

PROGRAM DESIGN FOR POLICY,  
INSTITUTIONAL AND REGULATORY REFORM IN THE  
CITY OF LAHORE

# WATER, SEWERAGE & SOLID WASTE MANAGEMENT IN LAHORE

ATIF HASSAN



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**POSITION PAPER - III**

# **WATER, SEWERAGE & SOLID WASTE MANAGEMENT IN LAHORE**

**ATIF HASSAN**

Centre for Public Policy and Governance  
Forman Christian College (A Chartered University)  
Lahore

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## FOREWORD

The Centre for Public Policy and Governance (CPPG), Forman Christian College (A Chartered University) Lahore started Program Design for Policy, Institutional, and Regulatory Reform in the City of Lahore in collaboration with the United States Agency for International Development (USAID) FIRMS Project in November 2012. The purpose of the project was to prepare Lahore Vision 2035 to support the preparation of Integrated Strategic Development Program for Lahore Region 2035 (IDSP-35), by the Lahore Development Authority (LDA). The drafting of Lahore Vision 2035 was considered necessary because it was felt and conveyed by several experts and institutions that Lahore was not utilizing its full potential for achieving economic growth due to inadequate policy choices and institutional arrangements. While Director, CPPG supervised all activities of the project; Dr. Imdad Hussain was selected by the CPPG as the Lead Researcher. He built a team of more than ten consultants/researchers who collected and consolidated urban research carried out by public and private sector entities in order to prepare Lahore Vision 2035. To ensure that Lahore Vision 2035 is designed by practitioners, professionals, architects, engineers, urban developers and grass root civil society community activists, we created a 15 member Core Working Group (CWG). The CWG played a pivotal role in mentoring and providing guidance to our team of researchers. This is the 3rd Position Paper in the series. While we remain indebted to each member of the CWG for their advice and guidance for specific position papers, I am particularly grateful to Mr. Suleman Ghani for his clarity of purpose, dedication and invaluable assistance and advice throughout this project.

This Position Paper identifies two sources of water pollution/contamination in Lahore; first, the entire waste of Lahore city is collected through 14 drains and then dumped into River Ravi without any cleaning or treatment. An estimated over 270 industries waste including; textile, chemical, food processing, pulp and paper, poultry, dairy, plastic, paint, pesticides, leather, tanneries and pharmaceuticals is discharged into the canal system. Second, the Gharki system in combination with innumerable waste water ponds around the city contaminates the surface and drinkable water. The quality of ground water is generally good near the Ravi River but deteriorates in the south and south-western direction. The quality of shallow ground water is generally considered poor and high in arsenic, particularly in the surrounding areas of the city. Recognizing water related health and environmental risks the position paper makes several recommendations. It makes a case for regularly monitoring the quality of water; raising awareness among citizens on water conservation and efficient usage; encouraging entrepreneurs and industrialists to invest in waste water treatment; engage stake-holders including civil society through deliberation and dialogue on devising long term plans for water conservation; calls for integrated water resource management strategies and finally provides a framework for improving institutional coordination among LDA, WASA, departments of Environment, Health, Housing and Planning and Development for ensuring sustainable management of water for Lahore and its surroundings.

We do hope that findings and recommendations of this Position Paper would help Punjab government in developing a sustainable water management strategy. And policy analysts and civil society do contribute in raising awareness on how continued mismanagement and neglect of water sector would impact the ecology of Lahore and prove hazardous for the health and well being of city's citizens.

Dr. Saeed Shafqat  
Convener, Lahore Vision 2035

## ACKNOWLEDGEMENTS

The writing of this position paper became possible primarily because of the extensive deliberations and guidance of members of Core Working Group (CWG) and officials of Water and Sanitation Agency (WASA), Lahore Waste Management Company (LWMC), City District Government Lahore and officials of the Cantonment Board Lahore. Furthermore, managers of private housing schemes, academicians/scholars and civil society representatives have provided profound feedback for the refinement of work. I am highly thankful to all these institutions for the sincere and insightful contribution to make this paper a quality work. The researcher, though is exceedingly grateful to all the officials and representatives of these organizations, but would offer special thanks to Mr. Qadeer Khan (Director Planning, WASA) and Mr. Sohail Malik (Manager Operations, LWMC) for their exceptional interest and fine-tuning of research outcomes.

I also pay my gratitude to Dr. Saeed Shafqat (Convener, Lahore Vision 2035) who has extended reflective discussions, managerial support and effective oversight during the course of research work. Same amount of gratitude goes to Dr. Imdad Hussain (Lead Researcher, Lahore Vision 2035) who diligently coordinated the team efforts to help prepare a synthesis of research work. Ammar Ahmed (Literature Reviewer), Abeeha Islam (Research Associate), and Ansa Shafi (Research Assistant) have assisted the researcher with a great zeal and zest in building various segments of position paper. I am really thankful to all of them.

I am too indebted to Mr. Suleman Ghani (USAID) and Mr. Azeem Niazi whose oversight and support has proved instrumental in refinement of research work. In the end, I pay my thanks to the people living in low-income areas, who should be the ultimate beneficiary of this position paper, for their opinions and views. I wish an environment friendly Lahore for them in coming times.

Atif Hassan

## LIST OF ACRONYMS

ASB	Anjamane Samaji Behbood
Cu.m	Cubic Meter
CPP	Changa Pani Program
CPM	Changa Pani Model
CSM	Component Sharing Model
DHA	Defense Housing Schemes
EPA	Environmental Protection Agency
GIS	Geographical Information System
JICA	Japan International Cooperation Agency
LWMC	Lahore Waste Management Company
LIT	Lahore Improvement Trust
LDA	Lahore Development Authority
LCS	Lahore Conservation Society
LID	Low Impact Development
NGOs	Non-Governmental Organizations
NARC	National Agriculture Research Centre
NEQS	National Water Quality Standards
O & M	Operation & Maintenance
OPP	Orangi Pilot Project
OHR	Overhead Reservoirs
PEPA	Pakistan Environmental Protection Act
SDOs	Sub-Divisional Officers
SDWD	Solid Waste Management Department
UCs	Union Councils
WASA	Water & Sanitation Agency
WASCO	Water and Sanitation Community Organization





## **EXECUTIVE SUMMARY**

Water, sewerage (drainage also) and solid waste management are critical for human habitats, but highly critical for metropolitan cities such as Lahore. Citizens' health depends largely on adequate clean drinking water, safe drainage, disposal of liquid waste and well managed solid waste collection, disposal and recycling system. Effective service delivery can save people from water-borne and other infectious disease, reduces their health expense, reduce productive time loss due to bad health and generate employment and economic opportunities.

### **Existing Conditions**

Lahore remains highly underserved as regards water and sanitation services. Water and Sanitation Agency (WASA) serves only half of the city population. Similar is the case of solid waste collection with least resource recovery. Some of the key issues are given here:

- Ground water depletion: 3 feet annually
- Water contamination: 49% in the city and most parts of River Ravi
- Unaccounted for water: 23%
- Shortage of overhead reservoirs: Lesser than required, mostly in operational
- Water treatment: Hydro-chlorination operational in 30% of tube wells
- Wastage of water by consumers: 51% connections are metered; only 13% are functional
- Drainage: Storm water drains are filled with liquid and solid waste.
- Low water tariff rates in contrast to higher expense of WASA (working ratio is 1:2)
- Lack of co-ordination amongst sector actors
- Exclusion of low income areas: peripheral areas are devoid of services
- Institutional inefficiencies: capacity issues, financial crunch and top down approach

### **Protect Water Resources**

Lahore's aquifer is depleting due to over-extraction and misuse of water. Fall in recharge capacity owing to decrease in water flows in River Ravi and rain capturing places due to construction of roads and buildings are other prominent reasons contributing in running down of water. WASA needs to conduct a study to measure total aquifer of Lahore and total water extraction to prepare water budget for next two decades. This study should also propose water recharging plan for the city including rain harvesting options. Systematic land use and town planning are essential measure to ensure green spaces amid colonies as a precondition for water infiltration. Six storm water drains, if cleaned up from the liquid and solid waste, can also become a natural water recharging source. Forestation in open spaces will also improve the rainfall and boost ecosystem of the city.

### **Eliminate Water Contamination**

Studies confirm that almost half of (49%) Lahore's drinking water is contaminated with biological and chemical contaminants. Leakage of sewer water into old rusted porous water pipes, penetration of unmanaged foul water into groundwater and mixing of industrial waste into domestic waste are the primary reasons for water contamination. Contamination effects of gharkis (soak pits) mainly used in cantonment area prevails through

rest of the city due to the permeable rock bed of the city. Furthermore, water ponds in peripheries and untreated waste water disposed in River Ravi poses a big contamination threat for the city. Government, instead of investing in water filtration plants, need to focus on safe drainage, disposal and treatment of foul water by adopting measures proposed hereunder.

- Build constructed wetlands as liquid waste treatment on the various edges of river
- Ensure elimination of gharki system by providing underground sewerage
- Ensure universal coverage of underground sewerage in all the settlements of the city
- Conduct social impact assessment study of ponds to prepare a plan for their reconstruction to keep it free from contamination
- Install and operate chlorinators on all the tube wells. Also monitor water quality at each tube well
- Rain harvesting is the best source of water purification, hence should be practiced in its real spirit
- Replace old galvanized water pipes with PVC pipes
- Operationalize old and construct new water storages to ensure 24/7 water supply to maintain water pressure which will stop contaminants to enter into the water supply networks.
- Provide alternative water sources where Arsenic is found
- Environment Protection Agency (EPA) compels industries to construct water treatment plants

### **Provide Equitable Water & Sanitation Services**

WASA's ninety percent coverage claim is true for its area of jurisdiction yet a lot of low income Lahore (almost 50%) locates at peripheries and is devoid of water and sanitation services. Similarly LWMC's 80% coverage is doubtful when we see the ground situation. Universal coverage of sector services is a basic human right. The position paper proposes establishing a separate Low Income Areas Development Authority to draw attention of policy makers and implementers to makeshift from ongoing development of well established areas to the marginalized segments. The left over areas should be reflected on maps to make a comprehensive and prompt plan for development of low income areas. Since low-income communities are willing to contribute to the cost of development, sector agencies can produce useful results in lesser time.

### **Conserve Water for Coming Generation**

Since water meters are functional in only 13% of the total connected households, a vast majority of the consumers pay fixed already low tariff. Resultantly consumers waste a lot of water. They would not like water metering for them. To compel consumers to opt water meters WASA has to offer subsidy in water tariff to the consumers opting for water metering. This is a pragmatic approach and can produce desired results. Illegal water extraction should be banned as per law. Furthermore, WASA should ensure overhead reservoirs and rationing of water to save water being wasted due to direct pumping. Rain harvesting is one of the best options for water conservation.

### **Improve Storm Water Drainage**

At present, there are 6 primary storm water drains (55.70 km); 14 secondary drains (43.63 km) and 209 tertiary drains (366.66 km). This drainage system is divided into three zones: north, central and south zones.

The whole system is finally discharged into the River Ravi without any treatment. Most of the drains are filled with solid and liquid wastes and are encroached by public and private buildings resultantly reduced in width and overflows impacting property badly. De-silting of these drains is arduous since machinery cannot reach to the encroached areas. Wet Weather Green Infrastructure (WWGI) and Low Impact Development (LID) are two essential methods, if adopted can improve drainage of the city. Situation analysis of the drains choking points and building a comprehensive plan for de-silting and separating liquid and solid waste from the drains. Improved designs, rehabilitation of existing drains, construction of trunk sewers, anti-encroachment drive are other essential measures to be in place to improve the drainage system of the city.

### **Ensure Waste Water Treatment**

The wasted water in the city of Lahore goes untreated into River Ravi endangering ground water contamination extinction of aquatic life. WASA's efforts for construction of water treatment plant failed in the past owing mainly to the heavy investment and Operation & Maintenance (O&M) cost. Construction of lagoons is a better option in contrast to mechanical methods. WASA should follow constructed wetland program of National Agricultural Research Council (NARC) to construct them on more than one location alongside river.

### **Reduce, Reuse and Recycle Solid Waste**

High solid waste generation, less collection, less storage arrangements, minimal resource recovery and unhygienic dumping of solid waste are the main ailments impacting the city of Lahore at the moment. Though LWMC has improved the situation by collecting more waste, constructing landfill site, outsourcing recycling yet a lot remains undone in terms of coverage, reuse and recycling. Sensitization of masses on curtailment of generation, banning manufacturing of shopping bags, adopting household collection system, construction of landfill sites on each corner of the city to decrease transportation cost and streamlining of informal waste collection and recycling sector are significant steps need to be taken up for improving the situation.

### **Groom Water and Sanitation Institutions**

Law enforcement in water and sanitation regimes is poor. EPA needs to ensure effective enforcement of Pakistan Environment Protection Act (PEPA), especially to the industries pouring waste into main drains. WASA needs to control water extraction following the provisions of Lahore Development Authority Act. WASA and LWMC are financially dependent on government. WASA has to raise tariffs and LWMC has to start collecting tariffs to sustain financially. Community investment in water and sanitation services can also reduce this burden. Managerial and technical capacity of WASA needs to be enhanced especially in GIS and social mobilization. Government should give autonomy to WASA by delinking it from LDA with an independent board of directors and performance based assessment of staff.

### **Way Forward**

Cities can be governed in a better way if a single authority regulates, facilitates and monitors all the service delivery organisations. This body should plan and develop the city in accordance to its socio-cultural milieu. The whole effort requires collaboration of all stakeholders to make Lahore a developed, sustainable, effective, efficient and plentiful city and best solution to get maximum benefit with minimum resources.



# VISION

We envision Lahore provides universal access to safe drinking water to all of its inhabitants. Lahore also attains environment-friendliness featuring sustainable eco-system by ensuring conservation of natural water resources and by universally curtailing environmental degradation occurring due to unmanaged solid and liquid waste. Lahore also achieves inclusive and equitable coverage of water and sanitation services, especially in its marginalized, low-income peripheral settlements.



# OVERVIEW

**W**ater, sewerage (drainage also) and solid waste management are so critical for all human settlements, but they are particularly important for metropolitan cities such as Lahore, which can hardly function without these essential services. Not only water, sewerage and solid waste management have multiple linkages with each other but they have links with all other sectors of social and economic life of the city. Without adequate supply of water, the people will suffer tremendously. Sewerage and drainage are crucially important in order to prevent water from contamination, prevent properties from damages, to protect citizens from diseases. Solid waste management contributes to reduce disease, beautify cities, and generates an economy of its own. From recycling to employment to energy production, solid waste has a role to play. If only the contribution of all these services is counted towards health, well-being and productivity of the citizens of Lahore, the results will be startling. Of the large part of Rs. 112 billion, which is roughly Rs. 300 million per day<sup>1</sup> incurred on water borne diseases in Pakistan, is spent in megacities: Lahore is one of them. Considering this and the links of water, sewerage and solid waste management sectors with urban economy, it can be argued that not only these sectors need to be run effectively but their role for other social and economic sectors also needs to be enhanced.

## 1.1. EXISTING CONDITIONS

Despite the fact that a lot of money is being invested into the two institutions responsible for water, sanitation and solid waste, the existing situation of Water and Sanitation Agency (WASA), Lahore and Lahore Waste Management Company (LWMC) is less than satisfactory. As a city of 12.5 million people, spread within the area of 2300 km<sup>2</sup>, Lahore remains

highly underserved as regards to these basic services. WASA, which is responsible for the provision of water supply, sewerage and drainage to the city, serves just over half, i.e, 6.8 million of population. This coverage is available mainly in specific areas of Ravi, Shalimar, Data Gang Bakhsh, Aziz Bhatti, Iqbal and Nishtar Towns (see Annexure I). This makes 87% of coverage in these towns while rest of 13% population obtains water from private sources.<sup>2</sup>

There are 417 tube wells of different capacities installed at varying depth of 150m to 200m to supply water to citizen and total estimated water production is 1,608,000 m<sup>3</sup> per day from these installed tube wells<sup>3</sup> but 412 tube wells are functioning and a tube well works averagely 14-18 hours per day.<sup>4</sup> On the one hand, 68% of the tube wells have hydro chlorinators but only half are working properly<sup>5</sup> and half of 52 overhead reservoirs for storing water are operational. On the other hand, WASA serves 84% (350 km<sup>2</sup>) of Shahdra, Mehmood Booti, Khokhar Road, Central Area, South East and, Southern areas to provide sewerage through 12 major disposal pump stations and 79 lift stations.<sup>6</sup> If we consider all the peripheral settlements of Lahore, this kind of sewerage facility is available only to 19% of total area.<sup>7</sup>

LWMC is lifting 6,000 tons of solid waste per day. However, the peripheral low-income areas are still devoid of solid waste collection system. Recycling is limited and government has to subsidize the company to run the operations.

## 1.2. ISSUES AND PROBLEMS

In the present scenario, water, sanitation and solid waste issues are limited not only to coverage but persist in the shape of following:

- **Water Depletion:** The static ground water



level is monitored by WASA on regular basis and measured average decline in ground water level comes to approximately 3 feet (0.9m)<sup>8</sup> per annum.

- **Water Contamination:** Water is being contaminated due to mixing of waste water from deteriorated sewage lines in water supply pipelines. In most of the areas located outside WASA's jurisdiction, shallow wells, hand pumps and electric motor pumps are used for water extraction for drinking purposes. This extraction contributes to overall ground water depletion in the city. The quality of such water sources is also very poor due to infiltration of contamination in the ground water. People are suffering from diarrhoea, cholera, typhoid, gastric and other water-borne diseases due to the use of contaminated water.
- **Unaccounted for Water: Average Per Capita Demand** is 198 litres per day. WASA produces 294 litres per day per capita; this clearly shows that on the average 96 litre per capita per day is unaccounted for water.<sup>9</sup>
- **No Standards and Small Reservoir Capacity:** An installed overhead reservoir is having capacity of about 20,000 Cubic Meter (4.4 million gallons) having height between 60ft to 70ft (18m to 21 m) and depth of 10ft or 3m. There is no specific standard available for sizing reservoir in Pakistan and presently, there is no advantage of using existing reservoirs due to too small storage capacity.<sup>10</sup>
- **Wastage of Water by Consumers:** There are approximately 557,000 household connections in which 51% are metered whereas only 13% are working properly. Therefore, most of the customers open their tap or do not repair the faulty ones due to which a large quantity of clean water is being wasted which is a burden on WASA.<sup>11</sup>
- **Low Water Tariff Rates:** WASAs tariffs are already lower as compared to its expense on service delivery. As mentioned above, water metering is negligible on consumers connections

justified water tariff cannot be obtained from the consumers till water meters are not placed on consumer connections.

- **Lack of Co-ordination:** It is clear that all these sectors depend on one another. If solid waste is not collected, sewerage is choked, if sewerage is choked, underground aquifer gets contaminated. Hence, both WASA and LWMC need a lot to work in collaboration but they do not. For example, WASA de-silts drains and presumes that LWMC will pick up the silt. LWMC's scope of work does not allow this. Solid waste accumulated in the drains also needs collaboration. More specifically, WASA and LWMC have to collaborate to fix responsibility of silt picking and in curtailing solid waste disposal into drainage system.
- **Exclusion of Low-Income Areas:** What is most disturbing in the existing scenario is that a majority of the low-income settlements are located in the peripheries of Lahore and these settlements portray a grim picture in terms of water and sanitation infrastructure in contrast to well-developed city centres and posh localities, e.g. Model Town, Defence Housing Authority (DHA), Cantonment Board, etc. These low income areas have negligible access to clean drinking water and improved sanitation systems.
- **Institutional Issues:** There are also institutional issues regarding integration, technicalities & capacities and uses of latest methods/ technologies instead of outdated ones especially in WASA. These hard core factors are depleting WASA's financial viability (working ratio 1:2)<sup>12</sup> and institutional health. Storm water drains are choked with sewer water and finally untreated foul water is being disposed of in the River Ravi. Similarly, solid waste in the drains not only decreases the capacity of drains but also increases the maintenance cost of drain cleanliness.<sup>13</sup> In such circumstances, LWMC being the sole collector of solid waste could not offer any viable solution to the garbage collection and disposal.

# METHODOLOGY

Water, sanitation and solid waste management vision 2035 study was primarily conducted as a desk review. Various reports generated on the sector in the past five to ten years were reviewed. However, in order to link the previous studies with the present discussion, the researcher conducted key informant interviews of concerned stakeholders including service delivery organizations like WASA and LWMC and other civil society organizations. Guidance and expert opinions of CWG members, in collective and in individual capacity have also been sought to refine research findings and in building up vision for 2035. For the purpose of this analysis, three pronged methodology is adopted and elaborated in the subsequent paragraphs.

## 2.1. REVIEW OF SECONDARY DATA

Considering an initial and supportive step, the researcher collected and reviewed documents, reports, statistics, maps related to water, sanitation and solid waste sectors of Lahore. This was done with the objective of clearly comprehending the existing

situation and level of work of service delivery departments in Lahore. Moreover, review of studies related to low income or neglected areas exist at the outskirts of the city was also ensured to understand the exclusion perspective. Various news clippings of the last eight months of concerned sectors also helped to gather the necessary information. List of reviewed documents are given as Annexure II.

## 2.2. KEY INFORMANT INTERVIEWS

In depth interviews were conducted with concerned persons in WASA, LWMC, Non-Governmental Organizations (NGOs) and Director General Katchi Abadis (DGKA).

## 2.3. ANALYSIS AND DEVELOPMENT OF POSITION PAPER

Analysis of the information collected from secondary data and from the key informants was the final step to build research findings and recommendations.

### Persons Met

S.No	Name of Key Informer	S.No	Name of Key Informer
1	Mr. Qadeer Khan	6	Mr. Nazir Ahmed Wattoo
2	Mr. Sohail Anwar	7	Mr. Hafiz Rashid Mehmood
3	Mr. Rana Muhammad Arif	8	Mr. Ammar Ahmad
4	Mr. M. Umar	9	Mr. Amir Butt
5	Mr. M. Shoaib Dar	10	Mr. Tariq Latif

# HOW TO MAKE WATER, SANITATION & SOLID WASTE EXEMPLARY SECTORS IN LAHORE

This paper envisions that provision of safe water, sewerage and solid waste management to all of the population of Lahore should be arranged in an environment friendly, healthy, equitable and inclusive manner and within a defined coverage area. In addition, curtailing wastage of fresh water to zero, treating sewerage and reusing solid waste by composting and recycling should be organized in the city. These services should be managed in the city in a mutually supportive way.

For this purpose, before embarking on achieving sustainability in water, sewerage and solid waste management, three pre-conditions should be achieved:

1. The first precondition is establishing a well-coordinated and responsive institutional mechanism to plan and deliver all three services in an integrated manner.
2. The second precondition relates to the allocation of resources to the excluded communities and areas.
3. The third and significantly important precondition is to save the ecosystem. Ecosystem of a city depends on the protection of three elements i.e. water, vegetation and air. These elements are not well protected in Lahore. Incessant water table depletion and

**Restoration of ecosystem is the precondition to ensure environment friendly city. Water depletion, wastage, contamination and less coverage of water, sewerage and solid waste management services are the chief contributing factors in environmental degradation.**

its overwhelming contamination, decrease in vegetation due to concrete is damaging all these essential elements and resultantly the ecosystem of the city. Restoration of ecosystem is the precondition to ensure environment friendly city. Water depletion, wastage, contamination and less coverage of water, sewerage and solid waste management services are the chief contributing factors in environmental degradation.

# WHAT LAHORE CAN DO TO MAKE WATER, SEWERAGE & SOLID WASTE EFFECTIVE AND EFFICIENT

**W**ater, sewerage and solid waste management services still lag behind the actual requirement of the city. A step wise analysis of issues and proposed measures to deal with their problems are explained in the ensuing paragraph.

## 4.1. PROTECT WATER RESOURCES

Lahore's aquifer consists of sedimentary rock permeable to water infiltration from various water recharge sources. Topographically Lahore is located in the lap of Himalayas, hence, it receives a natural gravity based ground water inflow from the mountains which is almost constant since centuries. Second source of water recharge is rainfall which also stands constant in the last fifty years, although its infiltration to recharge ground water decreased due to concretization of rain capturing spaces. The River Ravi used to be the chief source of ground water recharge until its water stored by India under Indus Water Treaty. A decrease in water level in Ravi brought major decrease in water recharge. Studies reveal that there is 2-3 feet per annum decrease in draw down of water table. This causes imbalance in water budget which is very clearly going in minus at this moment.

Despite the fact that we are losing water, we are over extracting it. Incessant population expansion and

change in our life style from simple to modern are the two underlying reasons for extra water extraction. Water wastage on washing cars, watering lawns and other domestic usages, as well as in watering parks and golf courses are common practices prevailing in the city. WASA mainly relies on direct pumping in the absence of sufficient storage arrangements. This also results in over extraction. Legally water cannot be extracted by any entity without prior permission of WASA, but housing colonies, industries and residents extract water without seeking this permission.

A study to measure total aquifer of Lahore and total water extraction is the first essential step needed to be taken to learn how much water we have and for how long we can serve the expanding population over the period of next twenty odd years. This study would definitely mirror the real situation for the planners to prepare water budgets for years to come. It will also delineate the geographical distribution, in flows and expected recharge in each geographical catchment. A recharging plan can be proposed through the findings of this study.

Lahore is expanding in all of its corners very rapidly leaving little land left for vegetation essential for water recharging. Government has to curtail the expansion by enforcing a temporary ban on development of private housing colonies on greener agriculture land. This land is a valuable source of water recharging.

To protect this source systematic town planning is required. This paper proposes town and countryside planning model by which adjacent towns like Sheikhpura, Shariqpur, Kasur, Manga Mandi and Muridke should be developed separately and should look distinct from Lahore city. This can only become a reality if housing is banned in between these cities until the finalization and implementation of this plan. Focus should be on ensuring construction on the fifty two percent existing vacant plots in already planned housing schemes in Lahore<sup>14</sup> than building new housing schemes primarily being planned for speculation purposes.

Due to concretization, rain infiltration is reduced over the period. Six storm water drains crossing the city throw rain water into the River Ravi. Drains are sources of contamination, whereas principally they should be a source of water recharge. The elimination of solid and liquid waste from the drains can reinstate them as a permanent source of water recharging. If we summarize the desired action to improve the situation, following simple steps need to be taken to enhance groundwater recharge.

- Government and private entities suspend ground water extraction for couple of years. Surface water supply schemes need to be introduced as an alternative. Ground water table will rise to its upper limits during the course of time. Then we can go back to its extraction by adopting proper water management system.
- Increase rain water infiltration by providing green patches along the roads.
- Construct rain harvesting schemes in various parts of the city for infiltration of rain water on pilot basis. Housing schemes should treat waste water at their location that can be used for water recharge.
- Ban further housing in and around the city and lift the ban after undertaking proper city and region wise town planning.
- Stop inflow of liquid waste and accumulation

of solid waste in storm drains to protect them as a source of water recharge instead of present means of contamination.

- Increasing green areas in all the housing schemes.

Vegetation is a big factor contributing towards temperature control, water recharge, oxygen production, and carbon dioxide absorption and ensuring aesthetics. Agricultural land is affected badly over the years due to heavy infrastructure development in the city. Lahore used to be self-sustained in food production which is not the case now as most of the food is coming from countryside. City witnessed decrease in forest land and forests over the years; only Jalo forest and bunch of trees on riverside are available for the whole city. Excessive cutting of trees for construction of roads and other infrastructure has also reduced vegetation. This has also reduced fauna inside the town. Concretization also caused urban heat waves syndrome which causes severe heat inside the town in summers. All these factors relate to the protection of water and ultimately of the ecosystem. Protection of agriculture land and forestation should be ensured to protect water resources in the city. Integration of forest department in the fold of water recharging plan is recommended with an objective to enhance its role in increasing vegetation in the city. Simultaneously, awareness raising campaigns for growing trees inside house and on streets should be launched to increase vegetation.

#### **4.2. ELIMINATE WATER CONTAMINATION**

Various studies conducted for water quality monitoring reveal that almost half of (49%) Lahore's drinking water is contaminated having both biological and chemical contamination. Leakage of sewer system into old rusted porous water pipes, penetration of unmanaged foul water into groundwater and mixing of industrial waste into domestic waste are the primary reasons for water contamination.

The system of sewerage disposal in the jurisdiction of

cantonment and even in its nearby locations called Gharki system (soak pit as deep as 90 feet as collector of sewage water of number of houses) is dangerous. Since the land is permeable, liquid waste receives no barrier; hence it contaminates the whole area not only where the Gharkis are situated. Cantonment board though is in the process of replacing Ghraki System with sewerage system but a lot remaining undone. One of the key issues is transferring household's connections from Gharki system to sewerage system as residents prefer connection to Gharki owing to reason that they have to pay nothing for it as compared to sewerage system where they have to pay.

Hundreds of waste water ponds, especially in the peripheral areas of Lahore, are also contributing towards the contamination to a large extent. Similarly, in the areas devoid of underground sewerage, foul water spreads in the streets or in nearby depressions and becomes a source of contamination. Resultantly, water of low income and peripheral settlements is contaminated. Gradually, it will go deeper and deeper and subsequently safe water will become a dream for the city dwellers.

In order to avoid all these problems, the Cantonment Board should make a comprehensive sewerage development plan with an aim for incremental replacement of Gharki system with underground sewerage and safe disposal system. It has accomplished a lot yet other localities should also be provided with sewerage to abolish Gharki system once and for all. A legal provision allowing heavy penalties on the consumers still connected to Gharki system has to be enforced to ensure that they abandon Gharki system and get connected to sewerage system.

WASA should give priority to the areas so far left out of sewerage development and ensure underground sewerage to get rid of foul water spread in the vicinities. WASA should redefine its boundaries by studying left over areas especially located in the peripheries of Lahore and include underserved areas for the provision of sewerage services as a first priority. There should be a systematic study on the natural ponds to assess the socio-economic impact on the user of those ponds. On the basis of that

study, a strategy should be devised to turn those ponds into plausible ponds serving the interest of the users as well as to save groundwater contamination; constructed wetlands could be one of the option.

For purification of water, chlorinators in working condition are available only at 34% pumping stations among total 417 tube wells of WASA.<sup>15</sup> Operators are not trained in operations of chlorination even where they are available. Consequently, very few chlorinators are properly being used. Chlorination is an essential measure to curtail contamination. Hence it is highly desirable that chlorinators are fixed on all the pumping stations. Operators should be provided with proper training on how to operate chlorinators. WASA should constantly monitor water quality to ensure chlorination of water at all of its tube wells.

Old galvanized water pipes are also a source of water contamination. A lot of water pipe network still comprises of galvanized pipes laid about thirty five years ago. They have become porous letting dust and foul water into them and resultantly into the whole water pipe network due to negative pressure in off pumping hours. A common excuse used by the officials is that changing of those pipes would incur high cost, hence the matter stands unattended. However, this relates to the fact that how much priority does the government attaches to the construction of flyovers than replacing rusty pipes. Investment in pipe replacement would reduce water contamination. Decrease in contamination definitely will curtail water-borne disease and consequently save money being spent to cure diseases. This saving will go into the economic activities. WASA has planned to replace the old water pipelines in Lahore to eliminate underground water contamination, therefore, it is recommended that government should postpone investment on flyovers and amend water pipe network first. Another pragmatic solution to resolve this issue is to operationalize water storage tanks where needed more should be to ensure 24/7 water supply. This will keep the water pipes filled letting very little contamination to enter into the water supply networks.

Arsenic is one of the major threats to the water of

Lahore. A study found arsenic in 42% of WASA's tube wells<sup>16</sup> out of 392 tube wells at that time. The situation is more precarious in northern parts of Lahore especially Shahdara. WASA is working on providing Arsenic Removal Filtration Plant in Lahore to provide clean drinking water to citizens. WASA also envisages in its future plans to build water resources near Indian border where water is free of contamination (free of arsenic). In addition to that WASA is planning to harness the surface water for drinking purposes. WASA should pilot these options and then expand them if feasible. Furthermore it would be advisable if lining of Lahore canal, other distributaries and drains should strictly be prohibited to let water recharge build.

Environmental Protection Agency (EPA) is responsible for monitoring of waste water disposal in industries. No industry can dispose it off without treatment as per Pakistan Environmental Protection Act (PEPA 1997). Industries, however, hardly follow this law and throw waste water into nearby land, drainage channels and even in the sewerage pipe lines. In order to curtail contamination, concrete steps for identification of such industries and strict action to enforce PEPA to compel them to install waste water treatment plants is urgently required.

Government of the Punjab is in the process of launching water filtration plants on 3000 locations in Punjab (number of them in Lahore) with the cost of Rs. 10 billion.<sup>17</sup> The water filtration plants installed during Pervez Musharraf era stand non-functional presently. Water sector agencies hardly took ownership of these plants for operation and maintenance purposes. Additionally high costs were required for maintenance of high-tech filters used in those plants. Consequently most of such plants were closed down. It is anticipated that the new project will also encounter similar issues. Water filtration is not a sustainable solution as this does not help in removing the root causes of contamination elaborated above. Hence, it is recommended to the government that it should invest to ensure the measures described above to eradicate contamination rather than installing water filtration plants.

### **4.3. PROVIDE EQUITABLE WATER & SANITATION SERVICES**

WASA's more than eighty percent coverage of water supply and underground sewerage in its jurisdiction appears to be high yet this coverage stands on fifty percent if we include a lot of Lahore located outside of WASA's area of jurisdiction. Low income settlements located on the peripheries are almost devoid of water supply and sanitation services. Though LWMC has increased its coverage yet its claim of eighty percent coverage appears to be exaggerated since the low income areas located in the outer and peripheral sides of the city are still flooded with heaps of unmanaged garbage.

Inequitable coverage in water supply impacts the residents in terms of more expense on procurement of better quality water from far flung places or on purchase of expensive bottled water. Unsafe water and improper sewerage lead to spread of numerous diseases especially in monsoon season. Toxic elements of solid waste also harm human health drastically.

Equitable, inclusive development of marginalized areas should be ensured to decrease disparity. Government of the Punjab's priority is inclined towards development for already well to do class. This argument seeks its proof from the visible construction of flyovers and underpasses aiming to serve car owners not to pedestrians. Numerous societies, companies and authorities are formed to serve the upper class only. It would be prudent on the part of government to form a development authority of low income areas as separate entity to lay focus on development of marginalized areas. This would help in limelighting issues of such areas which are totally ignored in all respects. Studies reveal that residents of such areas are ready to pay up to Rs 500 if water and sanitation services are provided to them.<sup>18</sup> This amount would be sufficient to run development authority on sustainable grounds.

Universal coverage can only be achieved if WASA knows exact left over work in the city and its peripheries. Mapping and documentation are the most important tools to assess the exact situation

and plan thereof on incremental basis. Traditional mapping/documentation arrangements of WASA are not sufficient to complete the assessment speedily. Recently, WASA has hired Geographical Information System (GIS) staff for establishing its own GIS wing. This wing is presently marking sewerage system of the city with its attributes using latest technology by dividing Lahore into subdivisions which will help WASA in future in spatial planning and optimal use of available resources. On the other side, LWMC is also using GIS technology and has proper tracking system of vehicles for monitoring purpose. However, LWMC should collaborate with WASA for making their assessments of left over areas of the city. The Urban Unit has a strong developed GIS database of Lahore but in order to make things more effective, it should share the developed work with these agencies.

Since WASA is working on achieving financial sustainability under its business development plan, it would require financial assistance from the government to increase coverage. The financial burden can be reduced if WASA adopts Component Sharing Model (CSM) practiced by Orangi Pilot Project (OPP),<sup>19</sup> Anjamine Samaji Behbood (ASB),<sup>20</sup> and MUAWIN<sup>21</sup> and by WASA itself in Changa Pani Program in Badar Colony UC 60.<sup>22</sup> The model divides responsibility for development of infrastructure for sanitation between community and government agency. The community pays for and constructs internal infrastructure (household latrines, lane sewers) while the government agency provides external infrastructure (primary and trunk sewerage system). The division of these components is discussed below.

**a. Internal Development comprises of**

- House-sanitary latrines within the houses;
- Lane-underground sewerage line, and
- Small, secondary or collector sewers.

The community is largely responsible for the internal development.

**b. External Development constitutes**

- Large secondary or collector sewerage,

- Trunk sewer/nullah development,
- Disposal station, and
- Treatment plant.

The government is responsible for this external development.

Results of the component sharing model clearly demonstrate that internal development by community saves about 70% of the cost of government which can be utilized in external development. This way WASA can increase its coverage on rapid pace. Social mobilization is the most important tool required for effective implementation of component sharing approach. Since WASA has hired social mobilization staff with an objective to evolve community participation, this staff can be utilized for the purpose of social mobilization to establish this approach. The organization like OPP, MUAWIN, Anjamine-Samaji Behbood can provide training to the social mobilization staff of WASA. This model is even applicable to LWMC if adopted in collaboration with WASA.

**4.4. CONSERVE WATER FOR COMING GENERATION**

Water wastage is a major issue faced by WASA for the past few years. This is one of the causes of underground water depletion. As water meters are functional in only 13% of the total connected households located in the jurisdiction of WASA, a vast majority of the consumers pay fixed tariff (tariff is already low since it has not increased in last ten years).<sup>23</sup> When consumers pay fixed amount they hardly think of conserving water. Direct extraction of water from underground is another contributing factor in wastage of water.

WASA in its business plan (2010-2016) envisaged incremental water metering to cover all the consumers. However, nothing substantial appeared on the ground so far. Who will purchase water meter is a big question mark. WASA can hardly afford heavy cost to be incurred on the purchase of water meters for all of its consumers. If the responsibility of purchase of water meters is kept with the consumers,



it may not work again because consumers may opt for cheaper water meters which do not meet to the desired WASA standards and specifications. Consumers prefer fixed tariff rate over metered rates because they have access to fair amount of water on negligible rates letting them waste precious water on their wish and whim. To compel consumers to opt for water meters, WASA has to offer subsidy in water tariff to the consumers opting for water metering. On the contrary water tariff should be fixed high for those who are reluctant to install meters. This approach will bring them to opt water meters. This is the most pragmatic approach to ensure water metering at larger extent. Water metering will benefit in reduction of water wastage and consequently operation and maintenance cost of WASA. This will also help in attaining longevity of water supply equipment and infrastructure.

WASA has a legal provision in its act to curtail private extraction as no private entity can extract water without prior permission of WASA. Enforcement of law is hardly seen in Lahore. Industries, housing colonies and general public extract water without any hesitation all over Lahore. Hence, in order to conserve water, extraction should be regulated as per law. WASA on the one end should enforce this law and on the other end should increase its own coverage to discourage private water extraction. Direct pumping by WASA is another contributory factor in water wastage. Only 18 Overhead Reservoirs (OHR) are functional for 460 tube wells operating in Lahore.<sup>24</sup> Water storage and then its rationing could reduce water wastage. Hence, it should be made mandatory that OHR is constructed for each tube well. WASA should make its existing OHRs operational at the first instant. Rain harvesting is one of the pragmatic solutions to increase ground water recharge in the concretized areas of the city. WASA is planning to pilot test rain harvesting at Lakshmi Chowk and Qaddafi Stadium. Future rain harvesting plan should be prepared on the basis of results of this piloting.

A considerable quantity of the water extracted by WASA through its pumping stations goes unaccounted for due to illegal connections, seepage

and water theft. This levies extra financial burden on WASA and results in severe water wastage. So far WASA could not identify illegal connections. Water measurement is a viable solution to resolve this problem. Although planned, WASA could not place bulk water meters on its pumping stations so far in order to assess exact outflow in comparison to utilization. We propose third party validation from some reputed firm to un-surface illegal connections.

#### **4.5. IMPROVE STORM WATER DRAINAGE**

There were three main natural drains in Lahore in 1936. As city expanded, pressure on drainage also increased. As a result, drainage and water supply system was handed over to the Lahore Improvement Trust (LIT) in 1967. The LIT constructed more drains to deal with the increasing pressure of storm water. When Lahore Development Authority (LDA) was established in 1975, the drainage system was handed over to it. When WASA was created in 1996, the drainage system became its responsibility. WASA is now covering almost 70% of the drains in Lahore.<sup>25</sup>

At present, there are 6 primary drains with total length of 55.70 km; 14 secondary drains covering 43.63 km; and 209 tertiary drains which cover 366.66 km in which 67.95 km are open and 298.31km are covered. Lahore Drainage System is divided into three zones; North, Central and South. Each zone consists of one Executive Engineer (XEN), two to three Sub-Divisional Officers (SDOs) and three to five Sub-Engineers.<sup>26</sup>

The prime purpose of drainage system is to carry the storm water (rain water) and to avoid flooding in the city witnessed usually in monsoon period. Every year in monsoons, WASA has to put extra efforts to pump out rain water. This consumes a lot of cost, time and energy of WASA. Shahdra and Hudiara drains are built on gravity and other are being pumped out by four (4) pumping stations. The whole system is finally being discharged into the River Ravi without any treatment plant.<sup>27</sup>

Drainage system of the city is very important for the ground and surface water recharge. It is used for

irrigation and ground water infiltration. It saves the roads and property from flooding. It takes the rain water from roofs, parking lots and roads and other pavements. Roadside drains are specially designed to cater to the rain water runoff, so that the roads could be saved. If the proper system is not built then rain water management may result in a catastrophic deterioration of the humans, property and aquatic life. It is, therefore, essential to decipher that the drains are made for carrying storm/rain water to avoid the stagnancy of rain water on the streets and roads and should be utilized for the recharge of surface and ground water and as well as for the irrigation purposes.<sup>28</sup> On the contrary, most of the drains of Lahore are filled with solid and liquid wastes and are encroached by public and private buildings. As a result, the original width of these drains has been reduced. Therefore, these drains run with full capacity even in the dry season and overflow during the monsoon season.<sup>29</sup> Machinery cannot reach to the encroached areas for de-silting; therefore manual scavenging has to be done by the sanitary workers of WASA. Due to this, the energy, time and cost of de-silting increase and deaths of sanitary workers also occur due to the emission of poisonous gases.<sup>30</sup>

There is another alarming issue that most of the sewerage system of Lahore is also connected to these drains through 79 pumping stations; due to which the existing capacity of drainage is becoming lesser and the purpose of developing these drains has been compromised. Finally, the whole sewerage and drainage network is being discharged to the River Ravi without any treatment. Therefore River Ravi has become a sludge carrier of drainage and sewerage and a major environmental hazard, according to JICA report, 2010.

Five or six decades back these drains were freshwater channels and people used to come here for fishing and recreational purposes but now one cannot walk alongside these drains owing to bad odour and unhealthy environment. Due to the rapid urbanization and poverty people are forced to live on these drains: The Lahore Conservation Society (LCS) secretary information and urban development expert

Prof. Ajaz Anwar says. "Recently Rohi Drain spilled over due to heavy rain, damaging the houses in some localities partially or completely." Prof. Anwar also commented that the industrial affluent also causing the underground water contaminated due to which water-borne diseases like hepatitis and diarrhoea are in common. He also pointed out that the people should also take care of these drains.<sup>31</sup>

Water discharge and recharge are interlinked. There is a need to visualize the increasing population of Lahore. On the one hand, this population is exceeding from 10 million and about 2000 industrial units are contributing to the waste water discharge to the Ravi. On the other hand, WASA is extracting for water supply through 460 tube wells of the capacity of 2-4 cusecs. There is no mechanism of artificial recharge of water for the existing aquifers of the city. The available aquifer is depleting 2ft/per year.<sup>32</sup>

The severity of the issue is not only the ground water table depletion but the extent of the aquifer depletion zones. These zones are expanding every year with the rate of 25.5 km square areas of the city. A recent study has used GIS technology to interpolate the contours of 38 meter below aquifer zones with temporal change from 2007 to 2011.<sup>33</sup> It has shown the shift in depression zone in eastern part of the city in 2011; due to the recent development; which has transformed the permeable agriculture lands to the concrete structures. Resultantly, the recharge of ground water aquifer has been reduced and the extraction and wastage of water has been increased.

The storm water management can play an important role in recharging the aquifer and decrease its depletion using Wet Weather Green Infrastructure (WWGI) and Low Impact Development (LID) to cater these issues through many ways including, reducing storm water runoff, landscaping, recycling, infiltrate and restoring natural hydrology.<sup>34</sup>

JICA study revealed that there is no mechanism of updating of information regarding sore points of sewerage and drains and customer complaints are not maintained. Managerial staff is frustrated due to the lack of financial and technical resources. WASA does

not survey for the regular situation analysis of these drains. Ground water monitoring and regulation is absent. The machinery available is insufficient to cater to all the inundation points of the city. The drainage infrastructure is insufficient for the requirement of the current and upcoming population.

The infrastructure of this city is not designed in a way that the permeable pavements, parking lots, grounds and ponds could infiltrate the storm water devoid of contamination. WASA has not designed and developed its drainage which includes; perforated pipes and small drain equipments at various places of the city. There is no way that the rain water could be penetrated in the ground passing through sand and gravel layers to avoid the contamination caused by the grease on roads, cigarette butts, zinc in the tires and other harmful material in the parking lots and pavements. Such an investment in proper drainage system will not only reduce the storm water runoff but also refresh the ground water aquifers and recharge them for drinking and other purposes.<sup>35</sup>

The sewerage is connected to the drainage system of Lahore. Both the systems should be separated because one should not burden the other. Similarly, the drains are filled with solid waste which should not be disposed of in the drains or in the sewer lines at any cost. Most of the drains are choked due to the encroachment. A comprehensive and sustainable anti-encroachment plan should be executed to save drains from encroachments. Major drains of the city are damaged. Therefore, there are two drains McLeod Road Drain and Governor House Drain which needs to be rehabilitated as soon as possible.<sup>36</sup> Cantonment drain is the main and old drain of the city. This drain is receiving all the sewerage system of the catchment areas. According to JICA Study, 2010 there is a need of one trunk sewer along the cantonment drain on priority.

#### **4.6. ENSURE WASTE WATER TREATMENT**

The wasted water in the city of Lahore goes untreated into River Ravi to pollute it to a devastating extent. Since under Indus Water Treaty water flows of the river has already reduced chances of treatment

through water flows stands minimal. Therefore, all the waste water is a permanent source of contamination. On the one side, it threatens water table and on the other side, it destroys aquatic life. It also endangers agriculture, primarily food items by making them harmful for human consumption. WASA officials showed serious concerns that in the coming years River Ravi's contamination will spread in northern part of the city and ultimately in the entire city.

WASA has tried to launch waste water treatment projects in preceding years but failed due to one or the other reason. An attempt was recently made towards installation of activated sludge treatment plant in collaboration with a French company, which also failed due to heavy cost involved. Construction of lagoons is one of the viable options which may cost a little bit high for construction as well as on purchase of land but would require little operation and maintenance cost. National Agriculture Research Centre (NARC) has constructed wetlands, which treat waste water of 3,000 households of Chaka Shahab area in Islamabad. NARC has connected the project with livelihood generation by growing various beneficial plants on water and on the embankment of lagoons. This space can also be used as recreational park. WASA should follow the model of NARC and construct wetlands on more than one location near the river where cities main drains fall. The profit of beneficial plants on the constructed wetlands can contribute in bearing maintenance cost of these wetlands.

#### **4.7. REDUCE, REUSE AND RECYCLE SOLID WASTE**

Solid waste management is based on five factors; generation, storage, collection, transportation, resource recovery and disposal. Severe imbalance in generation, less storage arrangements, minimal resource recovery and unhygienic dumping of solid waste are the main ailments impacting the city of Lahore at the moment.

Generation largely depends on the cultural habits and life style which are changed over the time since people used to take cloth bags to bring goods even

pots for liquidised items in yester years. Merchants used to use paper bags for packing. Plasticised shopping bags have entirely changed the culture. Now both solid and liquid goods are packed in these bags. Since these bags are cheap, shopkeepers use them for packing without giving any consideration how harmful these shopping bags would be. Shopkeepers and consumers hardly bear awareness that these bags are not biodegradable and will add into solid waste piles. Generation also increased over the years due to other packing involved in take away food items and packing of milk, yogurt, water bottles and many other food items. The usage of paper plates, glasses, cups and plastic spoons has also increased. All this generation can be curtailed by simply legally banning the manufacturing of such packing material and by promoting cloth bags and paper packing for goods fetching. Reduction in generation would reduce burden on total solid waste generation which is 0.6 kg per capita at the moment.

There are three types of solid waste generated at city level, i.e., chemical, physical and biological. Domestic, recreational parks, institutions, commercial entities, industry and agriculture are the main sources generating such solid waste. In addition to that, hospitals also generate very toxic and harmful waste albeit its quantity is not very high. Golden principle for solid waste management is as soon as it is generated it should be stored at the place of its generation. System of storage is well in place in developed housing societies like DHA, Model Town and other private housing societies since garbage is collected from each household here. Heavy penalties are imposed in case garbage is disposed in open spaces or in streets in these areas. This process is absent in less developed and low income areas where household or street level collection system does not exist hence people throw solid waste wherever they want. Hence, household level collection is eminent if we want to ensure proper storage. Furthermore, area level collection is a common practice in less developed areas where a container is placed at some corner. This process increase workload of collection as once it is collected from premises and then from containers to the transporting vehicle. Household level collection

is recommended to reduce this cumbersome process.

Lahore Waste Management Company (LWMC) has taken over solid waste management functions in year 2009 from Solid Waste Department (SWD) of City District Government under an agreement spread over 20 years. Since then the company has added to sanitary workers human force, reorganized collection and transportation system and build managerial systems to improve efficiency. SWD used to collect 2,000 tons of solid waste per day. LWMC collects 6,000 ton per day. This, however, does not imply that LWMC is collecting waste of the whole city. LWMC outsourced collection to two international companies. Similarly complaint cell and third party monitoring is also outsourced. Company is constructing first sanitary landfill site at Lakhoder and providing part of solid waste for recycling to some private parties. It has developed GIS and IT based tracking system to keep a watch on the solid waste collection and transportation arrangements. These are positive measures but in order to solve solid waste management issues described in above sections, more concentre measures need to be planned.

This paper proposes construction of more than one sanitary landfill sites on each corner of the city to reduce time, distance and transportation cost. Transportation cost further can be curtailed if LWMC promotes decentralized recycling in various localities especially in housing colonies. Necessary legislation can be developed for decentralized collection and recycling.

Mahmud Boti still is a dumping site not a sanitary landfill site as per prescribed processes. LWMC recently has commenced some land filling practices at Mahmud Booti. Located near the river bed, site poses threats of water contamination.

LWMC is spending 8.5 billion rupees per annum to manage half of the solid waste of Lahore in which 5.5 billion is used for operation & maintenance while rest of amount spent on development. It has one composting plant at Mahmud Boti which is partially operational and does not stand as a formidable source of revenue generation essential for the financial

sustainability of LWMC. Service charges receipts from WASA are also far low as to the expenditures of LWMC. Solid waste is a resource not a trash. It can produce methane gas, fuel bricks, fertilizers and electricity. Hard physical material is also sellable. Justification for LWMC existence as an autonomous company relates to its financial sustainability. Hence LWMC has no other option except to formally adopt recycling on war footing basis to reduce its financial dependence on government and to turn it into a profit generating organization. Similarly levying user charges from the consumers is a paramount action prerequisite for financial sustainability of the organization. The Company should not be run on subsidies.

The role of informal sector in solid waste management is very important as garbage pickers collect big chunk of city's solid waste. Formalizing their role by ensuring their safety with provision of safety equipment is one of the steps which can reduce LWMC's burden of collection. Similarly, the government should encourage private companies to join solid waste management to reduce this burden. Moreover, government should play a key role as a regulator and facilitator for such entities. Awareness raising campaigns on reduction of generation and proper storage should be launched to sensitize general public and for them to adopt better civic sense in garbage disposal practices.

#### **4.8. ENFORCEMENT OF REGULATORY AND POLICY REGIMES**

The enforcement of Pakistan Environmental Protection Act (PEPA, 1997) is very poor in Lahore as well as in the other parts of the country. EPA lacks capacity as well as system and structures to ensure an effective implementation of this regulatory regime. The Act aims at implementation of National Water Quality Standards (NEQS) for provision of contamination free water and carries clauses to restrict disposal of untreated industrial and domestic effluents to the water bodies. Considering the fact that PEPA's scope is wider, Government of the Punjab has initiated a process of drafting Punjab Municipal Water Act to give more legal

cover to water & sanitation sector. However, the formulation process for this act is very slow. Lahore Development Authority Act gives WASA powers to control water extraction and ensure water and sanitation services in its service area. Special orders have to be issued to the law enforcement agencies for effective implementation of the laws related to water extraction and contamination.

The Government of Punjab has promulgated Drinking Water Policy (2011) while sanitation policy is in the process.<sup>37</sup> These policies suggested measures for institutional reforms of WASA. Translation of these policies into action by devising pragmatic sectoral strategies, rules and regulations and need based programming is a task government has to achieve.<sup>38</sup>

#### **4.9. GROOM WATER AND SANITATION INSTITUTIONS**

Illegal water connections, uncounted water, failed water metering program, less water storage capacity water contamination and non-rationalized water tariff are common in the financially challenged WASA Lahore. WASA has been implementing 6 years business development plan (2010-2016) to curtail all inefficiencies and to make it a financially viable institution. This plan envisions incremental tariff increase over the years. However, political leadership is not in favour of tariff increase yet. Consequently, the desired results could not be achieved so far. Progress based on hundred percent water metering measure to curtail uncounted water and enhancement of water storage capacity needs to be dealt seriously. In such a scenario WASA has to redefine its programs to achieve desired results.

Community participation as practiced in Changa Pani Program (CPP) is based on the component sharing approach by which internal (lane and neighbourhood level) water and sewerage infrastructure development is the responsibility of the local people and external (trunk sewers, disposal stations, treatment plants, tube wells and rising mains) is the responsibility of government. Local community operates and maintains water and sanitation system through

**WASA should focus on external development in the marginalised areas to ensure equity and inclusion. This would also help in increasing coverage on rapid pace if the community is entrusted with the responsibility of internal development as per Component Sharing Model (CPM). To achieve this WASA's mapping documentation section needs to be well equipped with the GIS based mapping techniques.**

their representative community organization. This approach makes people self-reliant and contributes in establishing relationship between community and implementing agencies.<sup>39</sup> WASA in collaboration with Urban Unit has successfully implemented this model in Badir Colony (UC 66), where Water and Sanitation Community Organization (WASCO) is operating and maintaining water and sewerage system to generate profit. There is a need to replicate this model in rest of the city of Lahore. Adoption of CPM in rest of WASA areas would reduce not only development cost because of hundred percent community contribution in internal development, but also decrease operation and maintenance cost to run water and sanitation system. This would make WASA a financially viable institution.

WASA should focus on external development in the marginalised areas to ensure equity and inclusion. This would also help in increasing coverage on rapid pace if the community is entrusted with the responsibility of internal development as per Component Sharing Model (CPM). To achieve this WASA's mapping documentation section needs to be well equipped with the GIS based mapping techniques. In order to achieve the desired goals, technical capacity of engineering staff also needs to be strengthened. Similarly newly recruited social mobilization staff would be used to sensitize communities to adopt CPM. Urban Unit has capacity in GIS, hence it could be used as capacity building organization for WASA. ASB, MUAWIN and OPP are the organizations having great resource in social mobilization and can train WASA staff well.

WASA can improve revenue collection using GIS based spatial planning. This can be done effectively by mapping/documenting all the consumers with a

clear-cut identification of illegal and bill defaulters on GIS based maps. Database of such consumers would be developed and notices should be issued to recover the payable. This process can further be strengthened by involving third party.

Management structure of WASA needs to be revamped by ensuring its autonomy and independence by converting it into an independent body. To achieve this following is proposed.

- Delink WASA from Lahore Development Authority (LDA), since this cause severe bureaucratic hiccups restricting WASA in timely and viable solutions. Conversion of WASA into an authority or company would be beneficial.
- There should be a professional board of directors for WASA to oversee its operations.
- A reward and punishment policy should be introduced in WASA to improve service delivery. This will help in increasing working efficiency.
- Establishment of key performance indicators with proper monitoring and evaluation of performance hence is proposed.

Though LWMC has been successful in cleaning developed parts of Lahore, yet a lot many areas are un-served. LWMC should play an effective role as a regulator and facilitator and encourage private entities including informal sector to take up functions of collection and disposal. This step will help reduce financial burden of the company. It would also be benefitting for the sustainability of LWMC if it lays focus on recycling rather than on collection and transportation.

# THE WAY FORWARD

**A**rif Hassan, a well-known architect, planner, activist, social researcher, and writer at many forums proposed that populous cities like Lahore, Karachi can be governed in a better way if one single authority regulates, facilitates and monitors all the service delivery organisations. He also says that development should be done in accordance with the socio-cultural milieu of the city. These two aspects need to be reckoned by the policy makers, project developers and implementers, if they wish to bring systematic and sustainable change in the city.

From the above discussion, it is clear that collaboration of all stakeholders is necessary to make Lahore a developed, sustainable, effective, efficient and plentiful city and best solution to get maximum

benefit with minimum resources. In such an overcrowded city, clarity of role of every stakeholder is very important in order to avoid duplication of effort and waste of time and energy. For this, government should develop rules and implement them strictly.

Service delivery organizations (WASA and LWMC) should provide equitable services to all the residents of the city by making assessments of left out areas and by making proper plans for their development.

WASA and LWMC can turn into financially viable institutions only if both the organizations decentralize operation and maintenance of services to local bodies, communities or to private sector.

## ENDNOTES:

1. For more information, visit <http://www.pakistantoday.com.pk/2012/04/17/news/national/polluted-water-causes-40-of-deaths-in-pakistan-annually/> Accessed on 13 October 2013.
2. Japan International Cooperation Agency, *Preparatory Study for Lahore Water Supply, Sewerage and Drainage Improvement Project* (Lahore: Water and Sanitation Agency, 2010). Chapter 5.
3. Ibid., 26.
4. Ibid., 29.
5. Ibid., 36.
6. Ibid., 74.
7. The formula for calculation is this: WASA sewerage system coverage area/total area of the city\*100
8. Japan International Cooperation Agency, *Preparatory Study*, 2010, 27.
9. Ibid., 28.
10. Ibid., 31-32.
11. Ibid., 5-7.
12. Working ratio means WASA is earning one rupee and spending two rupees on service rivalry.
13. Japan International Cooperation Agency, *Preparatory Study*, 2010, 104.
14. For more information, visit <http://www.dawn.com/news/347693/lahore-over-52pc-plots-lying-vacant> Accessed 13 January 2004.
15. Japan International Cooperation Agency, *Preparatory Study*, 2010, 8-9.
16. For more information, visit <http://www.thenews.com.pk/TodaysPrintDetail.aspx?ID=249321&Cat=5&dt=7/8/2010> Accessed on 13 October 2013.
17. For more information, visit <http://www.dawn.com/news/1054710> Accessed on 3 March 2014.
18. Freshwater Action Network South Asia, *Urban Sanitation In Pakistan: Case Study Of Lahore* (Lahore, 2013)
19. Orangi Pilot Project (OPP) is working in Karachi in water & sanitation sectors primarily by mapping and documenting low-income areas.
20. Anjuman Samaji Behbood works very closely with WASA, Faisalabad. Their focus is on institutional development of WASA.
21. MAUWIN works in Lahore. It replicates OPP's Component Sharing Model (CSM) of sanitation.
22. Changa Pani is a model where community invested financially in lane level infrastructure development on component sharing basis.
23. Japan International Cooperation Agency, *Preparatory Study*, 2010, 38.
24. Ibid., 31.
25. Punjab Urban Resource Centre, *Drainage System of Lahore: Technical Aspects* (Lahore: Punjab Urban Resource Centre, 2009).
26. Water and Sanitation Agency Lahore, Directorate of Drainage, *Presentation on De-silting of Drains* (Lahore: WASA 2013).
27. Japan International Cooperation Agency, *Preparatory Study*, 2010, 76.
28. For more information, visit <http://www.wisegEEK.com/what-is-stormwater-drainage.htm> Accessed 25 June 2013.
29. Japan International Cooperation Agency, *Preparatory Study*, 2010.
30. The interview was conducted with Mr. Adnan (SDO), Central Division, Directorate of Drainage, on 5 June 2013 at WASA Lahore.
31. A number of minor and major drains running through the city may pose a serious threat to lives and properties of those living along these channels if they spill over in case of heavy rainfall during the monsoon season. For more information, see <http://x.dawn.com/2013/06/24/city-drains-spillover-a-looming-threat/> Accessed 10 October 2013.
32. Muhammad Basharat & Sultan Ahmad Rizvi, *Groundwater Extraction and Waste Water Disposal Regulation – Is Lahore Aquifer at Stake With as Usual Approach?* World Water Day April-2011. 135. Lahore.
33. Kahlid Mahmood et al. "Groundwater Levels Susceptibility to Degradation in Lahore Metropolitan," *Science International* 25, no. 1 (2013): 123-126.
34. For more information, see <http://www.epa.gov/oaintrnt/stormwater/> Accessed 12 July 2013.
35. For more information, see <http://www.wisegEEK.com/what-is-stormwater-drainage.htm> Accessed 05 July 2013.



36. Japan International Cooperation Agency, *Preparatory Study*, 2010, 14.
37. Government of the Punjab, Housing, Urban Development & Public Health Engineering Department, *Punjab Sanitation Policy* (Lahore: Government of the Punjab, 2013).
38. Government of the Punjab, Housing, Urban Development & Public Health Engineering Department, *Punjab Drinking Water Policy* (Lahore: Government of the Punjab, 2011).
39. For more information, visit <http://www.ahkrc.net.pk/assests/pdf/Changa-Pani-march-2011.pdf> Accessed 12 October 2013.

# ANNEXURE I

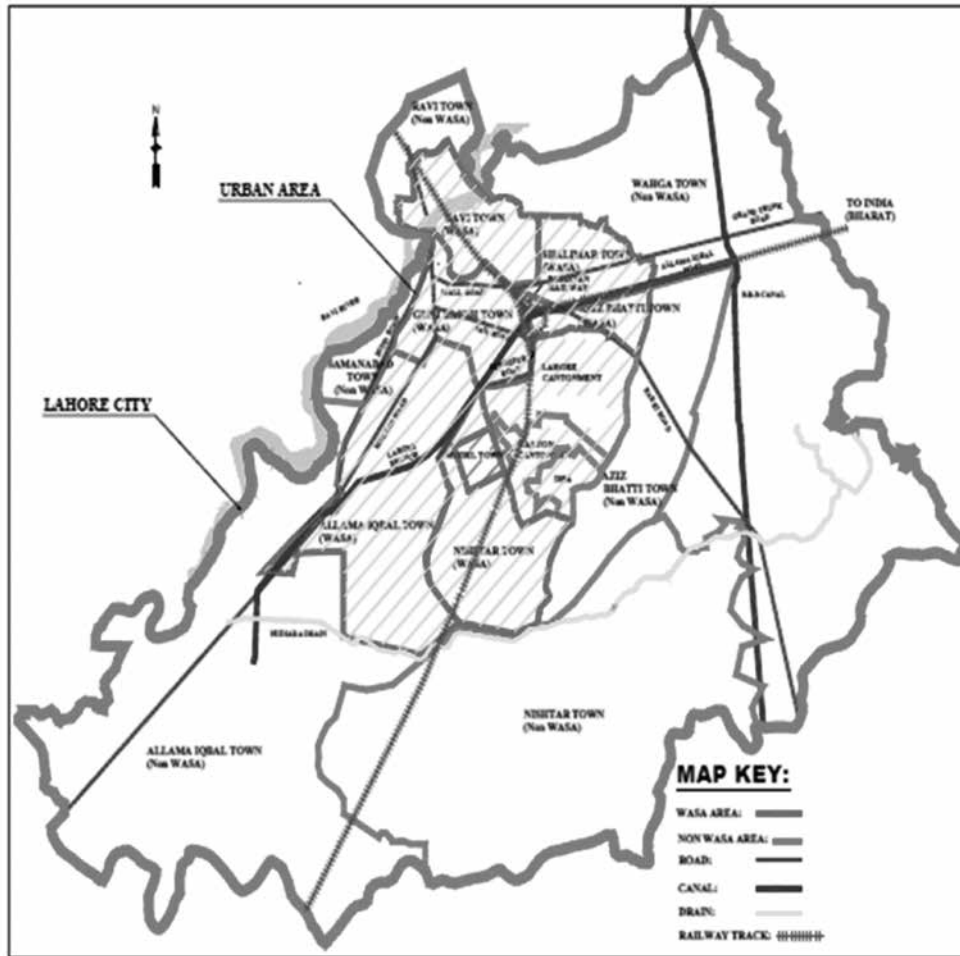


Figure 4.3 Jurisdiction of Each Agency/Town in the Study Area

## ANNEXURE II

### LIST OF DOCUMENTS REVIEWED

1. Japan International Cooperation Agency, *Preparatory Study for Lahore Water Supply, Sewerage and Drainage Improvement Project* (Lahore: Water and Sanitation Agency, 2010).
2. Lahore Waste Management Company, *Services and Assets Management Agreement for Solid Waste Management Services in Lahore among CDGL, TMAs and LWMC* (Lahore: 2011).
3. Government of the Punjab, Urban Unit, *Existing Situation of Sewerage in Lahore City and its Impact on River Ravi* (Lahore, 2013).
4. Dr. Nazir Ahmad & Dr. M. Akram, *A Study of Problems of Water Supply and Drainage of Lahore Zone using the Numerical Modeling* (Lahore, Unpublished, n.d.)
5. Engr. Sabir P. Chohan, Urban Development Planning of Mega Cities A Must: Integrated Master Plan for Lahore-2021. Online <http://pecongress.org.pk/images/upload/books/Paper247.pdf>
6. Dr. Nasir Javed, "Policy Learning Model for Urban Services in Un-served Areas in Poor Peri Urban Locality, Lahore: Deconstructing Globalization for Localization," Online [http://www.neduet.edu.pk/arch\\_planning/Seminar-Series/Abstract-ProceedingMURP-4/PolicyLearningModel.pdf](http://www.neduet.edu.pk/arch_planning/Seminar-Series/Abstract-ProceedingMURP-4/PolicyLearningModel.pdf)
7. Government of the Punjab, *The Punjab Local Government Bill 2013* (Lahore, 2013).
8. Muawin, *Mapping of Social and Physical Services in Shadipura using GIS Technology* (Lahore: Muawin, 2011).
9. FANSA, *Urban Sanitation in Pakistan: Case Study of Lahore* (Lahore: FANSA, 2013).
10. Punjab Urban Resource Centre, *Position Paper on the State of Water & Sanitation in Punjab* (Lahore: Punjab Urban Resource Centre, 2011).
11. Punjab Urban Resource Centre, *Water Supply in Lahore: Public Sector Reform, Not Privatization* (Lahore: Punjab Urban Resource Centre, 2008).

## ANNEXURE III

### PROFILES OF PERSONS MET

<b>S.No</b>	<b>Name of Key Informer</b>	<b>Designation</b>	<b>Name of Department</b>
1	Mr. Qadeer Khan	Director Planning	Water & Sanitation Agency, Lahore
2	Mr. Sohail Anwar	Manager Operations	Lahore Waste Management Company
3	Mr. Rana Muhammad Arif	Chief Financial Officer	Lahore Waste Management Company
4	Mr. M. Umar	IT Officer	Lahore Waste Management Company
5	Mr. M. Shoaib Dar	Manager GIS	Lahore Waste Management Company
6	Mr. Nazeer Ahmed Watoo	President	Anjumin-e-Samaji Behbood- NGO
7	Mr. Hafiz Rashid Mehmood	Director	Directorate General of Katchi Abadis
8	Mr. Ammar Ahmad	Manager	MUAWIN- NGO
9	Mr. Amir Butt	Coordinator	Punjab Urban Resource Center- NGO
10	Mr. Tariq Latif	WATSAN Specialist & Environmental	Siaban-NGO

## **About the Author**

Atif Hassan possesses 25 years of experience in water, sanitation and solid waste management. He has worked with Public Health Engineering Department, Government of the Punjab; Directorate General Katchi Abadis and Urban Improvement, Government of the Punjab; Water and Power Development Authority; Water and Sanitation Agencies in Lahore, Gujranwala, Faisalabad, Multan and Rawalpindi; UNDP, USAID, Unicef, the World Bank, Asian Development Bank, Department for International Development, WaterAid Pakistan, Misereor Germany, and Fresh Water Action Network South Asia on water and sanitation issues. His notable achievements include: successful replication of Orangi Pilot Project (OPP) in Punjab; drafting of Punjab Drinking Water Policy, Punjab Sanitation Policy, and Punjab Drinking Water Strategy. He is president of Muawin, a Lahore based NGO working on low-cost, community-based solutions in water, sanitation and solid waste management in Lahore.

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