
URBAN WASTEWATER

Livelihoods, Health and Environmental Impacts

The Case of Delhi

TOPICS

- Project Overview and Issues
- Existing Reuse of Wastewater
 - Reuse in Agriculture
 - Reuse in Aquaculture
 - Reuse in Floriculture/Horticulture
 - Environmental and Public Health Aspects of reuse
- Future Reuse Options
- Policy Directions



OVERVIEW

- The study confines to the Geographic realm of National Capital Region of Delhi
- Yamuna is the main Surface Source for water supply in Delhi
- Increase in population has lead to increased pollution load in the River
- Daily Wastewater generated is 3167 MLD
- Of the total wastewater generated only 47% (1478 MLD) gets treated, using only 63% of its installed Treatment Capacity (2330 MLD)



LIMITATIONS

The study confines to details of wastewater reuse for agricultural purposes, its benefits and potentials.

OVERVIEW

■ Wastewater Status in Delhi

Total Wastewater Generation	3167 MLD*
Number of Major Drains	22*
Number of STPs	30 STPs at 17 Location
Treatment Capacity	2330 MLD*
Treated Amount	1478 MLD*
Total Agricultural Area	46,100 Hectares**
Sewerage Zone	Rithala, Coronation, Pillar, Keshopur, Trans-Yamuna and Okhla*



* CPCB, Performance evaluation of Sewage treatment Plants in Delhi, 2003 - 2004

Reuse In Agriculture

- General Trends in Reuse
- Advantage and Disadvantage of Reusing waste water
- Effects on Crop Productivity
- Livelihood Aspects of Using waste water
- Other Reuse options



GENERAL TRENDS

- Agricultural irrigation is mainly concentrated near
 - ▶ Keshopur STP (Keshopur Village, Nilauthi, Ranhaura, Mundka, Bakkarwala) With an Area Apprx.1500 Hectares (GIS Estimation)
 - ▶ Okhla STP (Madanpur Khadar, Jaitpur) With an Area Apprx.205 Hectares (GIS Estimation)
- Various seasonal vegetables like cucurbits, brinjal, tomatoes, cabbage, radish etc along with some fodder crops are being grown in these areas.
- These vegetables are being used for personal consumption and are being sold in the local markets as well as a source of income.
- Estimated **71%** of the total market produce is met from grounds irrigated in and around Delhi



ADVANTAGE AND DISADVANTAGE OF REUSING WASTEWATER

■ Advantages

- Reduces stress on limited ground and surface water resources.
- Low cost method for sanitary disposal of w/w.
- Reduces pollution load on rivers and other receiving surface water bodies.
- Reliable source of irrigation water to farmers in all seasons.
- Source of livelihood augmentation and income generation.
- Reduces the need for fertilizers.
- Increases crop yield vis-à-vis irrigation with fresh water.

ADVANTAGE AND DISADVANTAGE OF REUSING WASTEWATER

■ Disadvantages

- Health risk for irrigators and communities in direct or indirect contact with w/w.
- Health risk to end consumers.
- Contamination risk to ground water.
- Build up of chemical pollutants in soil.
- Creation of habitats for disease vectors.
- Increased investment on weedicides and pesticides

EFFECTS ON CROP PRODUCTIVITY

- The farmers reported that their crop yield has increased upto 1.5 times as compared to the time when they were irrigating their crops with ground water.
- Out of approximately 60 farmers surveyed for the purpose, **most** agreed that the crop yield was better with the application of wastewater.
- The farmers also reported that the quality of their vegetable produce was up to their satisfaction level and has no problems with the quality of the vegetables.
- **Most** farmers were of the opinion that the requirement for additional application of fertilizers reduced with the w/w irrigation.



LIVELIHOOD ASPECTS OF USING WASTE WATER

Most farmers reported a higher income Generation with **w/w** irrigation. This could be attributed to:

- Increased crop productivity per unit of land and also decreased expenditure on fertilizers and water charges.
- The easy availability of **w/w** in all seasons (specifically in the lean season).
- Wastewater has nutrients in it necessary for the growth of plants
- On comparative study of income generation using Ground water vis-à-vis Wastewater, a unit of land generated higher profit margin if irrigated with wastewater

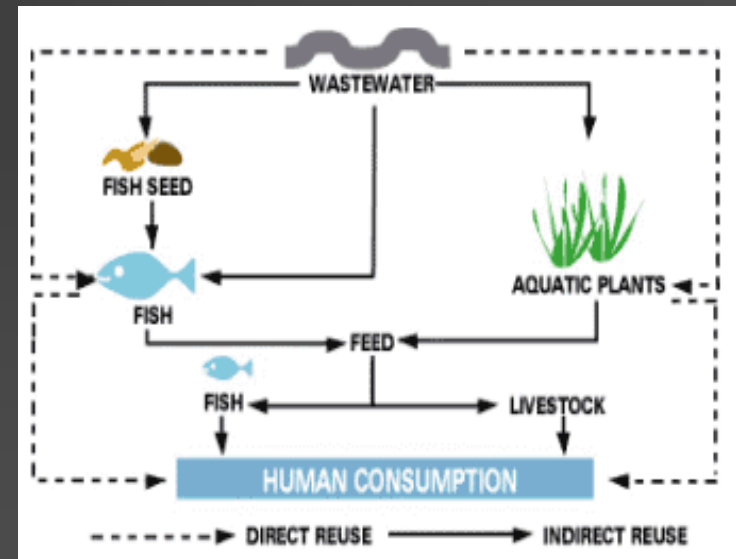


Study of income generation using Ground water vis-à-vis wastewater

s. No.	Factors	Use of fresh water for irrigation	Use of wastewater for irrigation
1.	Area of land	1 acre	1 acre
2.	Crops Produced	Cucurbit (<i>Tori</i>)	Cucurbit (<i>Tori</i>)
	Crop yield (tonnes/month) (summer season vegetables)	<i>Tori</i> - 1.5, <i>Ghiya</i> – 1.5, Eggplant - 2, Okra – 1.5)	<i>Tori</i> - 2.5, <i>Ghiya</i> – 2.5, Eggplant – 3.5, Okra – 2.5)
4.	Cost of land (Approximate Lease cost /month)*(Rs)	3000	3000
	Money invested in irrigation water (Rs/month)	90-100	NIL/Negligible
6.	Labour charges/month (average 2-3 laborers on 1 acre land)(Rs)	3000	4500**
	Equipment O & M cost (Rs)	100	Negligible***
8.	Total money invested/month (summation of 4,5,6,7,8,9,10)(Rs)	7,800	9,300
9.	TOTAL INCOME FROM SELLING OF CROPS/Month (Rs)****	15,000	25,000
	NET INCOME GENERATED (Rs/month)	7,200	15,700

OTHER REUSE OPTION OF WASTEWATER

- Wastewater Reuse for **Aquaculture** - A long practiced technique. Nutrients present in **w/w** act as fertilizers to produce natural food such as plankton. Also a source of nourishment for the aquatic species for direct water consumption.
 - In Delhi, some villages around Keshopur STP (Nilauthi, Bakkarwala, Ranhaura, Mundka) use treated effluent of the Najafgarh Drain being discharged by the STP for **fish culture**.
Series of ponds have been manually constructed for the purpose. Channels of treated effluent are the source of water supply for these ponds.
 - In large slum clusters like Yamuna Pushta slums, raw wastewater is commonly used for aquaculture, serving as a source of income as well as food for personal consumption.



WASTEWATER REUSE FOR AQUACULTURE

- Assessment of Positive and Negative Aspects
 - Positive aspects
 - Reliable source of income generation from good market of fish consumers.
 - High nutrient content reduces cost on fish food.
 - Increases fish yield.
 - Meets food demand of fish growers as well.
 - Serves as a low cost sanitary disposal method of wastewater.
 - Provides ancillary job opportunity



WASTEWATER REUSE FOR AQUACULTURE

- Assessment of Positive and Negative Aspects
 - Negative Aspects
 - Health risk with bioaccumulation of toxic chemical in untreated wastewater
 - High Nutrient loading in wastewater increases growth of Phytoplankton's & Algae that in turn decline in fish population
 - High Concentration of Ammonia increases fish mortality rate
 - Waste water provides excellent breeding place for mosquitoes and disease causing vectors
 - Health impacts finally translate into economic impacts



OTHER REUSE OPTION OF WASTEWATER

- Wastewater Reuse for **Floriculture/Horticulture** - Potential market areas for cultured floral species: Hotel industry, Pharmaceutical industry, Cosmetic industry, Traditional Indian Celebration Moments.

In Delhi

Land Under Agriculture : 46,100 Hectares

Land Under Floriculture : 5000 Hectares

Floriculture holds good potential for wastewater application.



REUSE FOR FLORICULTURE/HORTICULTURE

■ Assessment of Positive and Negative Aspects

■ Positive Aspects

- Potential for income generation with low investments.
- Can be practiced with low quality of wastewater, depending on flower type and usage.
- Floriculture practices enhance visual aesthetics of urban landscape.
- Bee rearing could also be practiced in well designed parks.
- Recreational parks could be designed using wastewater for urban life



REUSE FOR FLORICULTURE/HORTICULTURE

- Assessment of Positive and Negative Aspects
 - **Negative Aspects**
 - Health risk from direct or indirect contact of flower cultivators, surrounding communities, end users.
 - Vector related problems with wastewater accumulation.

ENVIRONMENTAL ISSUES

- The soils in some areas has become less productive due to intermittent discharge of toxic industrial effluents.
- Toxic industrial effluents effects crop productivity and vegetation of the areas.
- Though not tested for toxic metals, the long term application of toxic effluents could also have its effects on the ground water quality of the region.



PUBLIC HEALTH ISSUES

- Direct contact of wastewater during irrigation or from contamination of crops with toxic elements or pathogens - impacts could be on farmers, and their families and people living in the surrounding.
- No skin problem or nail discoloration has been reported.
- *Ranhaul* village problems has been reported like itching on prolonged exposure.
- No end consumer health effects like stomach problem, liver damage have been reported.
- Most of farmers have vector breeding problems that leads to vector borne diseases like fever.



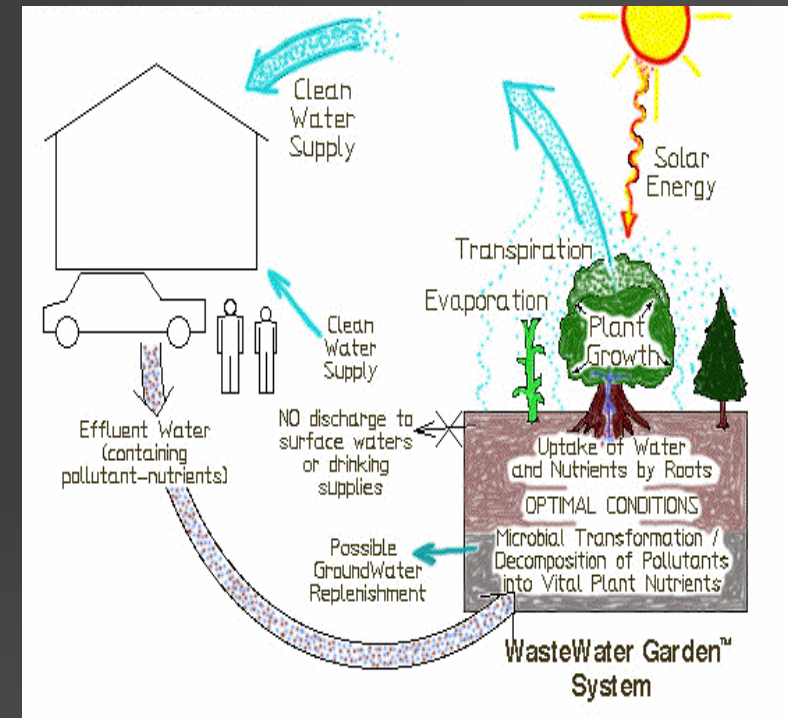
OTHER REUSE STRATEGIES: COMMUNITY GARDENS

- Used for landscape irrigation. At Source Reduction Technique for Large Scale wastewater Generation.

- Apart from direct benefits of using wastewater Garden, i.e removal of pollutants from sewage, one can indirectly profit from it in different ways.

- Wetland flowers can be cut, grasses can be harvested for animal consumption.

- Fresh water consumption is lowered hence low irrigation charges.



REUSE IN COMMUNITY GARDENS

- **Income Generation**
 - **Income generation is higher in Floriculture then the aquaculture**
 - **Aquaculture is high income sources then the Agriculture**
- **Public Acceptance**
 - **Aquaculture is better options because less areas is required as well as less time then other two option**
- **Environmental Effects**
 - **Aquaculture does have impact on ground water if used without liners**
 - **Agriculture also have impacts on Ground as well surface water if used in excess, or untreated.**

OTHER REUSE OPTIONS

- Demonstration Projects
 - River front Development Park
 - Reuse option for Urban areas
 - Restorer technology for Nalas

POLICY DIRECTIONS

■ Opportunity and Constraints

■ Opportunities

- It has a good market potential
- Generated in excess in almost every field
- Best for various purpose like agriculture, aquaculture, floriculture/horticulture
- Zero investment and large profits
- Require less skilled labor and minimum energy
- Conserve water, avoid direct pollution of rivers, lakes etc

POLICY DIRECTIONS

- Opportunity and Constraints
 - Constraints
 - Contamination of ground water with nitrates
 - Creation of habitats for mosquitoes and other diseases causing organisms
 - If untreated can cause skin problem and nail discoloration
 - Rapid Eutrophication from both urbanisation and industrialisation
 - improved sanitation reduces the availability of night soil for agriculture and aquaculture.
 - social and cultural acceptance of wastewater-fed

POLICY DIRECTIONS

■ Required Policy Changes

- Absence of Low governing decentralized wastewater treatment and use of treated effluents.
- No existing standards for wastewater application for various uses.
- Low cess rates for industrial and agri consumption of fresh water--- Demotes use of wastewater for he same.
- Existing Command and Control Policies in almost all the sectors such as Tax Charges etc. A Blend of both could be more feasible option.
- Level of awareness among masses regarding health and hygiene and possible measures to reduce wastewater quality improve is low. Education for this is must.

POLICY DIRECTIONS

- Required Policy Changes
 - With the large aim of Restoring Ecology of the River Yamuna in terms of Chemical, Biological and Physical Parameters, the diversion of wastewater towards various reuse options serves as an important link.
 - Riverfront parks could be one good option for restoration of ecology of River Yamuna.



Najafgarh Drain

National Science Park

Agricultural Fields in Yamuna Flood Plain

Wazirabad Road No. 59

ISBT Road

New Delhi Railway Station

Railway Track



Central Park Cannaught Place

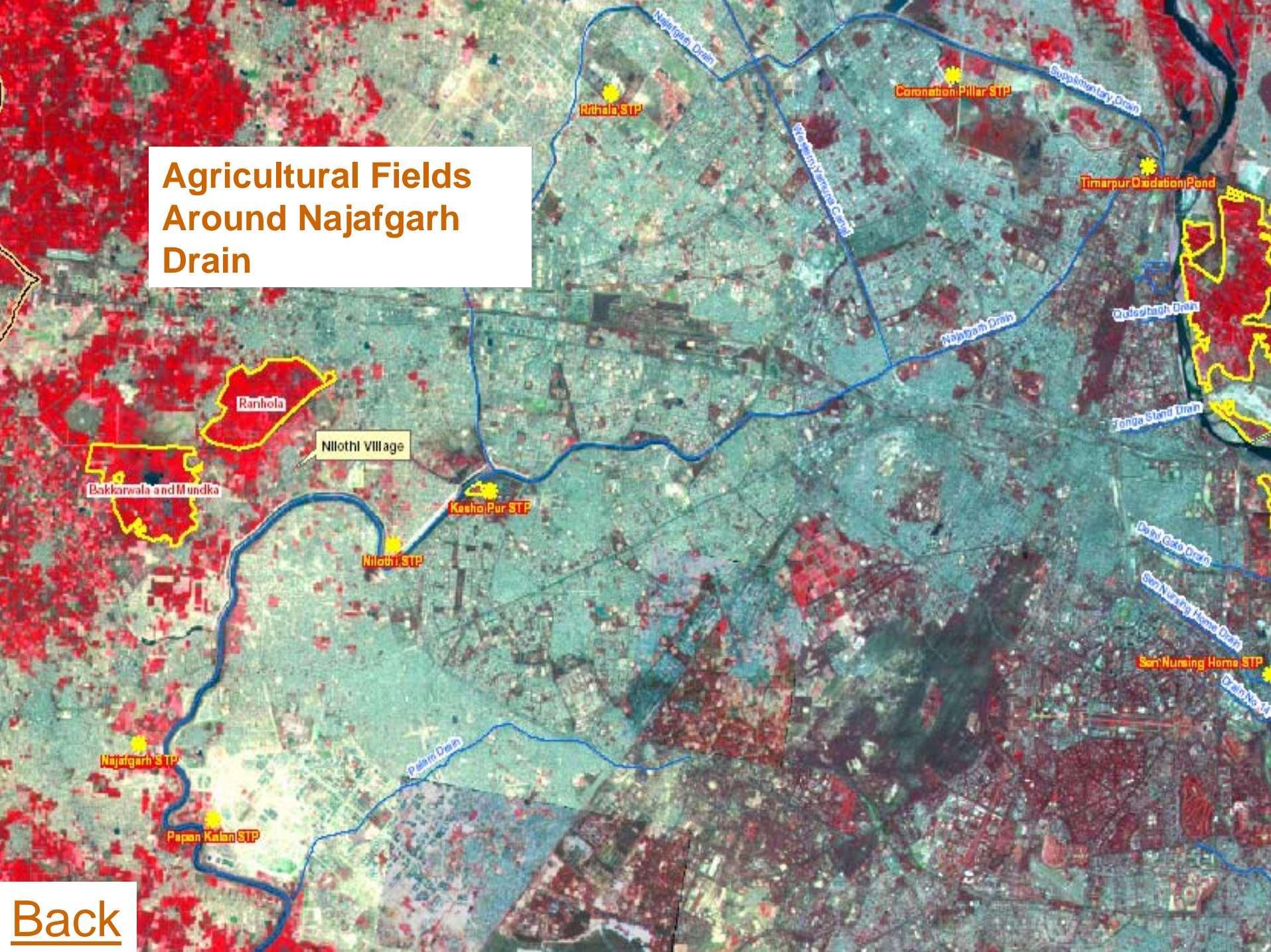
Indira Gandhi Indoor Stadium



Vikas Marg

[Back](#)

Agricultural Fields Around Najafgarh Drain



[Back](#)

Wastewater recycle & reuse for 30 IMGD Okhla STPs

- Delhi Jal Board Project, supported by USAID
- The project entails the Water Demand Assessment of the major consumers along the existing (DJB) pipeline that runs from Okhla STP to Rashtrapati Bhavan via ITO
- Surveyed 54 institutions falling along the pipeline and all major consumers within 5 Km of Okhla STP▲
 - Potable
 - Non-potable
 - Process water
 - Gardening
 - Fire fighting
 - Floor cleaning, car washing

Present reuse practices for Okhla STP

- 34 MGD to Rashtrapati Bhavan for landscape irrigation
- But, usually receive 20 MGD, deficient being collected from Raj Ghat pumping station
- Other horticulture purposes as Humayun Tomb and Millennium park I & II

Recycling prospects for Okhla

- Improved quality to existing end users
- New Prospective end users
- Non-potable
 - Okhla industrial areas
 - Nearby Hospitals (Apollo, Escorts) for non-critical uses (laundry, floor cleaning etc.)
 - Delhi Fire Service
- Non-contact
 - Construction
 - Upcoming Townships
 - Landscape irrigation in nearby areas
 - Industrial cooling water at NTPC's power plant in Badarpur

Constraints

- Non-revelation of preferences by the consumers.
- Inability of government officials to state price that they are willing to pay for the recycled water due to lack of authority.
- Free usage of ground water and very low prize by private tankers
- Apprehensiveness of the consumers to give accurate information about their water requirements
- Lack of metered readings
- Inflated bills by the DJB
- Difficulty encountered in meeting the concerned official in the government and high security establishments
- Difficulty in approaching different departments within the same institution owing to absence of the concerned officials
- Non-responsive attitude on the part of officials

Thank You

WATER DEMAND ASSESSMENT SURVEY OF MAJOR CONSUMERS 2006 - 2016

Br. No.	Description	Details		Remarks
1	Organization name and address			DJB Consumer No.
2	Organization's activity/category	(Industrial/ commercial/ educational etc - please specify)		
3	Growth anticipated in next 5 years and 10 years			
4	Plans for relocation/ new units			
5	Organizational strength (number of people)			
6	Administrative in-charge (Name and designation)			
7	Utilities in-charge (Name and designation)			
8	Water consumption (MG/month)	Requirement for Potable Needs		
		Requirement for non-potable applications		
		Process water		
		Gardening		
		Others (Specify)		
		Fire Fighting		
		Total requirement		

Demand assessment survey for Qkkh STP, November 2005



9	Present Source of Water and respective quantity	DJB (piped supply): (m3/day) Tankers (DJB/private): (m3/day) Ground water (borewell): (m3/day) Other: (m3/day)	
10	Do you further treat or condition water before use? If yes, what treatment and to how much quantity.		
11	What is the water quality requirement? Please specify application-wise.		
12	What is your quantity requirement? Is the requirement seasonal? Please elaborate.	Peak season requirement Normal requirement Black season requirement	
13	Water quality and its effect on product, water handling equipment and piping	(Analysis data) OR quality issue (hardness, scaling etc. and problems encountered with different waters)	
14	Water cost/ tariff	DJB (piped supply): (Rs/KL) Tankers (DJB/private): (Rs/KL) Ground water (borewell): (Rs/KL) Others: (Rs/KL)	
15	Annual water bill	DJB (Rs-) Others (Rs-)	

Demand assessment survey for Qkkh STP, November 2005

