methods*** that are ***appropriate to a particular community.***

Components of the model:

- **Discussions on establishing the links between behavioural change and personal benefits** such as health benefits or financial savings

- **Acquisition of knowledge and skills** through participation

- Development of locally appropriate solutions through **joint partnerships** with the community taking into consideration the **local values, believes and practices**

- Continuous **adaptation of changes by the community**

- Work on a series of **small steps to behaviour change that are manageable**, achievable and result in recognisable health benefits.

PROGRAMME/ APPROACH	ASSUMPTION	METHODOLOGY	TOOLS
UNICEF: SHEWA-B (Sanitation, Hygiene Educationand Water Supply Programme)	***Local* NGO appoints Community Hygiene Promoters (CHP)** (responsible for a "Ward" :around two/three villages, maximum 500 households) **for community mobilisation and hygiene promotion.**	*Review, social mapping and action planning:* •CHP assists the local people to assess the various components of the situation •community people draw a cluster/village/ ward map with WATSAN as focus •Community Action Plan (CAP) is developed by the community (Problems, methods to solve them, timeframe, responsibilities)	•*Courtyard meetings;* •*Facilitation sessions with men in tea stall/ grocery shops at ward level;* •*Focus Group Discussions (FGD) on menstrual hygiene;* •*Group meetings with working people, e.g. Day labourers.*

Journey towards changing behaviour: Evolution of hygiene education in Bangladesh
Rokeya Ahmed: WaterAid Bangladesh

PROGRAMME/ APPROACH	ASSUMPTION	METHODOLOGY	TOOLS
DISHARI, 2004 **The Decentralised Total Sanitation Project (DISHARI) of the Dhaka Ahsania Mission (DAM)**	(**Upazilla-based total sanitation model steered by the local government** with the participation of local departments of the government, NGOs and communities)	Local NGO conducts residential workshop with local government representatives to motivate them and build their capacity for pursuing full sanitation •**a *Union Task Force*** *at Union level (the lowest* level of local government, covering about 10 to 15 villages with around 4000 households); •**a *Ward Task Force*** *covering around ten paras* (clusters/hamlets); a union consists of nine wards; •**a *Para Action Committee*** *in each Para (cluster/* hamlet) which represents some 50-80 families.	•*mapping* •*Latrine or water source visits:* •*Participatory monitoring* •*Food hygiene* •*Hand washing* •*Drama, role-play and demonstrations*
			•**Rhymes, stories and a video** on arsenic contamination of drinking water.

Journey towards changing behaviour: Evolution of hygiene education in Bangladesh
Rokeya Ahmed: WaterAid Bangladesh

Financing

COMMUNITY LEVEL FACILITIES

1 Community / User Resources + Government / Donor agencies

2 Private / PPP

Parivartan Project, Ahmadabad – SEWA

33 % cost by private agency
33 % cost by Community
And Rest by AMC

Focused towards improved basic infrastructure services to slum dwellers. Sanitation a major component.

Slum Sanitation Programme, PUNE

Slum Sanitation Programme in Bombay

Building of Infrastructure through central provisions, Operation and maintenance community level organizations

Strategic Sanitation Programme, Ouagadougou, Burkina Faso

Pay and Use Toilets

MICROCREDIT

YOGYAKARTA, INDONESIA

- Yavasan Dian Desa (YDD) an NGO through Swiss support administered the movement
- Loans for Personal Toilets
- 2 – 3 years
- 65 % recovery rate

STRATEGIC SANITATION PROGRAMME, KUMASI, GHANA

- Loans to Land lords for construction of Toilets
- 2-3 years
- 80 % recovery rate

1 Government / Donor agencies

CENTRAL / STATE BUDGET ALLOCATIONS

- Traditional Model of creating and managing infrastructure through budget allocation or through programmes like JNNURM / BSUP, Sardar Awas Yojana / Indira Awas Yojana, UIDSSMT etc.
- State Government sources
- Loans from HUDCO
- Grants/Loans to ULBs by center/state or from development banks

PLANNED EXPENDITURE TOWARDS WATER AND SANITATION IN INDIA		Urban Sanitation
10th Plan	Rs. 64803 Cr. (7.44 %)	
11th Plan	Rs. 143730 Cr. (6.99 %)	Rs. 43119 Cr.
07-08	Rs. 19298 Cr.	Rs. 6731 Cr.
08-09	Rs. 22781 Cr.	Rs. 8203 Cr.
09-10	Rs.27323 Cr.	Rs. 10079 Cr.
10-11	Rs. 33266 Cr.	Rs. 12474 Cr.
11-12	Rs. 41063 Cr.	Rs. 15542Cr.

TOTAL : Rs. 143730 Cr.

- Central : Rs. 41681 Cr.
- State : Rs. 96299 Cr.
- Private : Rs. 5750 Cr.

1 Government / Donor agencies

DONOR AGENCIES / DEVELOPMENT BANKS – LOANS/GRANTS

- Asian Development Bank
- Germany
- Japan
- World Bank

- Andhra Pradesh Municipal Development Project;
- Karnataka Municipal Reform Project;
- Karnataka, Uttaranchal and Punjab Rural water supply and sanitation project;
- Amritsar sewerage Project;
- Orissa integrated sanitation improvement project etc

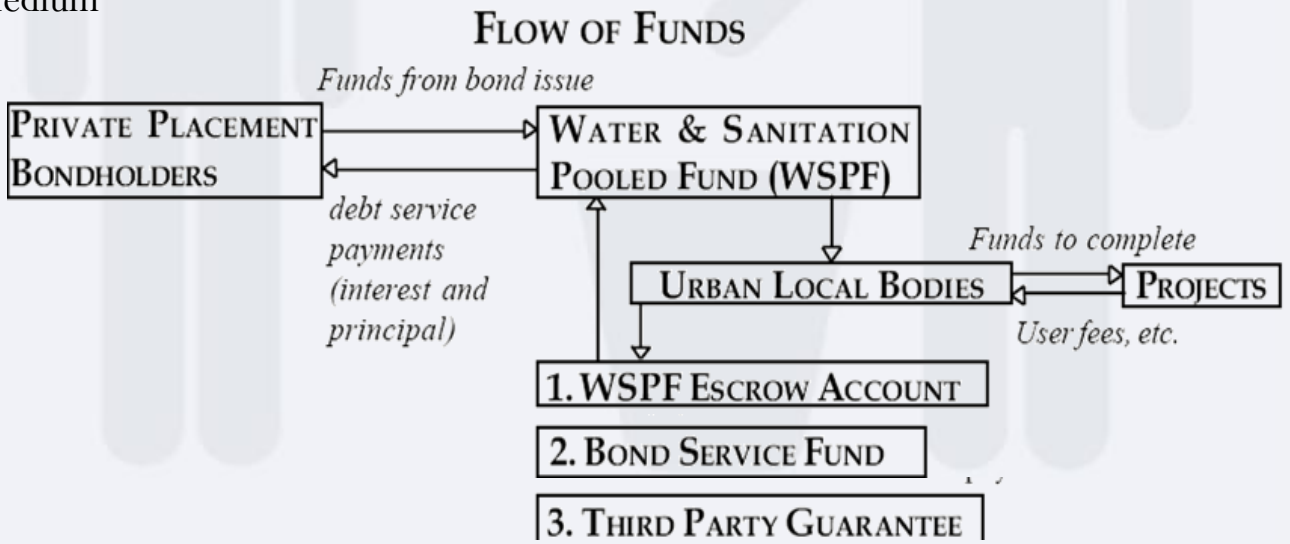
2 Market Borrowings/ PPP

TAMILNADU POOLED FINANCE FUND –WATER & SANITATION POOLED FUND (WSPF)

- **Tamil Nadu Urban infrastructure Financial Services Ltd. (TNUIFSL)**
- **GOI**
- **USAID FIRE (D)**

Rs. 1,00,000 Bonds at 9.20 % annual interest rate with 15-year maturity and redemption in 15 equal annual installments puttable/callable at the end of 10 years.

Rs. 110.5 Cr. Generated through this medium



2 Market Borrowings/ PPP

KOLHAPUR SOLID WASTE DISPOSAL PROJECT, MAHARASHTRA

- BOOT Format
- Private player to Build a waste treatment/Compost plant
- Revenue of the Private entity is through sale of compost
- Municipal corporation is fee of treatment and also gets additional revenue.
- Land is to be given by the government

CHAMOUT, FRANCE

- Water Supply and Sanitation network to be built by the Private player
- Bulk water given by ULB free
- Private player revenue through - water fees

FINANCING MECHANISMS

- Budget allocations through central / state / ulb
- Loan / grants / soft assistance from development banks
- Market borrowings through bonds
- Pubilc private participation model
- Micro credit – funded / community administered
- Loan / grants / soft assistance from development banks
- Community participation

Evaluation

What is Evaluation & Monitoring

Evaluation

- Assessment/ Measurement
- Systematic process
- Qualitative & Quantitative
- At a particular time
- Have a definite scope
- Comparison with goals, objectives & targets
- Level of Service

Monitoring

- Along a time line
- Techniques
- Qualitative & Quantitative
- Management information system
- Checking/ examination of service
- Continuous process
- Regular recording of data
- Identification of problem
- Only critical indicators

A tool for performance improvement through systematic search and adaptation of leading practices".

Why do we need Evaluation & Monitoring

Evaluation

- Measurement of performance based on the set of objectives, goals & targets identified
- To identify whether objectives are met or not
- To what extent they are met?
- Where are the gaps?
- What are the gaps?
- Comparing the performance with other cities across the world

Monitoring

- To record the progress over a period of time
- To identify real time problems
- Measure to check consistency
- To identify micro level operational problems

Players

	Utility associations	Government	Regulation
Coverage	National and regional level	National and state (province) level	National and regional level
Examples	Utility associations in Africa, South-East Asia, Australia, Netherlands, South Africa, Canada, Vietnam and Indonesia	*Performance monitoring*: Brazil, Australia, Tanzania and South Africa *Performance-based funding*: Ecuador, Uganda and Tanzania	*Regulators*: UK, Zambia and Philippines *Performance-based contracts*: Senegal, Uganda, Burkina Faso, Malaysia and Bangkok
Objectives	▪ Sharing information across utilities ▪ Promote process benchmarking	▪ Support decision making and improvement plans, promote process benchmarking ▪ Funding as incentive for improved performance	▪ Comparative regulation ▪ Review against agreed performance targets in contract
Major themes	Service levels, finance, consumer services, environment	Service levels, consumer services, finance, environment, health and asset management	Service levels, consumer services, finance
Frequency of measurement	Annual (Netherlands: once in three years)	Annual	Annual

Tracing Performance Evaluation

No	Name	Year	Type of Agency	Objective	Focus area
1	The Netherlands	NA	National	NA	water quality, service levels, environmental performance, finance and efficiency
2	European Benchmarking co-operation	NA	European Region	Mission of the co-operation is to facilitate water utilities in the continuous process of improving performance and transparency by: 1.offering an international benchmarking programme for water services; 2. providing a platform for exchanging best practices of management and operations; 3. exchanging knowledge and experiences on benchmarking.	water quality, reliability, service, sustainability and finance & efficiency.
4	ADB Utility Data Book-Water Funding Programme	NA	International	To develop a utility data bank which helps in financing program, decision making for planners, urban managers etc	Health & Environment, Access & Coverage, Service Level & Quality, Financial Sustainability, Plan & Policy, Legal Framework
5	IBNET	NA	International	To support access to comparative information that will help to promote best practice among water supply and sanitation providers worldwide and eventually will provide consumers with access to high quality, and affordable water supply and sanitation services.	Service Coverage, Service Level & Quality, Financial Management, Efficiency, Equity, Assets

Tracing Performance Evaluation

6	NIUA study sponsored by CPHEEO	1999	National	To determine the status of water supply, sanitation and SWM services	
7	CRISIL Advisory Services study sponsored by WSP	2003-04	National	To create awareness about benchmarking and develop performance indicators	Water & Waste Water-coverage, production and consumption, financial and resource management
8	Utility data book sponsored by ADB and MoUD	2007	National	formation for JNNURM cities, to initiate benchmarking in operations and annual business planning, and promote transparency	Water Supply-to coverage, availability and consumption of water, metering, financial and human resources management
9	Service Level Benchmark	2009	National	It aims to develop a set of standardised service level indicators and related benchmarks for water supply, wastewater, solid waste management and storm water drainage..	Access & Coverage, Service Levels & Quality, Financial Sustainability, Efficiency
10	National Rating & Award Scheme-NUSP	2009	National	In order to rapidly promote sanitation in urban areas of the country (as provided for in the National Urban Sanitation Policy and Goals 2008), and to recognize excellent performance in this area, the Government of India intends to institute an annual rating award scheme for cities.	Public Health & Environmental Standards ,sanitation, equity
11	Performance Assessment System	2009	State	To develop better information on water and sanitation performance at the local level.	Access & Coverage, Service Levels & Quality, Financial Sustainability, Efficiency & Equity

Performance Evaluation in India

- In case of India, SLB initiated by GoI and National Award and Rating Scheme based on NUSP policy does it at the national level

- According to 13th Finance Commission-

> *"For a start, State Governments must notify or cause all the municipal corporations and municipalities to notify by the end of a fiscal year (31 March) the service standards for four service sectors – water supply, sewerage, storm water drainage, and solid waste management proposed to be achieved by them by the end of the succeeding fiscal year. These levels may be different for different municipalities. We envisage such a commitment to be achieved through a consultative process with the local bodies. Such a notification will be published in the State Government gazette and the fact of publication will demonstrate compliance with this condition"*

A Comparison Between SLB & NUSP Rating Scheme

SLB of GoI

1. It aims to develop a set of standardised service level indicators and related benchmarks for water supply, wastewater, solid waste management and storm water drainage.
2. Provides a benchmark for services
3. Based upon individual indicator Describes
4. Input, output and process related indicators
5. Scope does not include health and hygiene parameters

National Rating & Award Scheme- based on NUSP

1. In order to rapidly promote sanitation in urban areas of the country (as provided for in the National Urban Sanitation Policy and Goals 2008), and to recognize excellent performance in this area, the Government of India intends to institute an annual rating award scheme for cities.
2. Rates the cities based on weighted average marks in sanitation aspects
3. Shows integrated approach of the city in sanitation
4. Describes output, process and outcome related indicators
5. Covers health and hygiene and equity aspects

How do we do Evaluation & Monitoring

Defining Objectives
- Listing of goals, objectives & targets
- Formulation of set of indicator/ parameters based on the objectives/ goals to be achieved
- Defining qualitative indicators and quantitative indicators

Defining a model
- Focused area, level at which it has to be done.
- Household level, ward/ zonal level and at ULB level

Developing tools
- Comparing the set of indicators with international and national benchmarks/ standards/ guidelines
- Eg IBNET indicators, ADB utility bank, SLB of GoI, CPHEEO manuals etc

Data collection
- Through secondary surveys
- Primary surveys
- Standardization of data

Data Analysis & Validation
- Based on the reliability of the data

Identification of Gap
- Comparing the set of indicators with international and national benchmarks/ standards/ guidelines
- Eg IBNET indicators, ADB utility bank, SLB of GoI, CPHEEO manuals etc

Storm Water Drainage Management

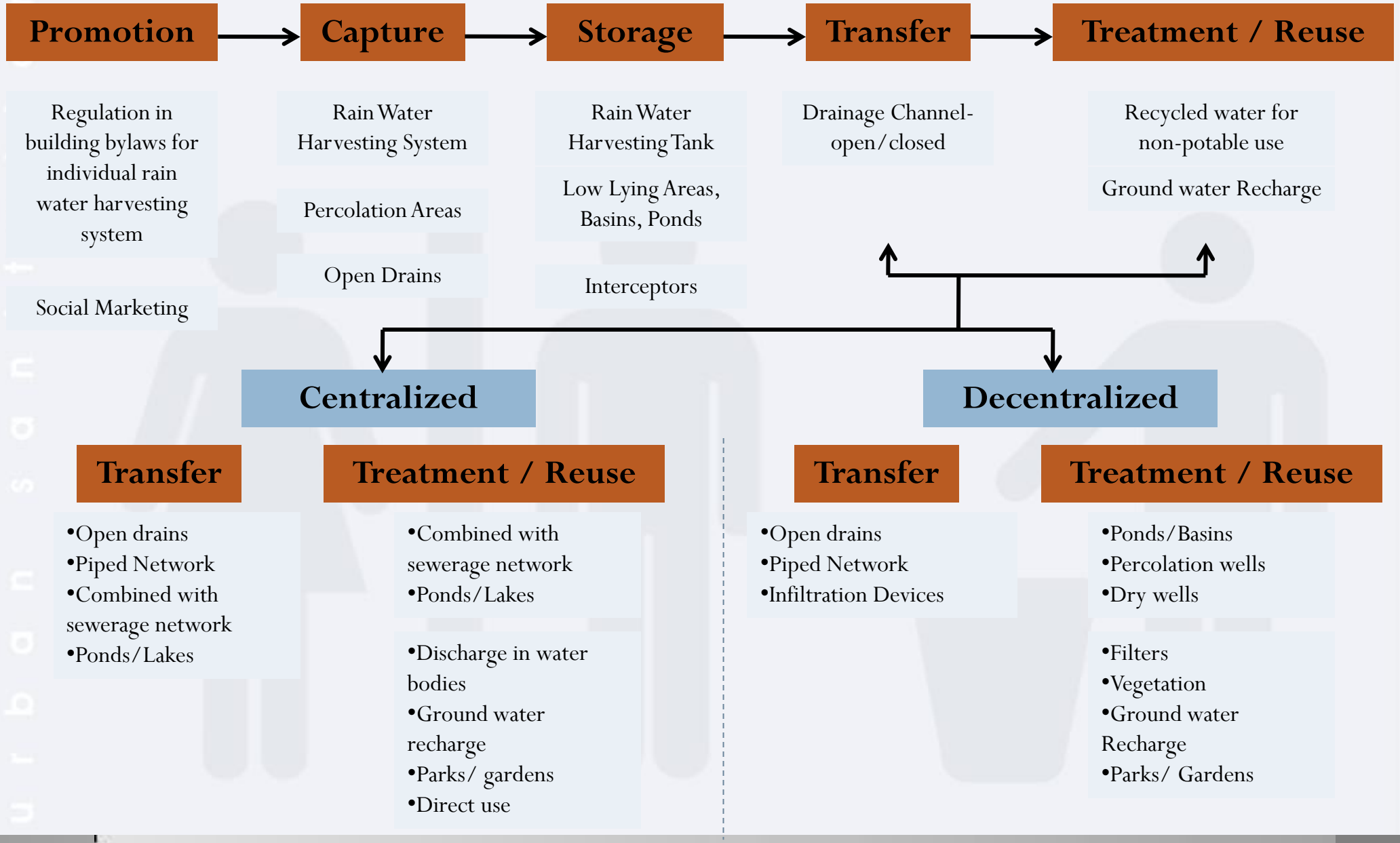
Technology Options

Extent of Services

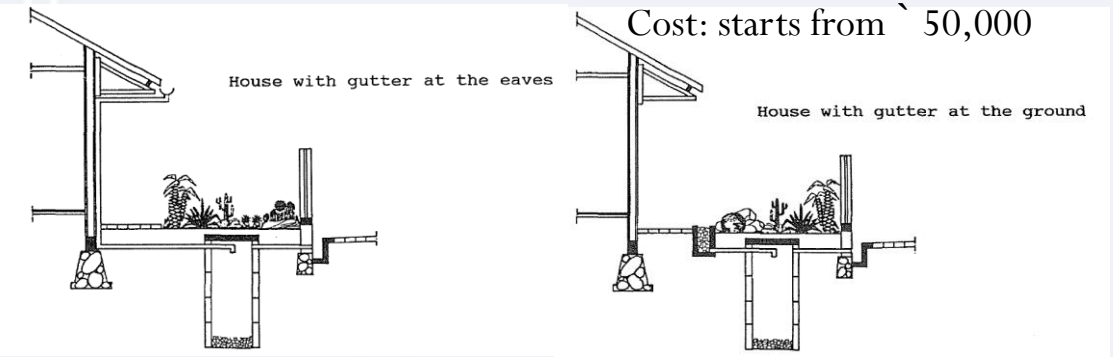
Proposals

Technology Option

Storm Water Management



Infiltration Well: Allows water to get in to the well which functions as a temporary storage facility, as well as to infiltrate, to become groundwater.



Cost: starts from ` 50,000

Advantages

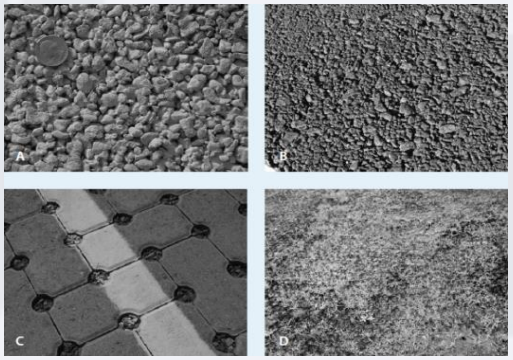
- a quantity of unconfined groundwater can be conserved;
- the surface level of unconfined groundwater stays stable;
- the area of ponding water is minimized;
- the dimension of drainage networks is minimized

Lake Interlinking: Storm water in the catchments area of a lake flows to the lake and recharges the groundwater level. Once that is done, the excess water will flow to the other lake by means of pipelines.

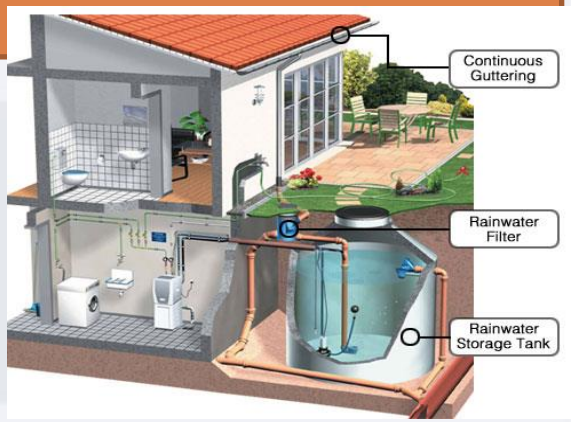
Rain Water Harvesting: Rainwater harvesting entails the collection of rain where it falls in a scientific and controlled manner for future use. RWH consists of rooftop water harvesting, water from open areas such as paved ways, parks, roads, fields and in lakes and ponds.

Green Roof

Bioretention Cell



Permeable Pavements



U.S Environmental Protection Agency

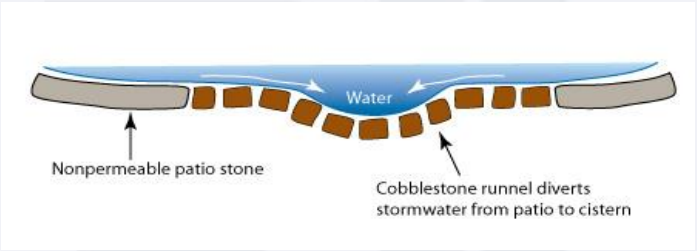
Bioretention cell

Green parking design

Permeable pavers

Rain Barrels or Cistern

Runnels

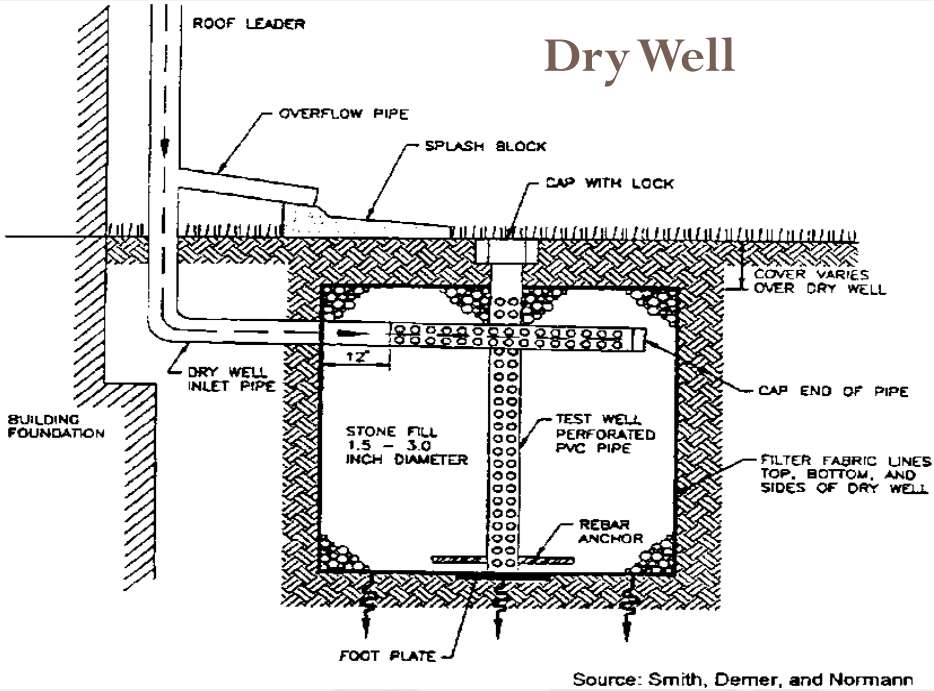


Storm Water Drainage-Best Practices

New Jersey

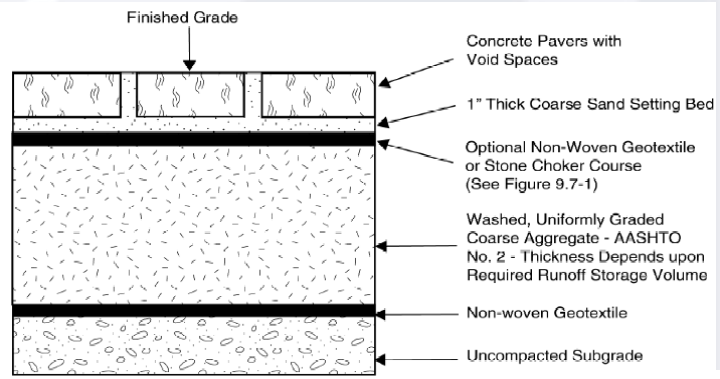
- **Structural**
  - Engineered to control both the quantity and quality of stormwater runoff
- **Non-structural**
  - Educational
  - Policy changing
  - Source-targeting (pollution prevention)

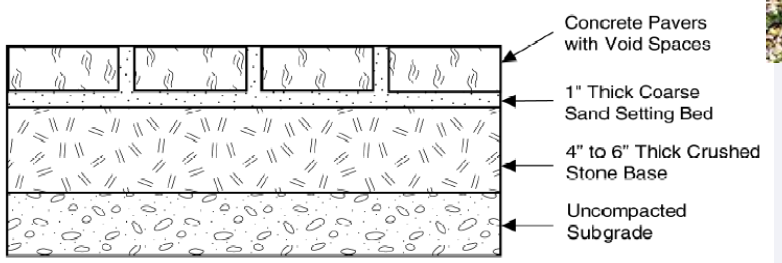
Dry Well



Source: Smith, Derner, and Normann

Pervious Paving





Stormwater Controls

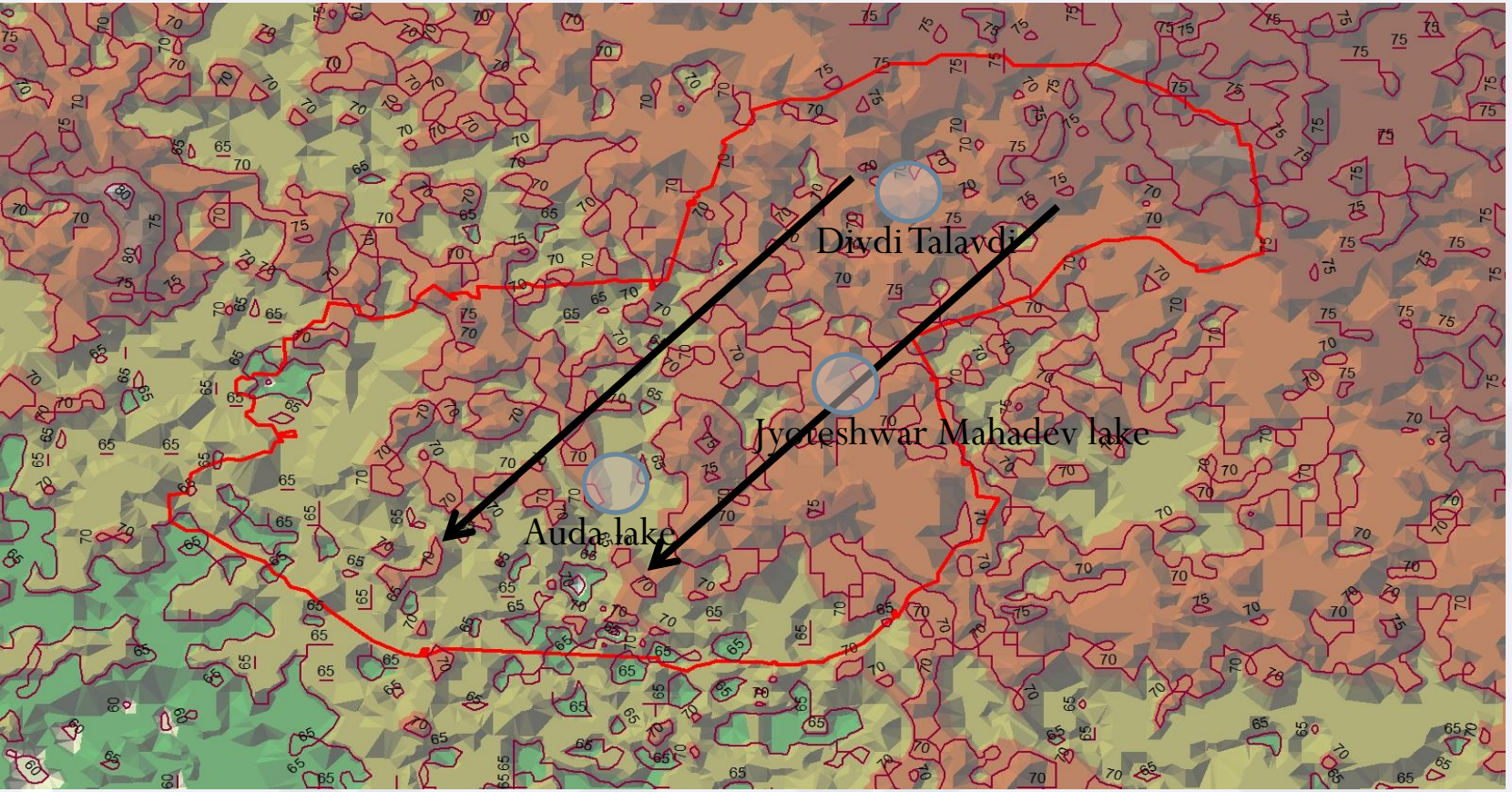
Diverting stormwater from drains will help reduce the impact to receiving lakes and streams

1. Rain Gardens (bioretention systems)
2. Rain Barrels
3. Green Roofs
4. Dry Wells

Extent of Services & Proposals

Storm Water Drainage

Capture → Storage → Transport → Treatment → Reuse



Elevation:

- 75 – 73
- 73 – 71
- 71 - 69
- 69 – 67
- 67 – 65

Water Bodies:

Avg. Seasonal Rainfall: 730 mm

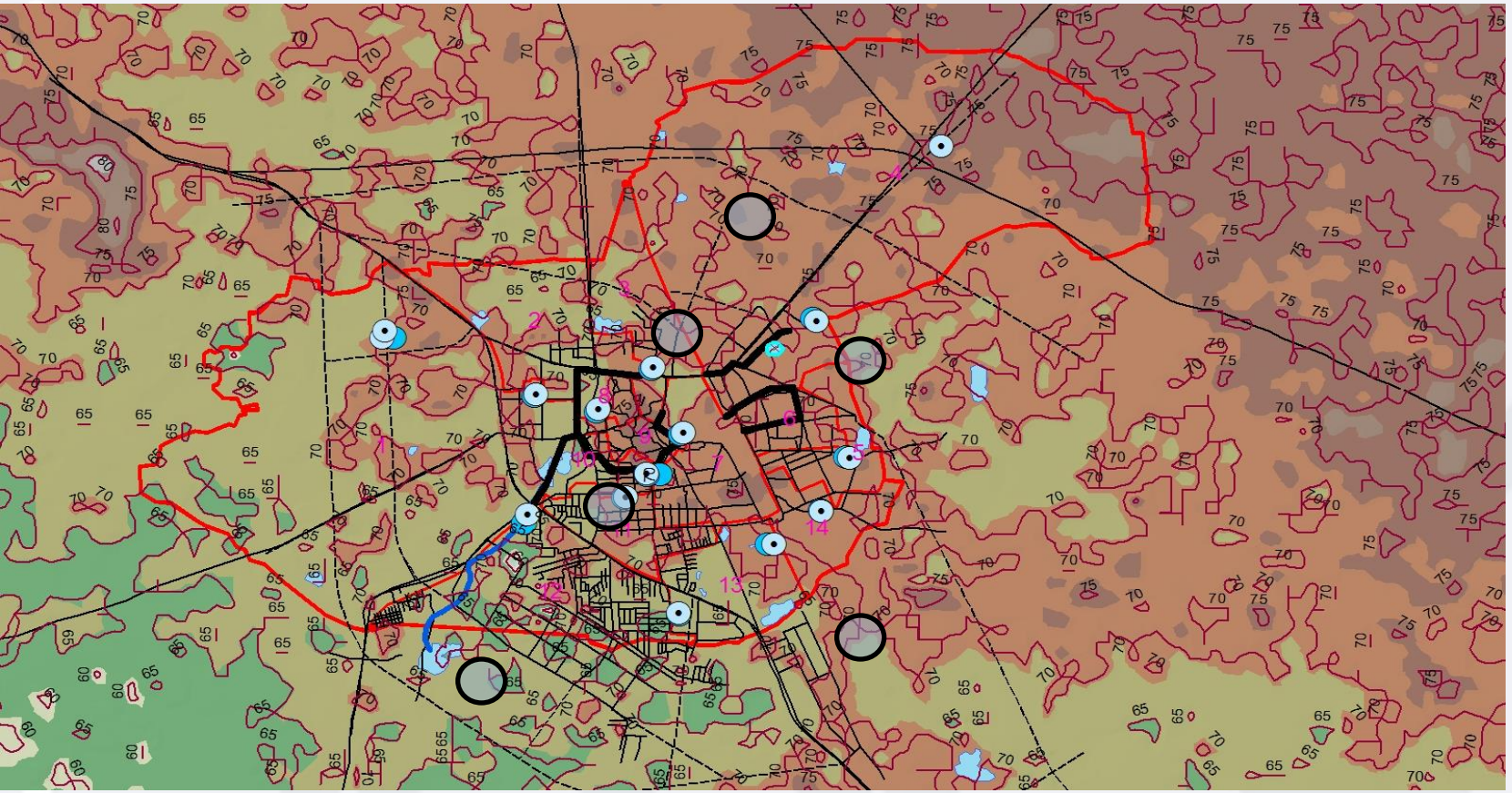
Intensity Factor: 0.8 mm / Hr

Area under Water Bodies: 39350 sq mts

Contour Range: 65 m – 75 m

Storm Water Drainage

Capture → Storage → Transport → Treatment → Reuse



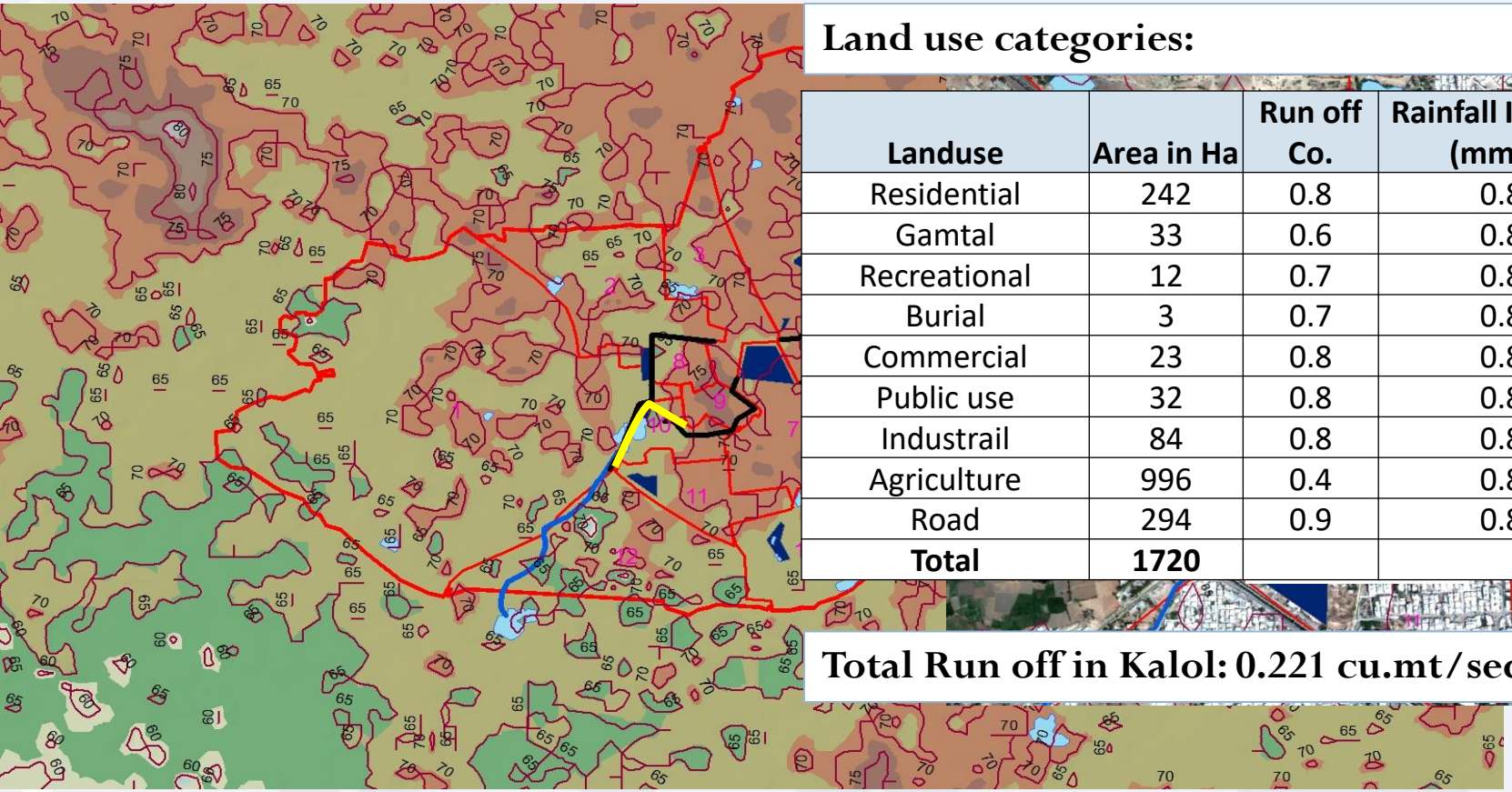
Depressions

Total Area under Water Bodies & Depressions: 125545 sq mts

Assuming avg. 1.5 mts Depth, Volume of water which can stored: 188317 cu.mts

Storm Water Drainage

Capture → Storage → Transport → Treatment → Reuse



Land use categories:

Landuse	Area in Ha	Run off Co.	Rainfall Intensity (mm/hr)	Total Run off (cum/sec)
Residential	242	0.8	0.80	0.043
Gamtal	33	0.6	0.80	0.004
Recreational	12	0.7	0.80	0.002
Burial	3	0.7	0.80	0.001
Commercial	23	0.8	0.80	0.004
Public use	32	0.8	0.80	0.006
Industrail	84	0.8	0.80	0.015
Agriculture	996	0.4	0.80	0.088
Road	294	0.9	0.80	0.059
Total	**1720**			**0.221**

Total Run off in Kalol: 0.221 cu.mt/sec

Man Made Drain

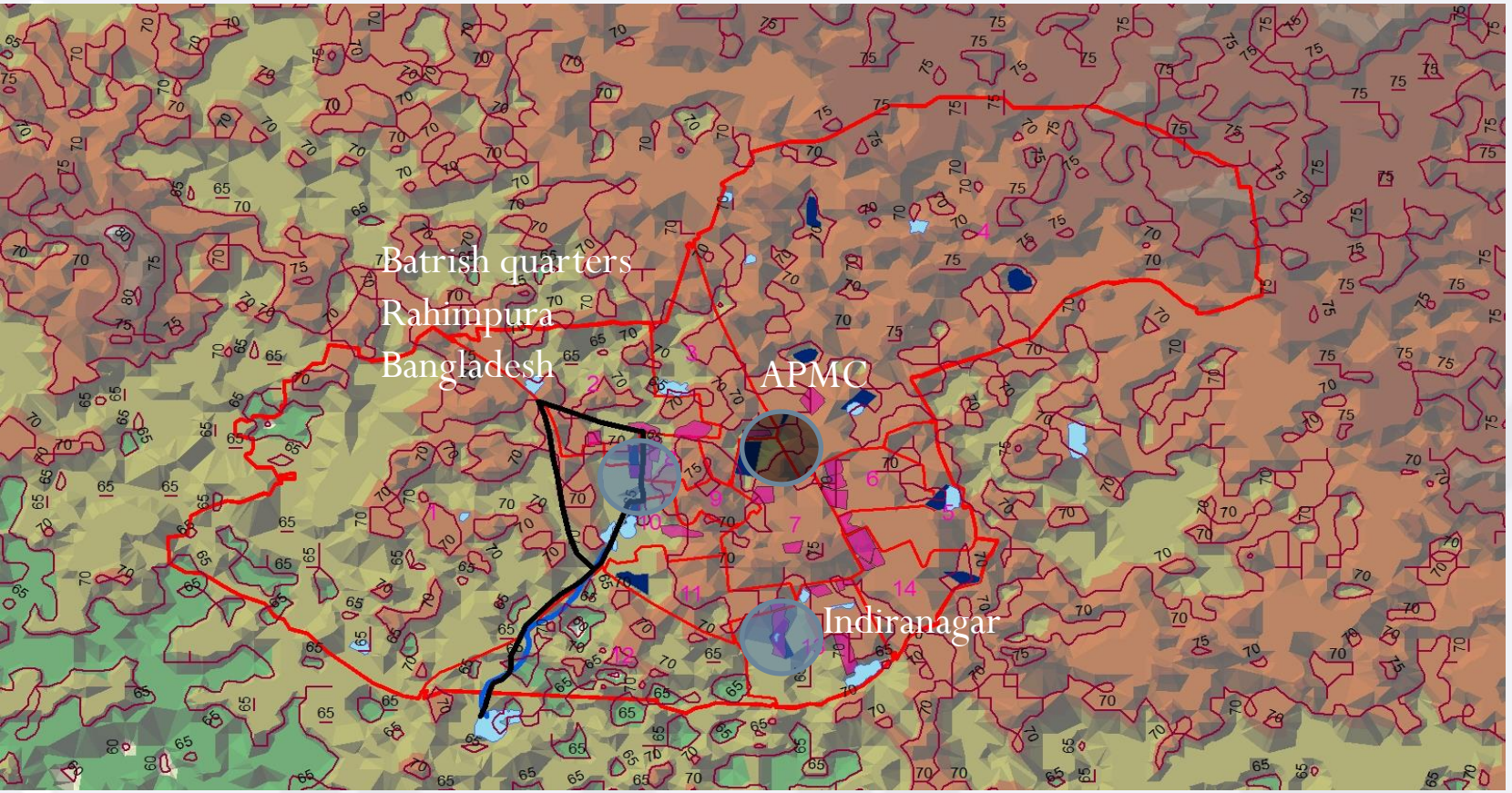
Closed Drain: 4.7 km

Open Drain: 0.45 km

Natural drainage: 1.5 km

Storm Water Drainage

Capture → Storage → Transport → Treatment → Reuse



Slum

Water logged areas

Critical Slum areas

Other Critical areas

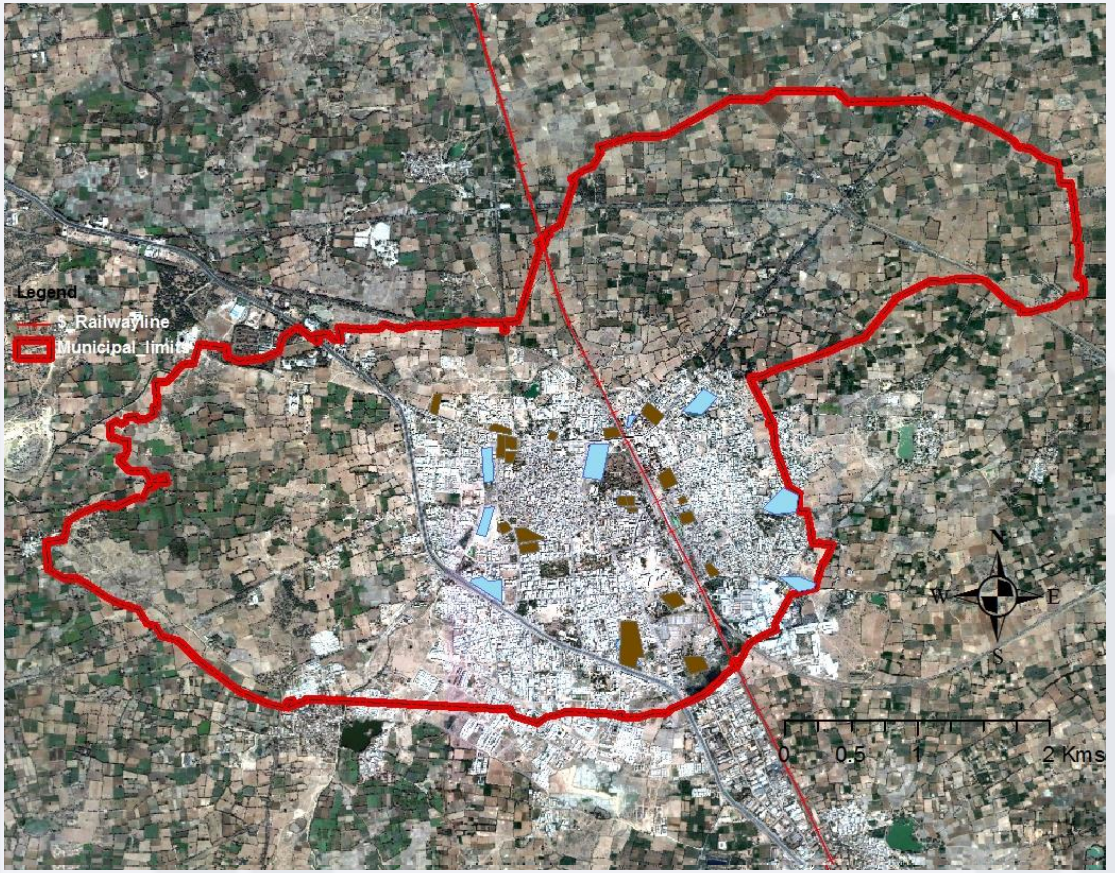
Population of slum affected:

Slum Areas	Population
Indiranagar	1600
rahimpura	1246
Bangladesh	813

Water logging on streets

Water logged areas

Overflow from sewerage network



Storm Water Drain

Average Seasonal Rainfall	730 mm
Mean no. of Rainy Days	41
Gradient	1:250
Intensity Factor	30 mm/hr.

Road Length	97 Km (Pucca), 49 km (Kutcha)
Sewerage Network Length	57 km
Storm Water Drain Length	6.5 kms
Water Logging Period	4 months (avg.)

Overflowing of lakes in the surrounding areas

Issue:

- **Water logging problem within slums and other part of the city for a duration of 4 months during monsoon and after monsoon, leading to breeding of mosquito's**
- **Damage in the lining of existing drain channel**
- **Dumping of solid waste in the drain leading to choking of the drain**

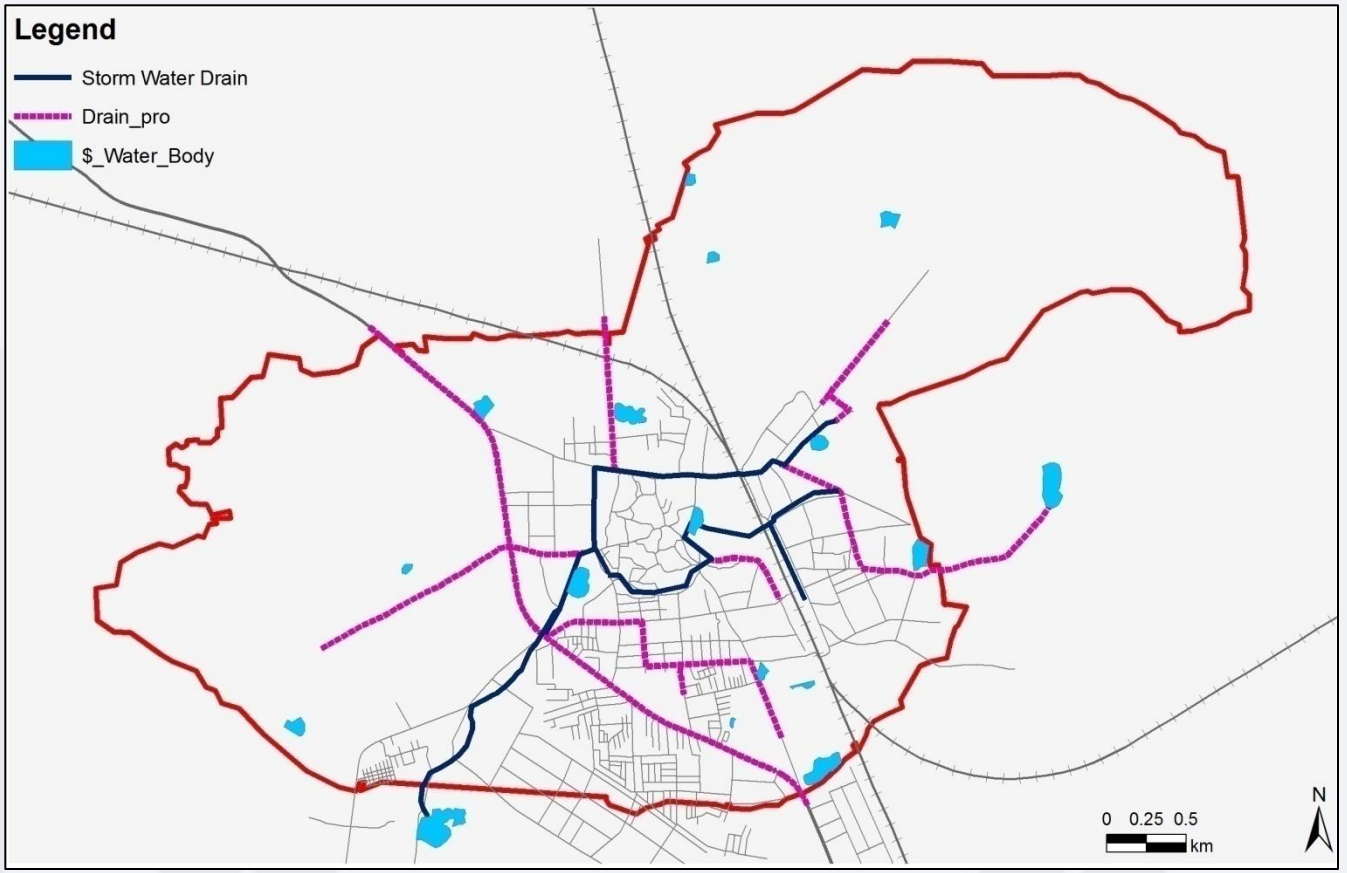
Emerging Issues & Probable Solution

Issues	Probable Solution
• 7% is only covered under storm water drain • Water logging during monsoon for a duration of 4 months • Existing open drain is in dilapidated condition – Channels are not lined – Choking of lines due to dumping of solid waste • Lakes overflow during monsoon	• City Level Solution – Storm Water Drainage line in the city – Revitalization of existing open drain channel – Deepening & Development of Lake – Interlinking of lakes – Use of Permeable Pavements • Premise Level – Promotion of Rain Water Harvesting – Promotion of use of Infiltration Well at HH level/ Municipal Gardens – Use of Permeable Pavements

Revitalization of Existing Drain

Drainage	Length	Unit
existing	4.7	km
natural drain	1.5	km

- Interlining of existing Drains
- Covering of Drains by using Kota stone /Concrete slabs or Pavement.
- One time repairing cost: 47 Lakhs



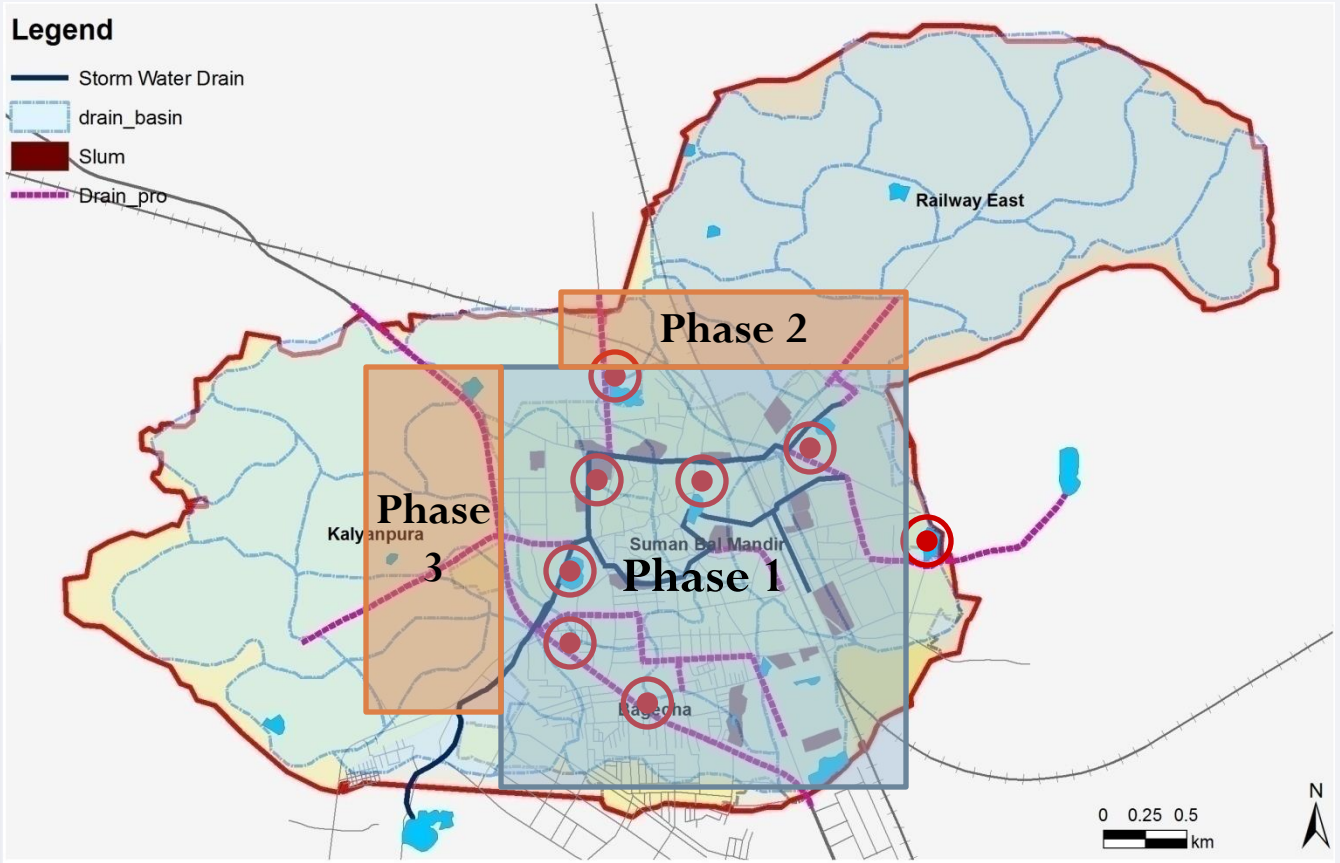
Needs an immediate intervention

Extension of Storm Water Drainage Network

Drainage	Length	Unit
existing	4.7	km
natural drain	1.5	km
proposed	13.2	km

- Total area (Drainage Basin) = 16.06 sq.km.
- Total length of Drain = **13.2 km**
- Quantity req.= 17924 CuM

Total cost of Project: Rs.
11 lakhs



Intermediate Intervention (Extension of Storm Water Drain)

- Phase 1: 8.4 km (70 lakhs)
- Phase 2: 4.8 km (40 lakhs)

Lake Interlinking

Concept:

Storm water in the catchments area of a lake flows to the lake and recharges the groundwater level. Once that is done, the excess water will flow to the other lake by means of pipelines.

- No. of Lakes Covered through Storm water drains: 5
- No. of Lake Interlinked : 3
- Network Length: 2.23 km

- CAPEX

Lake Development = 80 Lakh

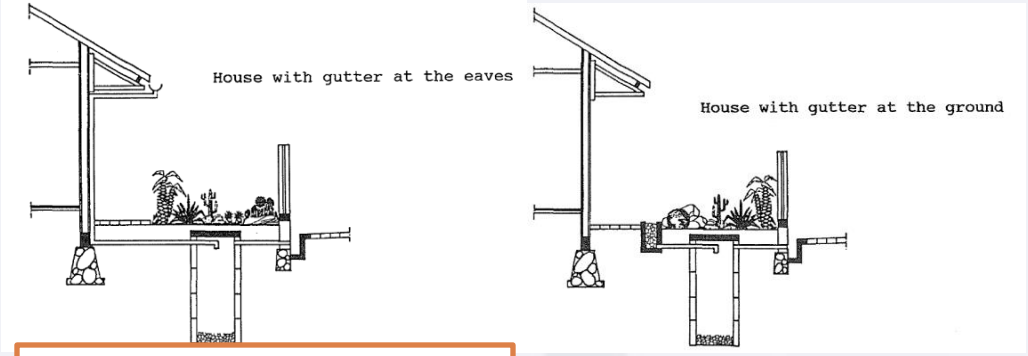
Network Cost = 17 Lakhs

Total = 97 Lakhs (approx.)

Long Term Intervention

- Phase 1 = 1.03 km (47 Lakhs)
- Phase 2 = 1.20 km (50 Lakhs)

Infiltration Well: Allows water to get in to the well which functions as a temporary storage facility, as well as to infiltrate, to become groundwater.



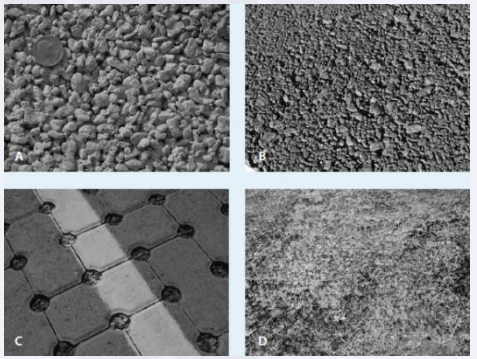
Cost: starts from Rs.50,000

Advantages

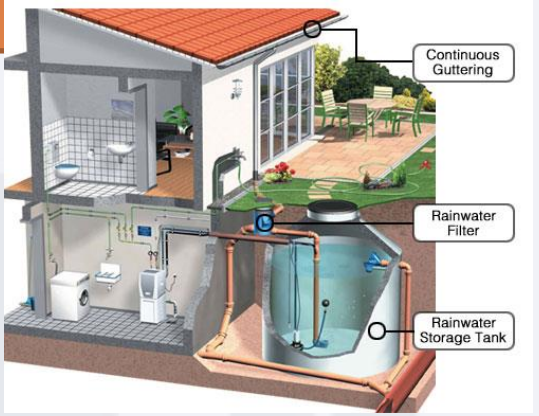
- a quantity of unconfined groundwater can be conserved;
- the surface level of unconfined groundwater stays stable;
- the area of ponding water is minimized;
- the dimension of drainage networks is minimized

Rain Water Harvesting: Rainwater harvesting entails the collection of rain where it falls in a scientific and controlled manner for future use. RWH consists of rooftop water harvesting, water from open areas such as paved ways, parks, roads, fields and in lakes and ponds.

Bioretention Cell



Permeable Pavements



Premise Level Approach

urban sanitation

Rain Water Harvesting

- Incentives to HH for constructing Rain Water Harvesting Tank
- Compulsory use of Rain Water harvesting tank for the new G+3 or more storey's building coming up
- IEC Campaign for use of Rain Water Harvesting in institutions

Permeable Pavements

- Promoting use of Permeable pavements in
  - residential compounds
  - footpaths
  - Parking's

Infiltration Tank & Bio-retention Cell

- Use of infiltration tank in garden

Waste Water Management

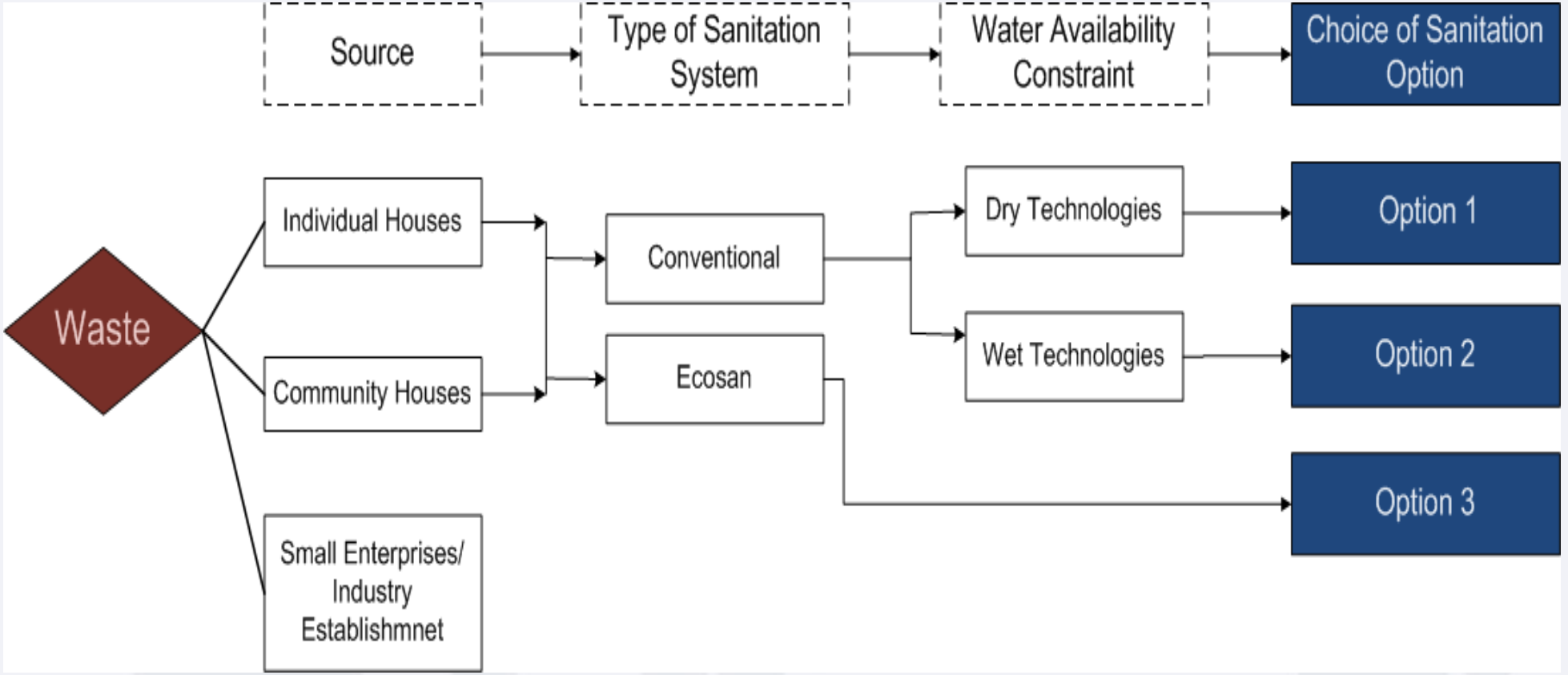
Technology Options

Extent of Services

Proposals

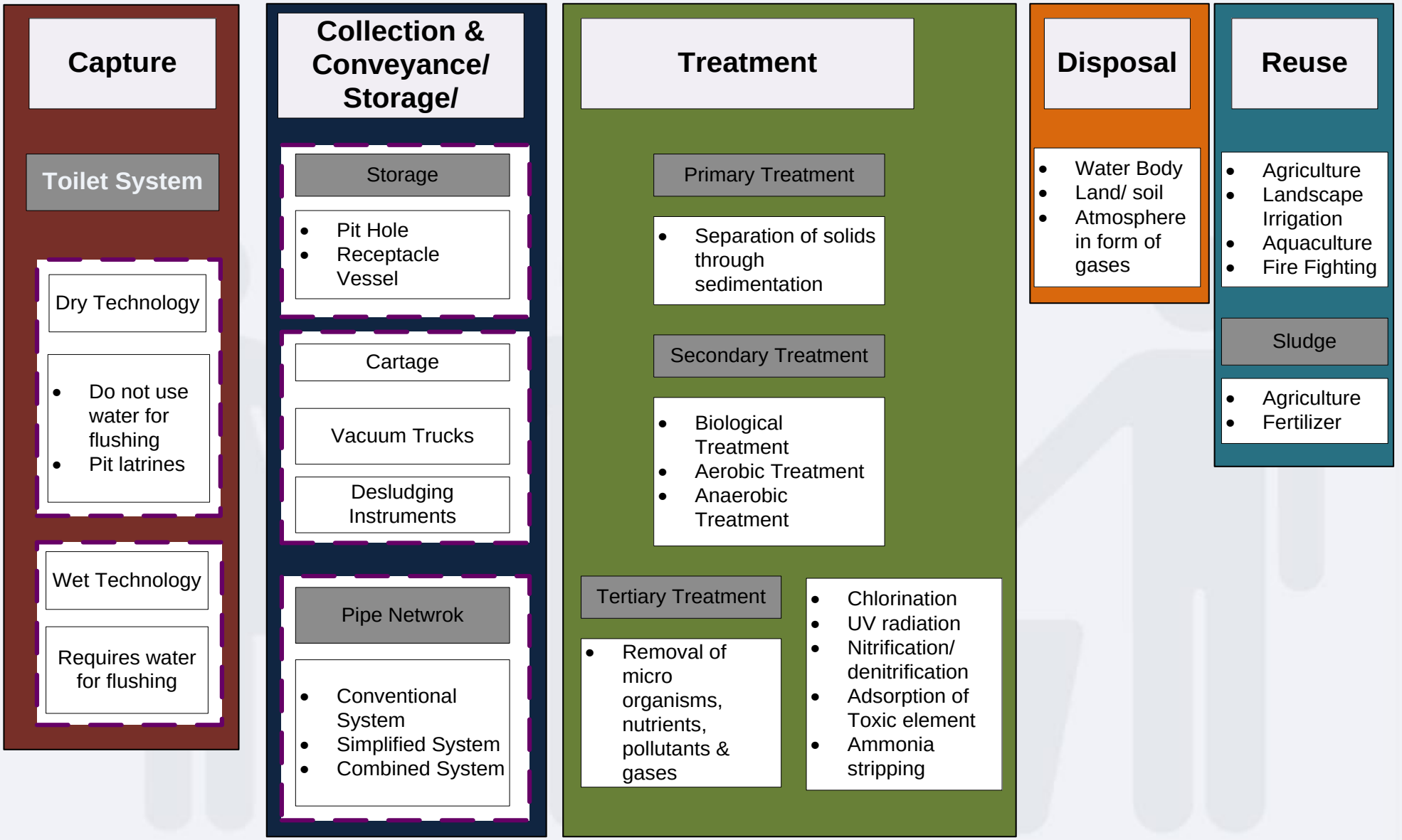
Technology Option

Categories of System Configuration

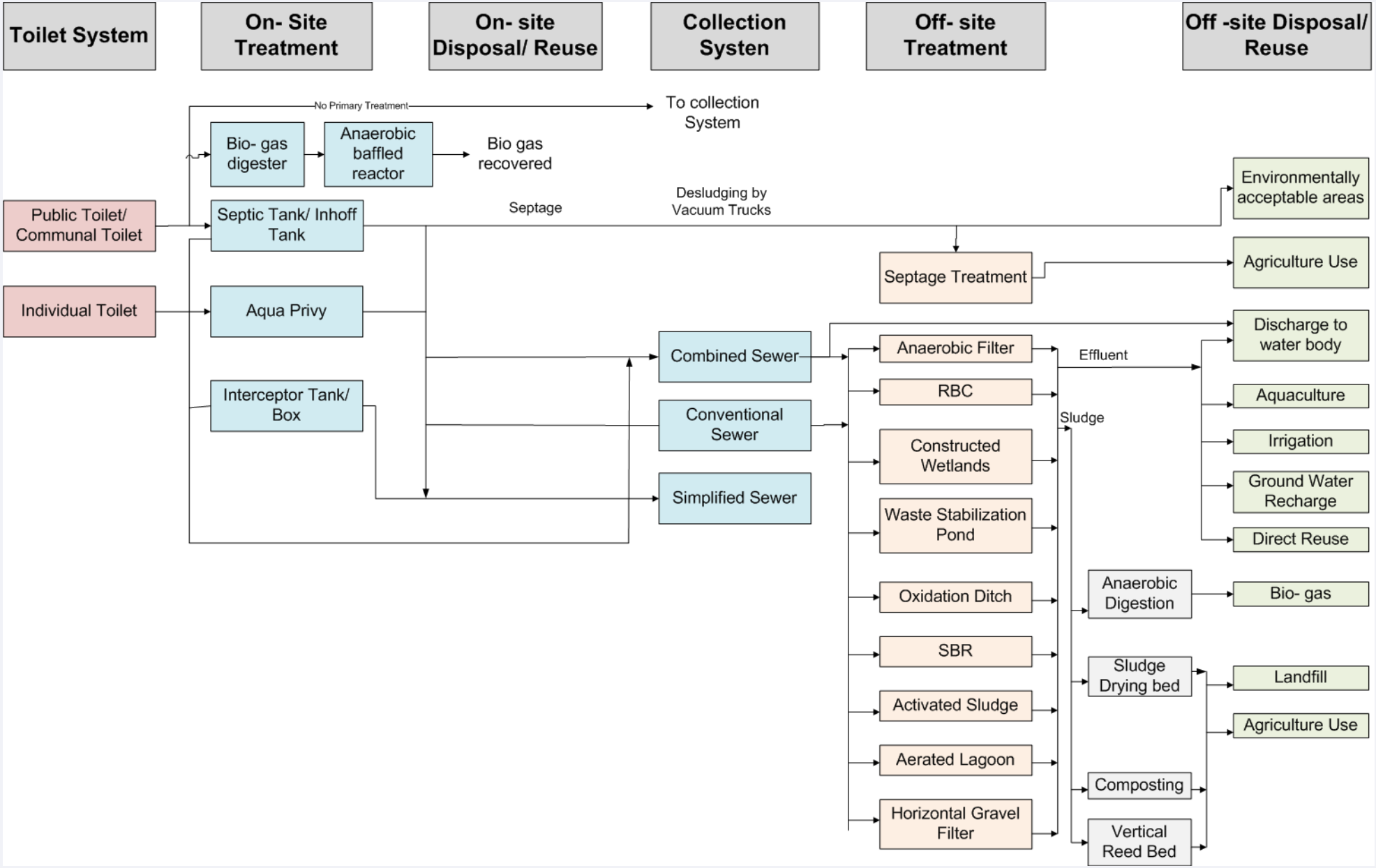


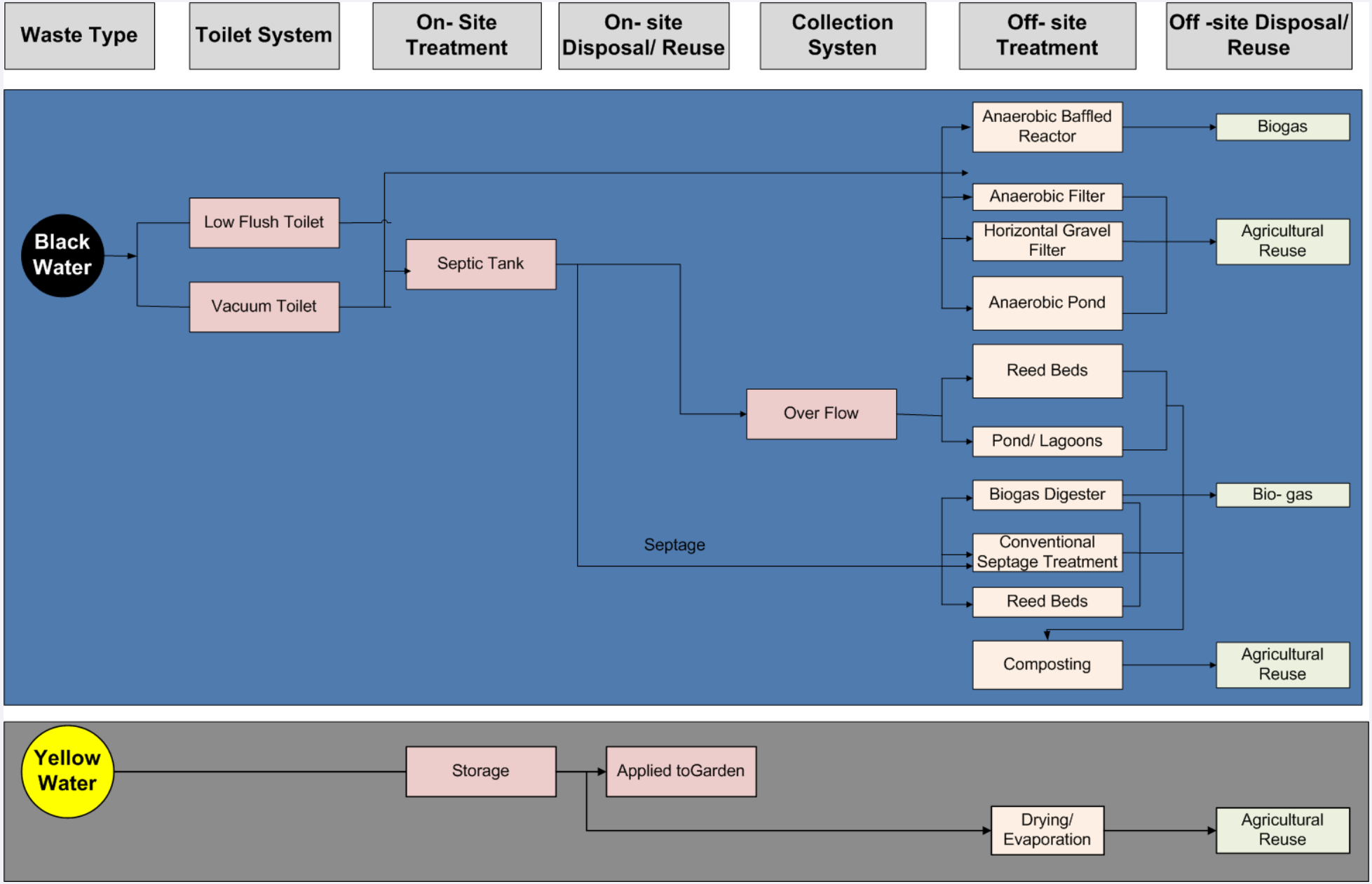
- Depending on the type of system i.e. Dry technology & Wet technology, the option for value chain differs from the type of treatment and disposal
- Apart from the toilet technology, the system also depends on the type of water to be treated

Components of Sewerage System

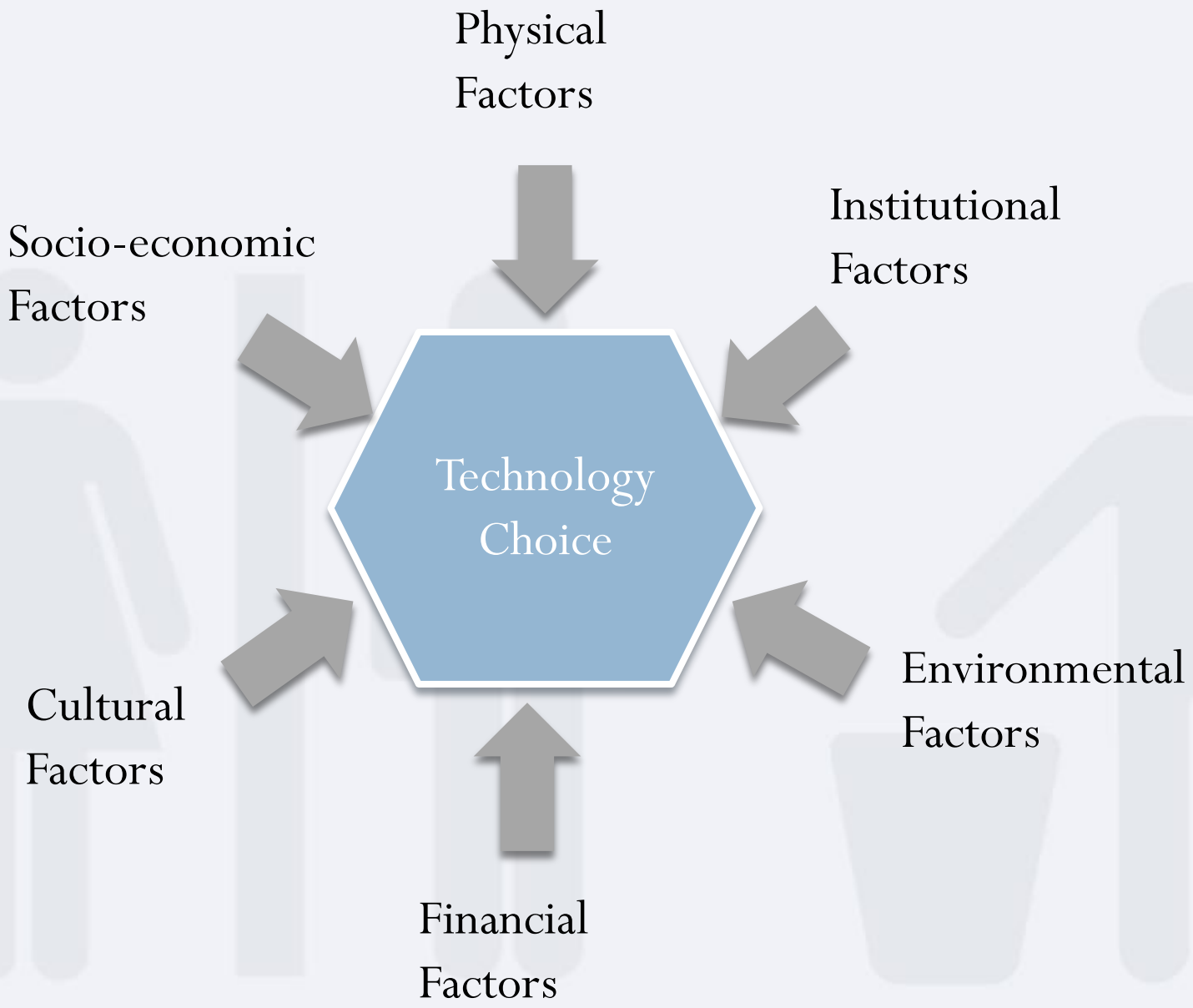


Wet Technology Option




Waste Type
Toilet System
On- Site Treatment
On- site Disposal/ Reuse
Collection Systen
Off- site Treatment
Off -site Disposal/ Reuse
Black Water
Low Flush Toilet
Vacuum Toilet
Septic Tank
Over Flow
Septage
Anaerobic Baffled Reactor
Anaerobic Filter
Horizontal Gravel Filter
Anaerobic Pond
Reed Beds
Pond/ Lagoons
Biogas Digester
Conventional Septage Treatment
Reed Beds
Composting
Biogas
Agricultural Reuse
Bio- gas
Agricultural Reuse
Yellow Water
Storage
Applied toGarden
Drying/ Evaporation
Agricultural Reuse

Factors Affecting Technology Options



		WATER RELIANT SYSTEMS					
		Community Pour- FlushToilet			Community/ Individual	Individual ur- Flush Toilet	
						h ic k	Aqua Privy
Site Specific	Nature of the area	Urban Environment					
		Topography					
		FLOODING OR POOR DRAINAGE IN THE AREA					
		High groundwater level					
		Soil Permeability					
		INORDERLY ROADS/ PATHS CIRCULATION SYSTEMS					
		Difficult Vehicular Access to facilities					
		Limited Space					
		FOOTPRINT	Small/ Medium	Large	Small	-	Medium
Option Specific		CAPITAL COST	High	Medium/ High	Very Low	-	Medium
		O&M COST	High	Medium	Very Low	-	Medium
		SYSTEM ROUBTNESS	Fair	Good	Excellent	-	Good
		SYSTEM FLEXIBILITY	Good	Excellent	Fair	-	Excellent
		EASE OF CONSTRUTION	Fair	Easy	Very Easy	-	Easy
		SIMPLICITY OF OPERATION	Fair	Simple	Very Simple	-	Simple
		Usability of by products	Yes	-	-	-	-
		Health Implication	-	-	-	-	-

Toilet Provision: Mainly for slums

- Community level
- Household Level
- Addition of Infrastructure: Laying Sewerage

Toilet Provision: Mainly for slums

- Community level: With Septic Tank/ Imhoff Tank
- Household Level: With Septic Tank/ Aqua Privy

	WATER RELIANT SYSTEMS		
	Collection Systems		
	Combined Sewerage System	Conventional Sewerage System	Simplified Sewerage System
PIPED			
FETCHED			
Urban Environment			
Topography			
FLOODING OR POOR DRAINAGE IN THE AREA			
High groundwater level			
Soil Permeability			
INORDERLY ROADS/ PATHS CIRCULATION SYSTEMS			
Difficult Vehicular			
SYSTEM ROUBTNESS	Excellent	Excellent	Fair
SYSTEM FLEXIBILITY	Excellent	Excellent	Excellent
EASE OF CONSTRUTION	Very Difficult	Very Difficult	Easy
SIMPLICITY OF OPERATION	Fair	Simple	Fair
Usability of by products	-	-	-
Health Implication	-	-	Some Hazard

Collection Mechanism: City & Slum

- Simplified Sewerage
- Conventional Sewerage

Treatment: City/ Slums

		Treatment Systems											
		Activated Sludge	Constructed Wetlands	sequencing Batch Reactor	Aerated Lagoon	Oxidation Ditch	Waste Stabilization Ponds	Trickling Filter	Rotating Biological Contactor (RBC)	Sand Filter	Anaerobic filter	Anaerobic Reactor	Leaching or soakway pits
Water Supply	**PIPED**												
	Fetched												
Nature of the area	**URBAN ENVIRONMENT**												
	Roral environment												
	Topography												
	Flooding or poor drainage in the area												
	High groundwater level												
	Soil Permeability												
	Inorderly roads/ paths circulation systems												
	Difficult Vehicular Access to facilities												
	Limited Space												
	FOOTPRINT	Small/ Medium	Large						mall/ edium	Large	Medium	Medium	Small
	CAPITAL COST	High	Low						High	High	Medium	Fair	Low
	O&M COST	Medium/ High	Low						edium	High	Medium	Medium	Low
	SYSTEM ROBUSTNESS	fair	Fair						or/ fair	Excellent	Fair	Fair	Excellent
	SYSTEM FLEXIBILITY	Excellent	Poo						Poor	Poor	Poor	Poor	Poor
	Ease of construction	Easy	Very E						y Easy	Very Difficult	Easy	Easy	Very Easy
	SIMPLICITY OF OPERATION	Fair	Very Simple	Fair	Simple	Fair	Very Simple	Difficult	Difficult	Difficult	Difficult	Fair	Very Simple
	Usability of by products	Yes	No	Yes	No	No	No	No	No	Yes, grey, H2O	yes	yes	No
	Health Implication	-	-	-	-	-	-	-	-	-	-	-	-
Treatment efficiency	BOD	Good	Fair	Good	Good	Good	Good	Good	Fair/ good	Excellent	Good	Good	Poor

Oxidation Ditch

Aerated lagoon

Anaerobic Filter

Anaerobic reactor

Activated Sludge

Sequencing Batch Reactor

TOILETS:

- **Compost Privy:/ UDDT:** Below Ground
- **Tank/ Container Urine-** Above Ground

COLLECTION:

Sanitary Manual Collection

TREATMENT

- **Anaerobic Digestion for Biogas**
- **Dehydration or Stabilization of sludge & Storage & drying of Urine**

			NON- WATER RELIANT SYSTEMS											
							Collection				Treatment			
			Compost Privy	Dehydration Toilet	Latrine/ Family Pail	Tank/ Container for Urine	Pit Latrine or privy	Sanitary Manual Collection	Vacuum Truck	Hauling Cart/ Truck	Anaerobic Digestion for Biogas	Composting of sludge	Dehydration or Stabilization of Sludge	Storage &/ or Drying of Urine
Site Specific	Nature of Area	Urban Environment												
		Rural Environment												
		Flooding in the area												
		High groundwater level												
		Soil Permeability												
		Difficult Vehicular Access to facilities												
		Limited Space												
Option Specific		Footprint	Large	Medium	Small	Medium	Small	-	-	-		Large	Large	Medium
		Capital Cost	Medium	High	Very Low	Medium	very Low	Low	Very High	Medium		Medium	Medium	Medium
		O&M cost	Low	Very High	Low	Medium	Low	Low	High					
		System robustness	Poor/ Fair	Excellent	Excellent	Excellent	Excellent	Fair	Excellen					
		System flexibility	Poor	Good	Excellent	Good	Excellent	Fair	Excellen					
		Ease of construction	Difficult	Easy	Very Easy	Very Easy	Very Easy	-	-					
		Simplicity of Operation	Fair	Fair	Simple	Simple	Very Simple	Simple	Difficult	Fair	Difficult	Fair	Simple	very Simple
		Usability of by products	Yes	-	-	Yes	No	Yes	Yes	Yes		Yes	Yes	Yes
		Health Implication	-	Some Hazard	Hazardous	Some Hazard	-	Hazardous	-	Some Hazard		-	Some Hazard	Some Hazard

Waste Water Management- Best Practices

SLUM SANITATION PROGRAMME, BOMBAY

- World Bank aided BMC project
- Awareness creation,
- Formation of community level operating mechanisms
- Provision of hard infrastructure through NGOs
- Maintenance of the facilities with the local community level groups

WATER AID PROJECT FOR WATSAN IN URBAN AREAS OF MADHYA PRADESH

- Bhopal, Indore, Jabalpur, Gwalior
- Mass Community Mobilization for general awareness
- Capacity building and exposure programmes for government officials and community
- Support to Individual and community toilets managed by community
- Construction of child and women friendly designs

dual toilets

- Design and provision of systems with community involvement and participation
- Reuse of waste water in industrial usage
- Creating demand for sanitation

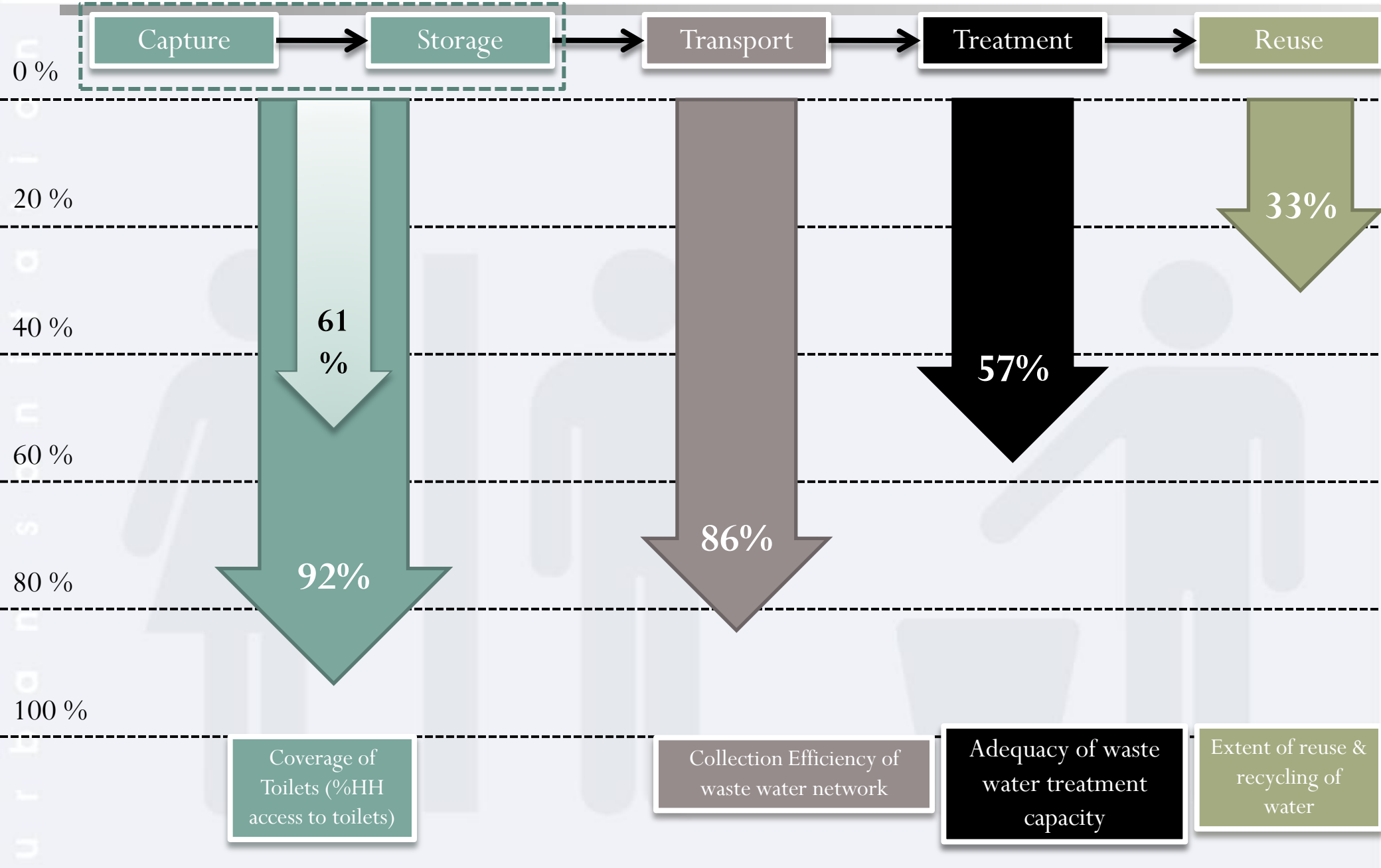
WOMENS SEL
TIRUCH

Community Toile
education teams
The toilets work on a pay and use principle, and user charges are collected by these teams. These toilets have been so successful that the
NGO has constructed 126 community toilets along with the city corporation.

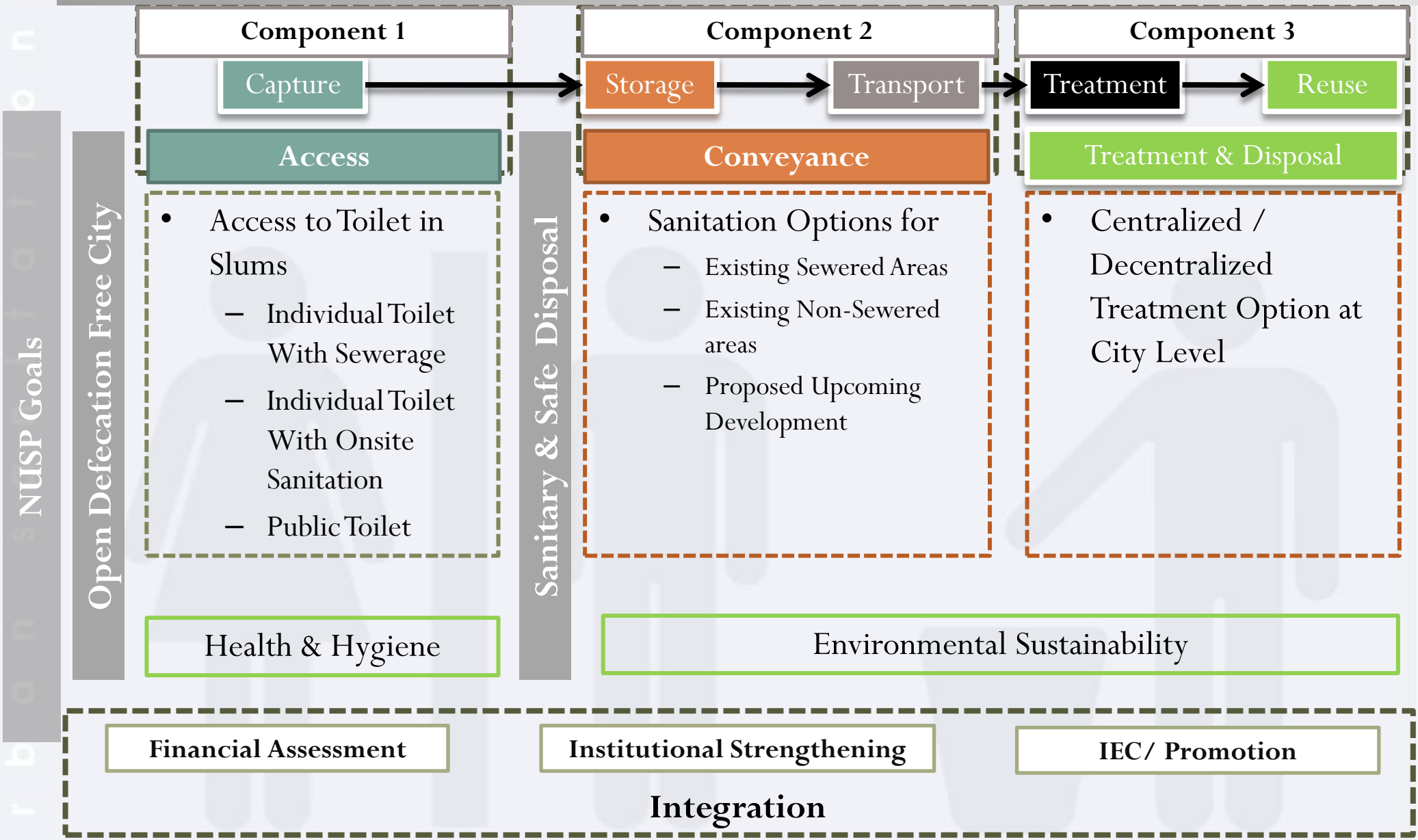
Water sanitation issues and possible approaches, UNHABITAT 2004, Water Aid activity report for WATSAN in Madhya Pradesh, Pramod Dabhrase, 2009.

Extent of Services & Proposals

Waste Water


Capture
Storage
Transport
Treatment
Reuse
0 %
20 %
40 %
60 %
80 %
100 %
61 %
92%
86%
57%
33%
Coverage of Toilets (%HH access to toilets)
Collection Efficiency of waste water network
Adequacy of waste water treatment capacity
Extent of reuse & recycling of water

Waste Water Management Plan



Access

Component 1

Open Defecation

- 3,732 HH (13%) practices Open Defecation (Estimated)
  - 2,649 (47%) Slum HH
  - 1,083 (4%) Non- Slum HH

Public Toilet Provision

- 9 'Pay & Use' Toilet with 90 Seats
- 10,000 Floating Population
- 12 Community Toilets of 175 Seats (Non Functional)

Individual Toilet

- Total No of HH: **26,000**
- HH with individual toilet facility: 23,933 **(92%)**

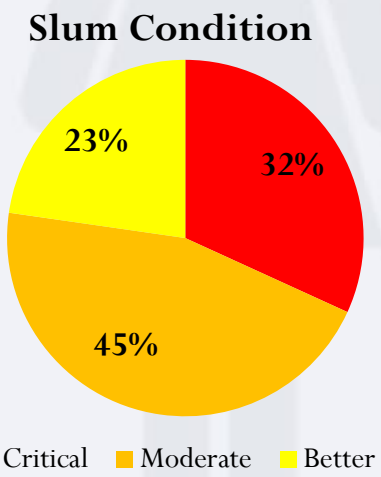
Issue

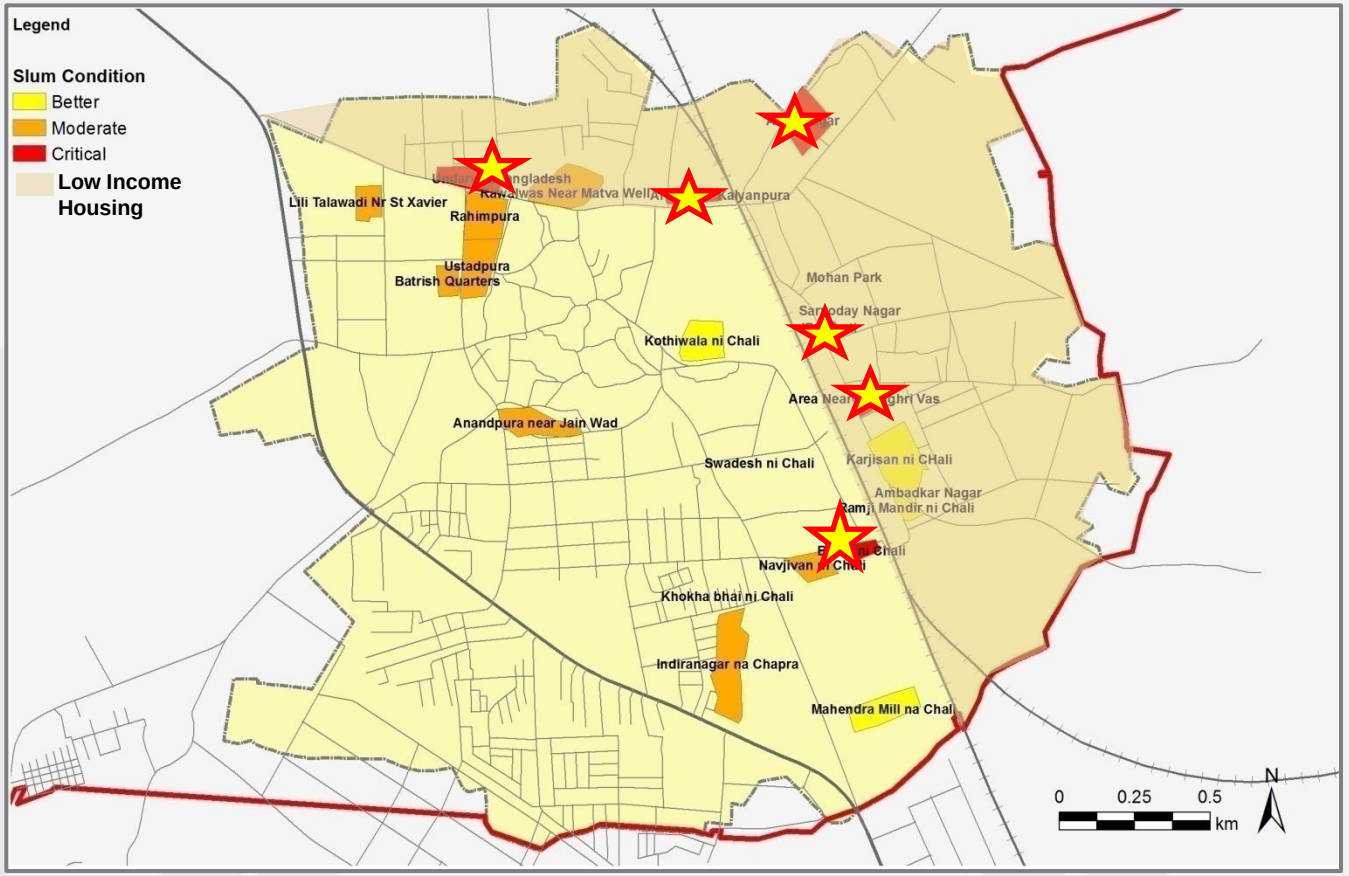
- **3,500 (13%) HH practices Open Defecation**
- **43% of the total slum HH practices Open Defecation**

- Total 22 Slums
- Total Slum HH: 5,580
- No of IT in slums: 3,523

Parameters:

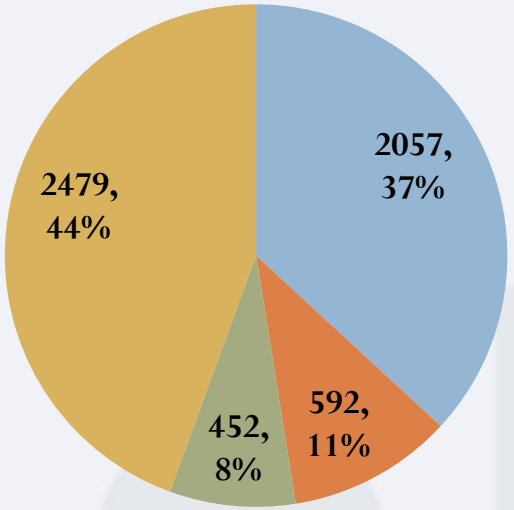
- Individual Toilet
- Density
- Size of Dwelling Unit (<18 sq mt)
- % practicing OD

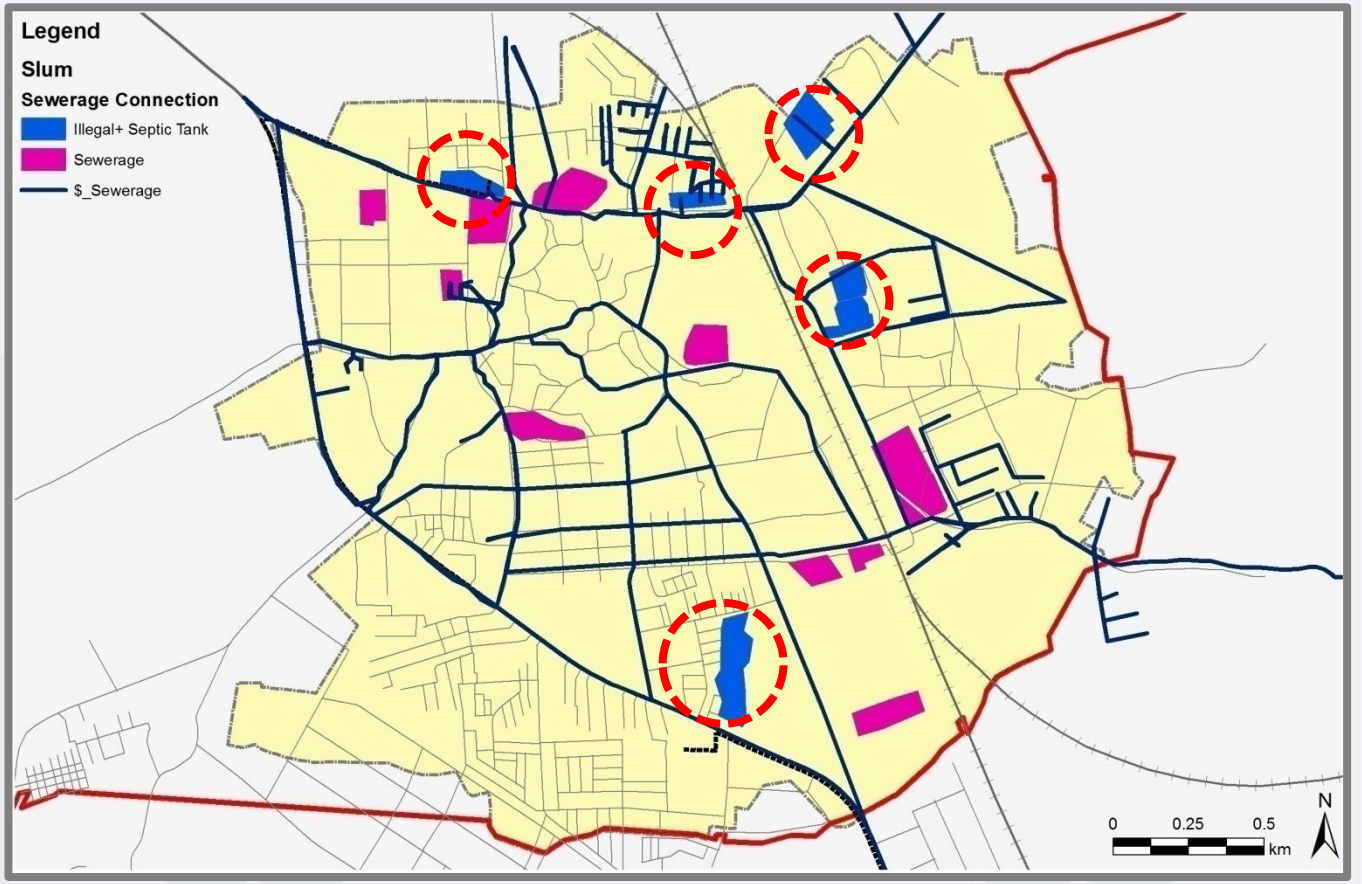




Most of the Slums in Critical Conditions are located in low income group area

Sanitation in Slum HH





Toilet build under scheme lacks of any connection

Toilet build under scheme used as storeroom

- **9 out of 22 Slums** only has Legal Sewerage Connections
- **10 out of 22 Slums** located along the network don't have any Legal Internal Sewerage Network
- **2,649 HH** does not have any option for sanitation
  - **2,057 HH** do not have Individual Toilet
  - **592 Toilets** constructed under Vyaktigat Sauchalay Scheme, lacks of any type of disposal

Project 1: Provision of Individual Toilet

2,057 HH without toilet

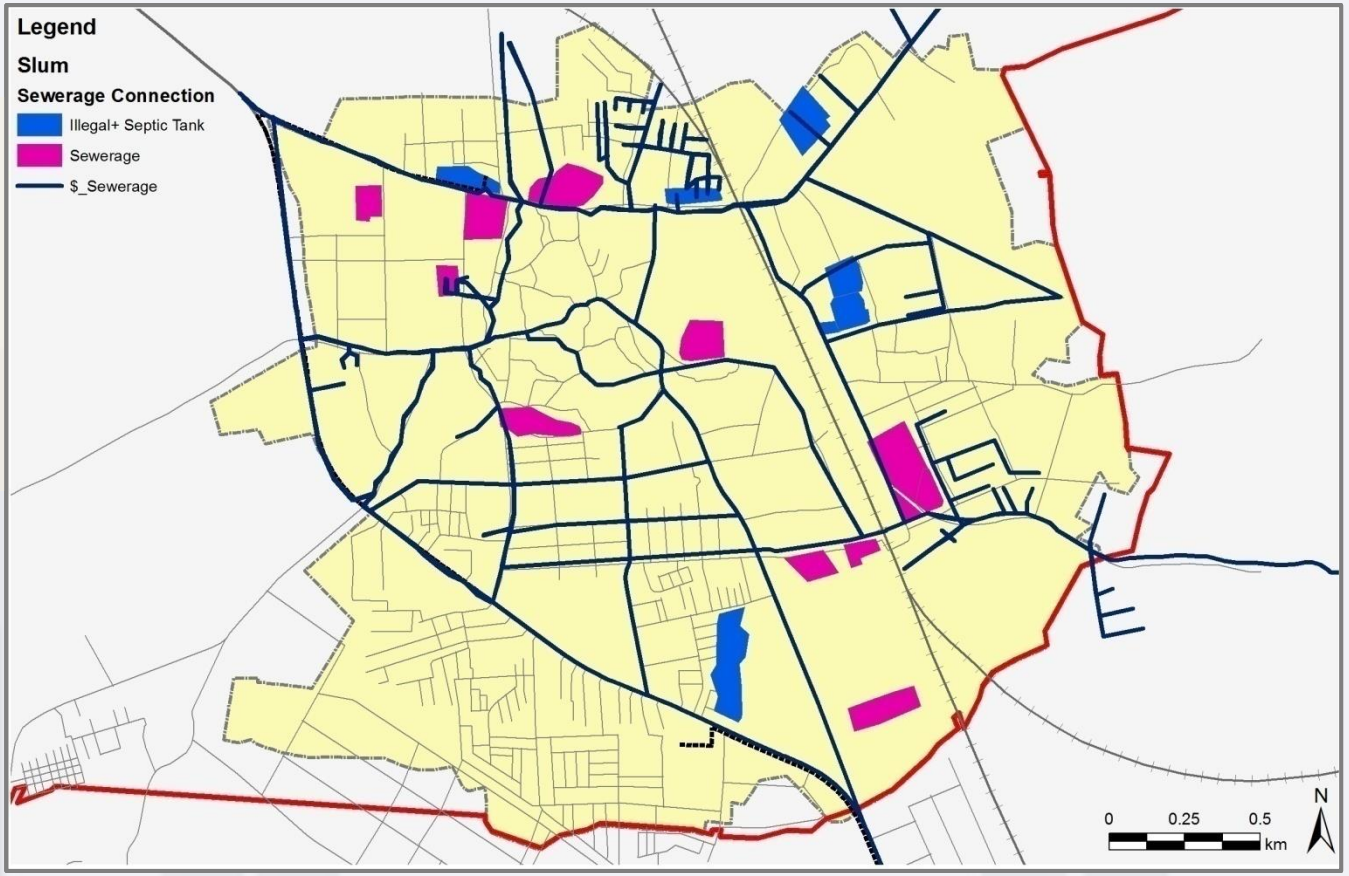
Parameters:

- Land Tenure
- Flood Prone Areas
- Space Constraint
- Extent of Existing services

557 HH Can't be provided IT

Funding Pattern	Cost	Unit
Vyaktigat Sauchalay Scheme	3700	rs/unit
Nodal Agency	175	rs/unit
ULB	125	rs/unit
User's fund	900	rs/unit
Total	4900	rs/unit

Aligning with Vyaktigat Sauchalay Scheme, at State Level



Project 1	No of Toilet	Phase 1	Phase 2	Phase 3
	1500	600	600	300
Capital Cost	**73.5 Lakhs**	29.4 Lakh	29.4 Lakh	14.7 Lakh
User's Cost	**13.5 Lakhs**	5.4 Lakh	5.4 Lakh	2.7 Lakh

Project 2:Provision of Sanitation Option in Slum

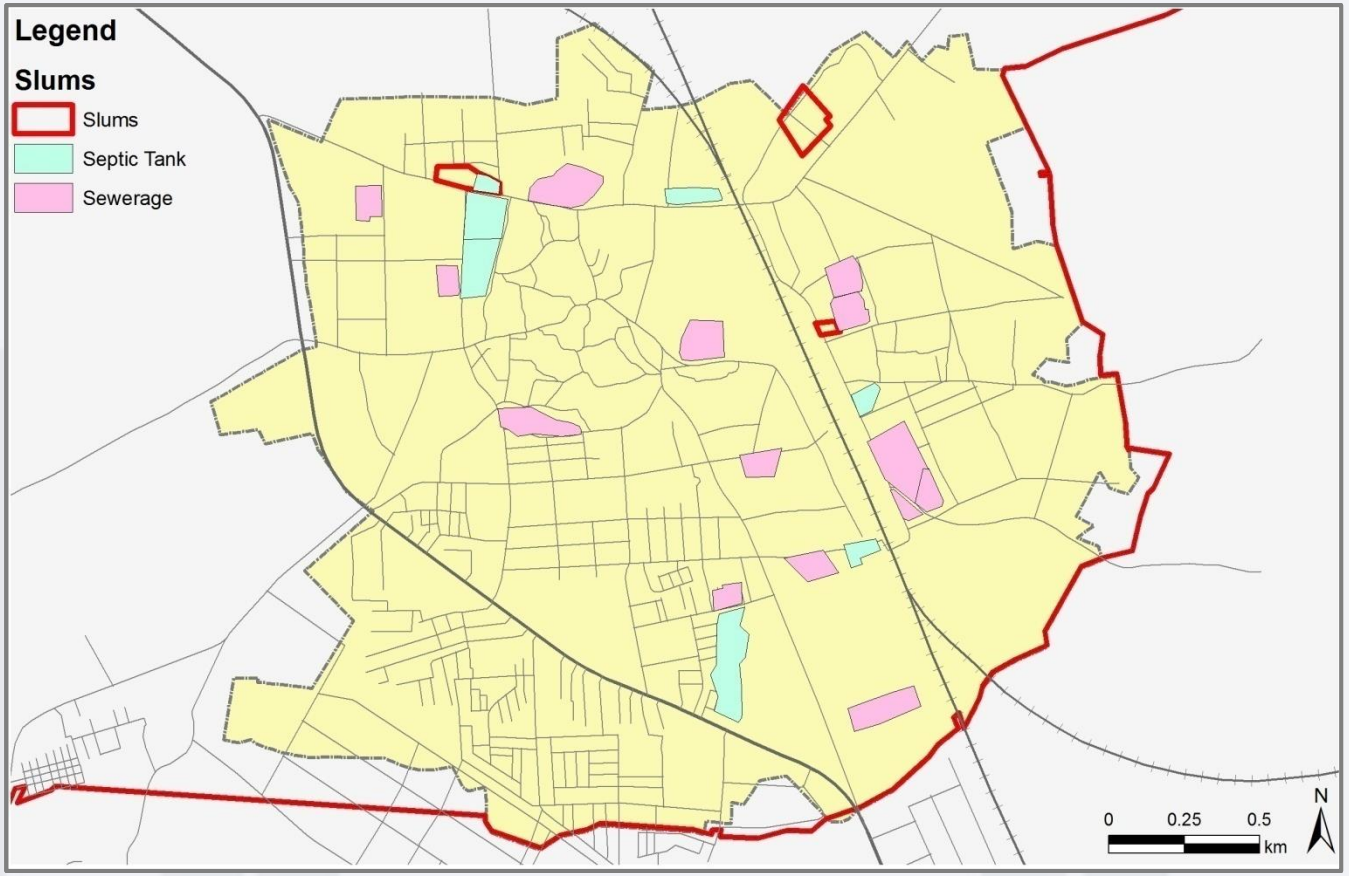
Requirement of sewerage connections/ onsite sanitation facility for 2,649 HH

Sanitation Options:

- Soak Pits
- Septic Tank
- Conventional Sewerage
- Small Bore Sewerage
- Shared Septic Tank

Factors for Option selection

- Extent of Existing Sanitation Service
- Land Ownership
- Density
- Space Constraint
- Flood Prone Area
- Capital Cost
- O& M Cost



Sr No	Project	No of HH Served	Total Capital Cost
2a	HH with sewerage connection	1,709	450 Lakhs
2b	HH with onsite facility (Septic Tank)	940	180 Lakhs

Community Toilets

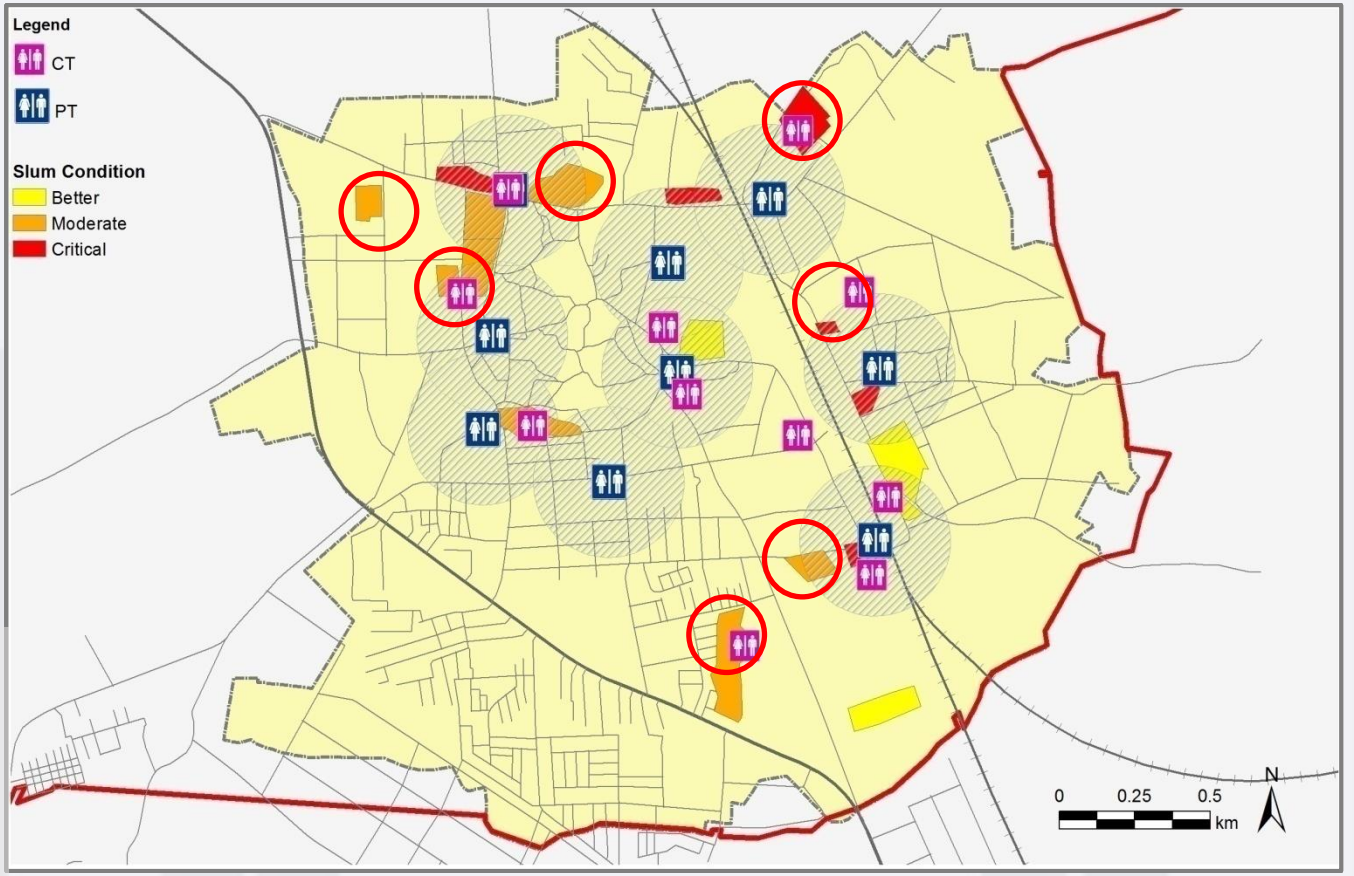
- 12 Community Toilets in Slums
- 175 Seats
- Non- Functional

Public Toilet

- 9 Pay & Use Toilet
- 90 Seats

Charges:

- Free for children's less than 11years of age, Old people and handicap persons
- For BPL card holders, 12- 15Rs per family



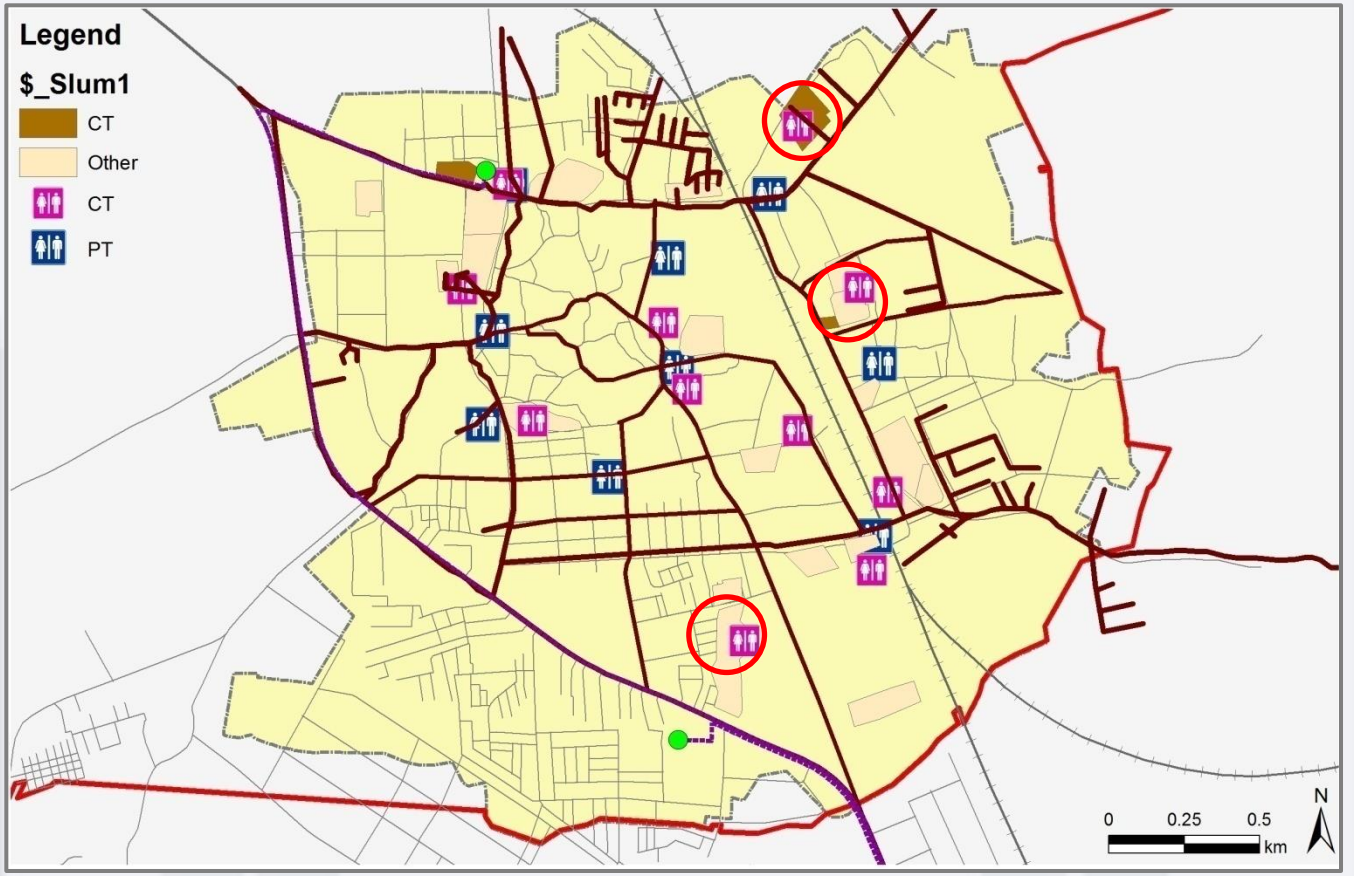
- **120 Users/ Seat** (recommended 50 Users/ Seat)
- **7 out of 22 slums does not have access to pay and use toilets**
- **Toilets are not used because of location, safety issue for women & children**

Project 3: Revitalization of Community Toilet

- No of HH to be served by CT- 557
- Revival of 3 Community Toilet Blocks in 3 Slums

Cost of each block	
Component	Cost
One Time Repair Cost	2,00,000
Daily Total users	500
Revenue/ HH/month	15
Total Revenue/annum	16,364
O&M Expenditure/annum	40,000
Subsidy/Annum	23,636

Year 2011:
CAPEX: Rs. 6,00,000
OPEX: Rs. 71,000



'Pay and Use Toilets' - PPP
Exiting No. of Blocks: 9
Total Seats: 10 Seats/Block

Current Load: 120 Users/Seat
Desired Load: 30 Users/Seat

No. of Blocks Required: 14
Cost / Block: Rs. 4,00,000

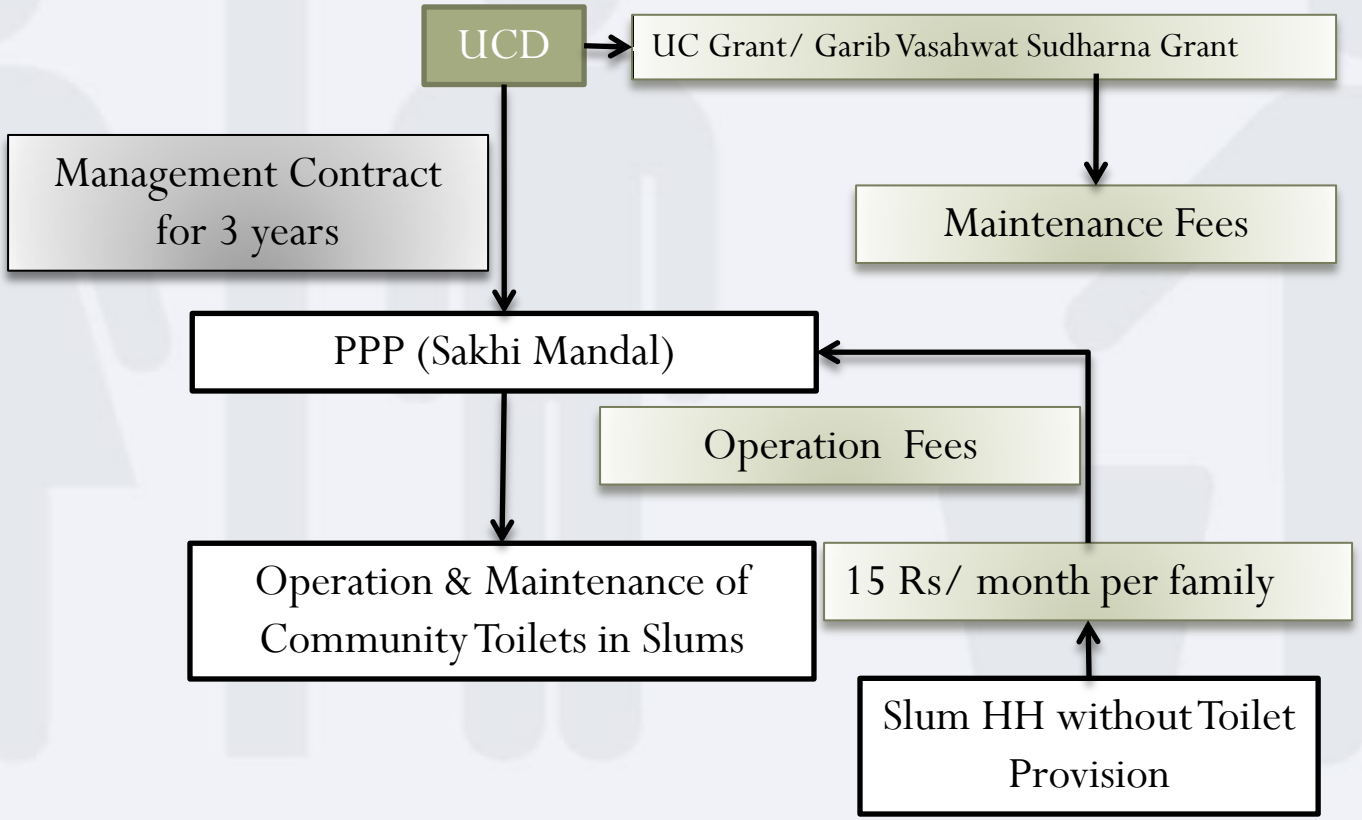
Year 2011:
CAPEX: Rs. 96,00,000

Project 3: Revitalization of Community Toilet

Immediate Action

Functioning of 3 Community Toilets on subsidized pay & use basis

Contracting out for community based management/ NGO based management of existing Community Toilet

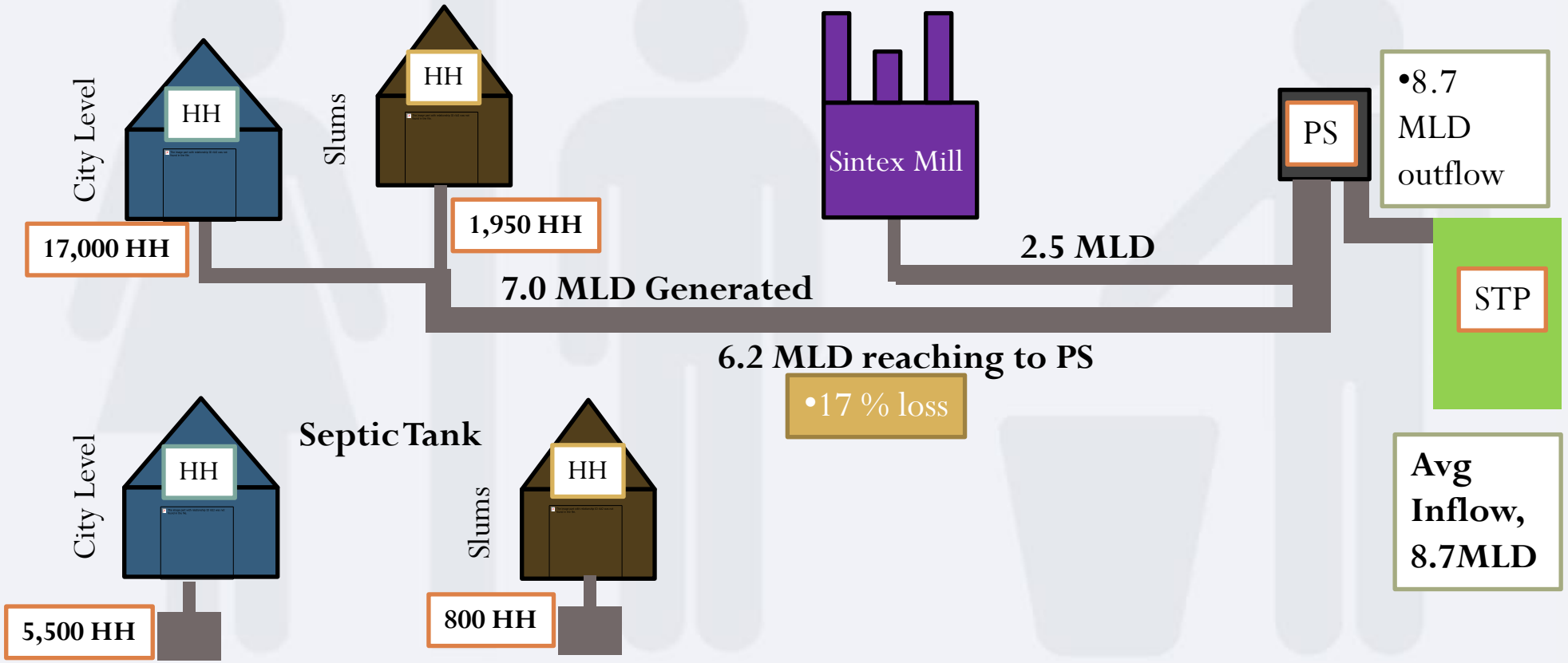


Conveyance

Component 2

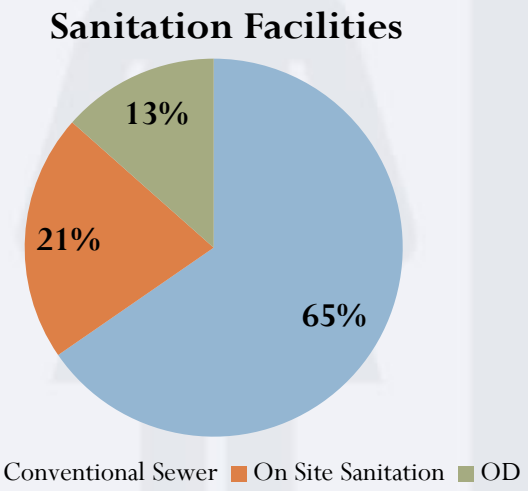
Waste Water Balance Diagram

- **Water Supplied at HH : 95 LPCD**
- **Hours of Water Supplied: 1.5 hrs**
- **Waste generated @80% water supplied**
- **Waste Generation: 10 MLD**

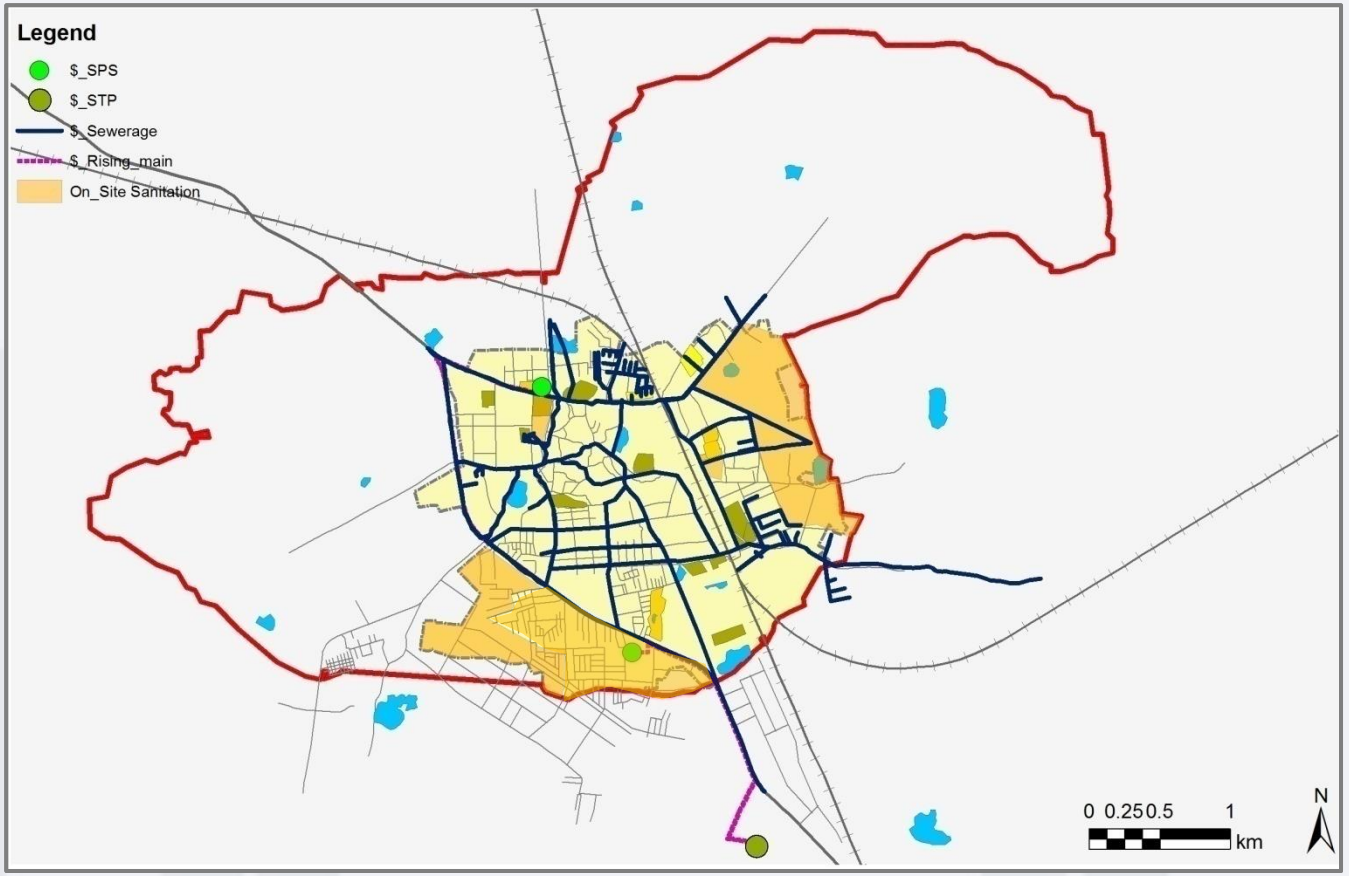


- Road Network: 97 Kms
- Road Network (Sewered Area): 37 Kms
- Network Length: 57kms

- **Except for existing slums, coverage in sewered area is 100%**



- 13% (1,038) HH practicing OD are from slums, & Railway East Areas which lacks of Sewearge Network

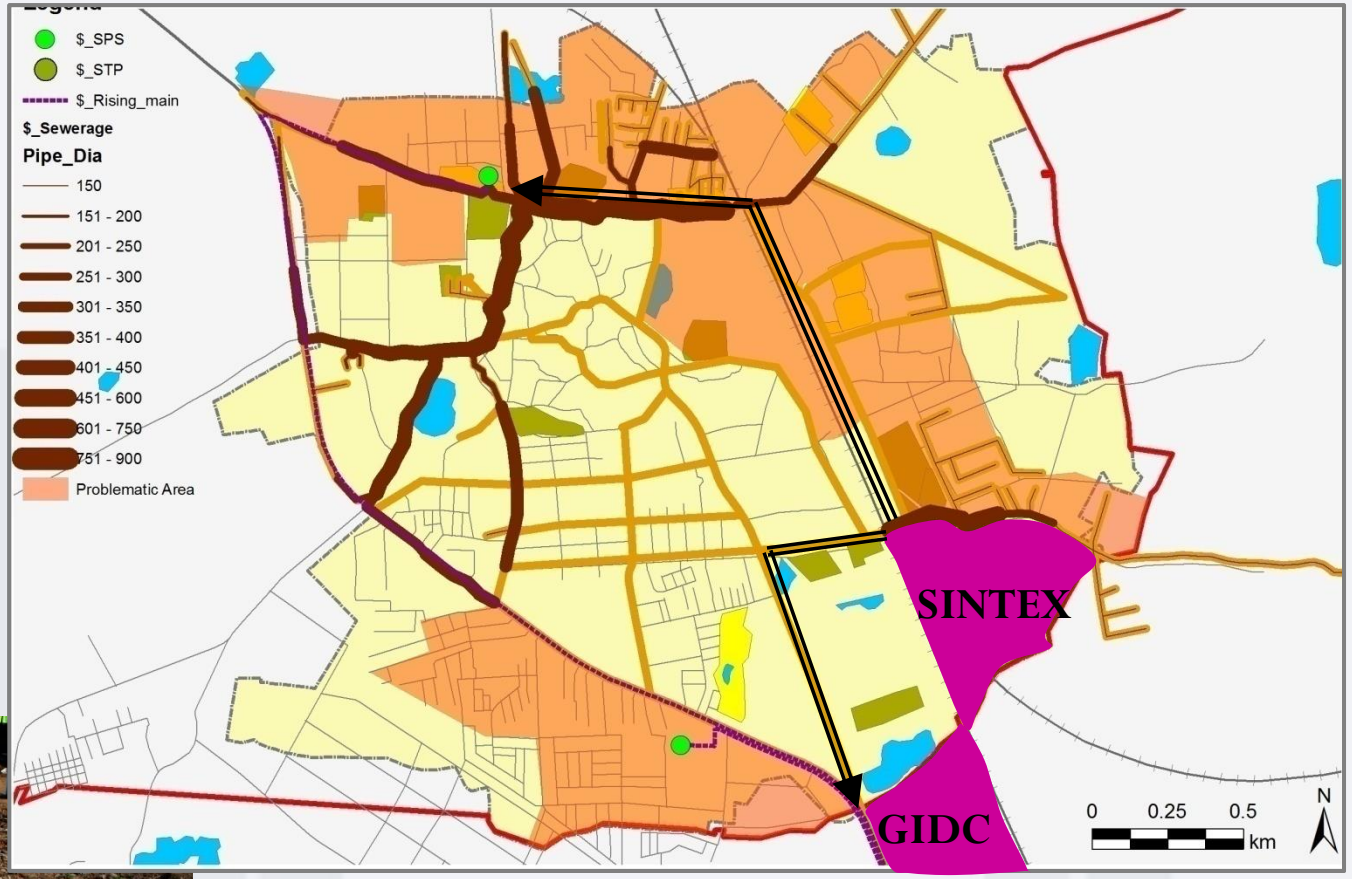


	Sewerage	Onsite	Total
Total HH	17,000 (65%)	5,500 (21%)	26,000 (100%)
Total Area (in sq km)	3.5 (63%)	2.0 (37%)	5.5 (100%)

- No formal Feacal Sludge Management (FSM) for onsite sanitation arrangements

Existing Network-Problems

- Rly East Area and Part Kalyanpura & Bagecha area are the problematic zones, where lines get choked up, backlogging of water & damaging of lines
- Frequent Damage of Rising Main
- Approx 40% of the area is problematic zone



Broken Pipe- water getting merged into storm water drain

Project 4: Replacement of Existing Rising Main

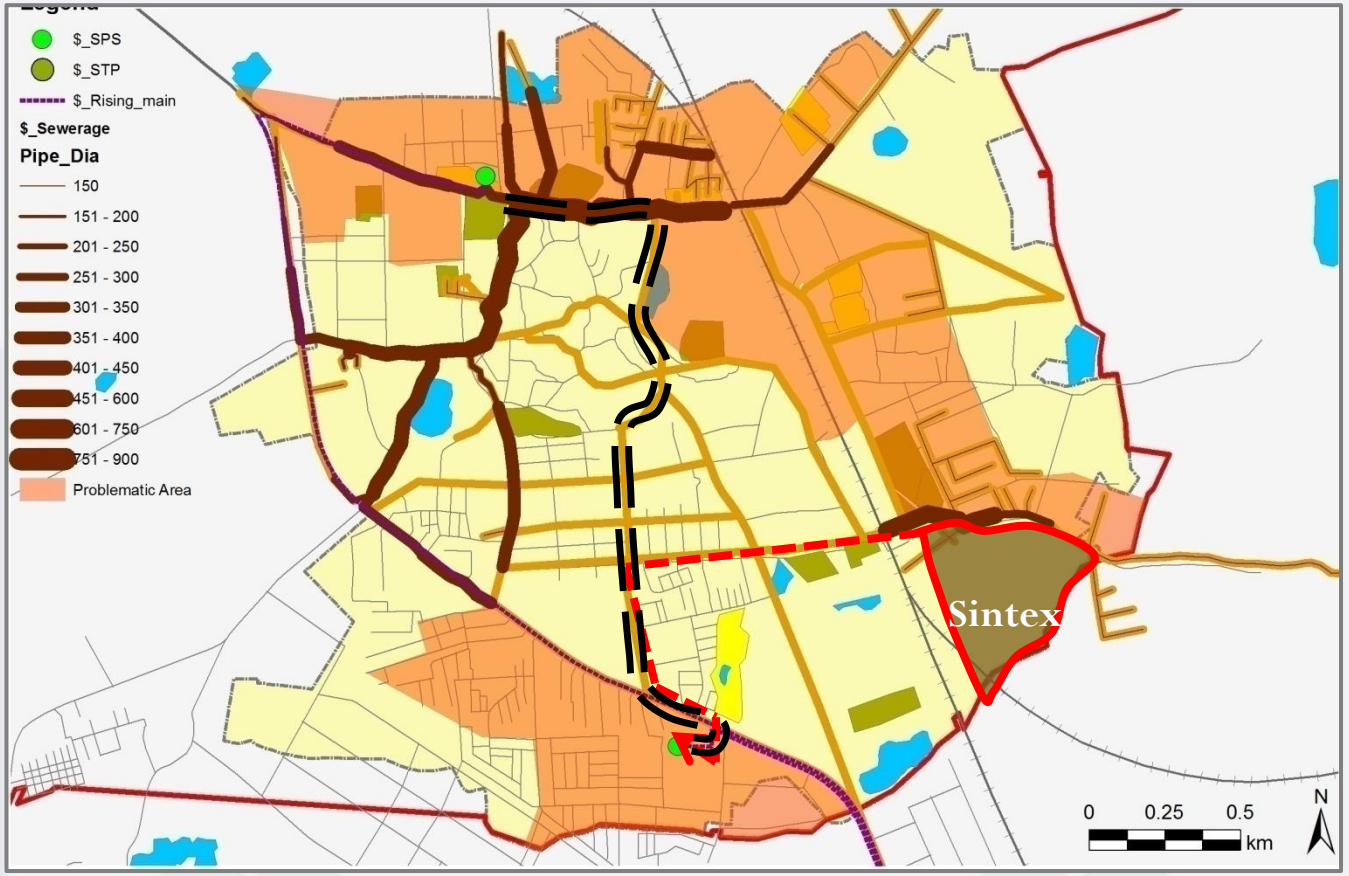
Rising Main:

- **450 mm Cast Iron Conduit**
- Length: 2.5 Kms
- Capital Cost: 21 Lakhs

For Sintex Industries:

300 mm RCC Conduit

- Length: 1.75 Kms
- Capital Cost: 6 Lakhs

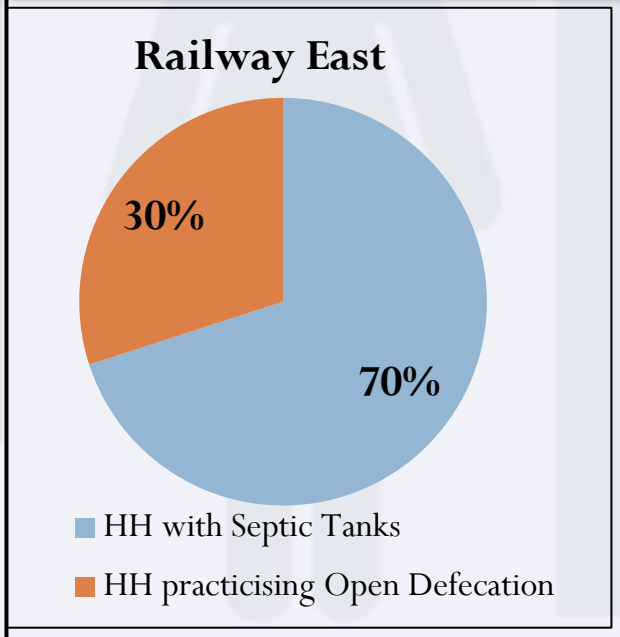


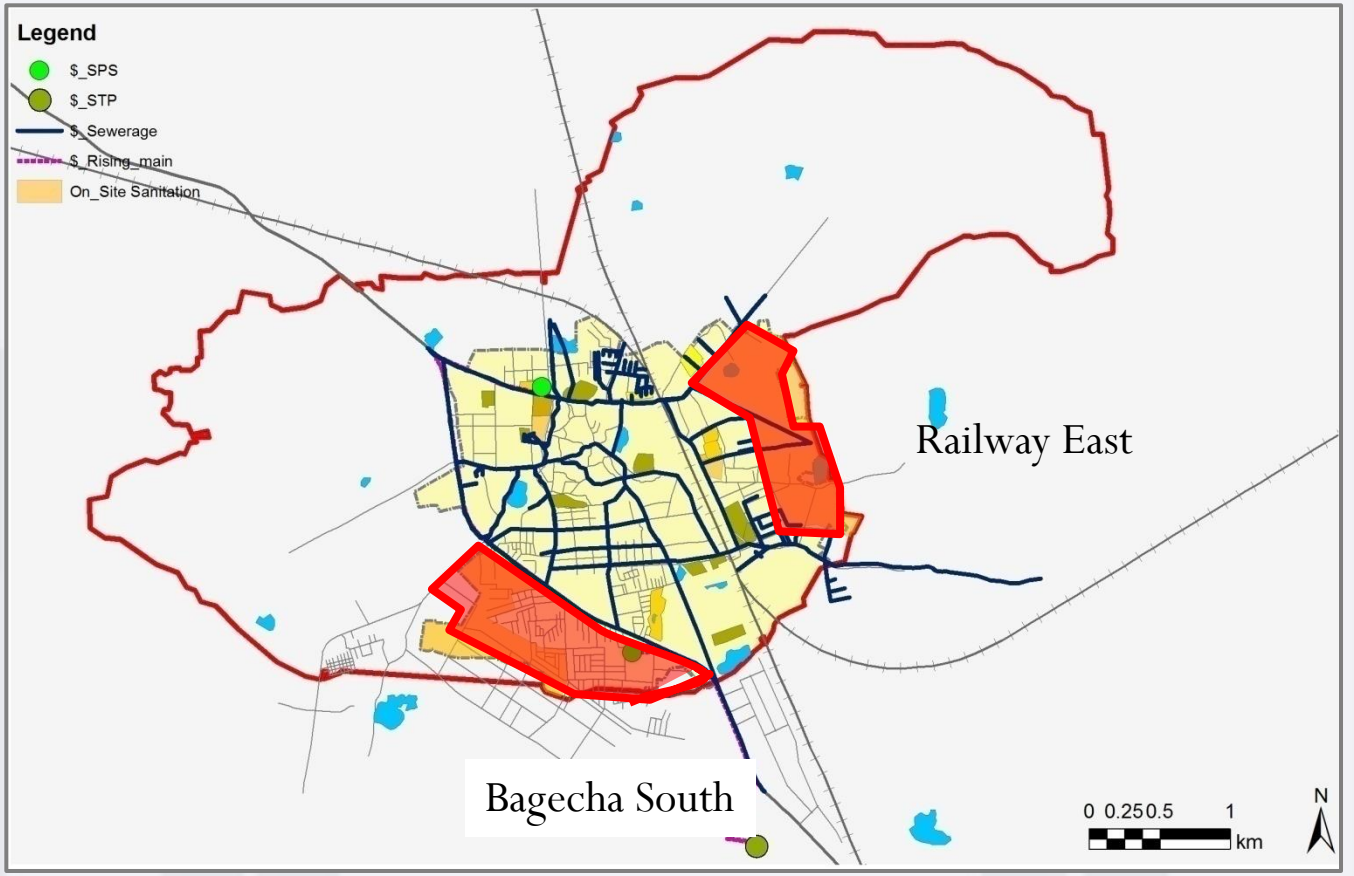
Options for Sintex Industry:

- Diverting of waste water to GIDC or
- Funding of Capital Cost for laying conduit

Existing Unsewered area

Details	Railway East		Bagecha South	
	2011	2031	2011	2031
Area (Ha)	62	62	75	75
Net Density (P/Ha)	178	322	197	260
Population	16240	19928	14710	19400
HH	3609	4428	3269	4311





Bagecha South:

- **100% HH depend on Septic Tanks**

Emerging Issues & Probable Solution

Issues

Railway East:

- 30% HH's of Railway East practices OD due to lack of connection to sewerage network
- 70% HH's dependent on Onsite sanitation does not practices proper management of septage
  - Non-affordability of pit emptying fees
  - Lack of Incentives/Sanctions
  - Low priority by ULB

Bagecha South:

- 3,629 HH's dependent on Onsite sanitation does not practices proper management of septage
  - Lack of proper fecal sludge management mechanism

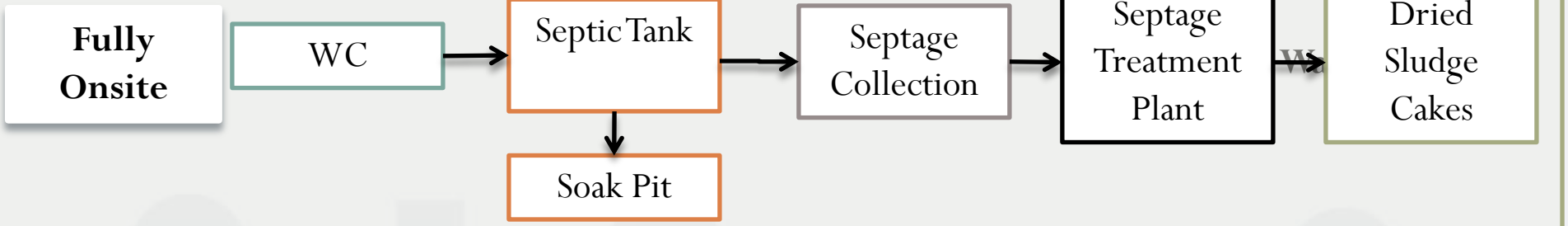
Probable Solutions

- Sanitation Options for Railway East
  - On Site Sanitation
    - Fully Onsite
    - Partially Onsite
  - Extension of Existing Sewerage Network
- Proper Fecal sludge Management System by ULB/Private Operator

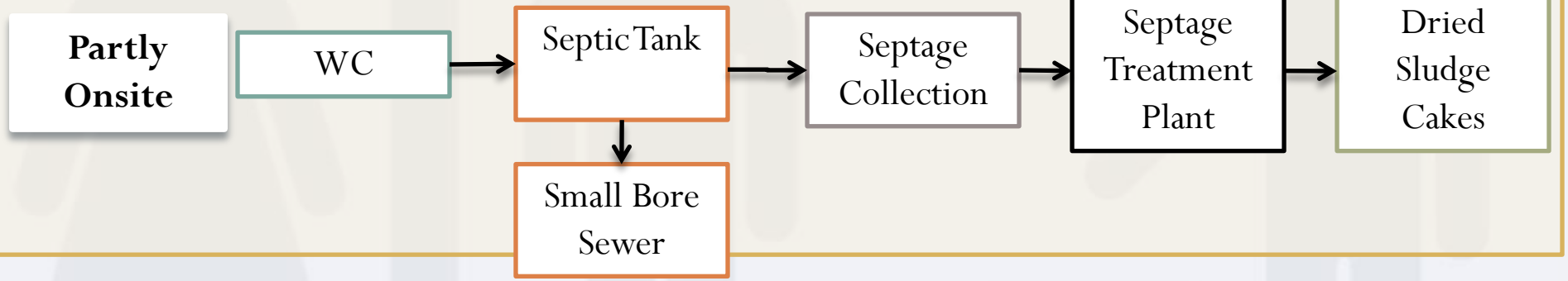
Sanitation Options for East

Reuse
Treatment
Transport
Storage
Capture

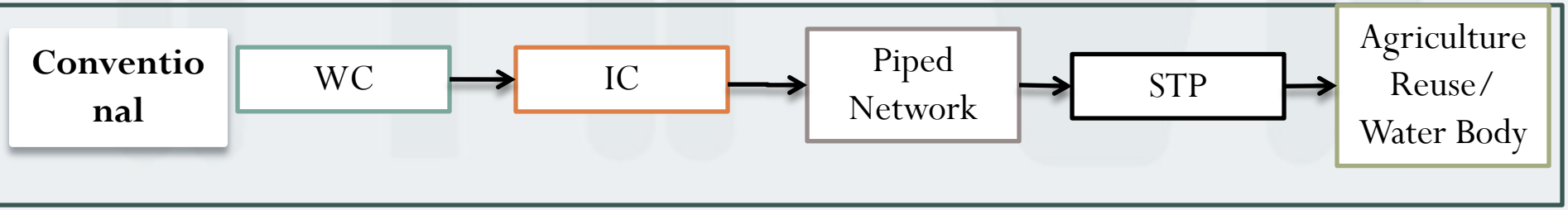
Option 1:Fully Onsite



Option 2:Partially Onsite

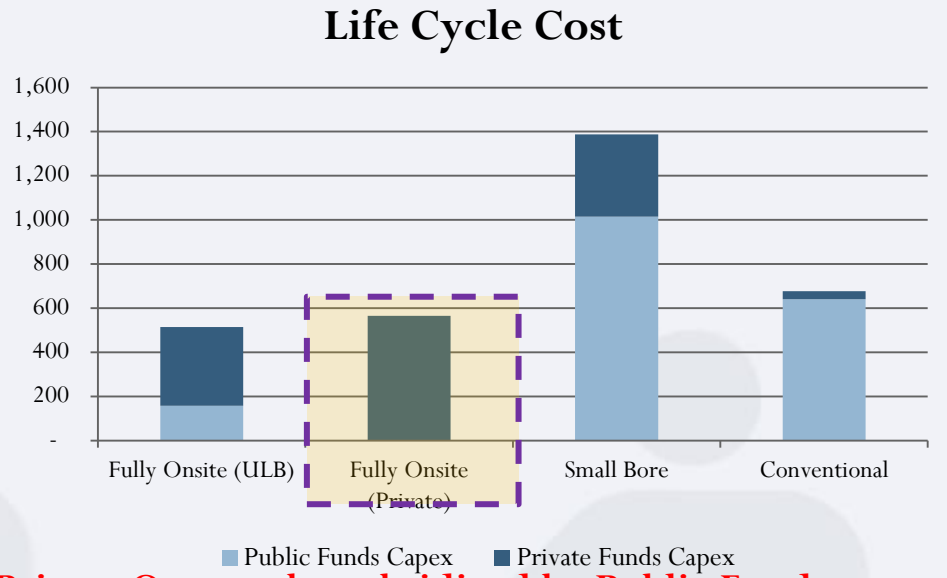


Option 3:Conventional Sewerage

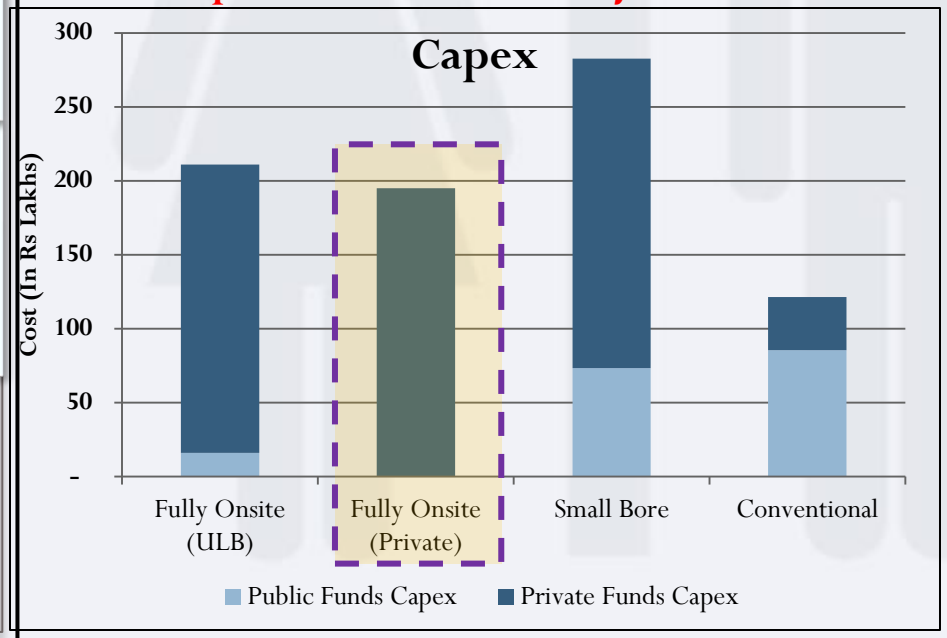


Details	Railway East	
	2011	2031
Area (Ha)	62	62
Net Density (PPHa)	178	322
Population	16,240	19,928
HH	3,609	4,428

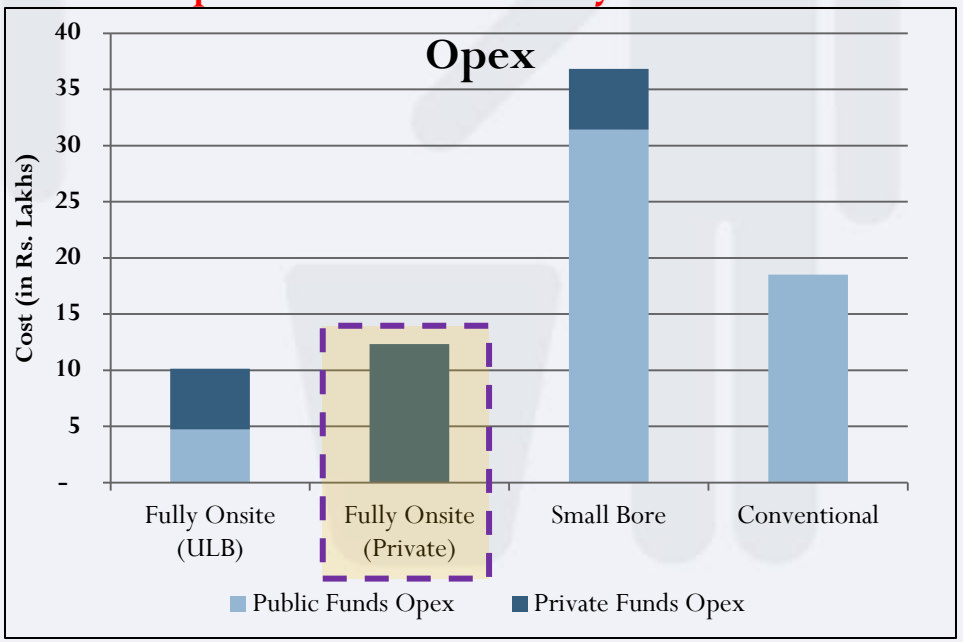
- As Subsidy has to be provided. Overall system cost need to be Considered.
- Public Capex: 190 Lakhs; Public Opex: 12.5 Lakhs



Private Capex to be subsidized by Public Fund

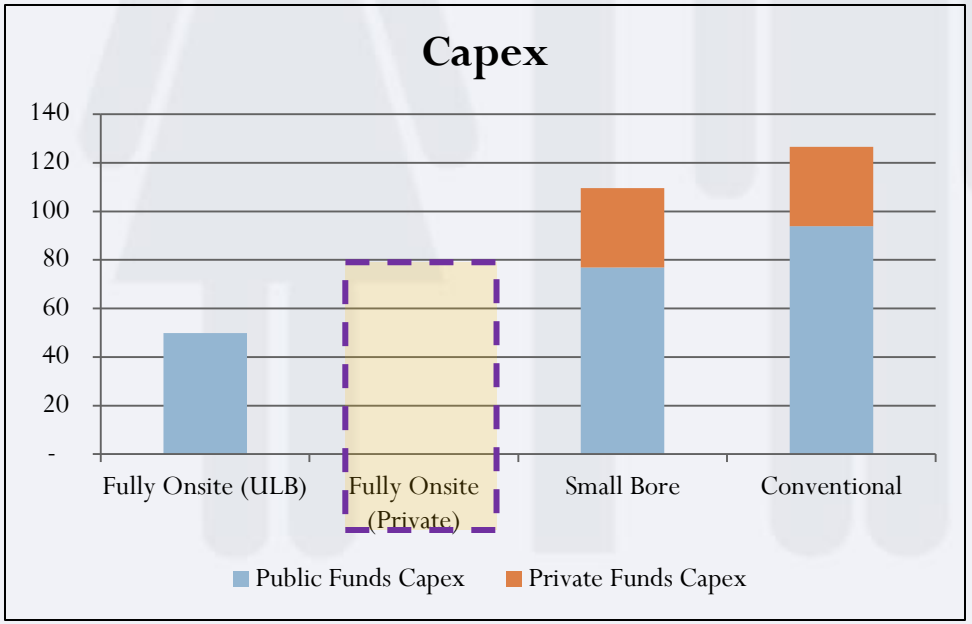


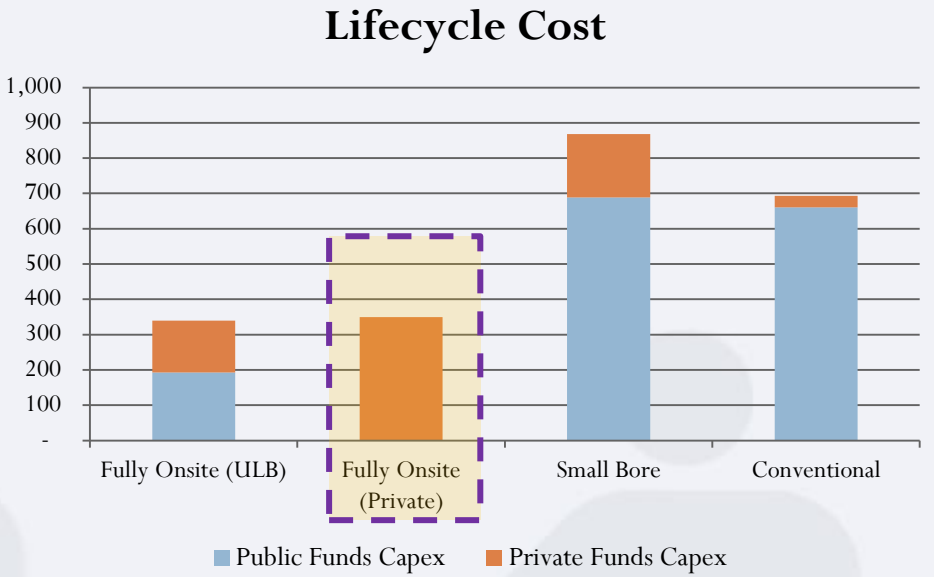
Private Opex to be subsidized by Public Fund

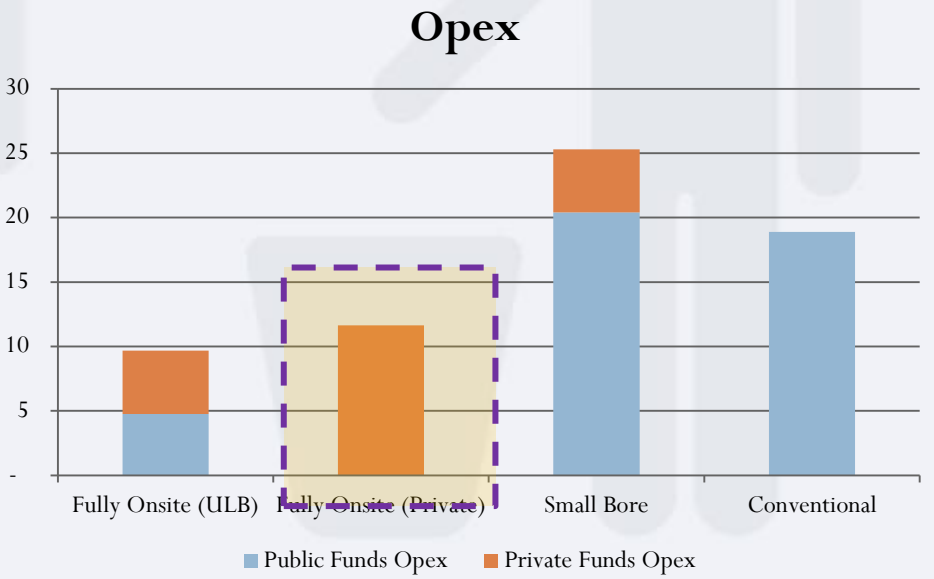


Details	Bagecha South	
	2011	2031
Area (Ha)	75	75
Net Density (P/Ha)	197	260
Population	14710	19400
HH	3269	4311

- Although, Overall System Cost is Marginally Low in FSM by ULB, but FSM by Private is Considered because of No Capex or Opex by ULB
- Public Capex: 0; Public Opex: 0

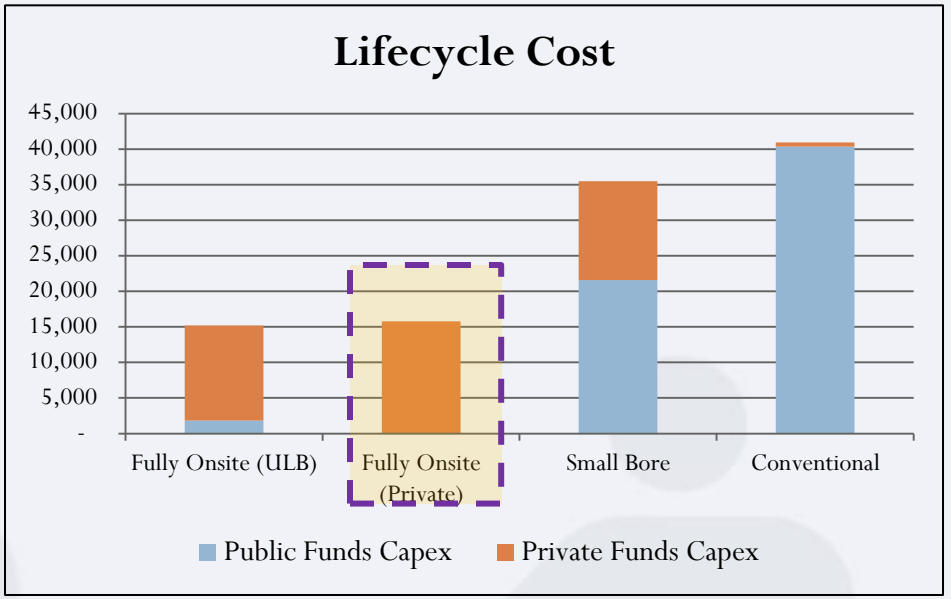


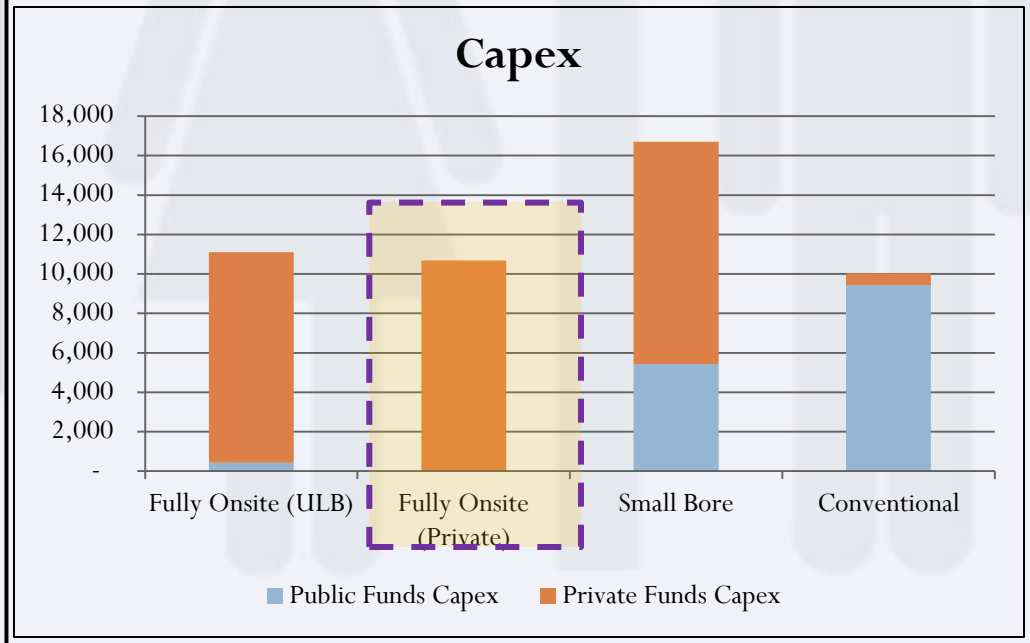


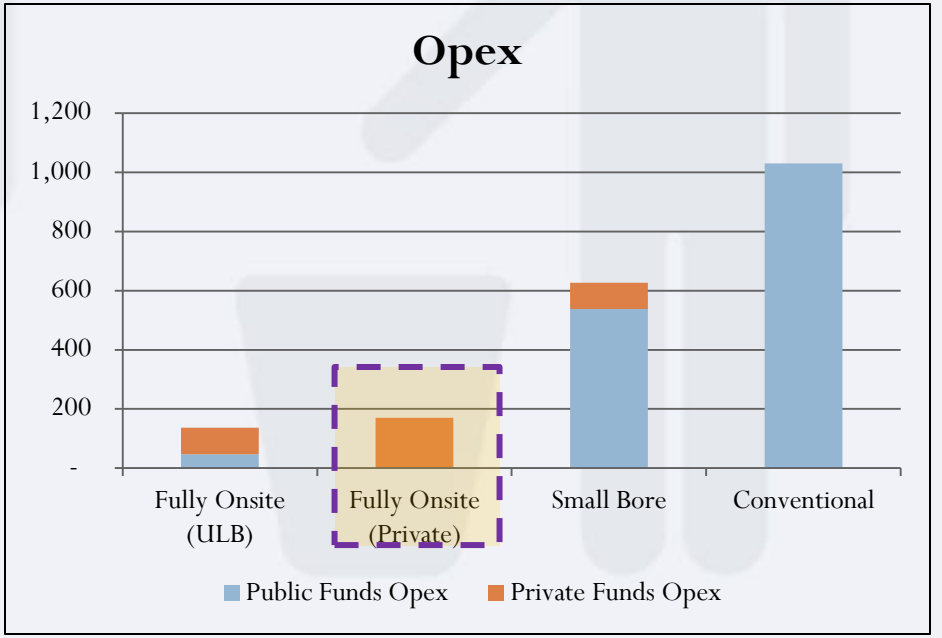


Details	Upcoming Development Areas (2041)
Area (Ha)	1320
Net Density (P/Ha)	150
Population	3,44,000
HH	68,800

- Although, Overall System Cost is Marginally Low in FSM by ULB, but FSM by Private is Considered because of No Capex or Opex by ULB
- Public Capex: 0; Pubic Opex: 0







Feacal Sludge Management Contract

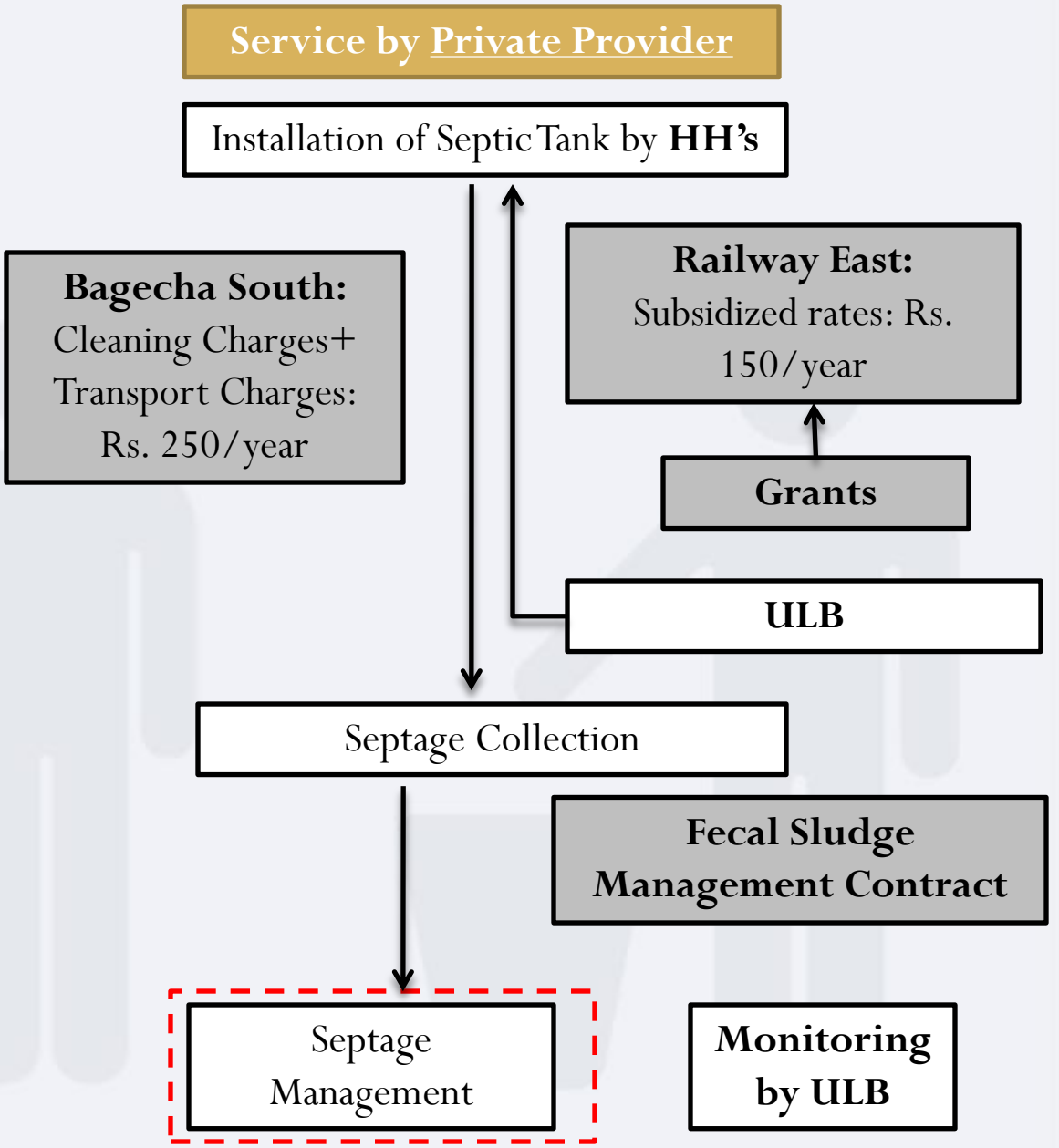
Service Management Contract on Retainership Basis

- **IRR: 16%**
- **Management Contract to be renewed every 5 Years**

O/M Charges: Rs. 78,000/Annum

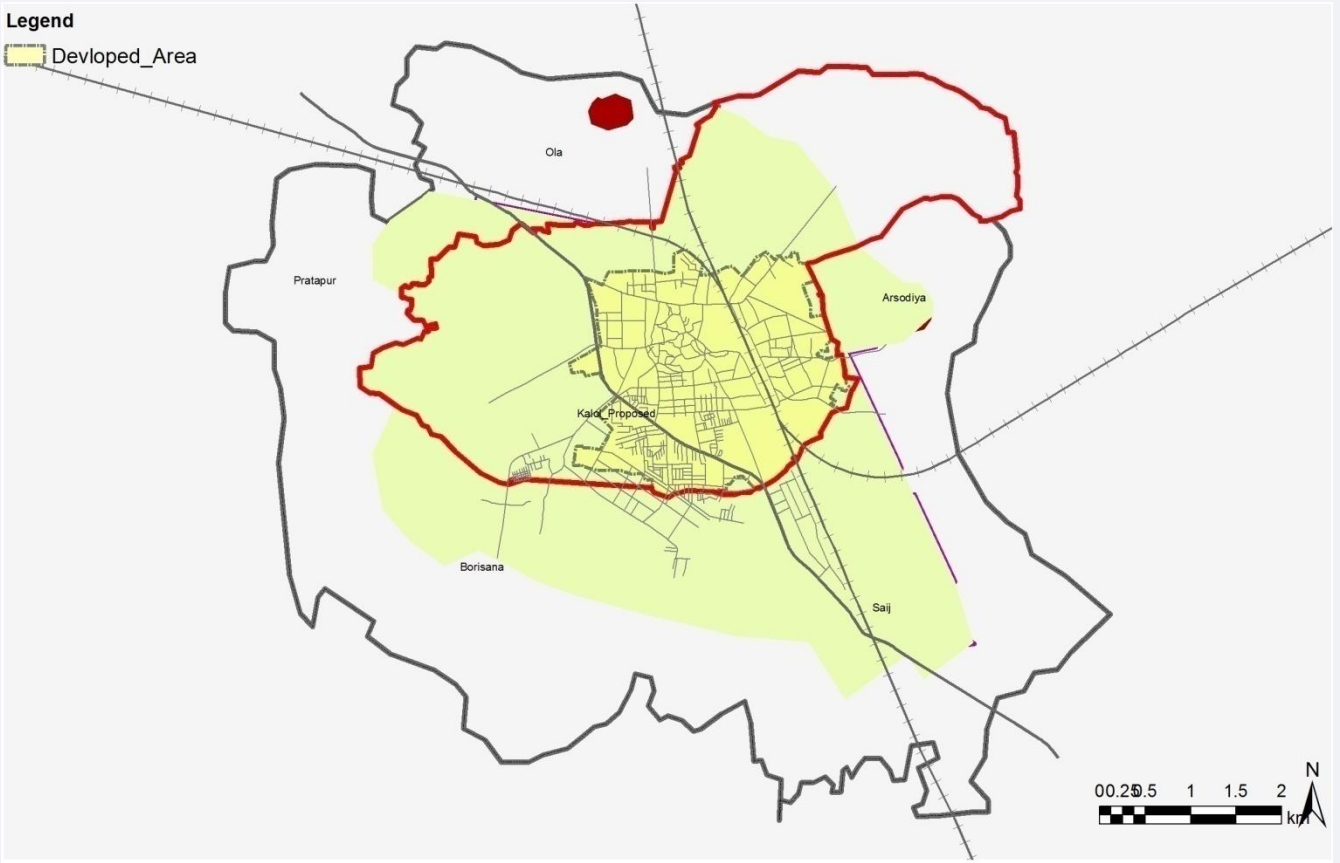
Incentives by ULB

- Land for Sludge Treatment: 2,500 Sqm (To be Developed at Oxidation Pond Site)
- Space for Parking / Maintenance of Vehicles (ULB Office)
- Retainership Charges @ Rs.250/Septic Tank
- Other Incentives
  - Cost Recovery from Selling of Sludge Cakes as Fuel/Manure



Project 3:Additional Areas

Details	Additional areas (2041)
Area (Ha)	1320
Net Density (P/Ha)	150
Population	469456
HH	104324



Alternatives:

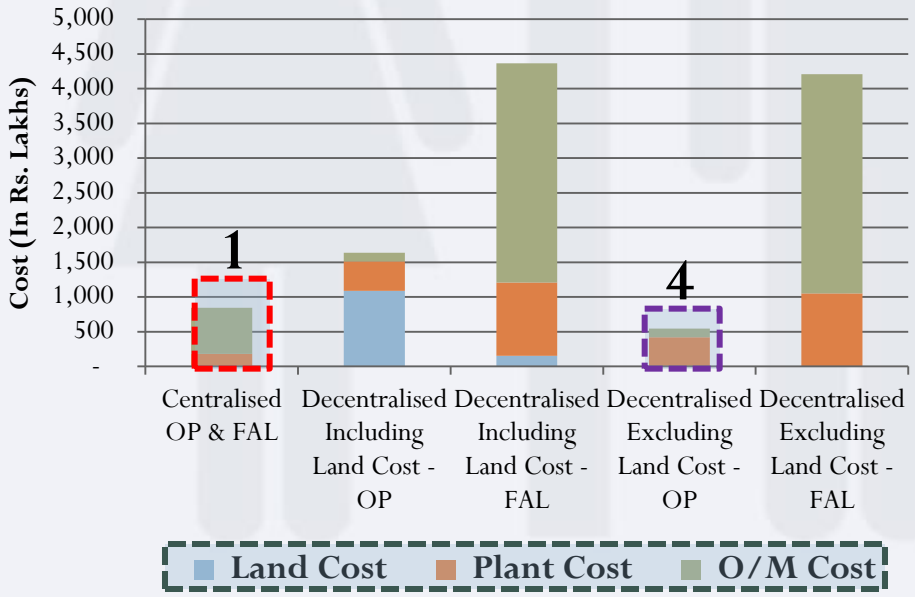
- On Site Sanitation
  - Fully Onsite
  - Partially Onsite
- Extension of Existing Sewerage Network

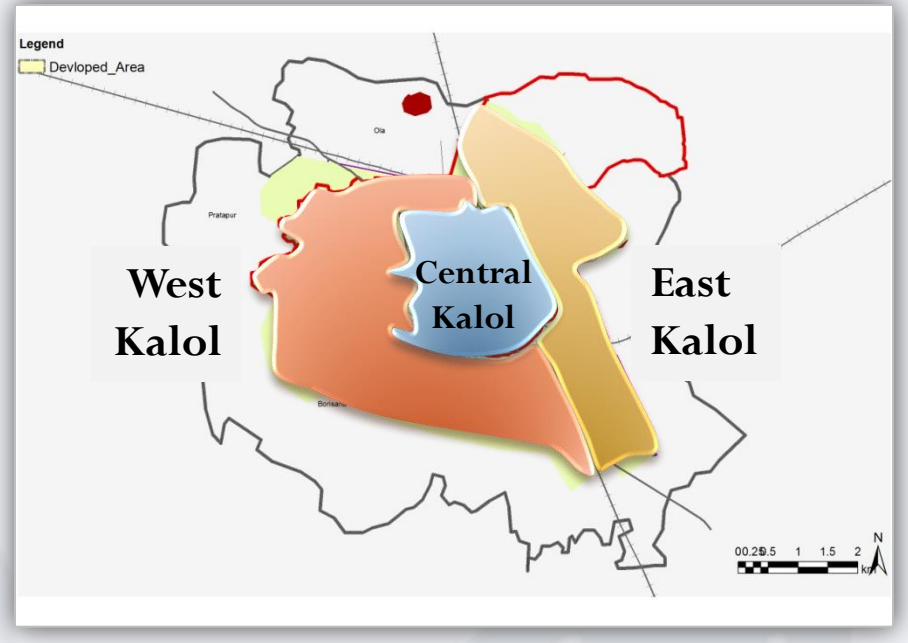
Treatment & Disposal

Component 3

Treatment Capacity Required for Future Year (2041)

	Total
Population	4,70,000
Waste Generation (In MLD)	42.1
Land Rate (In Rs/Sqm)	-



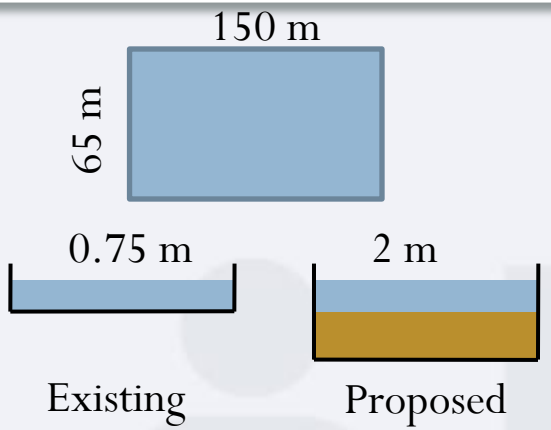


Treatment Options

1) Centralized OP & FAL
2) Decentralized OP (Inc Land Cost)
3) Decentralized FAL (Inc Land Cost)
4) Decentralized OP (Exc Land Cost)
5) Decentralized FAL (Exc Land Cost)

Centralized Treatment Option

Increase Depth from 0.75 m to 2 m

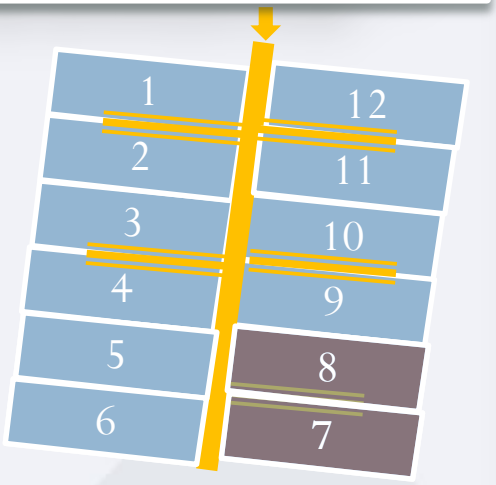


- Aerobic Digestion at Top
- Anaerobic Digestion at Bottom

	CAPEX	OPEX
2011	111	1.0
2012	-	1.1
2013	-	1.2
2014	16	1.4
2015	17	1.6
2016	8	13.7
2017	-	18.3
2018	20	19.0
2019	9	25.0
2020	-	31.8

All Figures in Rs. Lakhs

Facultative Aerated Lagoon



Management Contract

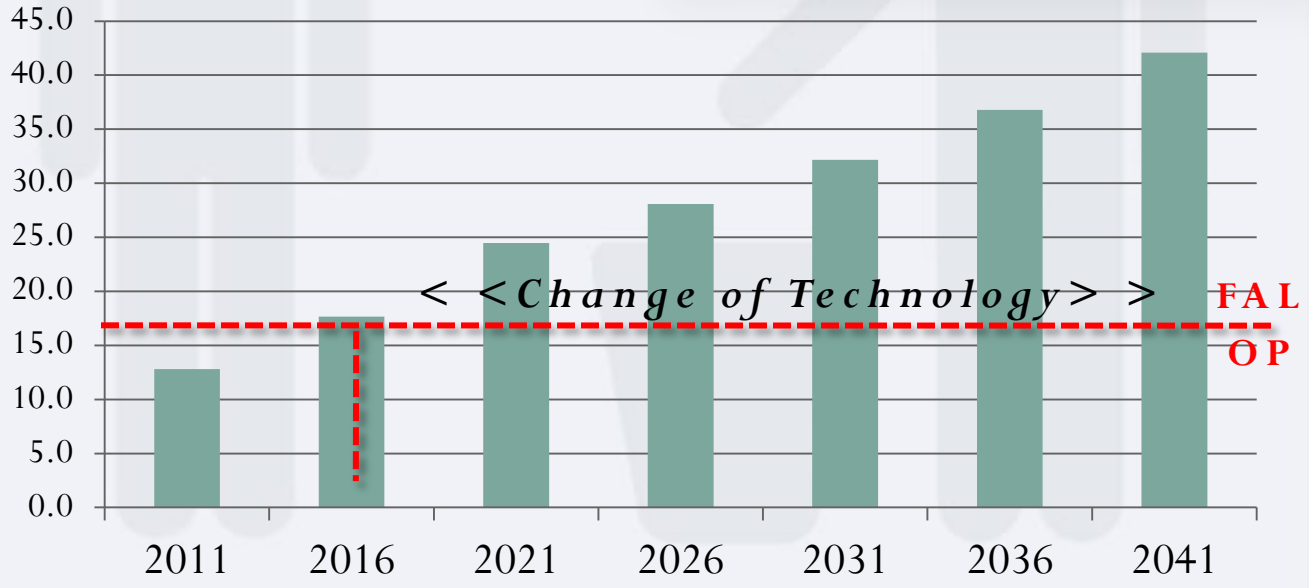
Immediate Interventions: Revitalization of 8 Ponds in 2011

Intermediate Interventions: Addition of One Oxidation Pond Capacity Each in 2014 & 2015

Long Term Interventions: Introduction of FAL Technology 2016 Onwards

Reuse of Waster Water in Agriculture

Tripartite Agreement Between ULB, Operator and Arsodiya Paani Samiti



Implications of Promoting FSM

Life Cycle Cost

With Sewerage: Rs.7.1 Cr

With FSM: Rs. 1.6 Cr

	CAPEX_FSM	CAPEX_SEW	OPEX_FSM	OPEX_SEW
2011	111	111	1.0	1.0
2012	-	-	1.1	1.1
2013	-	-	1.2	1.2
2014	-	16	1.4	1.4
2015	17	17	1.6	1.6
2016	-	8	1.7	13.7
2017	-	-	1.8	18.3
2018	-	20	1.9	19.0
2019	-	9	1.9	25.0
2020	-	-	1.9	31.8

All Figures in Rs. Lakhs

Management Contract

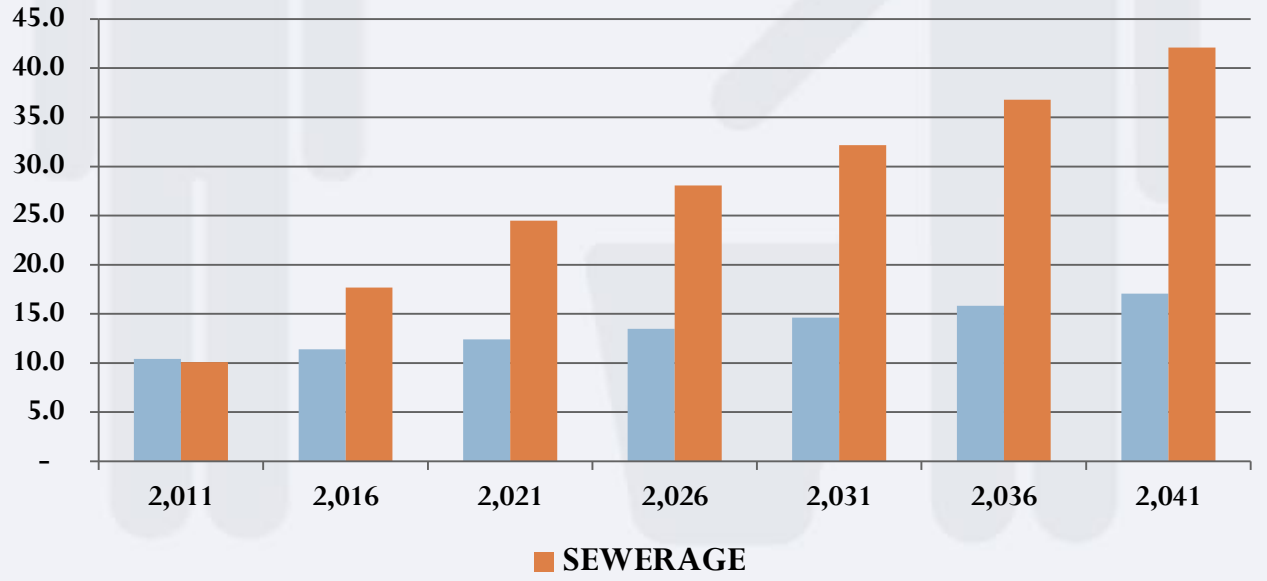
Immediate Interventions: Revitalization of 8 Ponds in 2011

Intermediate Interventions: Addition of One Oxidation Pond Capacity in 2015

Long Term Interventions: Addition of Oxidation Pond as and when required

Reuse of Waster Water in Agriculture

Tripartite Agreement Between ULB, Operator and Arsodiya Paani Samiti



Project Prioritization

Immediate

- Project 3: Revitalization of Community Toilets
- Project 4: Replacement of Rising Main

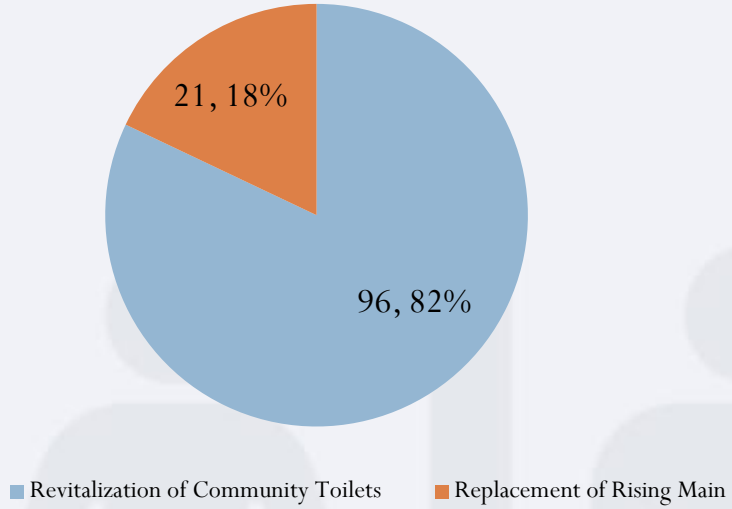
Intermediate

- Project 1A: Provision of Individual Toilets in Slums
- Project 2A: On site sanitation for Slums
- Project 2B: Conventional Sewerage for Slums
- Project 5A: Fully Onsite Sanitation for existing non- sewered areas (Railway East, Bagecha South)
- Project 7: Storm Water Drainage Network Extension

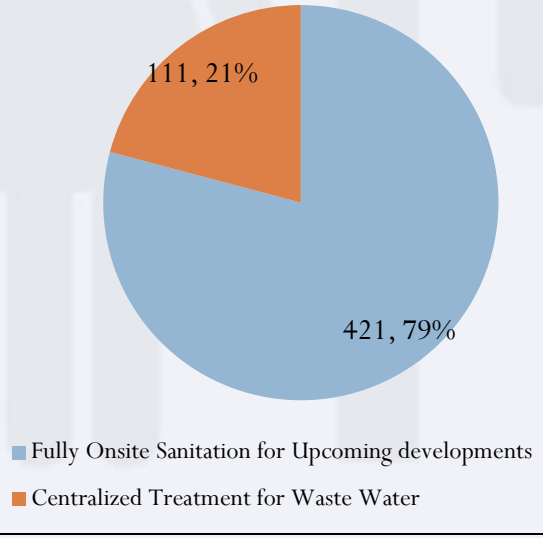
Long Term

- Project 5B: Fully Onsite Sanitation for Upcoming developments
- Project 6: Centralized Treatment for Waste Water

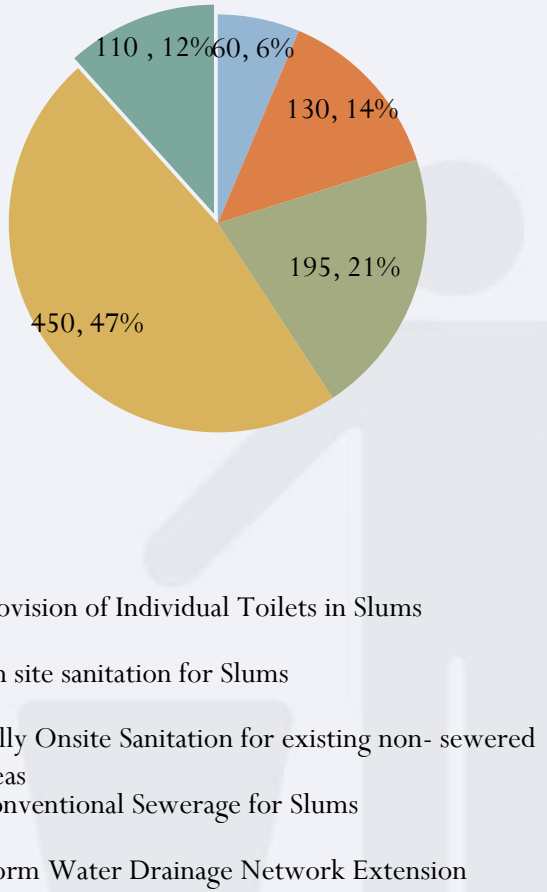
Immediate Measures



Long Term Measures



Intermediate Measures



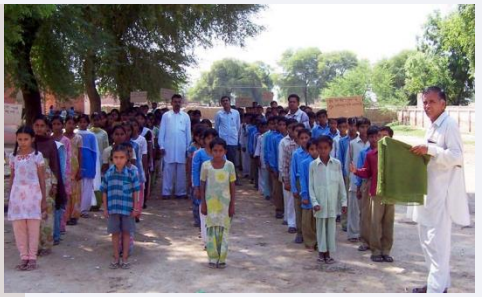
Project Summary

Span of Project	Projects	Total	Private	ULB Fund (Lakhs)
Immediate	Revitalization of Community Toilets	**96**	**-**	**96**
	Replacement of Rising Main	**27**	**6**	**21**
Intertermediate	Provision of Individual Toilets in Slums	**73.5**	**13.5**	**60**
	On site sanitation for Slums	**180**	**50**	**130**
	Fully Onsite Sanitation for existing non- sewered areas	**195**	**-**	**195**
	Conventional Sewerage for Slums	**450**		**450**
	Storm Water Drainage Network Extension	**110**	**-**	**110**
Long Term	Fully Onsite Sanitation for Upcoming developments	**11101**	**10680**	**421**
	Centralized Treatment for Waste Water	**111**	**-**	**111**

IEC/ Promotion

Target Groups

- Children
- Women
- Senior Citizens
- Youth



Institutions to be involved

- Schools
- Sakhi Mandali
- Welfare Groups
- Colleges

Advertising

- Cleaning Programs
- Campaigns
- Rallies
- Print Media

Target Groups

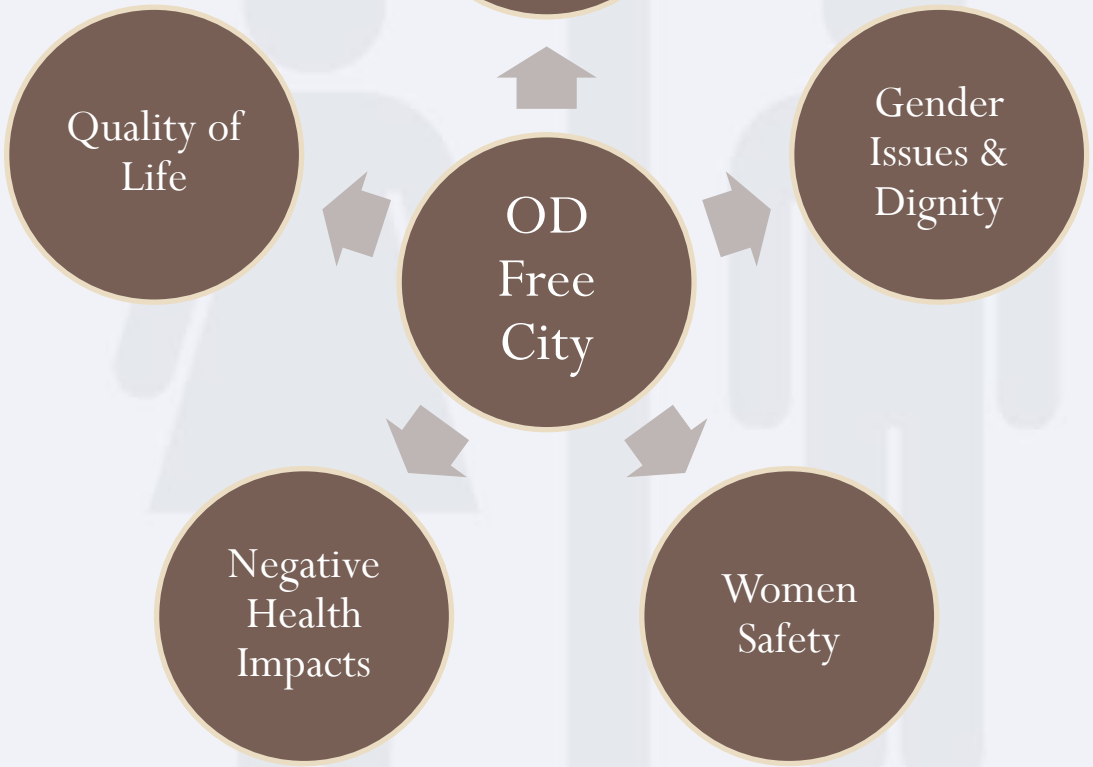
INVOLVE USER ⟷ UPGRADE ENVIRONMENT

IEC Campaigns for "Open Defecation Free City"

AWARENESS

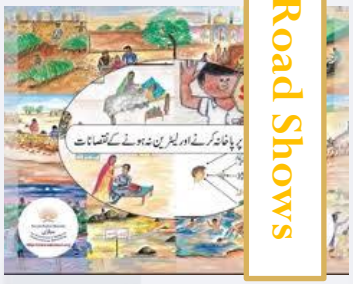
School Children

Women



Aanganwadi

Skits/ Painting Competition



Road Shows

Educating Children

Street Play

Sensitizing Women & Youth

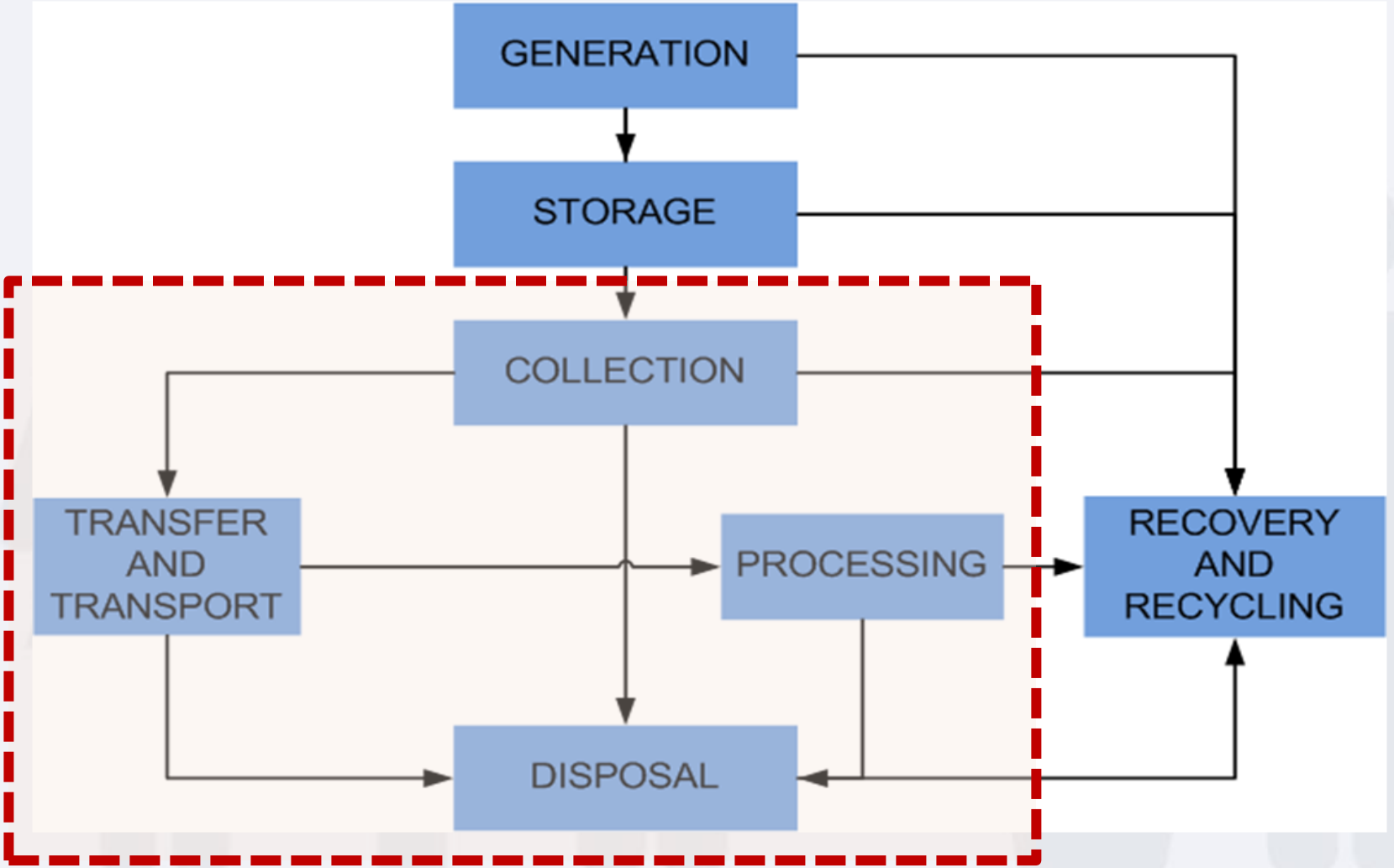
Solid Waste Management

Technology Options

Extent of Services

Proposals

VALUE CHAIN


GENERATION
STORAGE
COLLECTION
TRANSFER AND TRANSPORT
PROCESSING
RECOVERY AND RECYCLING
DISPOSAL

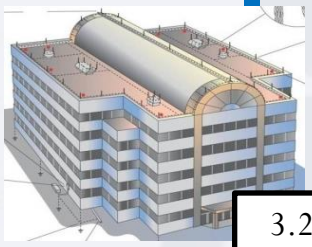
Solid Waste Management System

Capture → Transfer → Treatment

House

27T

Commercial



3.2T

0.8T

Market

2.3T

Road Sweeping

6.3T

DOOR TO DOOR COLLECTION CONTRACT

31T

No treatment, unscientific dumping

Dedicated containers (4 in num)

MARKET

ULB

ULB

8.6T

Door To Door Collection Mechanism

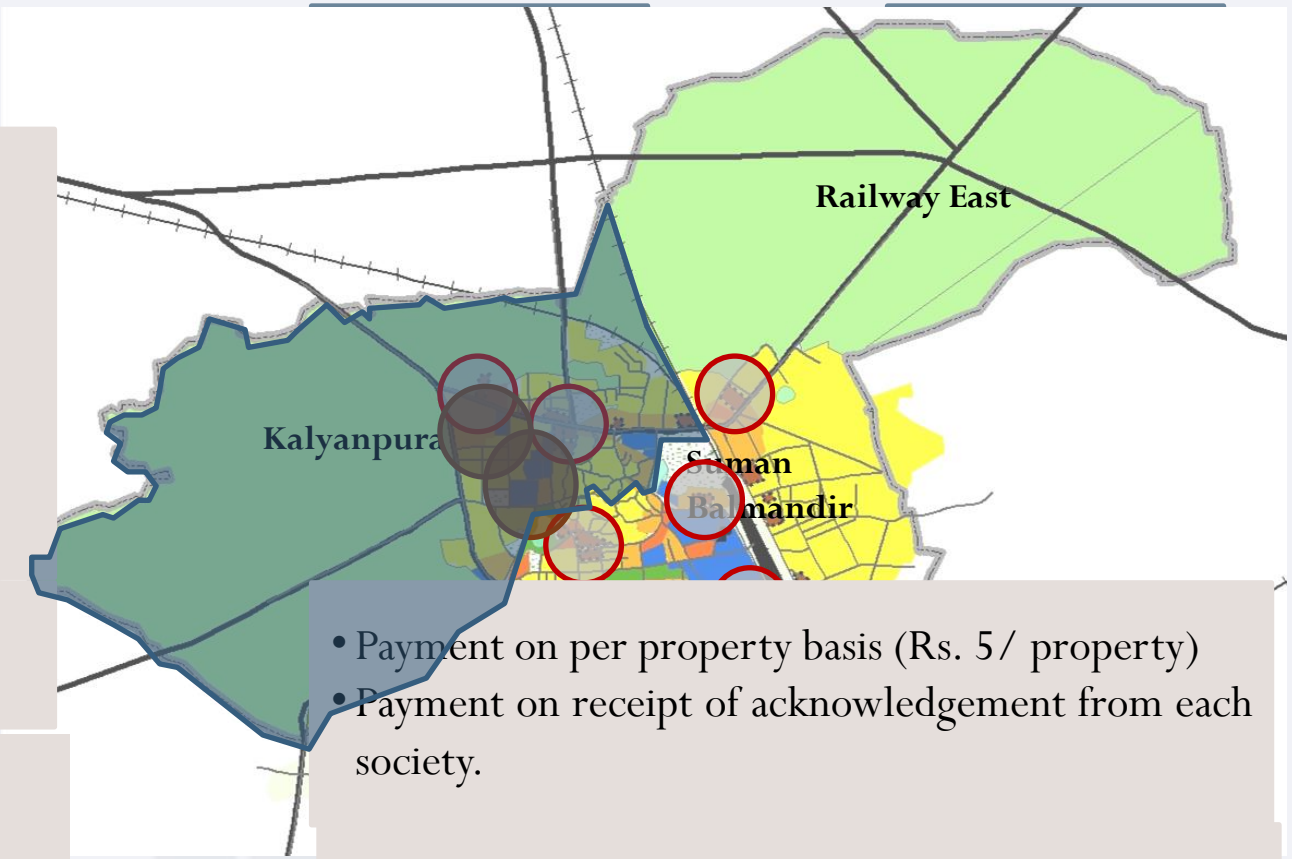
ISSUES

COVERAGE: 82%
(Residential Prop. : 21104 of 26339)
(Commercial Prop. : 8413 of 9342)

COVERAGE IN SLUMS : 8 %
(Prop. Covered :455 of 5960)

Monitoring of the contract

IEC is not carried out
No segregation of waste



- Payment on per property basis (Rs. 5/ property)
- Payment on receipt of acknowledgement from each society.

- IEC is the responsibility of the contractor

SLB INDICATORS

Indicator	Kalol	Benchmark
Household Level Coverage Of Solid Waste Management Services	82%	100%
Extent Of Segregation Of Municipal Solid Waste	0%	100%

Road Sweeping

Total length of Roads : 82 km
Total length of Major Roads : 33 km

Road Sweepers: 94 nos.
Road length allotted : 600 m

Total length of road swept : 57 km
Coverage : 70%

ISSUES:

- Lack of manpower
- Open plots not swept

Waste Transfer Points- Bins

Total waste generated : 39.7 tons
Total nos. of bins : 70 bins
Capacity : 4.5 cum
Total capacity of bins : 105 tons

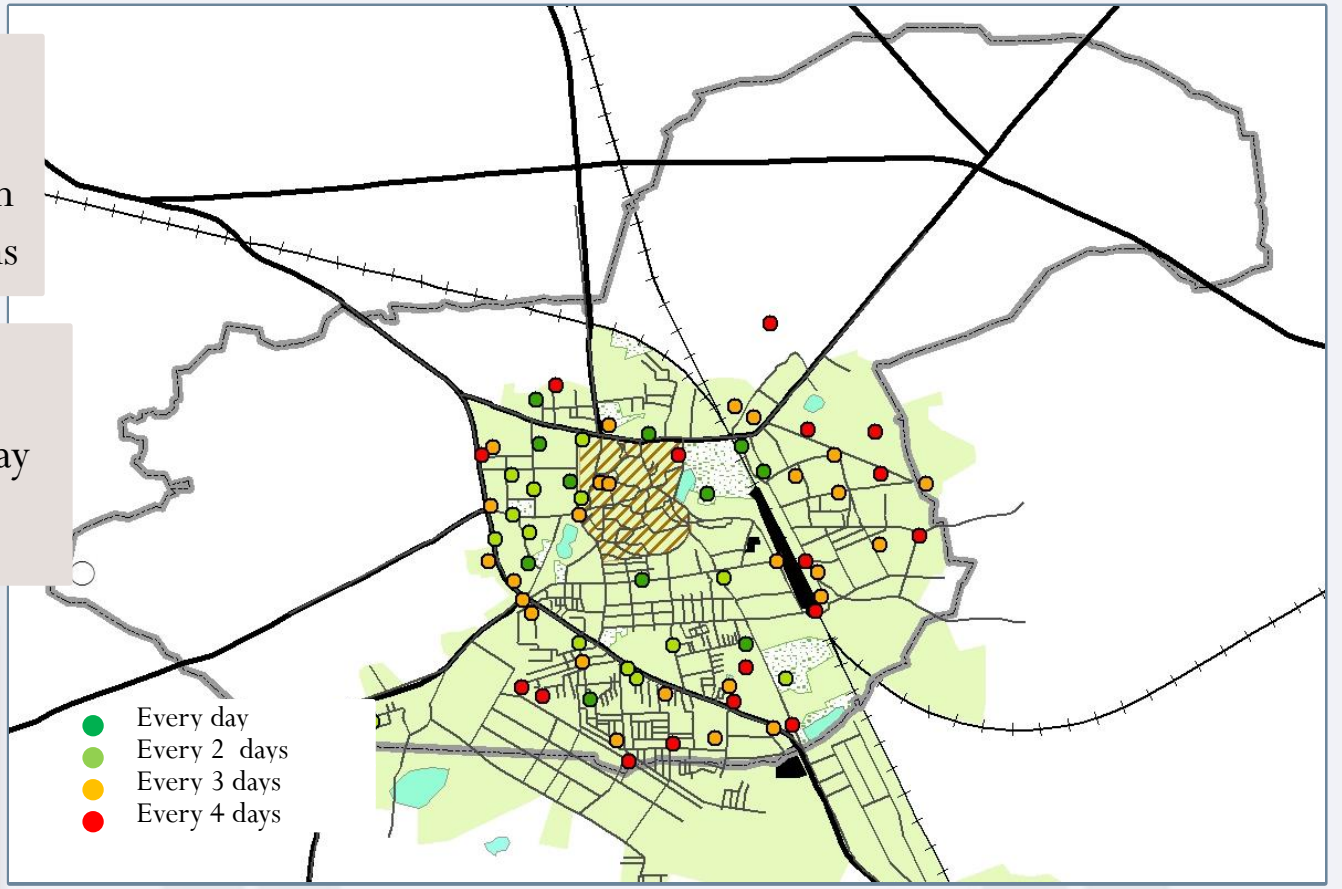
ULB has 4 tractor trolleys
1 trolley each zone – 5 trips per day
Daily the ULB empties 20 bins

ISSUES

Over provisioning of bins- creating nuisance points

Irregular lifting of bins

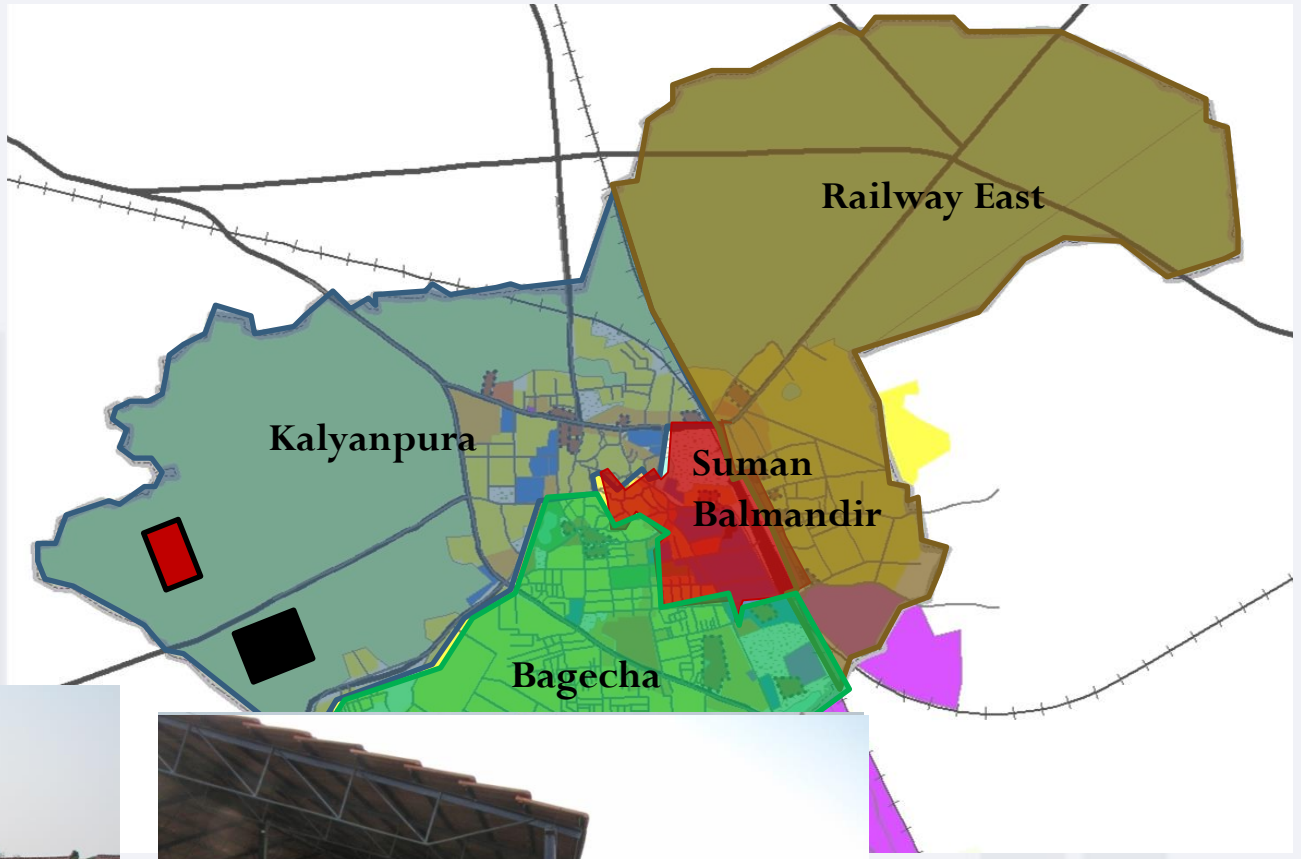
Lack of equipments and manpower

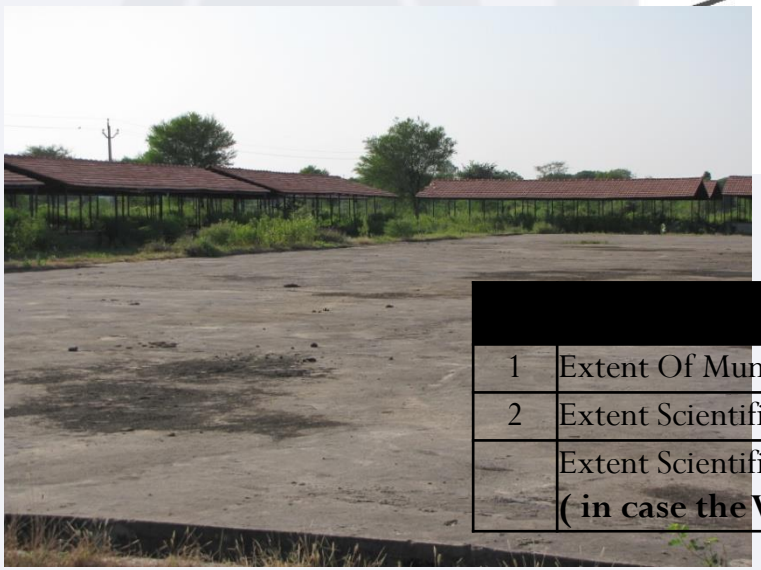


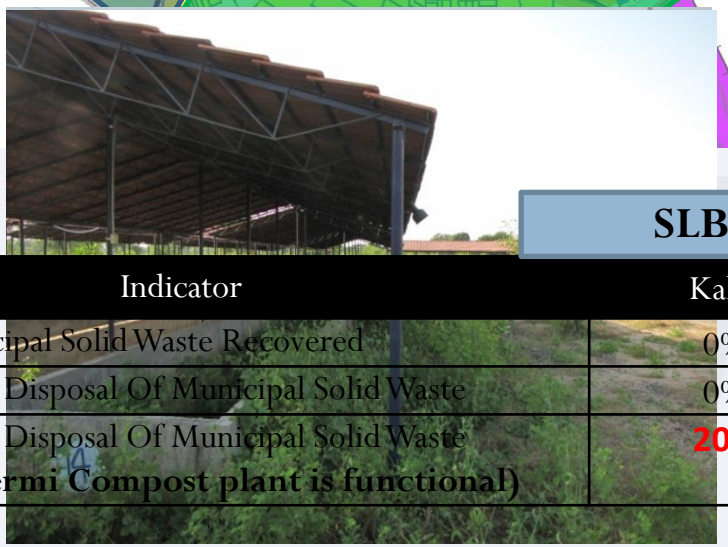
SLB INDICATORS

Indicator	Kalol	Benchmark
Efficiency Of Collection Of Municipal Solid Waste	86%	100%

Vermi Compost Plant
Constructed by GUDC
Capacity : 10T
Distance : 3 km
Non functional







SLB INDICATORS

	Indicator	Kalol	Benchmark
1	Extent Of Municipal Solid Waste Recovered	0%	80%
2	Extent Scientific Disposal Of Municipal Solid Waste	0%	100%
	Extent Scientific Disposal Of Municipal Solid Waste **(in case the Vermi Compost plant is functional)**	**20%**	100%

Indicator	Benchmark	Kalol
Household Level Coverage Of SWM services	100%	82%
Extent of Segregation of MSW	100 %	0 %
Road Length Per sweeper	400 – 600 m	600 – 650 m
Efficiency of Collection of MSW	100 %	86 %
MSW Recovery	80 %	0 %
MSW Processing	100 %	0 %
Extent of Scientific Disposal of MSW	100 %	0 %
Sweepers per 1000 Population	3	1.2

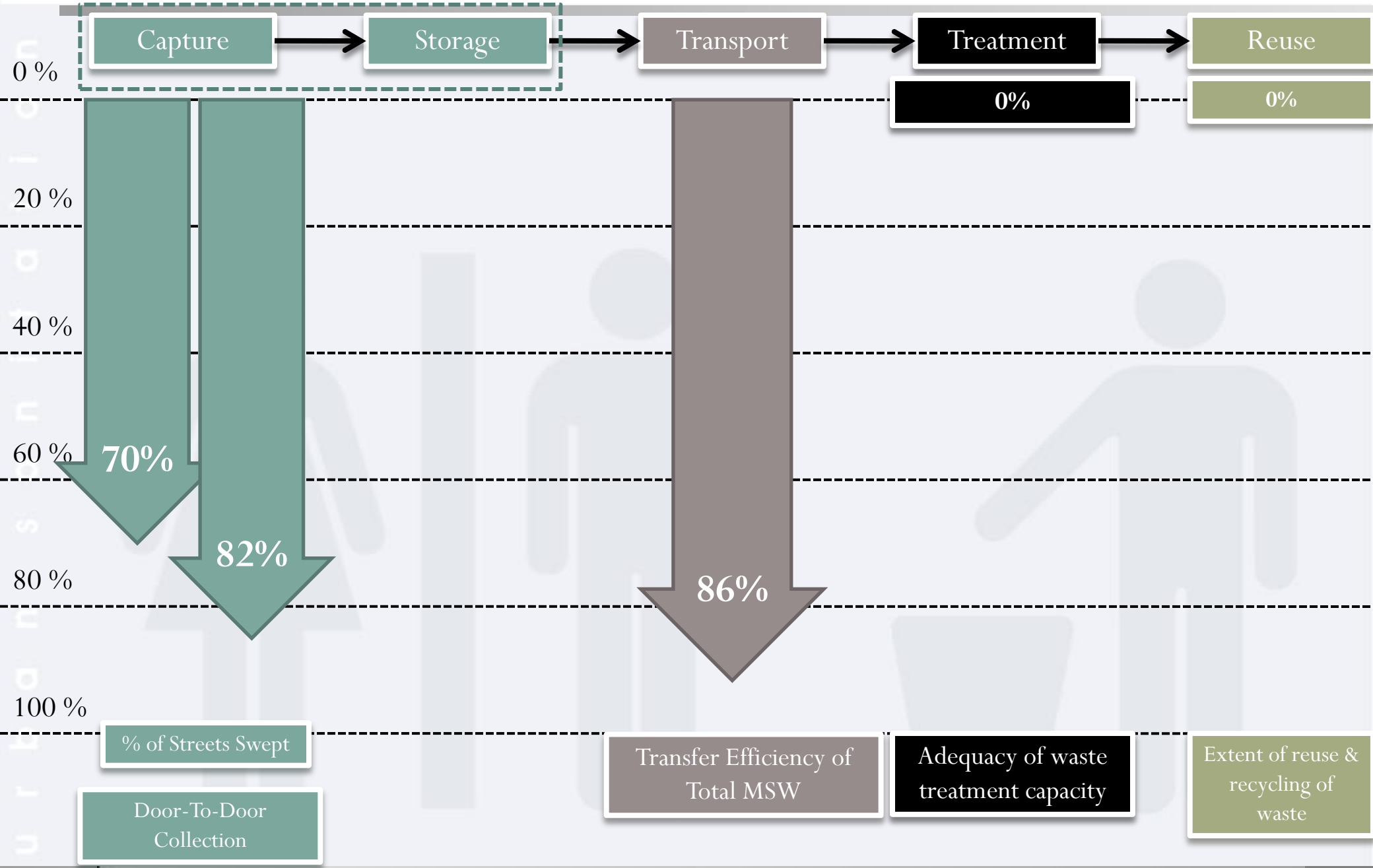
CITY LEVEL

- **No segregation**, lack of awareness among the citizens
- Household coverage of **door to door collection is 82%**
- Lack of manpower and equipments for **street sweeping 57% coverage**
- **Lack of monitoring** of the system
- **No treatment** facility
- **Lack of technical know how** and skilled manpower for treatment and disposal of waste

SLUM LEVEL

- No solid waste management in slums
- Slums included in door to door collection contract but **coverage is only 7%**
- **Lack of monitoring**

Solid Waste


Capture
Storage
Transport
Treatment
Reuse
0 %
20 %
40 %
60 %
80 %
100 %
0%
0%
70%
82%
86%
% of Streets Swept
Door-To-Door Collection
Transfer Efficiency of Total MSW
Adequacy of waste treatment capacity
Extent of reuse & recycling of waste

Identification of Hot Spots

- Open Plots
- Transfer Points
- Treatment Plant Location
- Other visually dirty areas

→ **Immediate Attention**

System Analysis (Coverage, extent of service)

Streams of waste

- **D-T-D Collection Mechanism**
- Households
- Slums
- Commercial
- Market/ Restaurants
- **Road Sweeping**

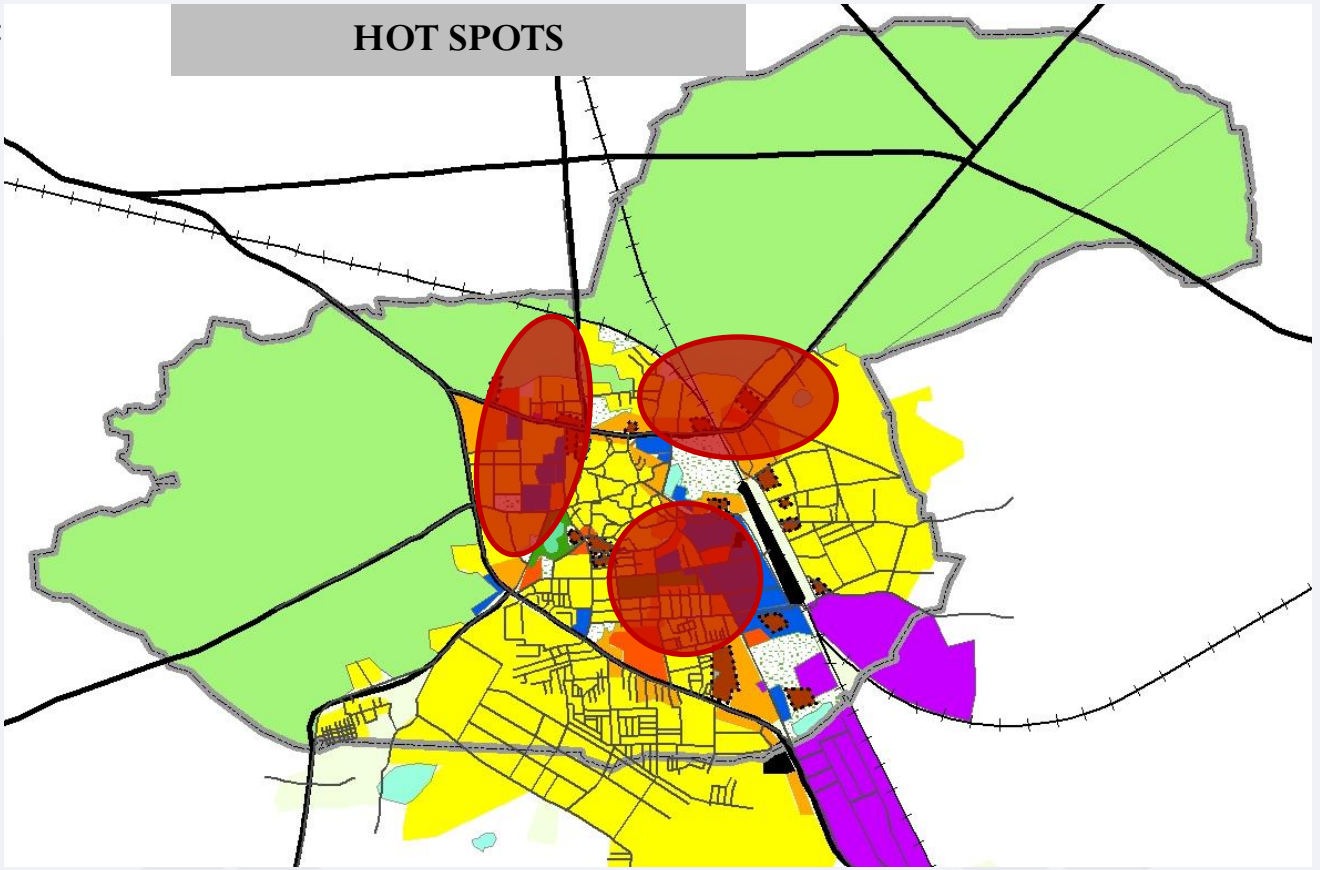
→ **Intermediate Measures**

→ **Long Term Measures**

IMMEDIATE INTERVENTIONS:

- Mass Clean-up
- Awareness Campaign
- Beautification

HOT SPOTS



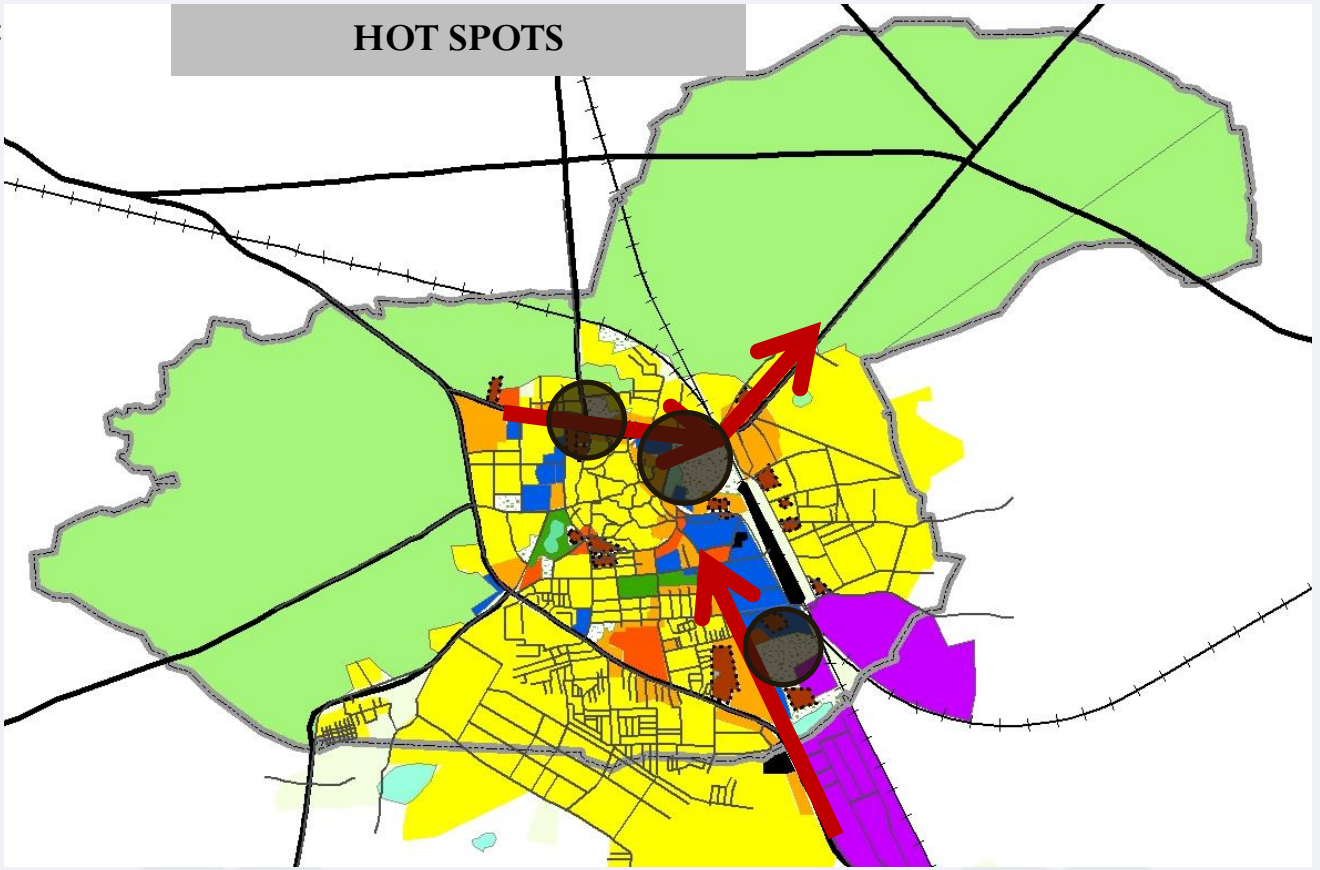
IMMEDIATE INTERVENTIONS:

- Mass Clean-up
- Awareness Campaign
- Beautification

MASS CLEAN-UP:

- Major roads
- Open plots

HOT SPOTS



AWARENESS CAMPAIGN

- Awareness creation for keeping the city clean
- Changing the practices of people to clean the city & not just the house

ACTIVITIES	RESPONSIBILITY
• Announcements through rickshaws • leaflets	• ULB
• Notice in local newspapers	• ULB • Media

BEAUTIFICATION

- Beautifications of major roads

ACTIVITIES	RESPONSIBILITY
• Plantations along major roads- 33kms • Building footpaths where ever required	• Rotary Club

Identification of Hot Spots

- Open Plots
- Transfer Points
- Treatment Plant Location
- Other visually dirty areas

→ **Immediate Attention**

System Analysis (Coverage, extent of service)

Streams of waste

- **D-T-D Collection Mechanism**
- Households
- Slums
- Commercial
- Market/ Restaurants
- **Road Sweeping**

→

- **Intermediate Measures**
- **Long Term Measures**

CAPTURE → TRANSPORT → TREATMENT → REUSE → DISPOSAL

Household

Commercial

Restaurants

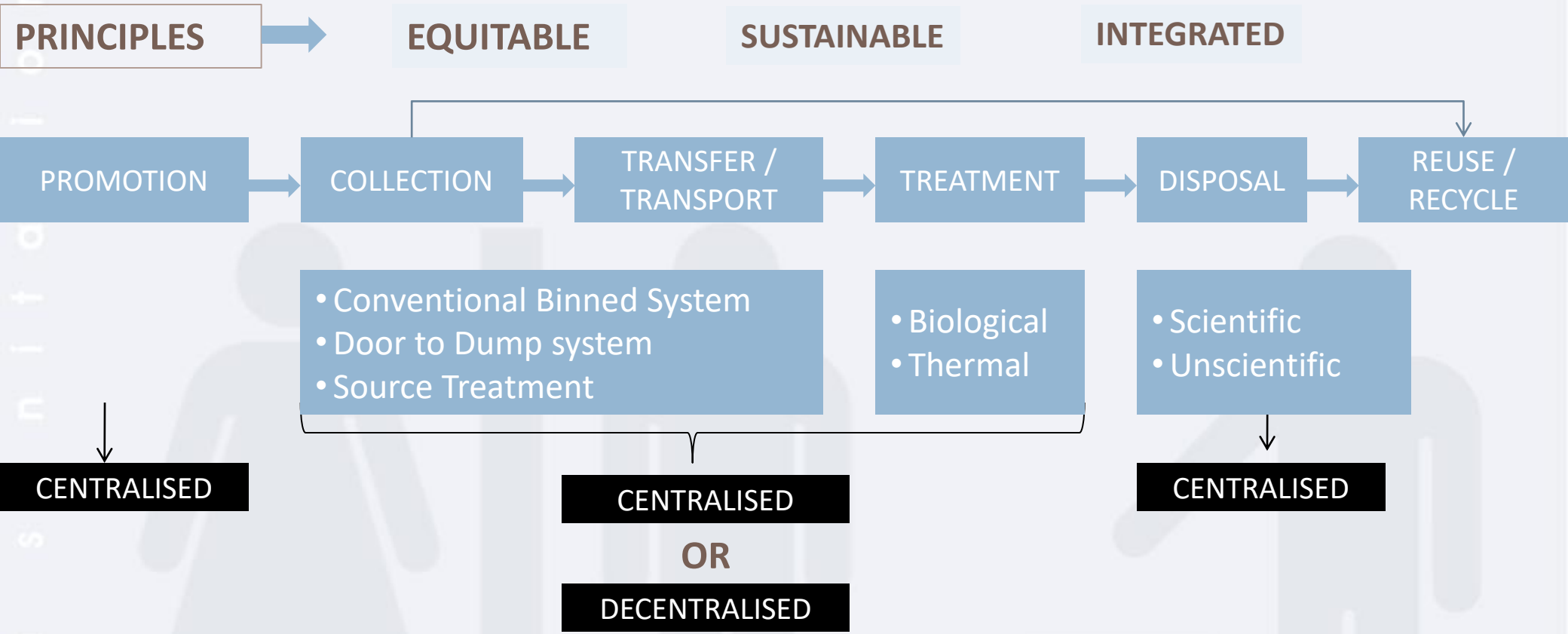
Market

Road Sweeping

WASTE HANDLING & MANAGEMENT SYSTEM SELECTION

POSSIBLE TREATMENT TECHNOLOGIES

- Composting
- Anaerobic Digestion
  - Bio Gas
- Incineration
- Pyrolysis
- RDF


PRINCIPLES
EQUITABLE
SUSTAINABLE
INTEGRATED
PROMOTION
COLLECTION
TRANSFER / TRANSPORT
TREATMENT
DISPOSAL
REUSE / RECYCLE
• Conventional Binned System
• Door to Dump system
• Source Treatment
• Biological
• Thermal
• Scientific
• Unscientific
CENTRALISED
CENTRALISED
OR
DECENTRALISED
CENTRALISED

CENTRALISED TREATMENT OPTIONS

TREATMENT	BIOLOGICAL	THERMAL

	1. Digestion
	  1. Bio Methanation / Anaerobic Digestion
	2. Composting
	  1. Composting
	  2. Vermicomposting
		1. Incineration
		2. Gasification
		3. Pyrolysis
		4. Palletization / Refuse Derived Fuel (RDF)

BY PRODUCTS	1. Bio – Gas 2. Compost /Manure 3. Inert Rejects	1. Gas : synthesis 2. Organic liquids 3. Inert Rejects

BIOLOGICAL TREATMENT

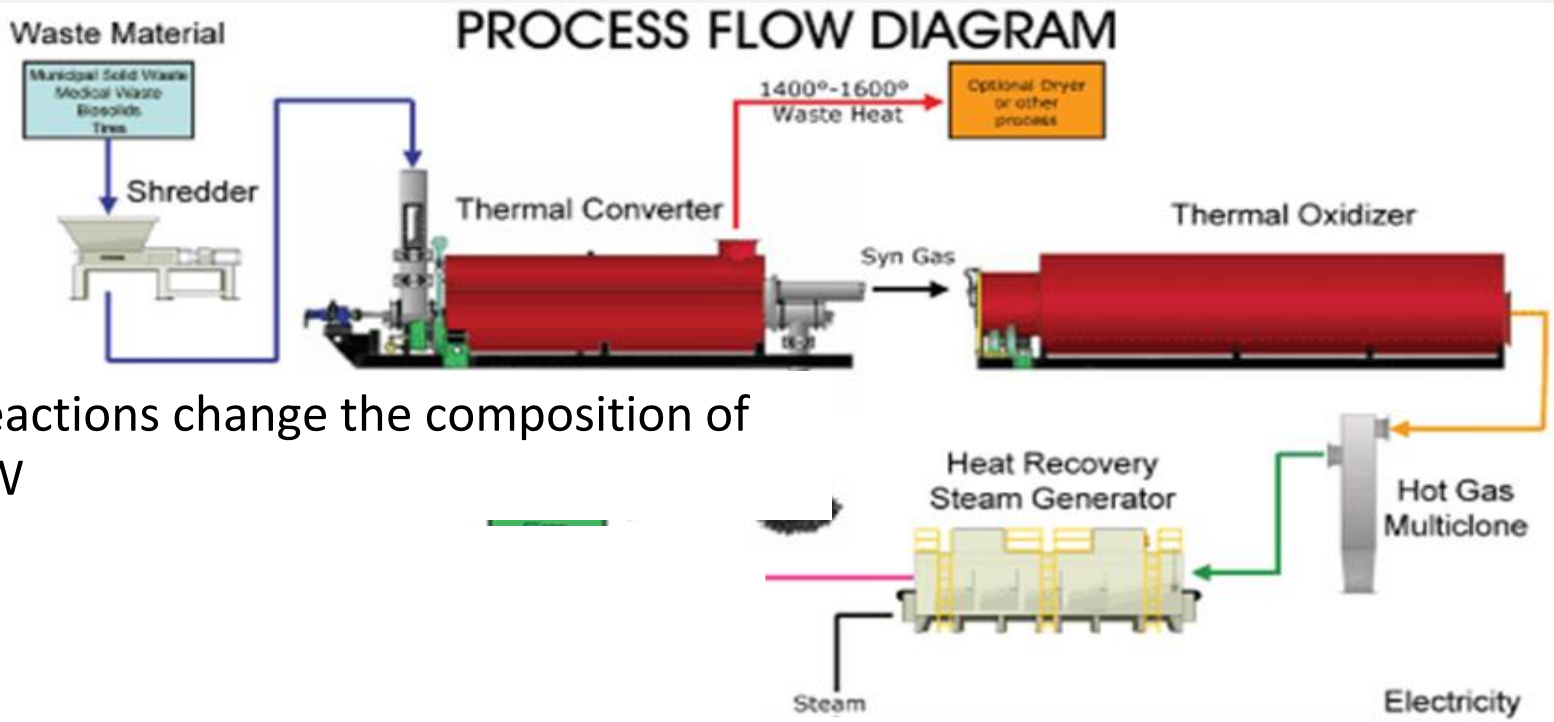
	Composting	Anaerobic Digestion
Process	▪ Waste is segregation set for Initial windrow decomposition and then to Maturing yard.	▪ Processing of waste, Decomposition and stabilization
By Products	▪ Compost and ▪ Inorganic material	▪ Manure ▪ Bio-Gas
Waste Characteristics	▪ Sorted organic content ▪ 50 – 60 % Moisture Content ▪ Higher organic content	▪ Sorted organic content ▪ More than 50 % ▪ Higher Organic Content
ADVANTAGES	▪ Easy and simple to Implement ▪ Suitable to Waste in Indian Conditions ▪ Experience in Indian Conditions ▪ Possibility of Decentralized Systems ▪ Suitable for lesser quantities of waste	▪ Easy and simple to Implement ▪ Suitable to Waste in Indian Conditions ▪ Experience in Indian Conditions ▪ Possibility of Decentralized Systems ▪ Suitable for lesser quantities of waste
DIS ADVANTAGES	▪ Occasional foul smell ▪ 25 to 30 % product recovery	▪ Slightly sensitive to type of waste in terms of organic content and moisture ▪ Cost increases if inappropriate quality of waste

THERMAL TREATMENT

	Incineration	Pyrolysis
Process	▪ Combustion of waste for volume reduction and recovery of heat through steam.	▪ Gasification of waste in an oxygen starved environment to decompose. Uses high electricity and temperature to fuel the conversion.
By Products	▪ Gas / Steam ▪ Inorganic content & Ash	▪ Synthesis Gas ▪ Inert material
Waste Characteristics	▪ High calorific Value ▪ Lesser Moisture Content	▪ High calorific Value ▪ Lesser Moisture Content
ADVANTAGES	▪ Can accommodate variation in waste quality ▪ Can handle large quantities of waste ▪ Waste to energy	▪ Can accommodate variation in waste quality ▪ Can handle large quantities of waste ▪ Waste to energy
DIS ADVANTAGES	▪ Difficult to implement ▪ Very less experience in Indian conditions ▪ Indian waste slightly unsuitable for this process ▪ High Capital and O&M costs ▪ Skilled workforce required as technologically sophisticated	▪ Critical to type of waste ▪ Less experience and not mature ▪ High Capital and O&M cost ▪ Skilled workforce requirements

THERMAL PROCESS

- **Incineration**
  - Modular
  - Fluidized Bed
- **Plasma**
- **Pyrolysis**



Exothermic chemical reactions change the composition of organic fraction of MSW

- Syn Gas
- Organic liquids

- **Perungudi Dumpsite in Chennai (600 MTPD @ Rs. 180 Cr.)**
- **Hyderabad & Secunderabad (2200 MTPD)**

Requirement of waste of high calorific value more than 1500 Kcal.
Else requirement of auxiliary fuels make operations expensive

DIGESTION PROCESS - COMPOSTING

PREPARATION
- Removal of Non Combustible substances
- Shredding
- Moisture Adjustment

DIGESTION
- Wind row
- Aerated Static Pile
- Horizontal
- Rotating Drum

CURING
- Forced / Passive Aeration

SCREENING / FINISHING
- Screening / Packaging

STORAGE/DISPOSAL
- Disposal of residual matter through landfill

- Simple and no advanced Technology requirements
- Suitable for type of homogeneous waste generated in India
- No segregation at base level
- Widely applied in Indian conditions

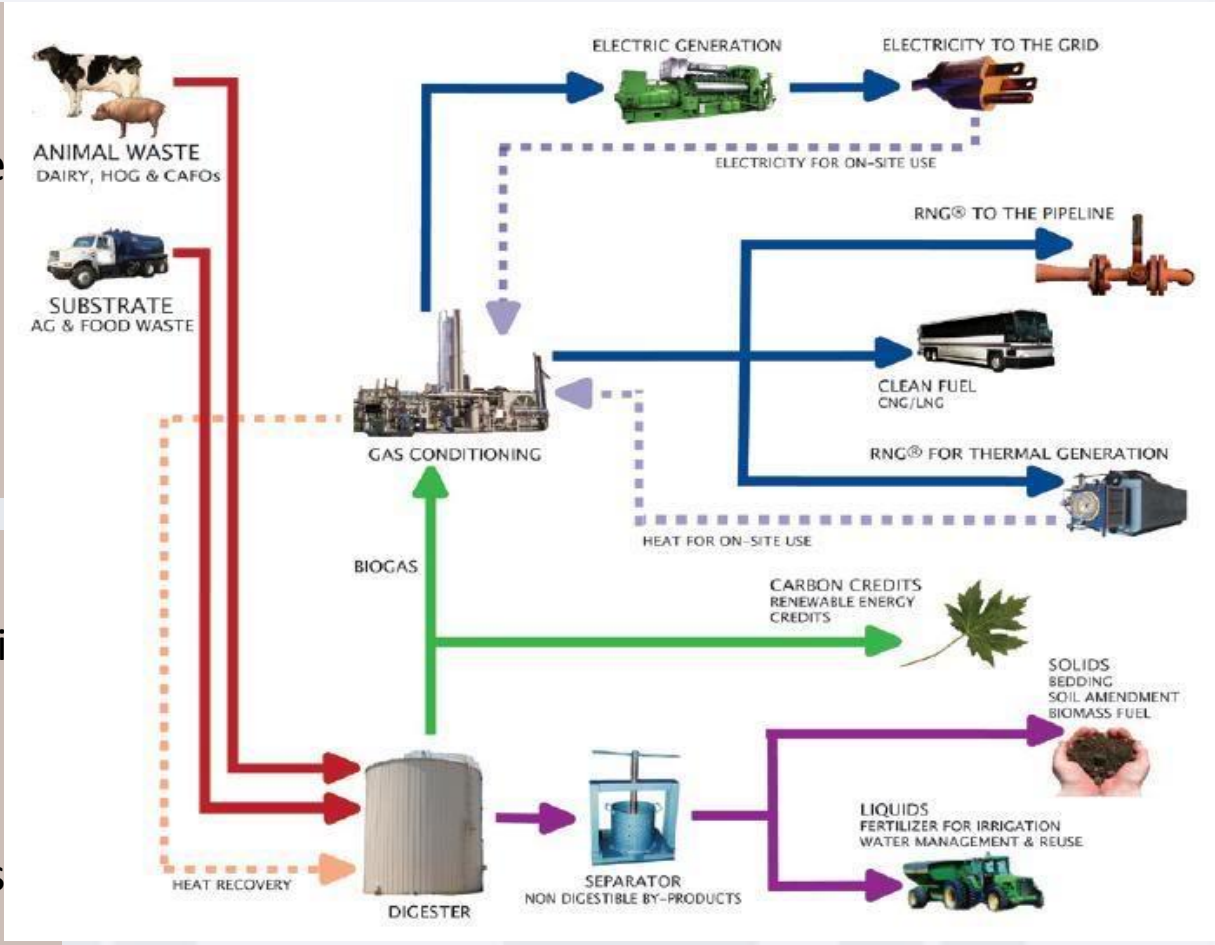
- Occasional foul smell
- Only 25 – 30 % recovery

- Compost
- Organic waste

BIO – METHANATION

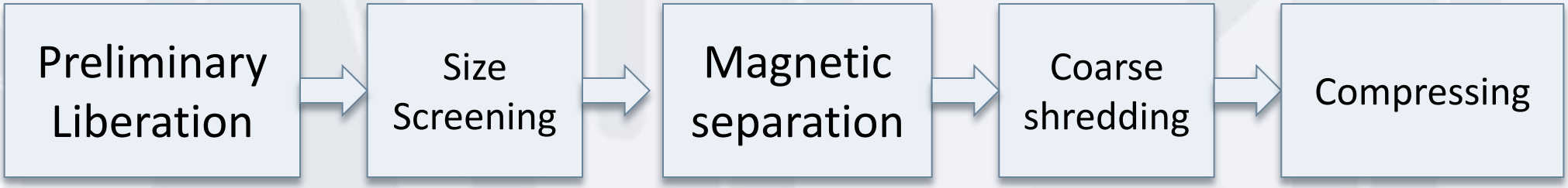
- Anaerobic digestion process
- Bio-chemical digestion occurs in absence of oxygen in a controlled condition.
- Produces Methane and CO2 rich biogas and fertilizer as a left over
- Widely used for organic waste

- Source separation of plastics etc inorgani waste
- Foul smell is an issue
- Pre Processing of waste (in terms of particle size and organic matter) is a mus
- More than 50 % moisture content is desirable (Sewage is often added)
- Cycle of 15 to 40 days
- Approx. 30 Sq.M area for 1 tonne of MSW



PELLETIZATION / REFUSE DERIVED FUEL (RFD)

- Partly mechanical process of converting the mixed MSW into enriched fuel feed for thermal processes
- RDF mostly consists of organic and biodegradable waste components compressed into pellets, bricks or logs.
- Non combustible materials are removed pre or post treatment.



- As an add on to traditional source of fuel in coal power plants
- Cement kilns
- Thermal waste processing plants
- Pyrolysis plants etc…

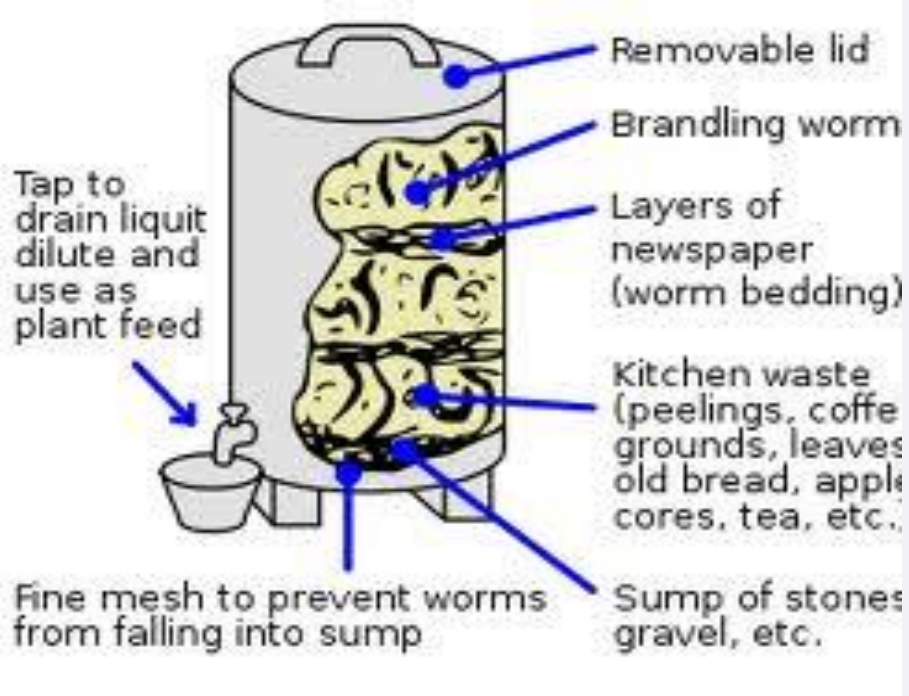
DECENTRALISED TREATMENT OPTIONS

From 50 to 600 households

VERMICOMPOSTING & INVESSEL COMPOSTING

VERMI COMPOSTING

- Organic matter is broken down by a certain species of earthworm leaving behind nutrient rich, natural fertilizer or soil conditioner.
- Suitable to de centralized type of systems. However larger applicable models exist
- Maintenance issues
- Foul smell an occasional problem



IN VESSEL COMPOSTING / COMPOSTING BINS

- Bio degradable waste processed in a concrete or appropriate material bin by aerobic microbial composting method with high rate bio trigger mechanism
- Models of up to 600 families exist
- Siting a problem - NIMBY

VERMICOMPOSTING & INVESSEL COMPOSTING

ORGANIC WASTE CONVERTER

- OWC Machine shreds, cuts and homogenizes organic waste with appropriate additive and bio culture within a cycle of 15 min.
- Capital intensive
- No foul smell and spillage
- Strict segregation

DECENTRALISED WIND ROW COMPOSTING

- Same concept as in centralized systems
- Large land area requirements
- 30 to 45 days of cycle time

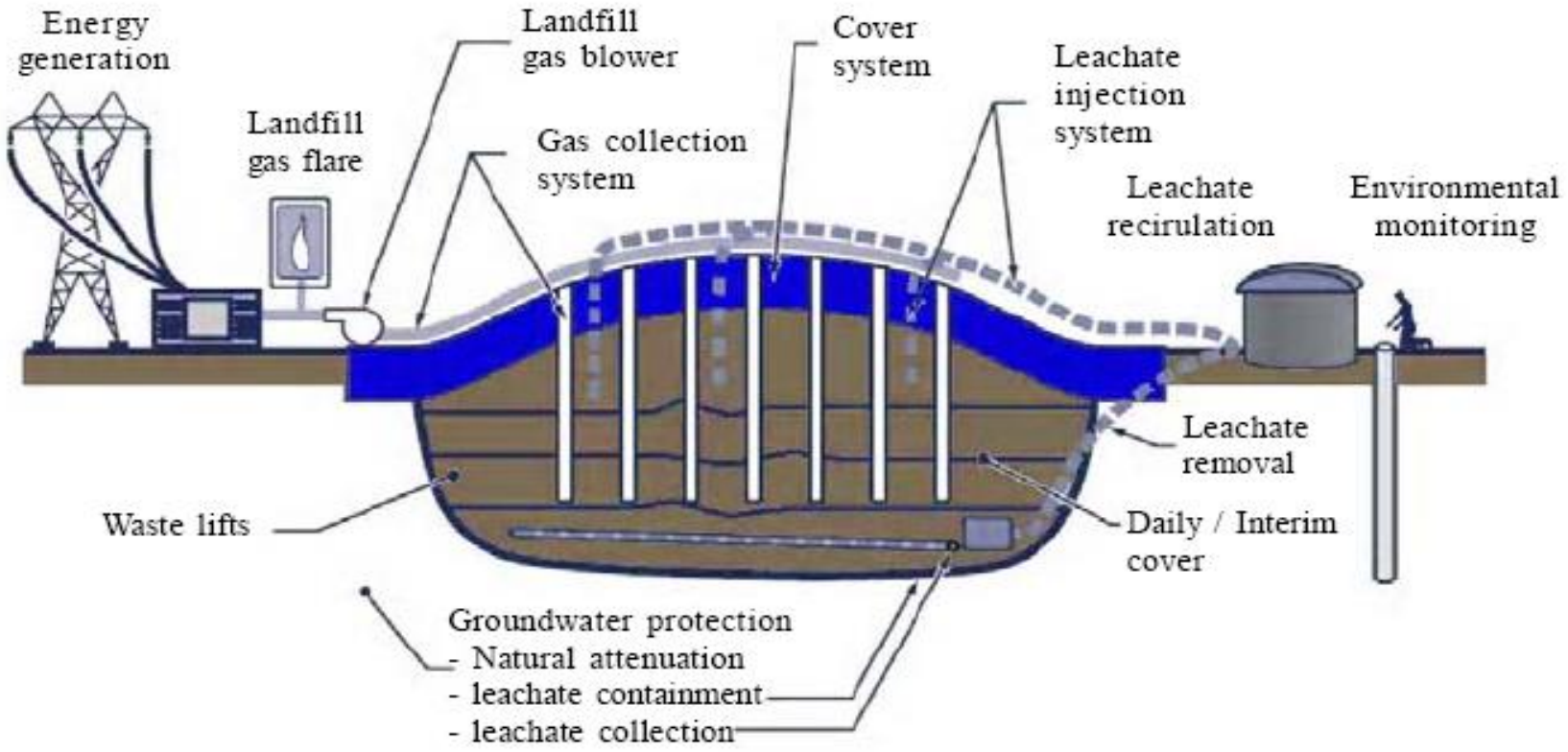
DUMPING / DISPOSAL METHODS

CONTROLLED LANDFILLS

1. Liner
2. Leachate collection
3. Systematic layering and compaction

SCIENTIFIC DUMPING SITE

1. Geo – Synthetic liner
2. Leachate collection & treatment
3. Passive venting
4. Layering and compaction



COSTING

BIOLOGICAL			
COMPOSTING	Rs. 4 Cr. to 4.5 Cr.	160 TPD	Rs. 2,50,000 Per Ton
BIO-METHANATION	Rs. 15 Cr. To 16 Cr.	160 TPD	Rs. 10,00,000 Per Ton
THERMAL PROCESS			
RDF	Rs. 25 Cr. To 30 Cr.	330 TPD	Rs. 7,57,000 Per Ton
INCINERATION			
PYROLYSIS			
DECENTRALISED			
Vermi Composting	Rs. 50 Lakh	8 TPD	Rs. 6,25,000 Per Ton
Organic Waste Convertor			
SCIENTIFIC DUMPING SITE	Rs. 2.5 Cr. To 3.0 Cr.	60 TPD	Rs. 5,00,000 Per Ton

12TH FINANCE COMMISSION RECOMENDATIONS

- UPTO 50 MTPD - Vermi Composting
- 50 MTPD to 500 MTPD - Vermi Composting + Mechanical Composting
- More than 500 MTPD - Mechanical composting and Waste to energy

COMPARATIVE STATEMENT

PARAMETERS	COMPOSTING	BIOMETHANATION	INCENERATION / THERMAL	RDF	VERMI COMPOSTING
QUANTITY	LOW	MEDIUM	HIGH	LOW	HIGH
QUALITY	MEDIUM	HIGH	LOW	LOW	HIGH
LAND REQUIREMENT	MEDIUM	LOW	LOW	MEDIUM	LOW
CAPITAL INVESTMENT	LOW	MEDIUM	HIGH	HIGH	LOW
O&M COST	LOW	MEDIUM	MEDIUM	HIGH	LOW
DECENTRALISATION	YES	-	NO	NO	YES

MUNICIPAL SOLID WASTE CENTRALISED TREATMENT

	CENTRALISED				
	Composting	Anaerobic Digestion	Incineration	Pyrolysis	RDF
Quality of Waste	Decomposable Heterogeneous waste	Decomposable Heterogeneous waste	Mixed Waste with calorific value > 1200Kcal/Kg, Moisture content < 45 %.	Mixed Waste with calorific value > 1200Kcal/Kg.	Mixed waste with less inert materials
Quantity of waste	Upto 700 TPD	650 TPD	25 TPD to 3000 TPD	4 TPD onwards	5 TPD min
Availability of technology	Easy	Easy	Medium	Difficult	Medium
Familiarity	Yes	Yes	No	NO	NO
Labor Requirements	Medium	Medium	Low	Low	Low
Skilled workforce	NO	No	Yes	Yes	Yes
Land Area Requirements (Value)	High (Low) - 3.3 Ha (for 100 TPD)	Medium (L (for 1			
Location issue (NIMBY)	NO				
Criticality of User Involvement	Medium	Me			
Process Time Cycle	1.5 months to 3 Months	1 m			
Scaling up	Yes				
Environmental hazards	Least - Occasional foul smell	Medium - Liquid			
Capital Cost (Rs. Lakh per TPD)	3	10	6 to 7	6.5 to 9	7.5 to 8
O&M cost (Rs. Lakh)	Low	Medium	High	High	High
Possibility of Revenue generation	Yes	Yes	Yes	Yes	Yes
Sources of Finances	More				
Possibility of PPP	Yes	Yes	Yes	Yes	Yes

- Less waste than required to make it viable
- Not widely applied in Indian Scenario and in cities similar sized to Kalol
- Expensive and too advanced to be managed by the ULB
- High Environmental measures
- High energy use

MUNICIPAL SOLID WASTE – DECENTRALISED SYSTEMS

	DE-CENTRALISED			
	Vermi Composting	Invessel Composting	Organic Waste Converter	Wind Row Composting
Quality of Waste			Decomposable	Decomposable
Labor Requirements			Low	Low
Skilled workforce			No	Yes
Land Area Requirements (Value)			Low (High)	Medium (High)
Location issue (NIMBY)				Yes
Criticality of User Involvement				High
Process Time Cycle				1 month
Scaling up			No	No
Environmental hazards			Low	Medium
Capital Cost (Rs. Lakh per TPD)				
O&M cost (Rs. Lakh)			High	Medium
Possibility of Revenue generation			Less	Less
Sources of Finances				
Possibility of PPP			No	No

DE-CENTRALISED
Vermi Composting
Invessel Composting
Organic Waste Converter
Wind Row Composting

- Expensive
- Technologically advanced

Source: Management of municipal solid waste, TV Ramachandran, 2008; Practicing Professionals and Private Players involved in Waste to Energy projects, Dr. K.V. Dinesh, Excel Industries.

Treatment Technology Selection

Quality of Waste	Quantity of waste	Availability	Capital, O&M and Cost recovery	Experience in Indian Scenario	Implementability

COMPOSTING ✓

ANAEROBIC DIGESTION ✓

INCINERATION | PYROLYSIS | RDF

- **Less waste** than required to make it viable
- **Not widely applied** in Indian Scenario and in cities similar sized to Kalol
- **Expensive** and too advanced to be managed by the ULB
- High Environmental measures & Energy usage
- **Inappropriate quality in such small quantity**

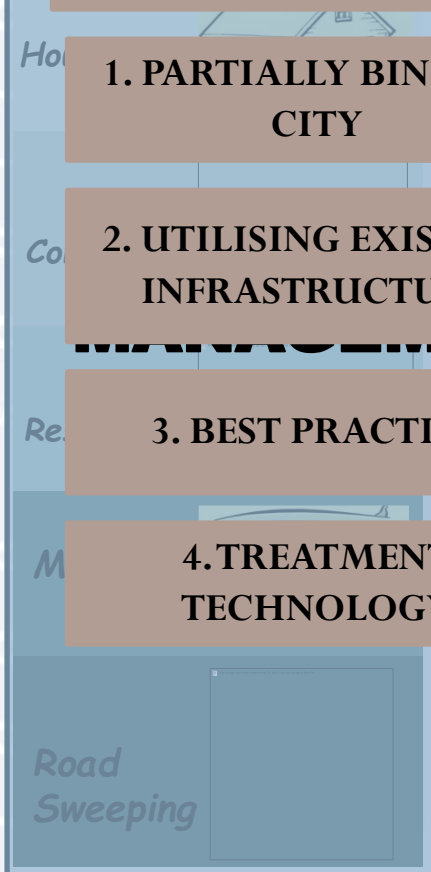
	DECENTRALISED SYSTEMS			CENTRALISED SYSTEMS	
	BIO METHANATION	VERMI COMPOSTING	ORGANIC WASTE CONVERTOR	BIO METHANATION	WINDROW COMPOSTING
Capital cost (Rs./ton)	11000	4200	3300	11000	820
O&M cost (Rs./ton)	650	553	658	650	160

CAPTURE → TRANSPORT → TREATMENT → REUSE → DISPOSAL

FACTORS CONSIDERED

1. PARTIALLY BIN FREE CITY
2. UTILISING EXISTING INFRASTRUCTURE
3. BEST PRACTICE
4. TREATMENT TECHNOLOGY

DLING & SYSTEM



RAJKOT CENTRALISED SWM SYSTEM

- Involving Rag Pickers
- Daily Reporting and Strict Monitoring
- Call centers for complain redressal

NASIK A BIN FREE CITY

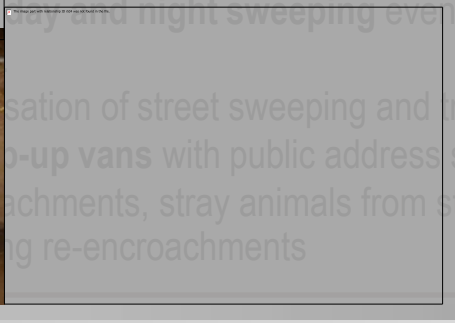
- Bin Free
- Door to Door Collection mechanism privatized

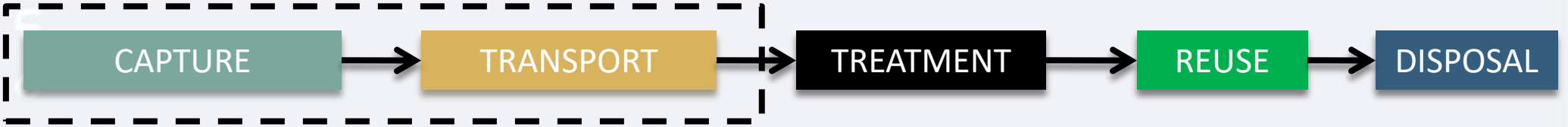
SURYAPET COMMISSIONER'S DAWN MEETINGS WOKE UPCITIZENS

- High level of Involvement of Municipal authorities
- High level of segregation
- Day and night sweeping

NAMAKKAL

- High level of segregation
- De-centralized System





FACTORS CONSIDERED

1. PARTIALLY BIN FREE CITY
2. UTILISING EXISTING INFRASTRUCTURE
3. BEST PRACTICE
4. TREATMENT TECHNOLOGY

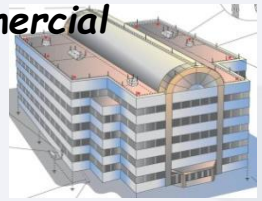
- CENTRALISED BIN FREE
- CENTRALISED WITH BIN
- DE-CENTRALISED AT WARD LEVEL
- DE-CENTRALISED AT SOCIETY LEVEL

DECENTRALISED BIN FREE

Capture → Transfer → Treatment → Reuse

House

Commercial



Restaurants

Market

Road Sweeping

WET

DRY

BIO BIN AT EVERY SOCIETY LEVEL

GARDENING

DRY

DOOR TO DOOR COLLECTION CONTRACT

WINDROW TREATMENT

BY PRODUCTS

FULF PALLETS

ECOBRICKS

WET

WET

BIO BIN AT MARKET

GARDENING

DRY

ULB

DECENTRALISED BIN FREE

Capture → Transfer → Treatment/ Disposal

House

Commercial

Market

Road Sweeping

RESPONSIBILITY OF CBO/ HHs

WET → BIO-BIN → GARDENING

DRY → DRY WASTE TREATMENT PLANT

COLLECTION BY CONTRACTOR

RESPONSIBILITY OF ULB

ULB → Container trolleys

CENTRALISED BIN FREE

Capture → Transfer → Treatment → Reuse

House

Commercial

Restaurants

Market

Road Sweeping

WET

DRY

DRY

DOOR TO DOOR COLLECTION CONTRACT

WET

ULB

WET

WINDROW TREATMENT

BY PRODUCTS

MANURE

FULF PALLETS

ECOBRICKS

ULB

DRY

CENTRALISED

Capture → Transfer → Treatment → Reuse

House

Commercial

Restaurants

Market

Road Sweeping

WET

DRY

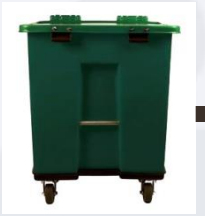
DRY

WET

WET

DRY

DOOR TO DOOR COLLECTION CONTRACT



MARKET

TRANSPORTATION CONTRACT

ULB

WINDROW TREATMENT

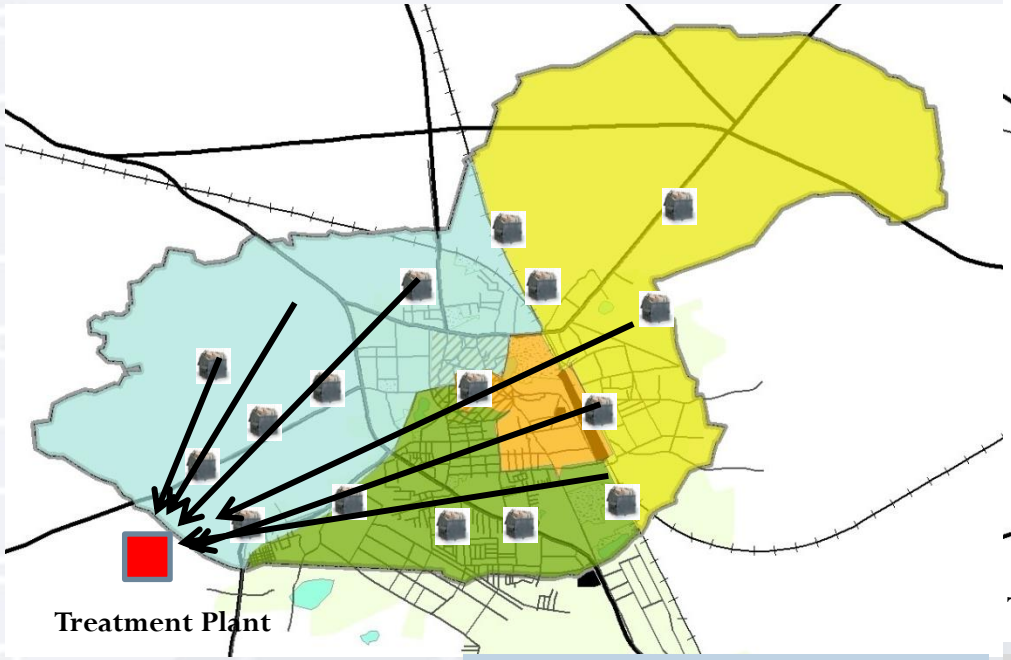
BY PRODUCTS

MANURE

FULF PALLETS

ECOBRICKS

CENTRALISED WITH BINS



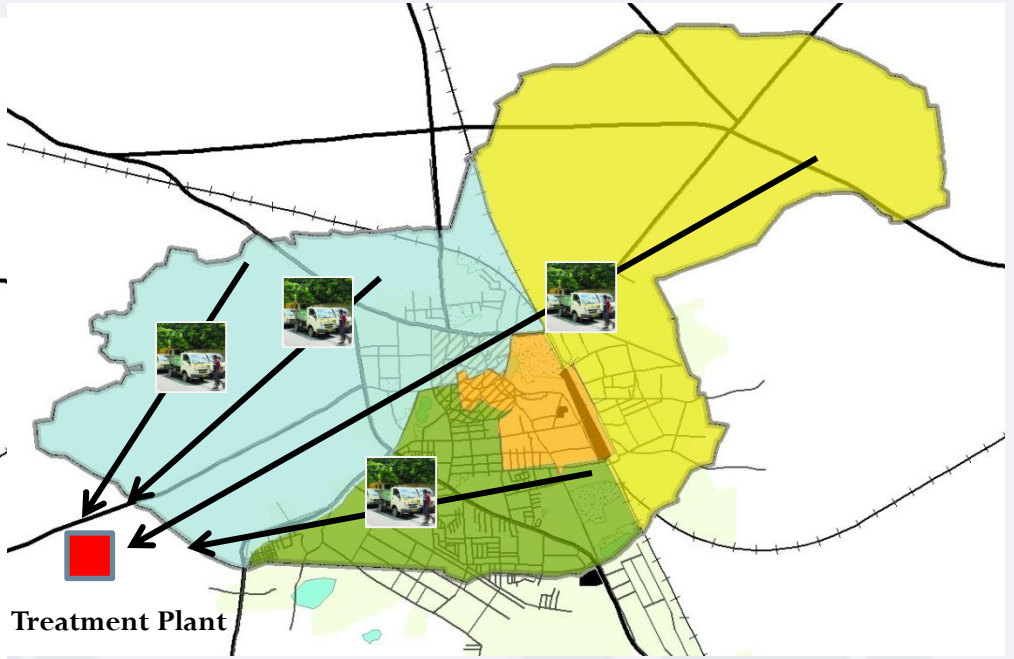
Advantages:

- Existing infrastructure gets used

Disadvantages

- Double handling
- Nuisance points get created at various locations in the city
- Bad practices may worsen the situation
- Monitoring becomes crucial

CENTRALISED BIN FREE



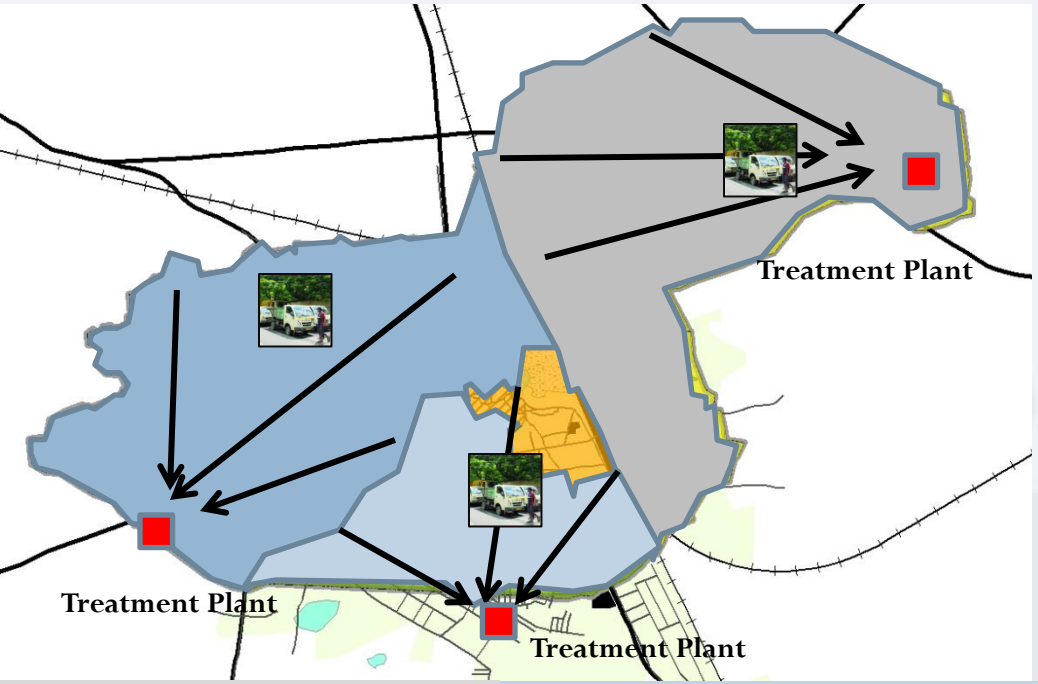
Advantages:

- Minimum handling of waste
- No nuisance points inside the city
- Easy to monitor
- Single overall system- less no. of stakeholders

Disadvantages

- Mixing of different waste streams
- Segregation is not easy

DECENTRALISED AT WARD LEVEL



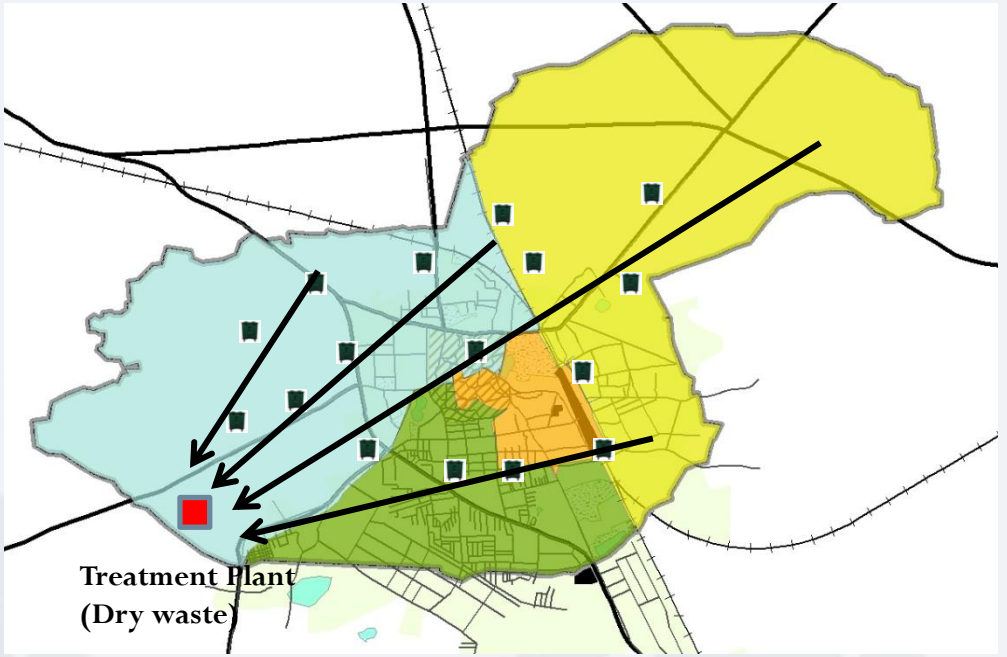
Advantages:

- Easy to implement for smaller quantities of waste
- Transportation cost is less
- Waste recovery is more than centralized
- Possibility of integrated contracts , thus reducing no. of contracts

Disadvantages

- Creation of nuisance points
- Identification of land pockets at many locations is difficult

DECENTRALISED AT SOCIETY LEVEL



Advantages:

- Wet waste gets composted at site itself
- Advantages of using the compost locally

Disadvantages

- Cost of transportation for dry waste has to be taken into account
- Procurement of bio-bins
- Ensuring the maintenance of bio bins by society is difficult
- High level of segregation required
- No profit generated in the form of revenue from compost

SYSTEM SELECTION: SUITABILITY ANALYSIS

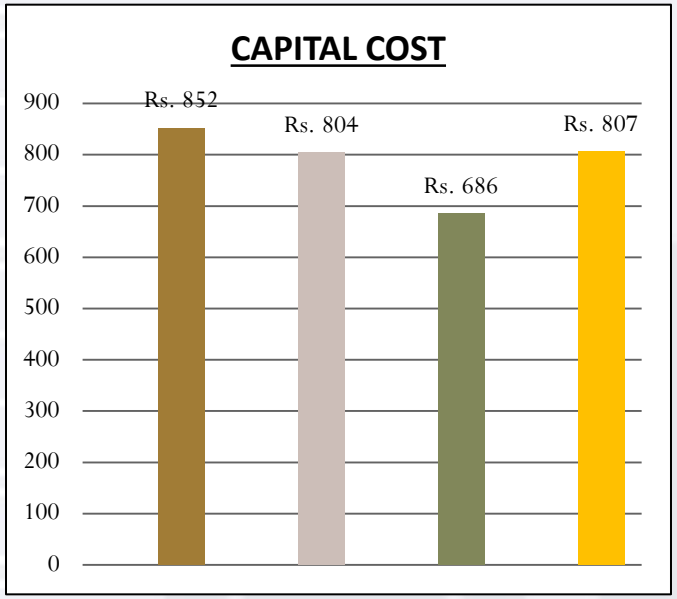
INSTITUTIONAL

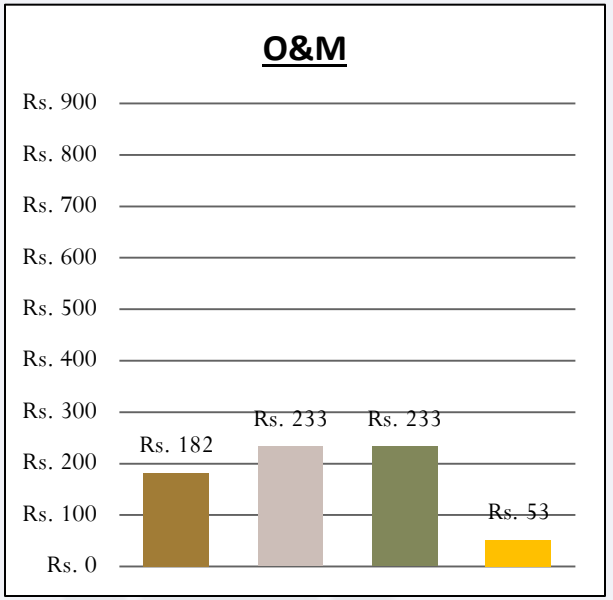
		CENTRALISED BIN FREE	DECENTRALISED BIN FREE	CENTRALISED BINNED	CENTRALLY DECENTRALISED
INSTITUTIONAL	Ease of procurement of services	2	1	3	2
	Monitoring Ease	3	1	2	1
	No. of Stake Holders / contracts	3	1	2	2
	Compulsiveness in Doing ones tasks / Ensuring that the task is done	3	1	1	3
	Maintenance	3	1	1	3
Institutional Total		**14**	**5**	**9**	**11**

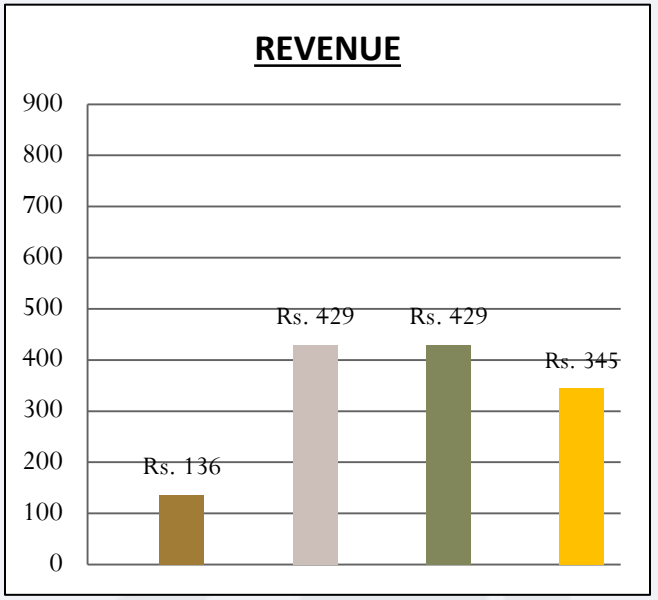
- Decentralised systems score low because of following reasons
  I. Large no. of stakeholders & difficulty in management at unit level
  II. Suitable for specific type of waste
  III. High degree of responsibility on users
- Centrally administered decentralized mechanism is required for very large scale of cities
- Centralised options score higher because of their advantages of easy monitoring, lesser no. of stakeholders

SYSTEM SELECTION: SUITABILITY ANALYSIS

FINANCIAL







Considering the revenue and the capital cost difference a centralised treatment facility with bin free collection mechanism comes out to be Suitable and scores higher

SYSTEM SELECTION: SUITABILITY ANALYSIS

TECHNICAL

		CENTRALISED BIN FREE	DECENTRALISED BIN FREE	CENTRALISED BINNED	CENTRALLY DECENTRALISED
TECHNICAL	Waste Handling	3	2	1	3
	Re-Use	3	3	2	3
	Separation of Recyclable materials	2	3	1	3
	Experience	3	1	3	1
	Usage of Existing infrastructure	1	1	3	1
	Environmental Impact	2	3	1	2
	Technical Total	**14**	**13**	**11**	**13**

Highest scoring system is most suitable

- Centralized Bin free scores highest in technical suitability
- Bin Free options score higher because of their advantages in waste handling and segregation potential but score low in experience
- Binned systems score low due to the nuissance to environments & higher transporttaion cost & more handling of waste

Door To Door Collection Contract

Capture → Transfer

House

Commercial

DOOR TO DOOR COLLECTION →  → TREATMENT PLANT

GHANTA GADI

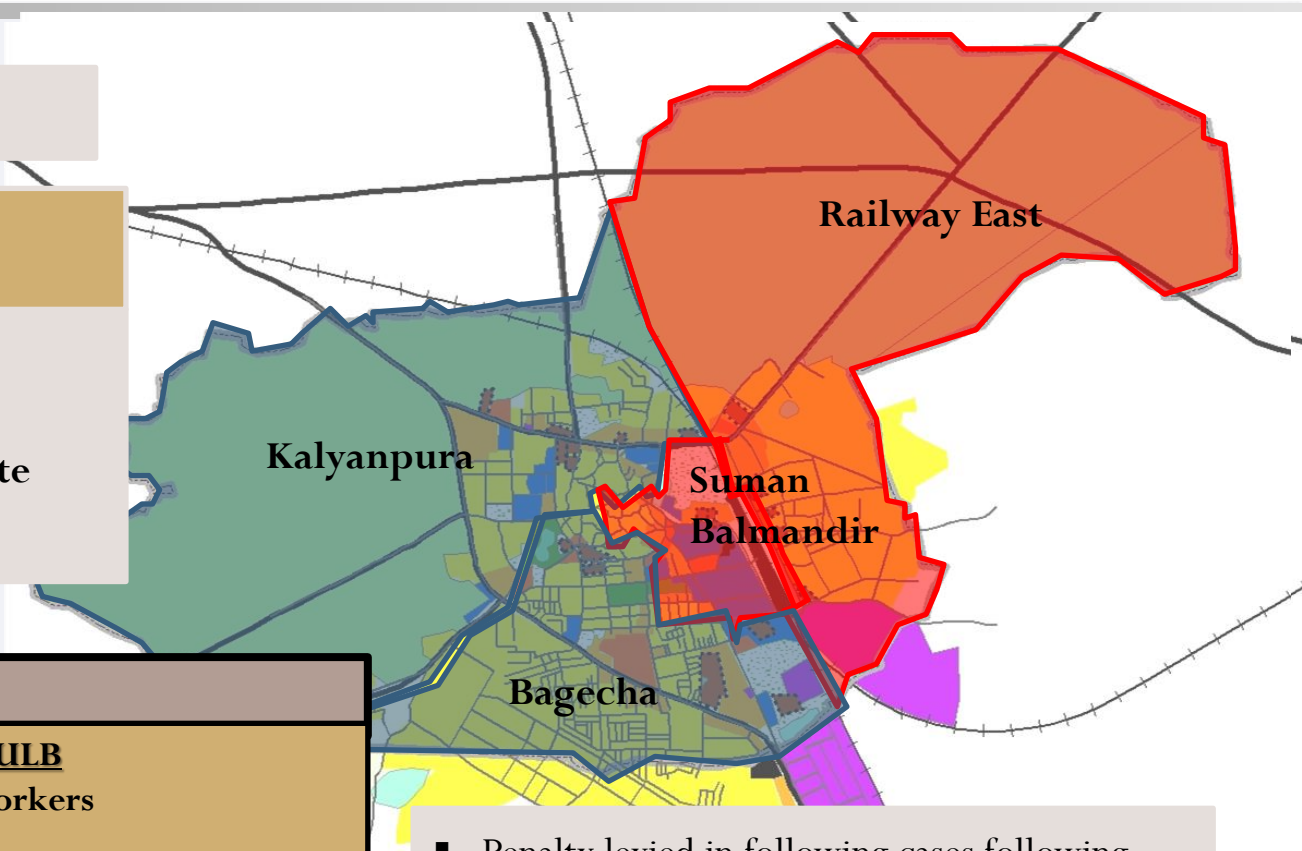
YEAR	POPULATION (LAKHS)	RESIDENTIAL WASTE	COMMERICAL WASTE (MT)	TOTAL WASTE TO BE COLLECTED
2011	1.3	27.7	3.3	29.3
2014	1.4	29.9	3.5	33.4
2021	2.6	54.5	6.4	60.9
2031	3.5	81.9	9.6	91.6
2041	4.7	111.7	13.1	124.9

Door To Door Collection Contract

CONTRACT DETAILS

- 2 year duration of contract
- Payment on **PROPERTY BASIS**

- 1 year duration of contract
- Payment on **WEIGHT BASIS**
- **Separate rates for wet and dry waste**
- **Revision of rates**



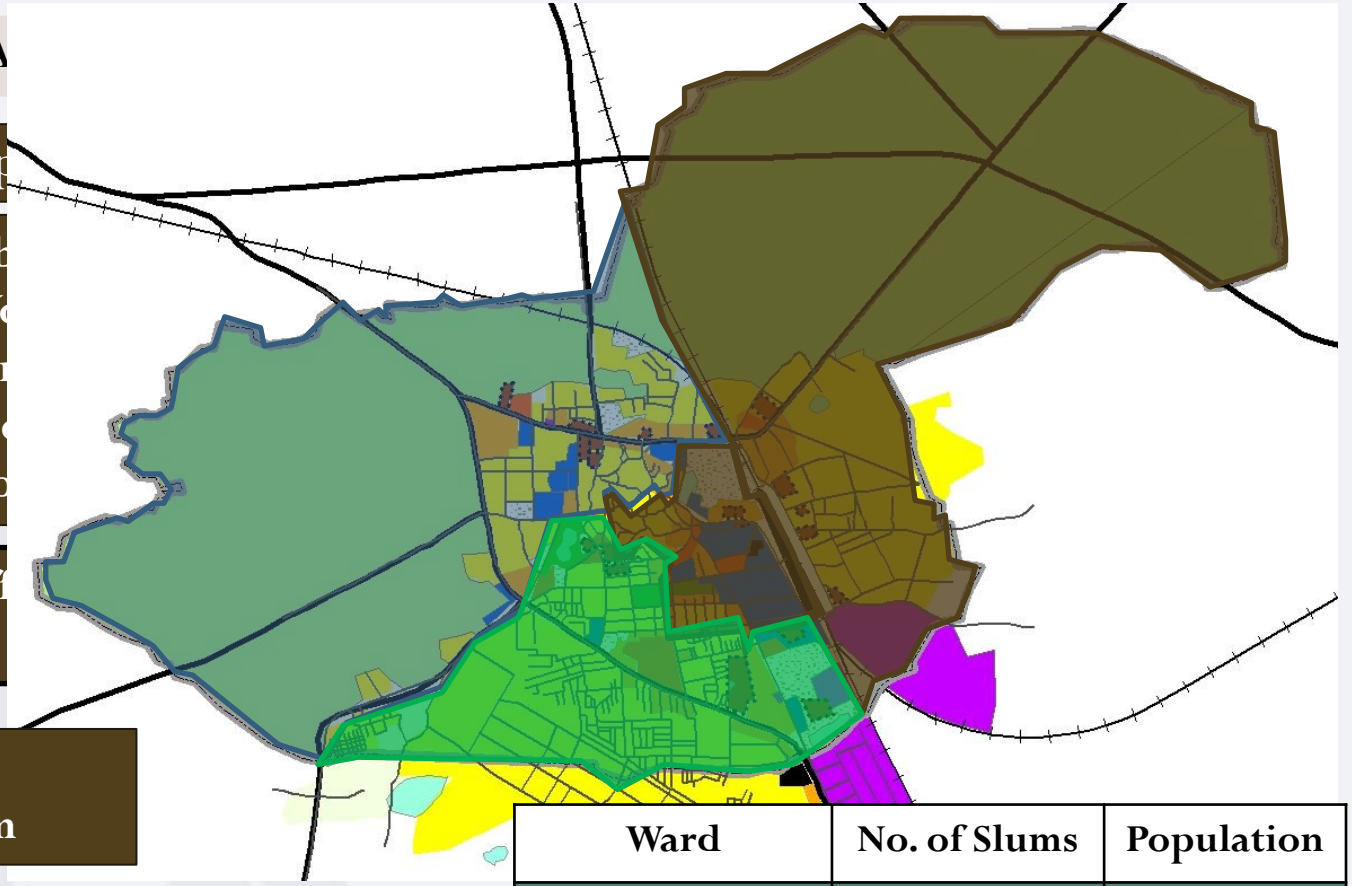
MONITORING	
CITIZENS **Volunteers / Society Secretaries / Association chiefs**	**ULB** ▪ **Attendance of workers**
Weekly reports on regularity of work to be approved	▪ **Non reporting vehicles / equipments** ▪ **Safety Equipments** ▪ **Localities / areas / open grounds found unswept / uncleaned** ▪ **Households with no collection** ▪ **Media reports / Complaints etC**

- Penalty levied in following cases following failures:
  - ➢ Inability to redress the complain in 24 hours
  - ➢ Failure of the ghanta gadi, payment deduction per vehicle
  - ➢ Absence of sweeper, payment deduction per sweeper

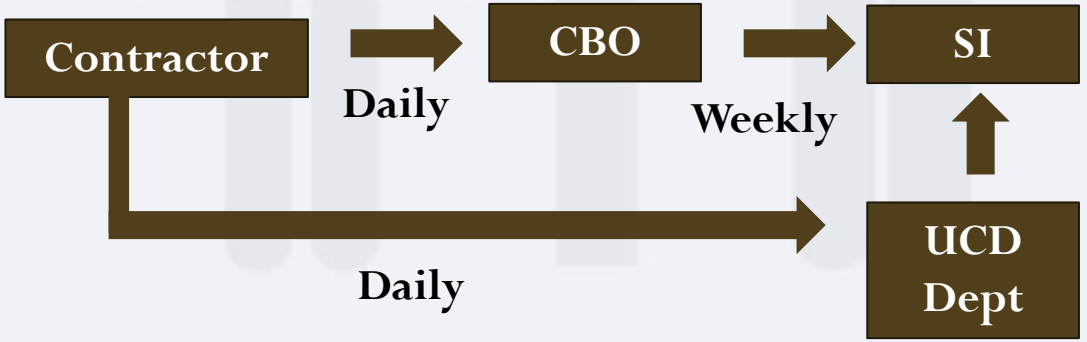
OPTIONS EVA

1.Responsibility Of ULB	Ap
2. Separate Contract To Sakhi Mandal	Ab W sa ar Co
3. Responsibility Of Door To Door Contractor	Eff

CBO- for slums of each zones member from each slum



Ward	No. of Slums	Population
Kalyanpura Ward	6	10311
Bagecha Ward	8	8035
Railway east + Suman Balmandir	8	10348



SLUM- INDIRANAGAR

WATER SUPPLY:

Connections are illegal

Other sources of water

- GEB
- GIDC

SEWERAGE:

- 80% have individual toilets
- No sewerage connections
- Open defecation practiced
- Community toilets not in usable condition

SOLID WASTE:

- No solid waste collection
- No street sweeping
- HH pay Rs.10/ month to clear the dump site

STORM WATER:

- Slum located in depression
- No storm water drains

: 2.6 HA

DENSITY : 630 PPHA

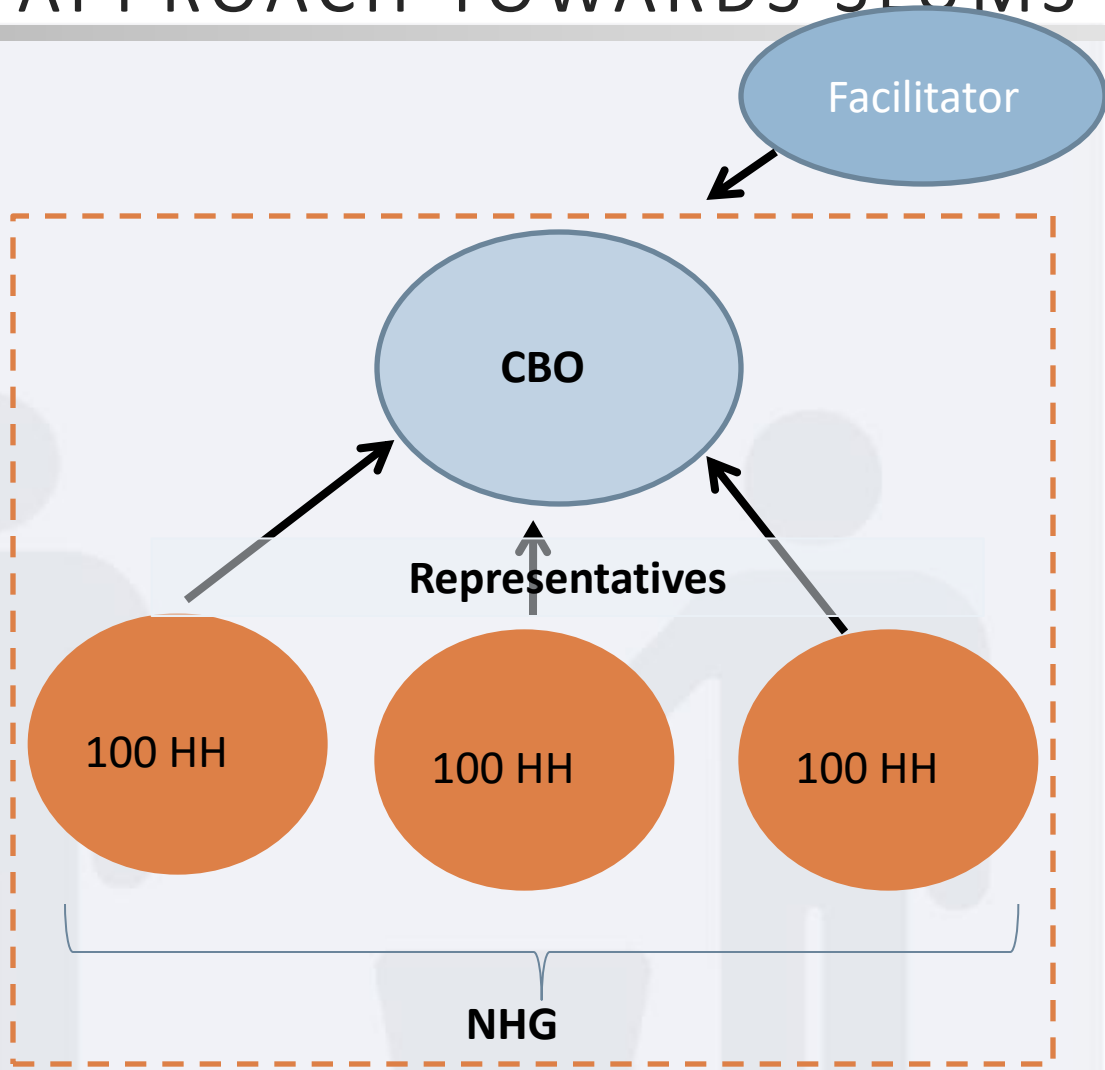
GRAPHY

POPULATION: 1636

HH : 330

23°14'10.92" N 72°30'01.67" E elev 224 ft

COMMUNITY PARTICIPATION THROUGH CBO



Community Structure

Slum will consists of neighborhood groups
The slum is divided into zones of 100HH each
Each zone represents a NHG.
Representatives/volunteers would be selected/elected from each NHG
CBO- will consists all representatives from all three NHG

Facilitator

NGO
Clubs: Rotary club, lions club
Industries
individuals

Its Role

Awareness
Promotion
Technical assistance
Help in resource mobilization

COMMUNITY PARTICIPATION THROUGH CBO

- NGO as the facilitator
- Sanitation and hygiene promotion
- Create interest to solve problems
- Motivate formation of self help groups

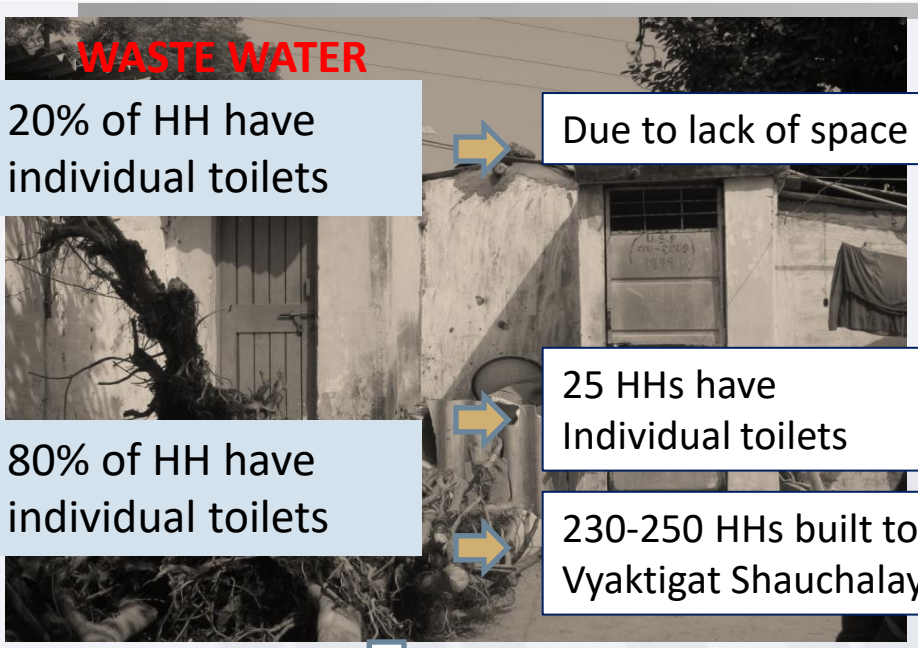
- Identify leader among themselves
- Will be in charge of the CBO
- Facilitate the activities of the CBO

- Generate need, problems, demand by community participation.
- Technology choice

- Mobilize funds- through programmes, contributions by community.
- Employment
- Training to the workers

- Monitoring by the CBO

SLUM: WASTE WATER



WASTE WATER

20% of HH have individual toilets

80% of HH have individual toilets

Due to lack of space

25 HHs have Individual toilets

230-250 HHs built toilets under Vyaktigat Shauchalaya Scheme

Technology:
Renovation of Community Toilets

ISSUES:
- **No sewerage connections**
- **30% only have soak pits**
- **Overflowing of waste water pits**
- **Open defecation**

Technology:
Septic Tank: Sewage
Soak Pit: Sullage

No of septic tanks: 7
50 HHs will share a septic tank

Technology:
Conventional Sewerage System

Laying Sewer lines & giving connections to all the HHs

Technology:
Non-water Reliant System:
UDDT/ Pit Latrines

- Convert existing toilets into UDDT
- Covert existing toilets into pit latrines
- Small bore for sullage

SLUM: WASTE WATER

Probable Locations of Septic Tanks

Cost of a septic tank: Rs. 12000 – 15000
Total Capital cost of septic tanks: Rs. 105000

Responsibility: ULB
Finance: Through BSUP Fund
Urban Infrastructure Service Provision: not linked to Tenure

Desludging once in a year: Rs. 2500
User Charge Per HH: Rs 50 annually

Regular Water Supply requires Provision of water connections

SLUM: WASTE WATER

UDDT:

Changing Habits of people:
IEC Programmes
Higher Costs: Rs. 4650

Onsite Collection & treatment at HH level
Laying of network: not needed
Non water reliant mechanism

Responsibility:
CBO

Finance from BSUP fund, loan from NGO & slum dwellers

Pit Latrines:

Foul Smell
Manual Collection
Unhygienic

Easy to construct:
Addition of Collection mechanism

Responsibility:
CBO

Finance from BSUP fund, loan from NGO & slum dwellers

Conventional Sewerage:

Low Cost
Regular Water Supply needed
ULB's willingness

Responsibility:
ULB till the plot

Finance from BSUP fund till the plot
Finance for Internal Infrastructure by Slum dwellers

DECISION:

- **ULB Willingness**
- **Slum dwellers' decision,**
- **Feasibility of resource mobilization from NGO**

SOLID WASTE MANAGEMENT

COLLECTION:

Zone wise collection of waste
Ragpickers to be employed

MANPOWER REQUIRED:

1 sweeper / zone
1 accountant/ clerk

COST / HH

One time charge Rs. 55/HH
Monthly service charge: Rs. 18/HH

TRANSFER:

Transfer to the nearest community bin

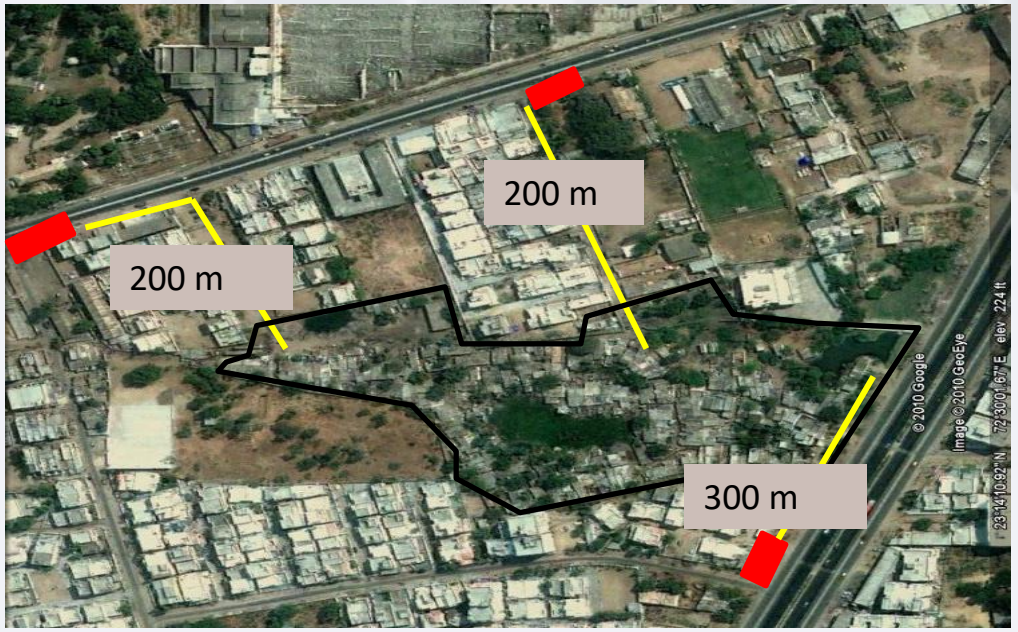
EQUIPMENTS REQUIRED:

1 wheel borrow with 6 bins per zone

Equipments can be sponsored by the clubs, industries

COST / HH

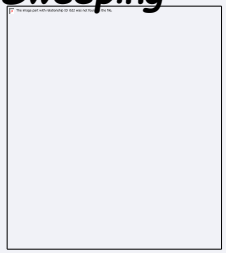
Monthly service charge: Rs. 18/HH



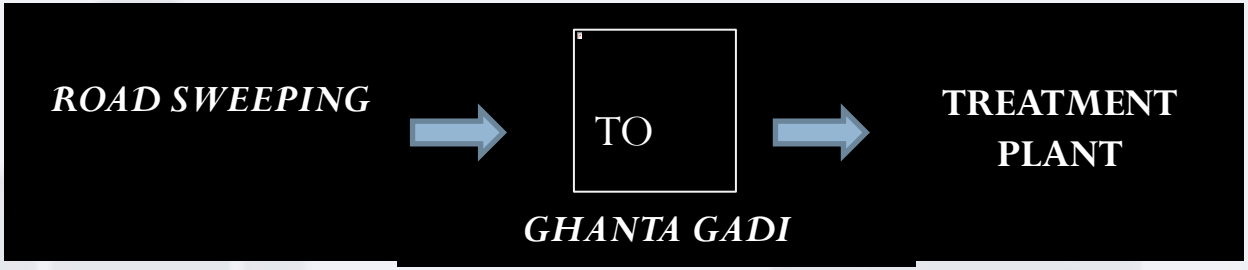
MONITORING

Responsibility of CBO
-Mobilization of equipments
-Maintenance of the equipments
-Collection of fees
- Payment to the workers

Road Sweeping



YEAR	ROAD SWEEPING WASTE
2011	6.5
2014	7.4
2021	12.8
2031	19.3
2041	26.0



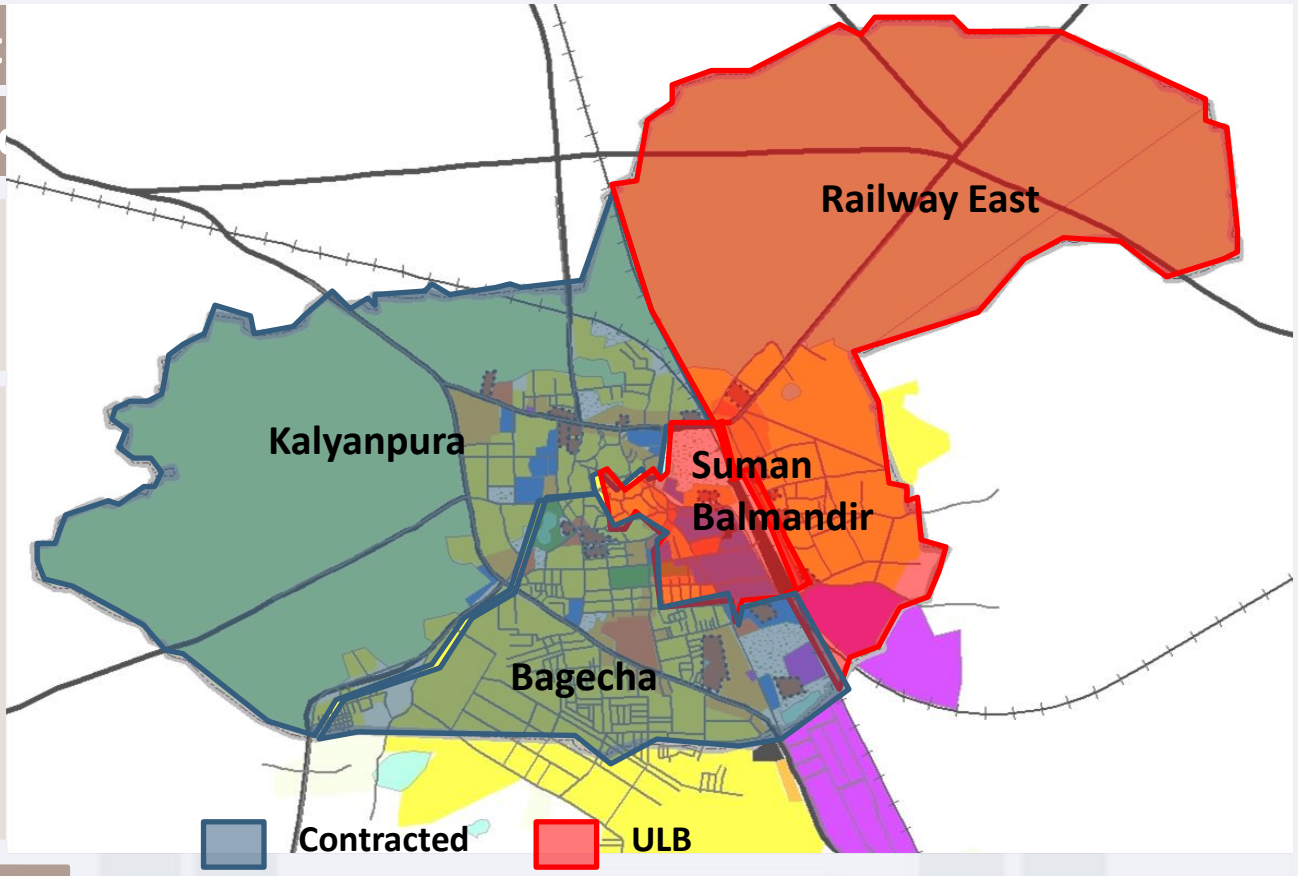
Road Sweeping Contract

Integrated with the door to d

- 1 years duration
- Payment on Per Km Road Length for road sweeping

Contract shall include the following work:

- Street Sweeping
- Clearing of open Drains
- Foot Paths
- Dust bins
- Monthly cleaning of Open Plots and Areas surrounding water bodies



- Introduce **2 Separate Contracts** after 3 years

- in 24 hours
- Absence of sweeper, payment deduction per sweeper

MONITORING

- Responsibility of sanitary inspector
- Complains redressed
- Attendance of sweepers

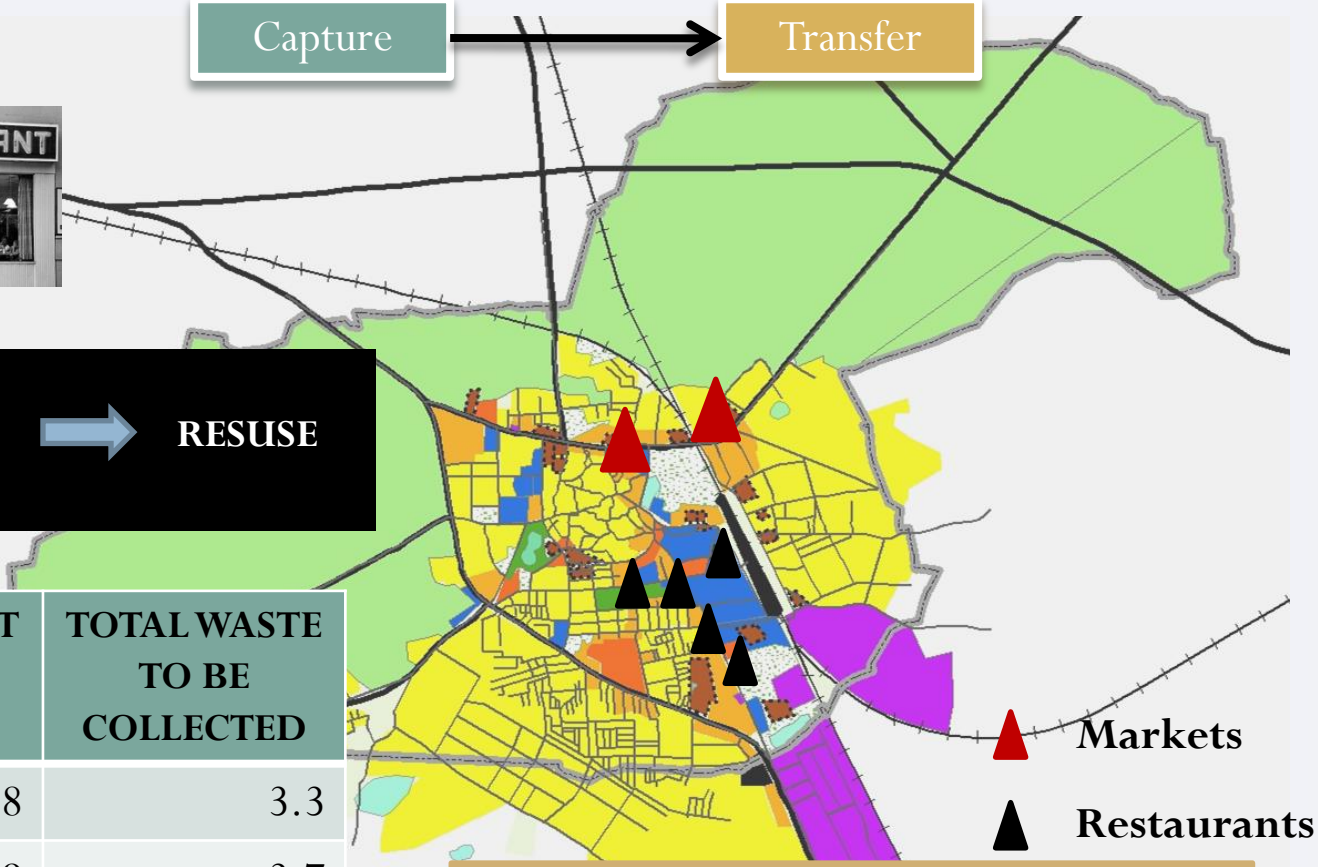
Market- Restaurants

Market

Restaurants

Capture → Transfer

MARKETS RESTAURANTS → ***COMPOST PLANT*** → **RESUSE**



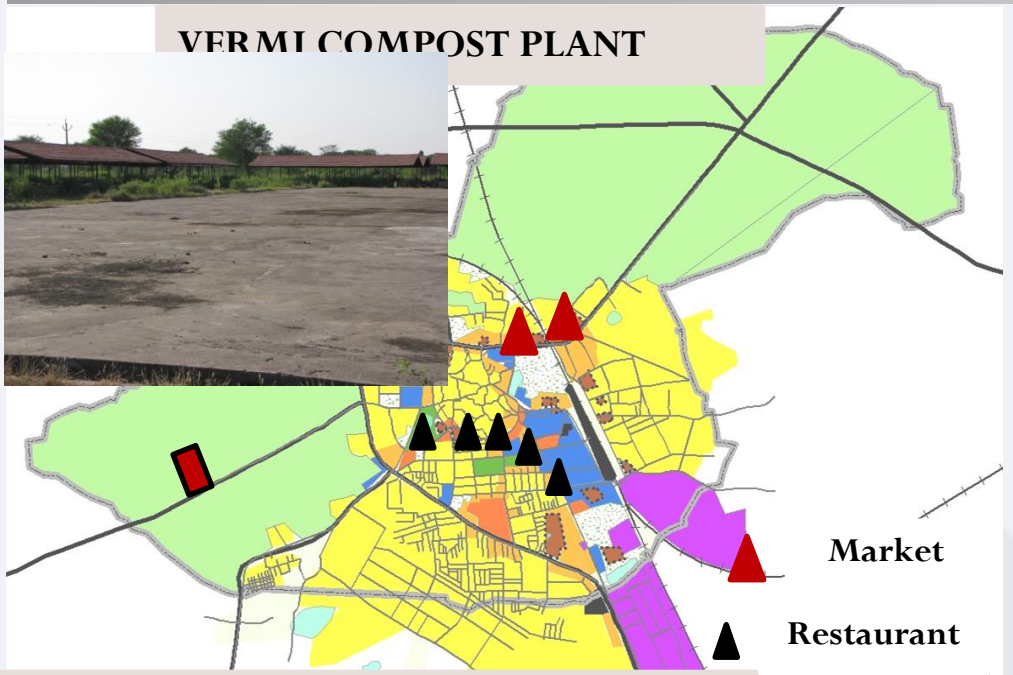
YEAR	MARKET WASTE	RESTAURANT WASTE	TOTAL WASTE TO BE COLLECTED
2011	2.4	0.8	3.3
2014	2.8	0.9	3.7
2021	4.8	1.6	6.4
2031	7.2	2.4	9.6
2041	9.9	3.3	13.1

OPTIONS EVALUATED

1. VERMI COMPOST PLANT (GUDC)
2. ORGANIC WASTE CONVERTOR

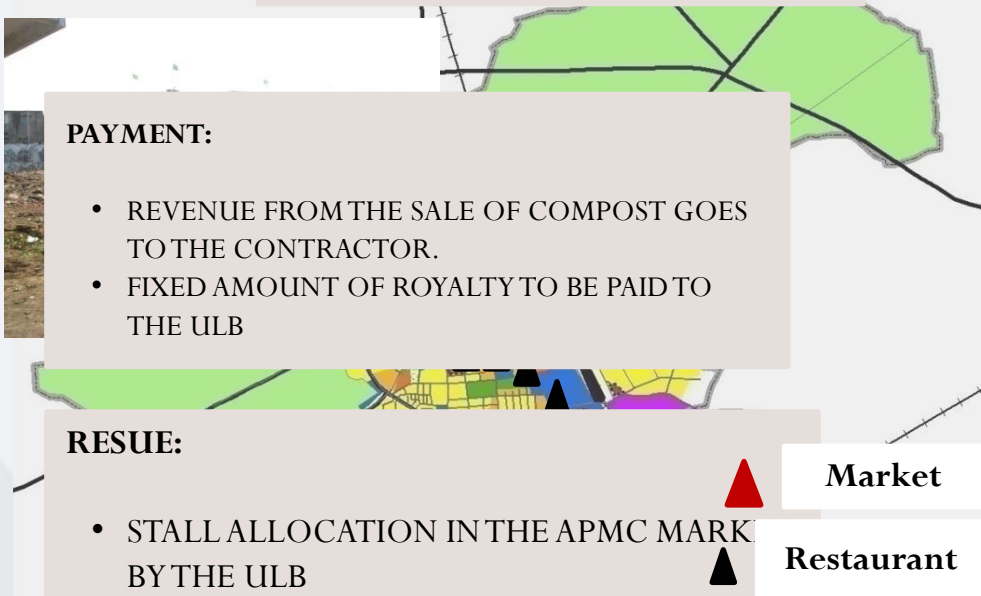
Market- Restaurants

VERMI COMPOST PLANT



LAND :VERMI COMPOST PLANT
CAPITAL INVESTMENT : -
COLLECTION+TREATMENT : CONTRACT

ORGANIC WASTE CONVERTER



PAYMENT:

- REVENUE FROM THE SALE OF COMPOST GOES TO THE CONTRACTOR.
- FIXED AMOUNT OF ROYALTY TO BE PAID TO THE ULB

RESUE:

- STALL ALLOCATION IN THE APMC MARK
  BY THE ULB

LAND :NEAR MARKET
CAPITAL INVESTMENT : ULB
COLLECTION+TREATMENT : CONTRACT

	Vermi Compost	Organic Waste Converter
Capital cost (Rs./ton)	0	3300
O&M cost (Rs./ton)	553	658

UTILISING EXISTING INFRASTRUCTURE

NO EXTRA CAPITAL INVESTMENT REQUIRED

Centralized Bin Free System

Capture → Transfer → Treatment → Reuse

House

Commercial

Road Sweeping

Restaurants

Market

WET

DRY

DRY

DOOR TO DOOR COLLECTION CONTRACT

DRY

CONTRACT +ULB

WINDROW TREATMENT

BY PRODUCTS

MANURE

FULF PALLETS

ECOBRICKS

WET

WET

COLLECTION & TREATMENT CONTRACT

VERMI COMPOST

MANURE

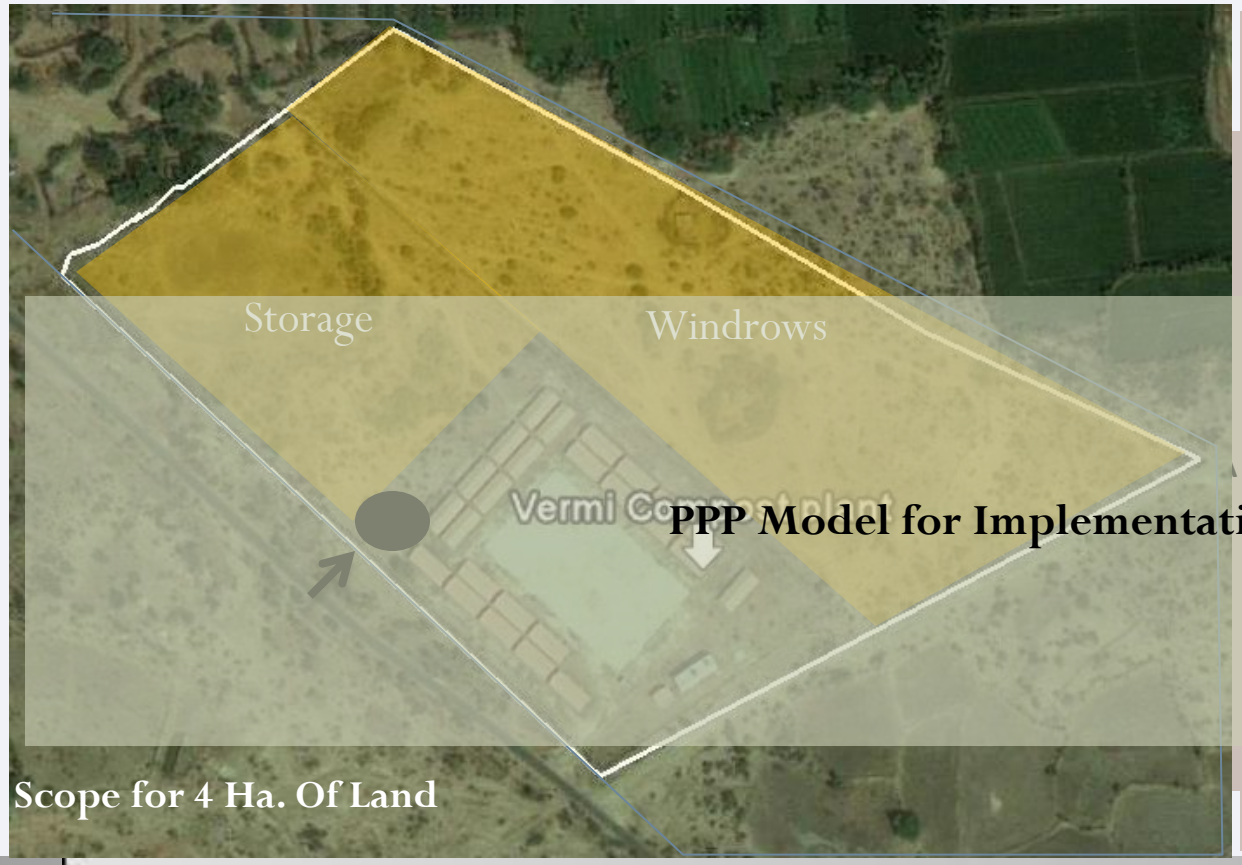
Waste Quantity

- 2011 - 40.8 MT
- 2021 - 80.1 MT
- 2031 - 120.5 MT
- 2041 - 164.3 MT

Rs. 800 per MT of Capital Investment in 2011 for 10 years of capacity
Rs. 230 per MT of O&M as against
Rs. 430 per MT of Revenue

Capital Investment of Rs. 2.04 Cr. in 2011 for 80 MT capacity

WINDROW COMPOSTING TREATMENT



WINDROW DIMENSIONS

Ht = 1.5 m
Wd = 2.0 m

Area Requirement : 2.3 ha

PPP Model for Implementation

LAND FILL FOR KALOL

Capital Investment :
Rs. 1.4 Cr. (2011)
Rs. 2.3 Cr. (2021)

O&M
Rs. 0.03 Cr. (2011)
Rs. 0.06 Cr. (2021)

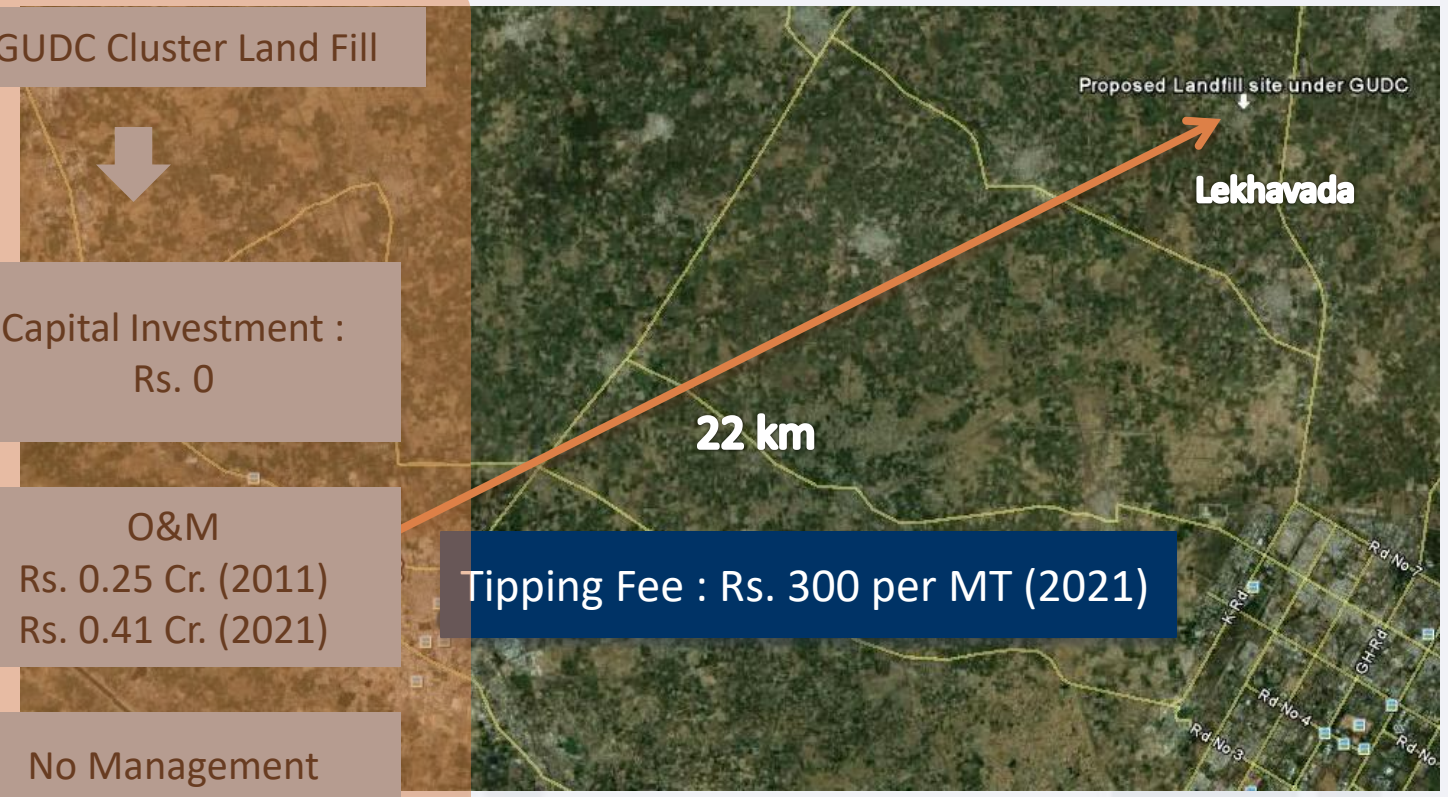
Management

GUDC Cluster Land Fill

Capital Investment :
Rs. 0

O&M
Rs. 0.25 Cr. (2011)
Rs. 0.41 Cr. (2021)

No Management



GUDC CLUSTER LANDFILL SITE WILL BE USED FOR SCIENTIFIC DISPOSAL OF WASTE

ULB TO PAY TIPPING FEE OF Rs. 300 Per MT

PROMOTION AT HH LEVEL

- Segregation at source
- Waste not to be thrown on road
- Changing habits

ACTIVITIES	RESPONSIBILITY
Campaign for segregation of waste by women for women	**Sakhi Mandals**
Campaign by school children (compulsory to them) for clean surroundings	**ULB, Schools, Rotary Club**

PROMOTION AT HH LEVEL

- Awareness creation for strict monitoring
- Awareness creation for image building
- Awareness creation for good practices
- Awareness creation for adoption of newer technologies
- Awareness creation for making combined efforts (Citizens, NGOs, industries & ULB)

› Training workshops › Ward-wise rating: Once in a year › Cleanest ward award in the form of saplings by ULB	**ULB**

Project Summary & Financial Analysis

Financial Analysis Waste Water & Storm Water

		ALL FIGURES IN LAKHS	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2
Waste Water Management		Component 1																			
	1.1	Provision of Individual Toilets	29.4	29.4	14.7																
	1.2	Revitalization of Community Toilet	30.0	24.0	24.0	16.0	16.0	10.0													
			1.2	2.1	2.2	2.3	2.4	2.6	2.7	2.8	3.0	3.1	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	
		Component 2																			
	2.1	Sanitation Option for unserved areas (Slums)																			
	2.1.1	Conventional Sewerage	180.0	180.0	90.0																
	2.1.2	On-Site Sanitation	72.0	72.0	36.0																
	2.2	Replacement of existing network	21.0																		
	2.3	Sanitation Option for unserved areas (Sewerage)	32.0																		
			2.6	2.7	2.8	3.0	3.1	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.1	5.3	5.6	5.9	
	2.4	Sanitation Option for upcoming areas (Onsite Sanitation)																			
			0.8	1.1	1.5	2.0	2.7	3.7	5.0	6.9	9.4	12.8	17.5	23.9	32.6	44.5	60.8	83.0	113.3	154.6	
		Component 3																			
	3.1	Centralized Treatment	111.0				17.0	8.0				0	0	11	0.0	0	0	0	0	0	
			1.3	1.4	1.6	1.8	2.0	2.2	2.3	2.5	2.7	2.9	3.2	3.4	3.7	4.0	4.3	4.7	5.0	5.4	
SWD		Component 4																			
	4.1	Storm Water Drainage Lines	268.0																		

		TOTAL CAPEX	743	305	165	16	33	18	-	-	-	-	-	11	-	-	-	-	-	-	1
		TOTAL OPEX	6	7	8	9	8	8	8	9	9	10	11	11	12	13	13	14	15	16	1
		Existing OPEX	44	46	49	51	53	56	59	62	65	68	72	75	79	83	87	91	96	101	1

Financial Analysis Solid Waste

		2011	2012	2013	2014	2015	2021	2031	2041
solid waste management	Mass Clean UP		0.5						
	IEC Campaign	2	2	2					
	Door to Door contract	17	17	18	19	21	36	20	32
	Road Sweeping	42	44	46	49	51	68	111	182
	Market + Restaurant collection & treatment	7.45	8	8	9	9	12	20	32
	Treatment Plant(Capex)	115					84	100	109
	Treatment Plant(Opex)	34	36	39	41	44	58	88	120
	Transportation Contract				22	25	39	60	85
	Establishment	21	21	22	29	32	47	75	115

	Total Capex	115					84	100	109
	Total Opex	60	63	67	90	98	146	225	323

Waste Water Management

	2011	2012	2013	2014	2015	2016	2019	2021	2023	2025	2029	2031	2035
Total Capex	115							**84**				**100**	
Total Opex	89	93	97	**127**	**138**	**149**	**182**	202	**224**	**247**	**296**	**323**	**388**

Solid Waste Management

	2011	2012	2013	2014	2015	2016	2019	2021	2023	2025	2029	2031	2035
Total Capex	115							**84**				**100**	
Total Opex	89	93	97	**127**	**138**	**149**	**182**	202	**224**	**247**	**296**	**323**	**388**

City Sanitation Plan

	2011	2012	2013	2014	2015	2016	2019	2021	2023	2025	2029	2031	2035
Total Capex	115							**84**				**100**	
Total Opex	89	93	97	**127**	**138**	**149**	**182**	202	**224**	**247**	**296**	**323**	**388**

O&M cost Recovery can be obtained through:

- Improved Collection efficiency
- Increase in tariff
- Increase in access to infrastructure

THANK YOU..