Drinking Water Sanitation and Hygiene

Punjab Sector Development Plan

2014-2024

PUNJAB SECTOR DEVELOPMENT PLAN 2014 – 2024

Drinking Water, Sanitation and Hygiene

Government of the Punjab

Planning and Development Department
Housing, Urban Development and Public Health Engineering Department
Local Government and Community Development Department
Health Department
School Education Department

Final Version – June 2015

FOREWORD

The Government of Punjab is pleased to present its Sector Development Plan for Water, Sanitation and Hygiene 2014 – 2024.

With the launch of Government of Punjab's new Growth Strategy 2018 for accelerating economic growth and improving social outcomes, the province prepares itself for sustainable development in the post-2015 Millennium Development Goals era. However, one social outcome that weighs heavily on the province is provision of and access to improved water and sanitation to almost half the country's population that resides in Punjab. Today, Pakistan's human development indicators, especially for health and water and sanitation are skewed because of the situation in Punjab.

The Government of Punjab is fully cognisant of this dilemma and has taken concrete steps to address the prevailing situation. The launch of the new 'Punjab Health Sector Plan 2018 – Building a Healthier Punjab' is directed towards improving the health indicators especially around maternal and child mortality, universal coverage and equitable access to health services. However, one of the foremost causes of child mortality and lowered nutritional status in children is diarrhoea as a result of inadequate water and sanitation facilities.

One of the key drivers for economic growth in the Punjab Growth Strategy 2018 is the development of industrial parks. To this end, the Government of Punjab has launched its 'Punjab Industries Sector Plan 2018 – Promoting Industrial Development and Investment'. Industrial development generates enormous volumes of industrial effluent and wastewater, which if untreated carries a high health risk for the population.

Urbanisation in Punjab is proceeding at a rapid pace and while this provides impetus to economic growth, it also brings with it its attendant challenges especially in provision of basic services like water and sanitation. In addition, solid waste management is one of the main areas of concern as Punjab gives rise to a large metropolis in Lahore and burgeoning mega and intermediate cities in the rest of the province. The new Punjab Urban Development Sector Plan has identified water and sanitation as one of its principal components.

Whether it is improving health outcomes or nutritional status, ensuring that expansion in industrialisation is also environmentally safe, or safeguarding the urban cityscape through effective sewage drainage systems and efficient collection and disposal of solid waste, provision of improved and safe drinking water and adequate sanitation are cross-cutting and serve as a common convergence point for these sectors.

The Punjab Water Sanitation and Hygiene Sector Strategy provides a strategic direction for an integrated response in the sub-sectors of drinking water, sanitation and solid waste management. It articulates the long-term aspirations of the Government of Punjab as it forges ahead with determination to ensure that its populace has universal access to improved water and sanitation. It is hoped that this document will serve as a ready reference for state and non-state actors for planning and development in the three sub-sectors, and that its impact will extend beyond these to other sectors like health, education, urban and industrial development.

The Government of Punjab is especially grateful to UNICEF and other UN agencies, international and national partners, technical experts and consultants who assisted in and facilitated the development of this sector plan.

Muhammad Irfan Elahi
Chairman, Planning & Development Board
Government of Punjab

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Introduction

The conception of a sector development plan has been wanting for a long time. Over the last few years, several key events have been a stepping-stone towards developing a crystallised picture of what needs to be done in Punjab for drinking water, sanitation and hygiene. While these events helped surface issues and sought strategic options in a resource constrained context, other things were happening in tandem with great rapidity, for instance privatisation of solid waste management, cities improvement project, formation of municipal development fund company, and more recently the promulgation of the Punjab Local Government Act 2013. Each clamoured for safe drinking water, improved sanitation and solid waste management, greater sustainability, better health and stronger economy.

The periodic South Asia Conference on Sanitation (SACOSAN) and biennial meeting of Sanitation and Water for All has repeatedly identified sanitation issues in Pakistan, especially for rural communities. Country participation at high-level meetings on Sanitation and Water for All in April 2014 reiterated the government's commitment to the preparation of provincial sector plans for water and sanitation. A visioneering exercise held under the leadership of Planning and Development Department with representatives from HUD&PHED, LG&CDD, Finance, School Education and Health departments helped to define a strategic direction and steer the development of a Sector Plan with two aims in mind. Firstly, to provide a comprehensive sector status review that would bring a fresh perspective and highlight sectoral priorities that are self-evident to the reader, and secondly, to draw out proposed strategies and formulate strategic actions.

Demographics

Punjab is the most populous province of Pakistan with approximately 55.6% of the country's total population. The population of Punjab increased from 20 million in 1951, to 73 million in 1998, and 94 million in 2011 and is expected to reach 101 million in 2015. The population growth rate in 1998 was 2.64%, which decreased to 1.9% in 2011. At the present growth rate of the population, Punjab is expected to double after 36 years. It is estimated that the population growth rate will reach 1.63% by 2030 with a population of 130 million, and by 2050 the population will have increased to 181 million. Rapid urbanisation and a growing population will continue to increase demands for sector and sub-sector services.

Policies and Institutions

Punjab has a Drinking Water Policy 2012, draft Municipal Water Act 2012 and draft Sanitation Policy 2012. The National Sanitation Policy 2006 and National Drinking Water Policy 2009 guided the development of these provincial policies. The Water Sanitation and Hygiene (WASH) sector is overseen by a number of departments, including Public Health Engineering Department (PHED), Local Government and Community Development, Works and Services, Health, and Education for

WASH in schools. The Local Government through TMAs works with PHED for seeking technical support in infrastructure development especially in relation to complex schemes[1]. These provincial departments are now working through an integrated approach to envision and design common implementation plans that are owned by multiple departments and supported by all major support organisations working in the sector. Several national and international partners collaborate with the Government and include UNICEF, WSP, WaterAid, WSSCC, Plan International, RSPN, UN-HABITAT and IRSP etc.

Strategic Actions

Finalise the Punjab Municipal Water Act, formulate a legal framework and operationalise the Punjab Water Commission to govern municipal water in addition to implementing the Local Government Act 2013.

Water Resources

Pakistan is considered to be a water-stressed country (rapidly moving to water-deficit) and many of its regions are categorised as arid. Pakistan lies in an arid and semi-arid climate zone. Most of Punjab receives less than 250 millimetres of rainfall a year. (By contrast, among nations of similar area, Nigeria receives more than 1,500 millimetres, Venezuela more than 900, Turkey nearly 700.) Per capita water availability has declined rapidly since 1951 and is currently only 1050 cubic metres/capita, which puts Pakistan in the category of a high water-stress country[2].

Strategic Actions

Strengthen municipal capacities in climate change adaptation, mitigation and resilience, develop rainwater harvesting interventions in mega and intermediate cities with ample precipitation, and increase use of surface water for municipal services.

Drinking Water

Overall in Punjab, about 94% of the population has access to improved drinking water supply, and major water supply is obtained through motorised pumps, hand pumps and piped water. In the province, 22% of households were using tap water as the main supply of drinking water in 2012-13 compared to 24% in 2010-11, followed by motor pump with 42% in 2012-13 compared to 39% in 2010-11 and hand pump with 28% in 2012-13 compared to 30% in 2010-11[3]. The proportion of households using tap water as a main supply of drinking water is higher in urban areas, 43% compared to only 13% in rural areas. The recently conducted Multiple Indicator Cluster Survey 2011 in Punjab[4] revealed that overall only 12.4% of households have tap water piped into dwelling. The majority of households (93.8%) do not use any water treatment method, and the commonest method used was boiling in 3.9%.

[1] Punjab Service Delivery Assessment Report, WSP World Bank 2012

[2] State of the Environment Report (draft) 2005. Government of Pakistan, Ministry of Environment

[3] Pakistan Social and Living Standards Measurement Survey 2012-2013. Pakistan Bureau of Statistics, Government of Pakistan

[4] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

Strategic Actions

Rehabilitate the non/dys-functional water supply schemes, increase access to tap water including selective use of filtration plants, introduce innovative approaches like energy efficient water supply schemes and enhance water storage capacities with regular maintenance.

Water Quality

The technical assessment of water supply schemes in 21 districts in north and central Punjab[5], conducted by the Pakistan Council of Research in Water Resources in 2011 revealed that 35% of the schemes are non-functional. About 88% of the population use ground water and 43% of functional schemes supplied water less than 5 hours per day, while 31% supplied between 5-10 hours per day. In 80% of the schemes, there is no water treatment facility, while only 12% provide some treatment (chlorination, bleaching powder, potassium permanganate etc). Water samples collected from the water sources of the functional water supply schemes indicate that 79% of the total collected samples are unsafe for drinking purposes because of microbiological and chemical contamination (iron, fluoride, nitrates) and physical problems (turbidity, hardness, total dissolved solids).

Strategic Actions

Strengthen periodic water quality testing at source and distribution network with regular chlorination of overhead reservoirs and storage tanks.

Sanitation

In Punjab, about 72% population has access to improved sanitation, and about 22.8% population defecates in the field. Furthermore, there has been an almost 19% reduction in 'No toilet' category in rural areas and 30% reduction overall in Punjab in the last five years. In Punjab[6], about 77% households have flush toilet, with 98% in urban and 66% in rural areas. About 5% of households have non-flush toilet facilities, while 18% of households reported no toilet. In rural areas, 26% households reported having no toilet compared to 2% in urban areas. With regards to districts, Jhang had the highest proportion of households with no toilet (45%), followed by DG Khan and Rajanpur with 43% each and Chiniot with 41%.

Strategic Actions

Enhance coverage of GIS mapping for sewerage and drainage, ensure optimal sewerage maintenance facilities and equipment, increase coverage for sewerage and drainage, create demand for ending open defecation and replace old and contaminated sewer lines.

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5 Report on Technical Assessment of Water Supply Schemes Northern and Central Punjab (Volume-I), 2011. Pakistan Council of Research in Water Resources

6 Pakistan Social and Living Standards Measurement Survey 2012-2013. Pakistan Bureau of Statistics, Government of Pakistan

Solid Waste Management

In urban areas, about 64% of solid waste is collected by municipal services or privately. However, there is no solid waste collection and disposal system in 93% of rural areas[7]. Data obtained from Tehsil/Town Municipal Administrations show that the percentage of waste that is disposed of per month ranges between 50% to 70%. There are significant numbers of TMAs whose performance is less than 50%. For cities and towns to remain clean, at least 75% of waste must be collected and disposed of. Recent data of nine cities in Punjab shows that over 10,000 tons of waste is generated per day. Of this, only 5300 tons are collected per day. On an average, 0.6 kg/capita/day of waste is generated[8]. The Lahore Waste Management Company estimates that the other 8 cities generate about 5000 tons of solid waste per day, led by Faisalabad whose daily waste is double that produced by any of the other 3 leading cities of Punjab.

Strategic Actions

Make solid waste management an integral component of district WASH plans, implement effective and efficient solid waste management strategies at district or sub district levels as per circumstances, introduce waste to energy solutions where feasible and ensure safe disposal of industrial and slaughter waste.

Health and Hygiene

In Punjab, the Infant Mortality Rate (IMR) is 82 per 1000 live births and Under 5 Mortality Rate (U5MR) is 104 per 1000 live births. In Pakistan, 53,000 children die every year from diarrhoea[9]. An estimated 25 million children and 50 million adults suffer from diarrhoeal morbidity annually in Pakistan. The recent resurgence of polio in Pakistan, especially following the floods suggests pollution of water reservoirs as one causative factor. Further, Hepatitis A and E are now endemic due to contamination of drinking water by faecal matter[10]. Child mortality rates in Punjab also share a common pattern with those districts with high 'no toilet'/'open defecation' rates. Further, on analysis of water quality and rate of diarrhoea in the last two weeks, the patterns suggest that diarrhoea was more frequent in areas where either the water was chemically or bacterially unfit or both. In Punjab, over 95% of households have a place for hand washing[11]. However, there was wide variation of availability of soap at the place of hand washing. Districts that had high rates of lack of soap at the place of hand washing also had moderate to high rates of diarrhoea in the last two weeks. While there may be other causes of diarrhoea, there is a suggestive association between lack of soap for hand washing and occurrence of diarrhoea.

Strategic Actions

Integrate WASH in health promotion at primary level through LHWs and health campaigns, improve WASH in health facilities and introduce effective disease surveillance for health alerts of water and sanitation related diseases to TMAs.

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[7] Pakistan Social Living Standards Measurement Survey 2011-2012. Pakistan Bureau of Statistics, Government of Pakistan

[8] Punjab Solid Waste Management Reform, 2007. World Bank

[9] Pakistan Demographic and Health Survey 2012-13

[10] Malik IA, Tariq WZ: Hepatitis E in Pakistan. EMHJ 2, 1:121-128, 1996

[11] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

Education

The National Education Policy 2009 lays emphasis on a school health programme along with health education. The Annual Status of Education Report 2013[12] for Punjab shows that 95% or more of rural schools have availability of usable drinking water. The same report also illustrates that while 90% and above of middle and high schools have usable toilets, 14.6% government schools in rural areas do not have usable toilets. However, the situation of usable latrines is different with middle and high schools having usable latrines in the range of 80% and above, while most primary schools fall in the range of 60%-80% for usable latrines. A study[13] conducted at the national level showed WASH facilities in schools are not supportive to menstrual hygiene management (MHM); majority of the girls rely on mothers and sisters for MHM related information; and little information is provided or discussed at school level.

Strategic Actions

Integrate WASH related materials in teachers training programme, ensure accessible water and sanitation in public schools and introduce menstrual hygiene education programme for girls.

Sector Efficiency

Provision of continuous 24/7 water supplies does not exist in any city in Punjab and people seek alternative sources of water supply. The frequent power outages are one reason for intermittent water supply. In urban areas, PHED uses a figure of 50 gallons/capita/day, which is equivalent to about 228 L/capita/day. In view of the compelling need to preserve precious groundwater, water production would probably need to be brought in the range of 136 L/capita/day (or 30 gallons per person per day) to allow for about 20% NRW and UAW (which would also need to be attenuated), and therefore a consumption rate of 114 L/capita/day (or 25 gallons per person per day). PSLM 2011-12[14] revealed that overall in Pakistan, 29% of households were connected to piped water supply, and that 67% of these households were paying for the utilities at an average rate of PKR 149 per month. These findings suggest that both setting of tariffs and revenue collection are inadequate and exacerbate the inefficiency in the system.

Strategic Actions

Rationalise per capita production for water supply, reduce system leakage losses, and ensure water metering in all new schemes and high income areas.

Sector Capacity

Majority of the managerial staff at Water and Sanitation Agencies (WASAs), responsible for five major cities of Punjab, have an engineering background from the parent department of PHED. The highly technical nature of PHED work has necessitated training in design and construction. TMA staff on the other hand may originate from different provincial government departments or local government bodies. An assessment of Local Government conducted in 2013 highlighted an

[12] Annual Status of Education Report. ASER-Pakistan 2013. District Directory (Provisional)

[13] Menstrual Hygiene Management for Adolescent School Girls in KP and PAK, Pakistan, May 2013, UNICEF Pakistan

[14] Pakistan Social and Living Standards Measurement Survey 2011-12. Pakistan Bureau of Statistics, Government of Pakistan

unsatisfactory professional development process which only exacerbates the limited technical capacities of Local Government in the sector, calls into question their role of community development when more than four-fifths of the officials and technical staff have no training in community mobilisation and development.

Strategic Actions

Establish a municipal services academy, revitalise the local government academy, and introduce compulsory training in community development for all staff engaged in WASH programmes.

Sector Financing

The Government of Punjab has steadily been increasing its expenditure in water supply and sanitation i.e. PKR 8.9 billion in 2009-10 to PKR 18.8 billion in 2013-14. Current revenue expenditure has also increased during this period, a significant proportion of which is due to salaries and utilities. The overall development revenue expenditure in water supply and sanitation averages around 10% of total provincial development revenue expenditure. If we consider 80% urban and 65% rural coverage with piped water (estimated cost about PKR 217.108 billion), and 82% urban and 70% rural coverage with underground drains (estimated cost about PKR 205.893 billion), the total costs are PKR 423.001 billion for 2014-2024 indicating roughly 50% for water supply and 50% for sanitation (sewerage and drainage). This comes to about PKR 42.3001 billion per year. By 2013-14, the Government of Punjab was already investing about PKR 12 billion annually in development expenditure in water supply, sanitation and sectoral component in cities improvement.

Strategic Actions

Allocate an additional PKR 30 billion per year in development funding for the sector for the next 10 years.

Sector Coordination

Different provincial departments responsible for WASH are in need of developing an integrated approach to envision and design common implementation plans that are owned by multiple departments and supported by all major support organisations. Currently, issue specific coordination arrangements through different committees exist in the province where stakeholders share their perspectives and initiatives, but there is no single coordinating focal point that holds the different sub-sector strands together. Resultantly, there is a compelling need for a specific provincial mechanism that takes the responsibility of coordination with WASH stakeholders and for setting and delivering the agenda of WASH in collaboration with other stakeholders.

Strategic Actions

Constitute a Punjab Steering Committee and Programme Management Unit on WASH under the Punjab Water Commission to strengthen coordination and monitoring and evaluation of water and sanitation interventions in the province. A special panel for research should be created to identify practical solutions for wastewater management at rural, peri-urban and urban settings.

Sector Monitoring and Evaluation

Monitoring and reporting of WASH sector takes place at various levels but it is fragmented. Furthermore, there are challenges of coordination for monitoring and reporting due to complexities in the roles and responsibilities of different stakeholders in the government, cantonment boards and defence housing authorities, non-government and private sectors. The PHED department has developed a Management Information System (MIS), which is currently restricted to provide input related information, and has not been providing output, or outcome related information. Presently, there are four reports/sources that provide information about access to water and improved sanitation. These are Poverty Reduction Strategy Paper (PRSP) Progress Report, Pakistan Social and Living Standards Measurement Survey, Multiple Indicator Cluster Survey Punjab, and Pakistan Demographic and Health Survey. In addition to these, there are other periodic reports and surveys that provide information about water and sanitation in the province but there are issues around clarity and uniformity of indicators.

Strategic Actions

Compile an annual sector status report and district dashboard or scorecard of WASH with clear indictors and source of information agreed with stakeholders including both government as well as non-government sector.

PREAMBLE

The conception of a sector development plan has been wanting for a long time. Over the last few years, several key events have been a stepping-stone towards developing a crystallised picture of what needs to be done in Punjab for drinking water, sanitation and hygiene.

While these events helped surface issues and sought strategic options in a resource constrained context, other things were happening in tandem with great rapidity, for instance privatisation of solid waste management, cities improvement project, formation of municipal development fund company, and more recently the promulgation of the Punjab Local Government Act 2013. Each clamoured for safe drinking water, improved sanitation and solid waste management, greater sustainability, better health and stronger economy.

In recent times, we have seen the articulation of many important sectoral works and documents that have great bearing on the conceptualisation of a water, sanitation and hygiene plan for the province.

The periodic South Asia Conference on Sanitation (SACOSAN) has repeatedly identified sanitation issues in Pakistan, especially for rural communities. The momentum gained from these forums gave birth to the national and provincial drinking water policies, sanitation strategies and the Pakistan Approaches to Total Sanitation (PATS).

The Asian Development Bank's evaluation of Punjab Rural Water Supply and Sanitation project in 2009 brought to light many issues related to dysfunctional tube wells, component sharing, quality, sustainability and capacity of the community organisations themselves on which all project hopes were pinned.

Following close on its heels in 2011 was the water quality assessment report produced by the Pakistan Council of Research in Water Resources, which alarmed the sector that a third of all tube wells were dysfunctional and brought to attention the deteriorating quality of drinking water heavily contaminated by chemicals, dissolved solids and disease spreading microbiological organisms.

The World Bank supported Water Sanitation Programme (WSP) helped organise the Pakistan Water Operators Network, produced the first directory and facilitated development of a monitoring and reporting system for the network.

The massive deluge of floods in 2010-11 awakened everyone's attention to how vulnerable the water supply and sanitation system was to climatic events, not forgetting the great human tragedy that ensued. Urgent humanitarian crises catapulted interventions in water and sanitation like never before. Suddenly PATS, which had remained in the shadows, was the answer sought by every organisation working for humanitarian assistance. UN Agencies, international and national non-government organisations joined hands and launched a massive programme on rural sanitation that would reach 7 million people affected by floods.

In 2012, a national sector review report was produced that reinforced findings that were known to sector specialists but also raised important observations regarding the need for provinces to develop sector plans, approach the sector holistically in a sector wide approach, conduct sector capacity development needs assessment, and strengthen provincial monitoring frameworks for the sub-sectors.

Pakistan submitted its first GLAAS report in 2012 that helped stakeholders to identify information gaps in the sector, human resource capacity status and encouraging trends of provincial governments for gradually increasing allocations to the sector.

Country participation at a high level meeting on Sanitation and Water for All reiterated the government's commitment to the sector, especially to improving sanitation.

In the same year, two other national reports were produced that looked at urban water supply and sanitation, and rural water supply and sanitation. The reports reinforced issues regarding efficiency and called for better coordination, improved sector financing and establishing a regulatory body.

Pakistan's country presentation at the fifth SACOSAN meeting in Nepal in 2013 reiterated previous commitments and identified research in water and sanitation as an emerging priority.

In 2013, a training needs assessment of local government in Punjab especially with regards to water and sanitation found several gaps in teaching and training capacity.

A service delivery assessment on water and sanitation in Punjab was done in 2013, which emphasised the need to promulgate the draft Punjab Municipal Water Act as soon as possible, create a regulatory body that was sorely lacking at present, expand the scope of public-private partnership in the sector, greatly enhance sectoral allocation, and proposed a provincial rural sanitation accelerated roadmap.

In 2014, national consultations were held by the Ministry of Planning, Development and Reforms and the Pakistan Water Partnership[15] to discuss the post-2015 development agenda on water and sanitation, having recognised that Pakistan was off-track to meet its international obligations on sanitation and access to safe drinking water was still an issue due to poor quality. The consultation made special emphasis on the need to improve by (15%) the sustainable use and development of water resources in Pakistan and reduce untreated wastewater by (2.5%), nutrient pollution by (5%) and increase wastewater reuse by (7%). The report highlighted the need to Reduce, Recycle and Reuse wastewater to the extent possible.

The Planning and Development department, HUD&PHE department, LG&CD department and Urban Unit developed a document called Punjab Water and Sanitation Rural Agenda 2014. The document proposes a strong provincial commitment for coordination in implementing and support for a reform agenda.

The Government of Punjab has developed an economic growth strategy 2014-2018[16] that places significant emphasis on social sector development including water and sanitation. There is a

[15] Pakistan stakeholder perspectives on a water goal and its implementation – The post-2015 development agenda. Global Water Partnership, 2014

[16] Punjab Growth Strategy 2018 - Accelerating Economic Growth and Social Outcomes. Planning and Development Board, Government of Punjab

growing recognition that investment in sanitation would not only help to strengthen health systems but also reduce the burden of water-borne diseases.

An extensive international consultation facilitated by WHO/UNICEF Joint Monitoring Programme has recommended the following new indicators for the post-2015 agenda:

By 2030, to:

- eliminate open defecation;
- achieve universal access to basic drinking water, sanitation and hygiene for households, schools and health facilities;
- halve the proportion of the population without access at home to safely managed drinking water and sanitation services;
- progressively eliminate inequalities in access.

The status of water and sanitation in Pakistan when compared with other regional countries indicates that while Pakistan has made good progress with regards to provision of water, it lags behind with respect to improved sanitation (**Tables 1 and 2**).

Table 1 - Use of Drinking Water Sources

Country	Improved (%)			Unimproved (%)	
	Total Improved	Piped on Premises	Others Improved	Other Unimproved	Surface Water
Afghanistan	64	10	54	27	9
Bangladesh	85	10	75	15	0
India	93	26	67	6	1
Nepal	88	21	67	9	3
Pakistan	91	36	55	6	3
Sri Lanka	94	30	64	4	2

(Source: JMP Report 2014, using 2012 as the reference year)

Table 2 - Use of Sanitation Facilities

Country	Improved (%)	Shared (%)	Unimproved (%)	Open Defecation (%)
Afghanistan	29	11	45	15
Bangladesh	57	28	12	3
India	36	9	7	48
Nepal	37	17	6	40
Pakistan	48	6	23	23
Sri Lanka	92	7	1	0

(Source: JMP Report 2014, using 2012 as the reference year)

Pakistan has a commitment for Millennium Development Goals (MDGs)[17], and specifically MDG Goal 7 that aims to promote sustainable development with a focus on sustainable access to safe drinking water and basic sanitation. Pakistan is on track regarding improving access to safe drinking water (89% against the target of 93%) and it is off track on access to sanitation (72% against the target of 90%). The province of Punjab has achieved the target of improved 'source' of water with 95% coverage, whereas it is lagging behind on access to sanitation with an achievement of 78% against the target of 90%.

The Planning and Development Department in Punjab gave careful consideration to the recommendations that had been proffered in the various documents, reports, conferences and technical consultations, and in close collaboration with Housing Urban Development and Public Health Engineering Department, and Local Government and Community Development Department, greatly facilitated by UNICEF, decided that it was high time for Punjab to have a practical, realistic and long term sector vision with an aspirational yet achievable action oriented plan.

The process was initiated with a visioneering exercise held in Planning and Development Department under the leadership of Member P&D responsible for water and sanitation, where senior government officials from HUD&PHED, LG&CDD, Finance, School Education and Health participated together with UNICEF and consultants who facilitated the process. This interactive and open meeting helped derive a strategic direction that would guide and steer the process of developing a sector plan.

Concurrently, UNICEF commissioned an equity study in water and sanitation that provides invaluable insight into inequity in the sector and establishes an unequivocal basis for determining need and setting priorities.

A stakeholder consultation was undertaken to determine emerging priorities, develop an insight into strategy gleaned from sector leaders, and distil commonalities that would serve as a compass bearing.

This document has been prepared with two aims in mind. Firstly, to provide a comprehensive enough sector status review that would bring a fresh perspective and highlight sectoral priorities that are self-evident to the reader, and secondly, to draw out proposed strategies and recommend strategic actions. The report does not seek to repeat detailed and comprehensive subject specific sub-sector analyses done by others. These have been amply referred to in respective sections of the report for those wishing to pursue further reading on the matter.

The document provides the sector status and proposes a strategy with short, medium and long term actions. The document has undergone an extensive consultation process and is now presented as a final sector development plan.

[17] Pakistan Millennium Development Goals Report 2013. Planning Commission, Government of Pakistan

INTRODUCTION

Figure 1 - District map of Punjab

Punjab is the most populous province of Pakistan, with approximately 55.6% of the country's total population (**Fig 1**). It is bordered by Azad Jammu and Kashmir to the north-east, Indian Punjab to the east, Sindh to the south, Balochistan to the south-west, Khyber Pakhtunkhwa to the west, and Islamabad Capital Territory to the north. The main languages spoken in the province include Punjabi and Saraiki and the dialects of Mewati and Potowari. The name Punjab province is derived from derives from the words Panj (Five), and Āb (Water). These refer to the Five Waters or the five tributaries of the Indus River, which are Jhelum, Chenab, Ravi, Beas and Sutlej that flow through the province.

Punjab has a geographical area of 20.63 million Hectares[18] (equivalent to 206,300 Km^2) and constitutes about 25.9% of Pakistan's land area[19].

[18] 1 Hectare = 2.471 Acres; or 10,000 square meters

[19] Punjab Development Statistics 2013. Bureau of Statistics, Government of Punjab

Administratively, the province is divided into Districts, Sub-districts (Tehsils), Union Councils and Mauzas. The districts are further grouped into 9 divisions. Five large cities have been identified as urban centres, while other urban and rural settlements are grouped into sub districts only.

The administrative units in the province are as follows[20]:

- 36 Districts
- 140 Tehsils
- 5 City Districts
- 38 Towns in 5 City Districts
- 25,914 Mauzas/villages
- 3464 Union Councils – of which 978 are Urban Union Councils and 2486 are Rural Union Councils
- 20 Cantonment Boards

Furthermore, the province has the following educational and health institutions:

- Education (2011-12):
    - 42,048 primary schools
    - 7756 middle schools
    - 5589 high schools
- Health (2012):
    - 340 Hospitals
    - 1201 Dispensaries
    - 337 Rural Health Centres (RHCs)
    - 2606 Basic Health Units (BHUs)

Population

The population of the province is estimated to be 98.223 million[21] in 2013 and is home to over half the population of Pakistan. About 31.9% of the population is urban and 68.1% is rural. The male population accounts for about 50.800 million (51.7%), while females account for about 47.423 million (48.3%). Nearly 50% of Punjab's population is under 20 years, and about 68% is under 30 years. This youth dividend is expected to dominate the population for another 30-35 years. The size, growth and age distribution demands that the province maintains a high and sustained GDP growth.

Health

Health indicators in Punjab have shown relative improvements in the context of South Asia, but remain far from satisfactory. Pakistan ranks 146th in the Human Development Index (HDI), and

[20] Punjab Development Statistics 2013. Bureau of Statistics, Government of Punjab

[21] Punjab Development Statistics 2013. Bureau of Statistics, Government of Punjab

Punjab has an average HDI of 0.67 with a maternal mortality rate of 276, infant mortality of 82, Under 5 mortality rate of 104 and skilled birth attendance at 59%[22].

Public sector current expenditure for health and nutrition has grown from PKR 38.5 billion in 2010-11, PKR 52.3 billion in 2011-12, to PKR 62.8 billion in 2012-13. However, development expenditure on health and nutrition grew from PKR 3.8 billion in 2010-11 to PKR 10.1 billion in 2011-12, and then had a modest increase to PKR 11.6 in 2012-13[23].

Education

Punjab has an overall literacy rate of 60% in 10+ years population, with 68% in males and 51% in females, 53% in rural and 75% in urban areas. In rural areas, 63% of males were literate as compared to 43% in females[24]. The primary school Net Attendance Rate is 59% of 5-9 years age group, with 61% for boys and 58% for girls, and 69% for urban and 56% for rural areas.

The Net Attendance Rate for secondary school children 10-14 years is 40% with 31% in primary school and 29% who are out of school. The overall primary school completion rate was 78%, with 74% for rural and 91% for urban areas. The transition from primary to secondary education is low. About 15% of children in the 10-18 years age group drop out before completing primary school.

The private sector has come to play a significant role in the delivery of education services. Overall, about 59% primary school children 5-9 years attend government schools and 41% go to private schools, with 68% in rural areas who attend government schools.

According to Pakistan Education Statistics 2010-11 of missing facilities in government primary and middle schools in 2010-2011, 33% were without drinking water, while 36% had no latrines. 35% of government primary schools did not have safe drinking water and 38% did not have adequate latrine facilities.

Poverty

In the last decade of 2001-2009, unemployment has increased from 3 million to 5.5 million, while per capita income growth has fallen from 7% to under 0.5%[25].

Although Pakistan has made significant progress in human development and poverty reduction over the past three decades, it is considered relatively slow over a long horizon. Social and economic exclusion has resulted in multiple deprivations for more than 50% of Pakistan's population. This situation has only been worsened by the recent deluge of floods in 2010 and 2011. Inflation reduced from a high 25% in 2008 to 10.8% in 2012[26].

[22] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

[23] PRSP Expenditure Reviews 2010-11, 2011-12, 2012-13. Ministry of Finance, Government of Pakistan

[24] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

[25] Analytical Review of the PSDP Portfolio. Planning Commission, Government of Pakistan, 2011

[26] Economic Survey of Pakistan 2012-13. Ministry of Finance, Government of Pakistan

Multi-dimensional Poverty

It is now established that poverty is not determined by a single factor, but is the result of several factors. Poverty indicators are considered under a broad theme known as multi-dimensional poverty.

Multi-dimensional poverty in Pakistan (**Table 3**) has been estimated by using four main dimensions (income, education, health, housing and services) and eleven sub-dimensions (income – unidimension, years of education, read and write, immunisation, purity of water, pre-natal consultation, occupancy status, electricity connection, gas connection, telephone connection, toilet)[27].

Table 3 - Multi-dimensional poverty in Pakistan - incidence, depth and severity

Group	% Incidence M_0	Contribution %	% Depth M_1	Contribution %	% Severity M_2	Contribution %
Punjab	35.56	22.67	17.42	22.74	8.54	22.82
Urban	25.62	22.30	12.61	22.34	6.20	22.37
Rural	42.38	23.22	20.77	23.33	10.18	23.44
Sindh	38.40	24.48	18.85	24.61	9.26	24.75
Urban	25.50	22.19	12.55	22.24	6.17	22.26
Rural	47.29	25.91	23.17	26.02	11.35	26.13
Khyber Pakhtunkhwa	38.39	24.48	18.66	24.36	9.07	24.24
Urban	29.73	25.87	14.60	25.87	7.17	25.87
Rural	42.54	23.30	20.63	23.17	10.01	23.05
Balochistan	44.49	28.37	21.67	28.29	10.55	28.19
Urban	34.05	29.63	16.68	29.55	8.18	29.51
Rural	50.33	27.57	24.46	27.47	11.89	27.38
Pakistan	38.31	100.00	18.73	100.00	9.16	100.00
Urban	27.64	100.00	13.57	100.00	6.66	100.00
Rural	44.80	100.00	21.86	100.00	10.67	100.00

(Source: Khan A et al. Mapping and Measuring of Multidimensional Poverty in Pakistan: Empirical Investigations, 2011)

On assessment of poverty with non-income deprivation indicators (**Table 4**), it was found that 57.30% of the population was in a state of multi-dimension poverty[28].

[27] Khan A et al. Mapping and Measuring of Multidimensional Poverty in Pakistan: Empirical Investigations, 2011

[28] Jamal H. Assessing Poverty with Non-Income Deprivation Indicators: Pakistan, 2008-09

Table 4 - Non-income multi-dimensional poverty incidence

Area	% Overall M_0	% Urban M_0	% Rural M_0
Pakistan	57.30	25.68	53.35
Punjab	36.93	22.42	43.58
Sindh	47.63	26.66	67.44
Khyber Pakhtunkhwa	56.10	36.53	60.00
Balochistan	78.53	44.83	88.61

(Source: Jamal H. Assessing Poverty with Non-Income Deprivation Indicators: Pakistan, 2008-09)

Table 5 summarises key results from the recent Pakistan Household Integrated Economic Survey 2010-11 (HIES 2010), in which the sample population was divided into five quintiles. The 1st quintile corresponds to the poorest 20% of the population, while the 5th quintile corresponds to the most affluent 20% of the population. There is over three times difference in average monthly income between the 1st and 5th quintiles.

Table 5 - Household economic situation by quintiles

		Quintiles					
		Total	1st	2nd	3rd	4th	5th
Percentage Households		100	15.86	17.63	19.07	21.52	25.92
Average Monthly Income per Household in Rupees		21785	11386	14274	16841	20784	37728
Members per Household	Pakistan	6.38	8.05	7.24	6.70	5.93	4.92
	Balochistan	7.08	8.09	7.65	7.19	6.55	5.64
	Khyber Pakhtunkhwa	7.17	9.33	8.08	7.42	6.50	5.09
	Punjab	6.16	7.66	6.89	6.39	5.69	5.05
	Sindh	6.39	8.43	7.43	6.90	6.13	4.50
End of Month Household Budgetary Position in Rupees Deficit (-) Surplus (+)	Pakistan	1955.9	258.52	435.89	661.67	1444.70	5405.07
	Balochistan	752.88	-100.24	169.45	1103.05	884.79	1855.53
	Khyber Pakhtunkhwa	1357.67	544.16	563.48	992.99	482.73	4130.98
	Punjab	3060.07	825.89	804.42	1292.04	2253.15	7610.56
	Sindh	-266.70	-1376.44	-455.46	-1155.09	-40.39	883.08
Average Monthly Per Capita Expenditure Housing and Rent in Rupees (includes water and conservancy charges)	Pakistan	421.96	121.6	186.71	259.95	381.28	1160.41
	Balochistan	274.81	136.3	183.89	247.38	340.48	647.61
	Khyber Pakhtunkhwa	273.34	90.9	139.35	192.94	299.32	826.88
	Punjab	405.39	122.54	192.29	262.18	370.88	994.6
	Sindh	582.09	134.56	208.53	300.18	466.68	1815.87

(Source: Computation from Household Integrated Economic Survey 2010-11. Pakistan Bureau of Statistics, Government of Pakistan)

Urbanisation

With an increasing population, Pakistan is the fifth most populous country in the world and second largest in South Asia. Pakistan's urbanisation is expected to reach over 50% by 2025. However, actual urbanisation is probably much higher since the definitions used in Pakistan are administrative rather than density based. By employing an amended definition, estimates of actual urbanisation at present place 50% in cities.

While increasing urbanisation is considered useful for economic growth in Pakistan, where cities produce up to 80% of GDP, rising urban poverty, quantitative shortage, inequitable coverage and poor quality of service delivery lead to further degradation of the urban environment. Nine of the top fifteen cities with populations of more than 1 million in 2030 are located in Punjab (**Table 6**).

Table 6 - Growing population in cities

City with more than 1 million population	Population 2030 ('000)
Karachi	27993
Lahore	14626
Faisalabad	6192
Rawalpindi	4149
Multan	3025
Hyderabad	3005
Gujranwala	3143
Peshawar	2778
Islamabad	3175
Quetta	2038
Sargodha	1074
Bahawalpur	1903
Sialkot	1087
Larkana	1174
Sheikhupura	1019

(Source: Pakistan: Framework for Economic Growth, 2011. Planning Commission, Government of Pakistan)

Underground sewerage systems have been developed and do exist in the provincial capital and intermediate cities. However, with the rapid pace of urbanisation since the 1970s, the sewerage systems have not been able to expand their coverage or cope with the increasing demand at the same pace. Furthermore, sewerage continues to drain from underground sewers to open drains that find their way to the natural drainage system and water bodies[29].

[29] Arif Hasan and Faisal S Khan. Urbanization in Pakistan – A synthesis and policy option study for urban programming. Oxfam 2014

The situation in small towns is even more challenging as most of them do not have an underground sewage system. They rely mostly on open drains, which dispose into nearby fields as raw sewage is valued by farmers for use in agriculture. In other instances, the open drains dispose into depressions or ponds. Sewage disposal becomes complicated when the owner of the land with the depression or pond decides to claim it for his own use.

Open drains and raw and untreated sewage pose serious health and environmental hazards in Punjab today. Furthermore, most of the industrial wastewater flows untreated and mixes with the sewerage systems further polluting adjacent areas and underground reservoirs with hazardous chemicals.

Solid waste management (SWM) is one of the rapidly growing challenges facing urbanisation. Recent estimates suggest that there is no garbage collection system in about 36% of urban areas and 93% of rural areas in Punjab[30]. Municipal services provide about 45% coverage of garbage collection in urban areas and only 1% in rural areas.

An area of rising concern is the inadequate and unsafe disposal of hospital waste. The common finding is either of no hospital waste management system or where it does exit, incineration technology is the main mode, which has its own hazards since it produces ash and emits acidic and toxic gases. There is need for introducing non-burning technologies for safe hospital waste disposal.

[30] Pakistan Social and Living Standards Measurement Survey 2011-12. Pakistan Bureau of Statistics, Government of Pakistan

SECTOR OVERVIEW

Demographics

Punjab is the most populous province of Pakistan with approximately 55.6% of the country's total population. The population of Punjab increased from 20 million in 1951, to 73 million in 1998, and 94 million in 2011 and is expected to reach 101 million in 2015. The population growth rate in 1998 was 2.64%, which decreased to 1.9% in 2011. At the present growth rate of the population, Punjab is expected to double after 36 years. It is estimated that the population growth rate will reach 1.63% by 2030 with a population of 130 million, and by 2050 the population will have increased to 181 million. Rapid urbanisation and a growing population will continue to increase demands for sector and sub-sector services.

Institutions

At provincial level, the two main departments responsible for water and sanitation are Housing, Urban Development and Public Health Engineering Department (HUD&PHED) and Local Government and Community Development Department (LG&CDD). City District Governments are responsible for carrying out water and sanitation functions through Water and Sanitation Agencies (WASAs) and Solid Waste Management Companies. Town/Tehsil Municipal Administrations (TMAs) take care of both rural and urban water and sanitation in their respective tehsils. Coordination mechanisms between these two departments is improving gradually although there is still much that needs to be done to bring it to an optimal level. Several national and international partners collaborate with the Government and include UNICEF, WSP, WaterAid, WSSCC, Plan International, RSPN, UN-HABITAT and IRSP etc.

With regards to governance of water and sanitation, the institutional structure is as follows:

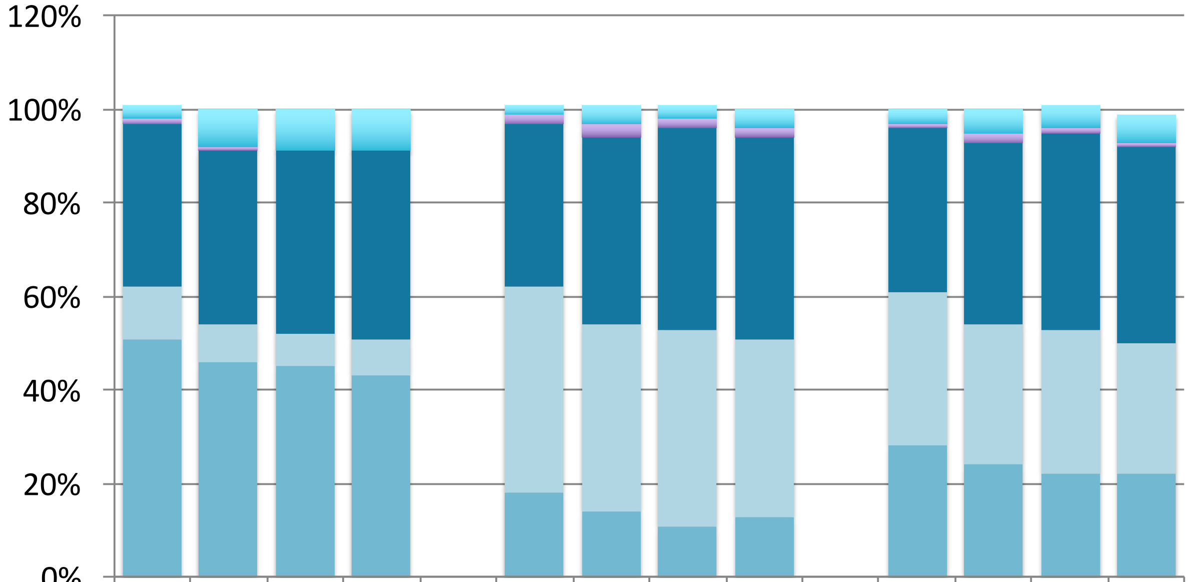
- At the provincial level - Housing, Urban Development and Public Health Engineering Department (HUD&PHED) and Local Government and Community Development Department (LG&CDD)
- Local governments – Water and Sanitation Agencies (WASAs) are responsible for 5 big cities
- All other areas – Town/Tehsil Municipal Administration (TMAs) are responsible
- Rural Water Supply Schemes – planned, designed and executed by PHED while operation and maintenance (O&M) is the responsibility of TMAs and Community Based Organisations (CBOs)

Drinking Water

Overall in Punjab, 22% of households are using tap water as the main source of drinking water in 2012-13 as compared to 24% in 2010-11, followed by motor pump with 42% in 2012-13 as compared to 39% in 2010-11 and hand pump with 28% in 2012-13 as compared to 30% in 2010-

11[31]. The proportion of households using tap water as a main source of drinking water supply is higher in urban areas, 43% as compared to only 13% in rural areas. **Fig 2** illustrates that there is an increasing trend of motorised pumping being used as a main source of drinking water supply.

Figure 2 - Main source of drinking water trends 2007-08 to 2012-13 in Punjab



	07-08 Urban	10-11 Urban	11-12 Urban	12-13 Urban		07-08 Rural	10-11 Rural	11-12 Rural	12-13 Rural		07-08 Overall	10-11 Overall	11-12 Overall	12-13 Overall
Others	3%	8%	9%	9%		2%	4%	3%	4%		3%	5%	5%	6%
Dug Well	1%	1%	0%	0%		2%	3%	2%	2%		1%	2%	1%	1%
Motor Pump	35%	37%	39%	40%		35%	40%	43%	43%		35%	39%	42%	42%
Hand Pump	11%	8%	7%	8%		44%	40%	42%	38%		33%	30%	31%	28%
Tap Water	51%	46%	45%	43%		18%	14%	11%	13%		28%	24%	22%	22%

(Source: Pakistan Social and Living Standards Measurement Surveys 2007-08, 2010-11, 2011-12 and 2012-13)

While comparing districts, 74% of households in Lahore use tap water (with 85% in urban areas) as the main source of drinking water, followed by Rawalpindi with 47% and Bahawalnagar with 42%. On the other hand, Hafizabad is the bottom ranked district with only 2% households with tap water, followed by Khanewal and Muzaffargarh with 3% each.

The main source of drinking water supply in rural areas is motor pump in 43% followed by hand pump in 38%. Tap water accounts for only 13% as the main the main source for drinking water supply in rural areas.

The recently conducted Multiple Indicator Cluster Survey 2011 in Punjab[32] reveals that overall only 12.4% of households have tap water piped into dwelling. The total access to piped water (piped into dwelling; piped into compound, yard or plot; piped to neighbour; public tap or standpipe; tube well) accounts for 18.6%, while hand pump is 33.6% and motorised pump is 40.7%. Overall, 94.1% of the population is using an improved source of drinking water (piped into dwelling; piped

[31] Pakistan Social and Living Standards Measurement Survey 2012-2013. Pakistan Bureau of Statistics, Government of Pakistan

[32] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

into compound, yard or plot; piped to neighbour; public tap or standpipe; tube well; hand pump with tap; motorised pump; protected well; protected spring; bottled mineral water).

Both surveys do not address the issue of quality of drinking water, which is an area of critical concern.

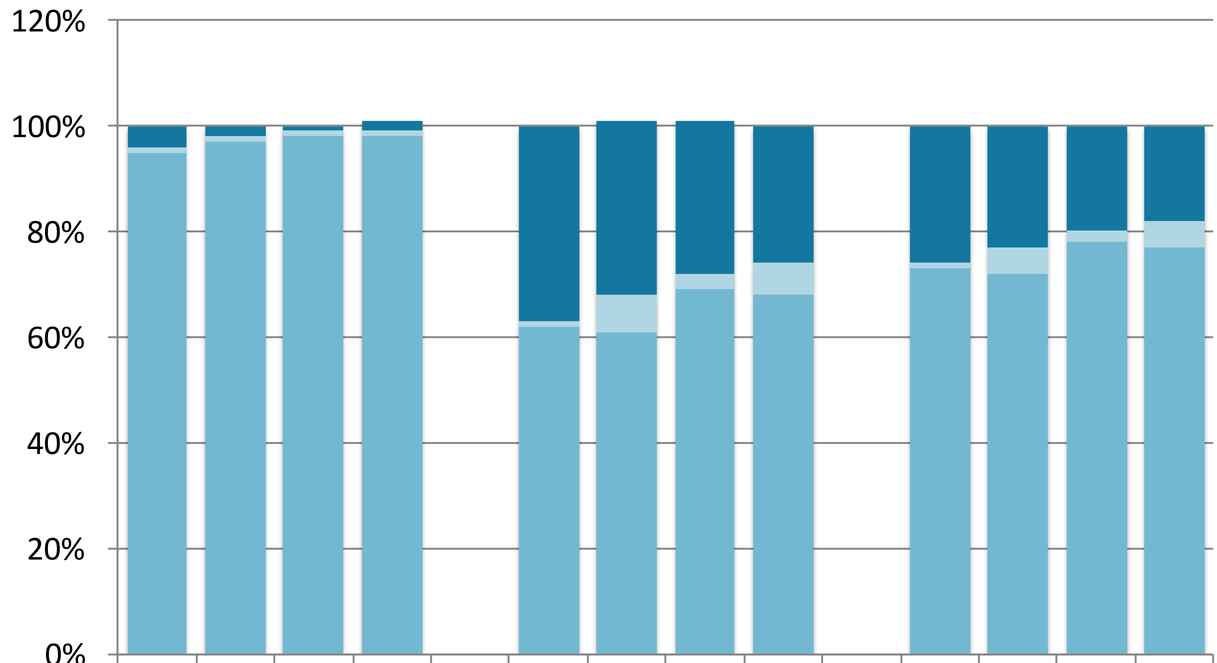
The majority of households (93.8%) do not use any water treatment method, and the commonest method used was boiling in 3.9%. Filtered water was used as a method mostly in the highest wealth quintiles in 7.9%. Most households (87.7%) had water on the premises, while in 2% of households it took 30 minutes or more to fetch water.

Sanitation

In Punjab[33], about 77% households have flush toilet, with 98% in urban and 66% in rural areas. About 5% of households have non-flush toilet facilities, while 18% of households reported no toilet. In rural areas, 26% households reported having no toilet compared to 2% in urban areas.

With regards to districts, Jhang had the highest proportion of households with no toilet (45%), followed by DG Khan and Rajanpur with 43% each and Chiniot with 41%.

Figure 3 - Sanitation trends 2007-08 to 2012-13 in Punjab



	07-08 Urban	10-11 Urban	11-12 Urban	12-13 Urban		07-08 Rural	10-11 Rural	11-12 Rural	12-13 Rural		07-08 Overall	10-11 Overall	11-12 Overall	12-13 Overall
No Toilet	4%	2%	1%	2%		37%	33%	29%	26%		26%	23%	20%	18%
Non Flush	1%	1%	1%	1%		1%	7%	3%	6%		1%	5%	2%	5%
Flush	95%	97%	98%	98%		62%	61%	69%	68%		73%	72%	78%	77%

(Source: Pakistan Social and Living Standards Measurement Surveys 2007-08, 2010-11, 2011-12 and 2012-13)

[33] Pakistan Social and Living Standards Measurement Survey 2012-2013. Pakistan Bureau of Statistics, Government of Pakistan

Fig 3 illustrates a rising trend of use of flush toilet in both urban and rural areas. Furthermore, there has been an almost 19% reduction in 'No toilet' category in rural areas and 30% reduction overall in Punjab in the last five years.

The MICS 2011 survey[34] provided more detailed information. It categorised sanitation facilities into the following options as shown in **Table 7** below.

Table 7 - Status of Sanitation in Punjab

Improved Sanitation	%	Unimproved Sanitation	%
Flush to piped sewer system	20	Flush to somewhere else	3.9
Flush to septic tank	42.3	Pit latrine without slab/Open pit	0.2
Flush to pit latrine	8.3	Bucket	0.1
Flush to unknown place/not sure	0.1	Other	0.8
Ventilated Improved Pit Latrine (VIP)	0.6	Missing	0.2
Pit latrine with slab	0.7	Open Defecation (no facility, bush, field)	22.8
Composting toilet	0.1		0
Total	**72.1**	**Total**	**28**

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Overall, about 72.1% households had improved sanitation, and a little over a fifth (22.8%) of households were practicing open defecation. Households with flush latrine improved sanitation accounted for 70.7%.

No toilet facilities were most commonly found in rural areas (31.8%), where the education level of the head of household was primary or below (58.1%), and mostly in the lowest wealth index quintile (82%).

The districts in DG Khan division had very high no toilet facility rates with DG Khan at 50.3%, Layyah at 39%, Muzaffargarh at 51.2% and Rajanpur with the highest at 61.8%. This was followed by two districts in Faisalabad division – Chiniot at 48.4% and Jhang at 44.2%.

Overall, 58.4% of households had improved drinking water sources and improved sanitation, with 52.1% in rural areas and 73.5% in urban areas. The least rates were found in the lowest wealth index quintiles (10.7%) and DG Khan division (33.7%).

Most households (96.5%) had a place for hand washing, while in 76.8% both water and soap were available.

[34] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

LEGISLATION AND POLICIES

The key legislations and policies and their salient features that relate to water and sanitation are presented below.

Pakistan EPA Act 1997

The Pakistan Environmental Protection Act 1997 was enacted on December 3, 1997. Some of its salient features are as follows:

Pakistan Environmental Protection Council

Apart from ensuring environmental protection, the council is authorised to:

1. Approve comprehensive national environmental policies and ensure their implementation within the framework of a national conservation strategy as may be approved by the Federal Government from time to time
2. Provide guidelines for the protection and conservation of species, habitats, and Biodiversity in general, and for the conservation of renewable and non-renewable resources
3. Consider the National Environment Report and give appropriate directions thereon

The Council may, either itself or on the request of any person or organisation, direct the Federal Agency or any Government Agency to prepare, submit, promote or implement projects for the protection, conservation, rehabilitation and improvement of the environment, the prevention and control of pollution, and the sustainable development of resources, or to undertake research in any specified aspect of environment.

Pakistan Environmental Protection Agency

Among its major activities, the agency is also responsible for:

1. Prepare, in coordination with the appropriate Government Agency and in consultation with the concerned sectoral Advisory Committees, national environmental policies for approval by the Council
2. Prepare and publish an annual National Environment Report on the state of the environment;
3. Prepare or revise, and establish the National Environmental Quality Standards (NEQS) with approval of the Council
4. Ensure enforcement of the National Environmental Quality Standards
5. Establishing standards for the quality of the ambient air, water and land, by notification in the official Gazette, in consultation with the Provincial Agency concerned
6. Establish systems and procedures for surveys, surveillance, monitoring, measurement, examination, investigation, research, inspection and audit to prevent and control pollution, and to estimate the costs of cleaning up pollution and rehabilitating the environment in various sectors

Prohibition of Certain Discharges or Emissions

Subject to the provisions of this Act and the rules and regulations made there under, no person shall discharge or emit or allow the discharge or emission of any effluent or waste or air pollutant or noise in an amount, concentration or level which is in excess of the National Environmental Quality Standards or, where applicable.

No person shall import hazardous waste into Pakistan and its territorial waters, Exclusive Economic Zone and historic waters.

Initial Environmental Examination and Environmental Impact Assessment

No proponent of a project shall commence construction or operation unless he has filed with the Federal Agency an initial environmental examination or, where the project is likely to cause an adverse environmental effect, an Environmental Impact Assessment (EIA), and has obtained from the Federal Agency approval in respect thereof.

Environmental Protection Order

Where the Federal Agency or a Provincial Agency is satisfied that the discharge or emission of any effluent, waste, air pollutant or noise, or the disposal of waste, or the handling of hazardous substances, or any other act or omission is likely to occur, or is occurring or has occurred in violation of the provisions of this Act, rules or regulations or of the conditions of a license, and is likely to cause, or is causing or has caused an adverse environmental effect, the Federal Agency or, as the case may be, the Provincial Agency may, after giving the person responsible for such discharge, emission, disposal, handling, act or omission an opportunity of being heard, by order direct such person to take such measures that the Federal Agency or Provincial Agency may consider necessary within such period as may be specified in the order.

In particular, and without prejudice to the generality of the foregoing power, such measures may include:

1. Immediate to stoppage, preventing, lessening or controlling the discharge, emission, disposal, handling, act or omission, or to minimise or remedy the adverse environmental effect
2. Installation, replacement or alteration of any equipment or thing to eliminate or control or abate on a permanent or temporary basis, such discharge, emission, disposal, handling, act or Commission
3. Action to remove or otherwise dispose of the effluent, waste, air pollutant, noise, or hazardous substances
4. Action to restore the environment to the condition existing prior to such discharge, disposal, handling, act or omission, or as close to such condition as may be reasonable in the circumstances, to the satisfaction of the Federal Agency or Provincial Agency

Further sections lay out the penalties applied to the various stakeholders in case of non compliance with the Act.

Punjab Local Government Act 2013

The main legislation at present that governs drinking water and sanitation is the Punjab Local Government Act 2013.

Responsibilities and functions of the Union Council

A Union Council shall:

- provide for rural water supply schemes and public sources of drinking water, including wells, water pumps, tanks, ponds and other works for the supply of water and open drains
- coordinate with the community organisations for proper maintenance of rural water supply schemes in the prescribed manner

Responsibilities and functions of District Council

A District Council shall:

- assist Union Councils in provision and maintenance of rural water supply schemes and public sources of drinking water, including wells, water pumps, tanks, ponds and other works for the supply of water

Responsibilities and functions of Municipal Committees

A Municipal Committee shall:

- provide, manage, operate, maintain and improve the municipal infrastructure and services, including -
    - water supply and control and development of water sources
    - sewage and sewage treatment and disposal
    - storm water drainage
    - sanitation and solid waste collection and sanitary disposal of solid, liquid, industrial and hospital wastes

Functions and responsibilities of Metropolitan and Municipal Corporations

A Metropolitan and Municipal Corporation shall:

- develop integrated system of water reservoirs, water sources, treatment plants, drainage, liquid and solid waste disposal, sanitation and other municipal services
- provide, manage, operate, maintain and improve the municipal infrastructure and services, including -
    - water supply and control and development of water sources
    - sewage and sewage treatment and disposal
    - storm water drainage
    - sanitation and solid waste collection and sanitary disposal of solid, liquid, industrial and hospital wastes, treatment and disposal including landfill site and recycling plants

- environmental control, including control of air, water and soil pollution in accordance with Federal and Provincial laws and standards

Water Supply
- A local government shall provide or cause to be provided to its local area a supply of wholesome water sufficient for public and private purposes
- Where a piped water supply is provided, the local government shall supply water to private and public premises in such manner and on payment of such charges as the byelaws may provide

Private source of water supply
- All private sources of water supply within the local area of the local government shall be subject to control, regulation and inspection by the local government

Draft Punjab Municipal Water Act

This categorises water into potable domestic for drinking, non-potable domestic, institutional, commercial, industrial, amenity, and environmental remediation use.

It proposes setting and notification of standards of water quality, and requires that when prescribing standards, consideration be given to:

- The need for everyone to have a reasonable quality of life
- The need for equitable access to municipal water services
- The operational efficiency and economic viability of municipal water services
- Any norms and standards for applicable tariffs for municipal water services
- Any other laws or any standards set by other governmental or federal government agencies
- Any guidelines and standards prescribed under the Punjab Environmental Protection Act 2012
- Any impact which the municipal water supply services might have on the environment; and
- The obligations of the Provincial Government as custodian of water resources

The draft Act has proposed the establishment of a regulatory authority called the Water Commission. Upon establishment of the Commission, the responsibility for regulating the conservation, protection, utilisation, exploitation, development, of water resources and the regulation of all municipal water services, including quality assurance of water, water services and tariff shall vest with the Commission.

The Commission shall perform the following functions:

- Safeguard the interest of the public through effective regulation and enforcement
- Regulate the exploitation and maintenance of all sources of municipal water
- Maintain a comprehensive database of all sources of municipal water
- Maintain a comprehensive database of all the bulk and retail service providers in the province

- Notification of standards of municipal water quality and quality of services delivered for all municipal purposes
- Notification of standards and norms for maintaining the quality of municipal water taken from or discharged into any water body
- Notification of standards for wastewater treatment /recycling
- Notification of regulation, standards for underground water injection control (UWIC) programs to protect underground sources of drinking water
- Notification of regulation of water supply emergency and declaration
- Describe the serving range of community water system for drinking water security, more than that require to conduct an assessment of the system's vulnerability to terrorist attacks or other intend to disrupt the safe and reliable drinking water supply
- Suggesting and notifying the measures and means for the effective and sustainable use of water resources for municipal water supply services
- Advise the Government on the regulations and methodologies for improving the nature, operation, sustainability, operational efficiency and economic viability of municipal water services
- Describe the requirements for persons who may install and operate water services works and provide assistance and coordinate with the water utilities and municipal water users for developing and improving the appropriation, usage and disposal of municipal water
- Present an annual report to the Government regarding the overall management and administration of municipal water, including monitoring reports and recommendations on measures to be taken by the Government to enhance the quality or quantity of available municipal water
- Develop, promote and support training and professional development of officials and other persons engaged in provision or regulation of municipal water supply and sanitation services
- Carry out research and development, by itself or in collaboration with the specialised institutions of research & higher education, either in the public sector or in the private sector; aimed at conserving, improving and extending the water sources and municipal water services in the province
- Advise the Government on all policy and planning matters related to municipal water
- Monitor the response of the municipal water service providers to the complaints from the consumers
- Monitor the agreement of the municipal water service providers with the consumers
- Prescribe the standard and norm of the response time for the municipal water service providers to handle the complaints
- To maintain a public register all kind of Water and Sewerage Services Providers such as Government and private bodies or any other corporate body established under any law for the time being enforced

Water Services

Under water services, the draft Act further proposes the following:

1. **Water & Sanitation Master Plan:** Every local government must, within three years after the commencement of this Act;

    (a) As part of the city or regional master plan; or
    (b) Separately, if no process for city or regional master plan has been initiated, prepare
        (i) A draft water & sanitation master plan for its area of jurisdiction: and
        (ii) A summary of that plan
    (c) The contents of the master plan and summary shall be in accordance with the rules
    (d) The draft plan shall be circulated and approved by the council
    (e) The master plan shall be published on the website as well as printed and shall be made available to the consumers at a reasonable cost
    (f) The summary of the plan shall be printed in sufficient numbers and shall be distributed free of cost to all the consumers or potential consumers

2. **Deviation from the Master Plan:** No substantial deviation from the master plan is valid unless it is embodied in a new master plan adopted in accordance with the procedure set out in the rules.

3. **Reporting on Implementation of Local Government Plans:**
    (1) A local government must report on the implementation of its plans in such manner and form as may be prescribed during each financial year
    (2) The report must be:
        (a) Made within four months after the end of each financial year, and
        (b) Submitted to the Commission and the Department of Local Government
    (3) The local government must publicise a summary of its report
    (4) A copy of the report and of its summary must be available at the offices of the local government for inspection upon payment of such fee as may be prescribed

Pakistan Water Sector Strategy, 2002

The National Water Policy was one of the initiatives taken by the Government of Pakistan at the beginning of the current millennium for the development of water sector in the country. The Pakistan Water Sector Strategy 2002 provided the road map for implementing the policy framed for development of the water sector. The Strategy comprises three independent documents as under:

1. The 'National Water Sector Profile' which summarises and details all aspects of water availability and utilisation as they exist. As such it will become a standard source document for all future work in water sector
2. The 'National Water Sector Strategy', which identifies the key issues and objectives for the water sector and proposals for planning, development and management of water resources and their use in all water sub-sectors

3. The ‘Medium Term Investment Plan’ which identifies the key programmes and projects which should be undertaken up to 2011 as the initial contribution to achieve the objectives of the strategy

As in the case of the National Water Policy, the Water Sector Strategy is also mainly focused on irrigation, which is the predominant user of water. However domestic water supply having the first priority in any water allocation the Strategy has given due importance to this sub-sector in its discussions.

The following key factors have been identified by the Strategy as the driving force for development of water resources in the country:

1. Population growth
2. Increasing agricultural demands
3. Domestic water supply needs
4. Dwindling water resources; and
5. Cross cutting issues

Linking the discussion on water resources and domestic water supply is the factor of additional demand of water for domestic needs by 2025. This would result in a shortfall of 11.3 million acre feet of water per annum available for irrigation if additional water resources are not developed.

Water conservation is a key component of the strategy. Most of the water saving will have to come from the irrigation sub-sector because it is by far the largest user of water.

Water quality has been identified as one of the main issues in water sector in Pakistan and its improvement a key component of the strategy. Poor water quality affects all sub-sectors as well as the quality of life of the people. Pollution of water sources is caused mainly by municipal and industrial waste water disposal and disposal of saline and chemically polluted agricultural runoff. Attacking this problem will require the cooperation of several agencies including municipal service providers and industrial sector.

Institutional and management issues also cut across the whole of the water sector. The lack of financial sustainability in water service delivery, caused by low levels of water tariff and their collection, has led to a strain on governmental resources and deteriorating infrastructure in domestic as well as irrigation sub-sectors. Failure to improve this will result in continued deterioration and poor service delivery.

The water sector strategy lays out a road map to guide the management and development of water sector and service delivery in water industry.

The Strategy divides the primary issues in the water sector into three categories viz. Institutional and Management issues, Social and Financial Issues and Technical Issues.

The Institutional and Management issues include- inadequate coordination between various organisations of various sub-sector of water; Absence of an inter-ministerial, inter-provincial body to oversee water sector planning, management and development; changing administration under the devolution plan and uncertainty in technical capacity during transition, particularly in domestic water supply and sanitation sub-sectors; and need for improvement of water sector infrastructure and activities.

Social and Financial Issues include: Limited availability of funds for the water sector; lack of financial sustainability in water sector services due to low level of public sector funds for O&M and insufficient cost recovery; limited private sector investment or participation; and inadequate public awareness of water sector issues.

Technical Issues include: Increasing demand for water; inefficient use of water; inadequate domestic water supply and sanitation coverage and quality of service; deteriorating water quality; and deteriorating infrastructure.

The key elements of the strategy for the water sector comprise water conservation, stakeholder participation in management, improving public awareness and understanding of issues, a good quality MIS for water, improving cooperation and coordination amongst various agencies in the water sector, ensuring long terms financial sustainability of infrastructure and services through reasonable cost recovery, improvement of water quality, and involvement of the private sector.

The details of the strategy relating to domestic water supply and sanitation sub-sectors are as follows.

Overall Objectives

The main objectives of the strategy are to:

1. Increase coverage of clean water supply for urban population to 96%
2. Increase coverage of functional sanitation for urban population to 80%
3. Achieve full compliance with EPA standards for drinking water
4. Achieve full compliance with EPA standards for Waste water disposal
5. Develop a water quality Information Management System

Financial Objectives

Achieve financial sustainability in all water sector developments through:

1. Appropriate levels of cost recovery to make operating agencies financially viable
2. Appropriate tariffs to ensure provision of adequate services to all users, including poor and disadvantaged
3. Urban wastewater charges based on cost recovery and "polluter to pay‟ principle
4. Private sector participation in appropriate areas of water management

Water Quality Objectives

Water quality objectives based on:

1. Establishing and maintaining water quality standards for potable water
2. Ensuring that wastewater effluent is treated before disposal
3. Preservation of surface and groundwater resource to ensure sustainability of supply

Management Measures

1. Establishing a Coordinating and Support body on a country-wide basis for urban water supply and sanitation sub-sector
2. Developing a strategy and medium and long-term plan including tariff levels, improved collection methods, demand management measures, participation by the private sector, and infrastructure improvement and expansion
3. Formulating appropriate institutional arrangements for smaller cities and towns in the light of Devolution Plan

Technical Measures

1. Renew the existing operational assets to address the maintenance backlog
2. Expand water supply and sanitation networks to increase coverage to the stated targets
3. Develop additional surface and groundwater resources to meet growth in demand
4. Construct new sewage disposal networks in line with EPA‟s effluent disposal regulations

National Drinking Water Policy, 2009

The policy provides a framework to the federal government, provincial governments, AJK, FATA, local governments and development authorities to address the issues and challenges facing Pakistan in terms of access to safe drinking water.

The goal of the policy is to provide clean and safe drinking water to improve the quality of life of people through decreased death and illness caused by water borne diseases at an affordable cost and in an equitable, efficient and sustainable manner by 2020. The key principles of the policy include:

1. Providing access to safe drinking water to every citizen of Pakistan by developing new and water supply systems in urban and rural areas especially the neglected areas by using improved technology and standardisation
2. Allocate water for domestic purposes such as drinking, hygiene, sanitation etc. on priority basis
3. Take measures to protect and conserve the surface and groundwater resources by developing ambient water quality standards, rain water harvesting, community management of local resources, recycling of water, etc.
4. Using water treatment systems and methods to ensure provision of safe drinking water
5. Involving communities especially women and children in planning, implementation, monitoring, and operation and maintenance of water supply systems
6. Creating public awareness through intensive information, education and communication campaigns to promote water safety and conservation, and sage hygienic practices
7. Carry out capacity development efforts to streamline and upgrade the roles and responsibilities of various agencies concerned with the water sector at the provincial and federal levels
8. Promote public private partnerships for enhancing access to safe water, O & M of water supply systems, resource mobilisation and capacity development
9. Carry out continuous research and development initiatives to develop new approaches and innovative ideas

National Sanitation Policy, 2006

The policy provides broad framework and guidelines to all governments to enhance and support sanitation coverage in the country through the formulation of sanitation strategies, plans and programmes for improving the quality of life of people and a providing a healthy work environment.

The overall sanitation and sewerage coverage in Pakistan is very low. The urban areas fare slightly better than the rural areas. Yet data on the occurrence of cases of diarrhoea suggests that people suffer repeated and continuous exposure to polluted water. Almost 40% of all reported diseases and 30% of all deaths in the country are attributable to faecal contamination of water due to mixing up of water supply and sewerage lines.

The provision of water supply and sanitation facilities in rural areas has considerably increased in the past few years. Apart from reducing health problems this has also considerably improved the financial and economic condition of the poor. There is marked improvement in infant mortality rates due to supply of safer water. There is noticeable reduction in diseases like diarrhoea, typhoid and cholera due to successful implementation of rural water supply and sanitation schemes in Khyber Pakhtunkhwa, Punjab and Sindh. However, the coverage is still low and concerted efforts are needed throughout the country to continue improvement in coverage as well as quality of water supply and sanitation in the rural areas to promote health and hygiene.

The policy primarily focuses on the following activities/premises:

1. Safe disposal of excreta by using sanitary latrines, creating an open defecation free environment, industrial and agricultural wastes, safe disposal of liquid and solid wastes, and promotion of health and hygienic practices in the country
2. Develop and utilise sewage and water treatment facilities for domestic and industrial use
3. Promote the concept of Community Led Total Sanitation
4. Develop an institutional and financial framework for the agencies concerned in this sector, along with capacity building initiatives
5. Carry out public awareness programmes
6. Using appropriate, low cost, easy and cost effective technology
7. Achieve sustainable development through the above initiatives
8. The sanitation initiatives will be financed by the government
9. For monitoring the industrial and municipal effluents, EPA will be the responsible body
10. Increasing numbers and access to public toilets
11. Promoting public private partnership
12. Safe disposal of hospital waste by following the Hospital Waste Management Rules 2005
13. Provision of incentives and rewards to tehsils/towns for the implementation of the sanitation policy

National Climate Change Policy, 2012

The Ministry of Climate Change launched Pakistan's new Climate Change Policy in 2012. Pakistan has been identified as one of the top 16 countries with a high climate change vulnerability index. Many sectors like water resources, agriculture and livestock, human health, forestry, biodiversity, ecosystems, are at great risk of being affected by climate change. The new policy recommends policy measures and proposes mitigation strategies in particular for energy, transport, town planning, industries, agriculture and livestock and forestry sectors.

While mitigation for water resources is a much broader area, beyond the scope of this review, introduction of climate change mitigation strategies in town planning particularly for water, sanitation and solid waste management is particularly pertinent. Three policy measures recommended, among others, that have a direct bearing on water supply, sanitation and solid waste are:

- Make installation of wastewater treatment plants an integral part of all sewerage schemes
- Ensure separate collection, disposal and re-use of recyclable, composite and biodegradable waste, preferably at source
- Introduce local rainwater harvesting measures

Hospital Waste Management Rules, 2005

Under these Rules, every hospital is responsible for proper management of waste generated by it till its final disposal in accordance with provisions given in these Rules. The Rules require each healthcare facility to constitute a waste management team, and to prepare and implement a waste management plan. The Rules also include guidelines for waste segregation, collection, transportation, storage, and disposal.

Punjab Urban Water and Sanitation Policy, 2007

The Punjab Urban Water and Sanitation Policy of the Government of the Punjab provides a framework to guide and support provincial institutions, District Governments, Tehsil Municipal Administrations, Water Utilities and communities for improving water and sanitation services. The policy is consistent with National Sanitation Policy 2006 and National Environment Policy 2005. The key policy principles are:

1. To provide sustainable water and sanitation for all and provide optimum quantity and acceptable quality of water and sanitation services on a sustainable basis

2. Provide a legal, regulatory framework and efficient institutional arrangements for sustainable water supply, sanitation and wastewater treatment services

3. Promote Public Private Partnership for revenue collection, metering, and water supply and sanitation (WSS) services

4. Encourage community participation initiatives through component sharing and decision making. Gender analysis to be used to assess levels of participation of men and women in the planning process

5. Encourage socially and environmentally sensitive investment in the sector. Through environmental and social impact assessment in order to design and implement appropriate mitigation measures and environmental management plans

6. Provide institutional capacity building by means of human resources development and the implementation of appropriate corporate institutional arrangements
7. Public awareness programs to develop an understanding of the importance of water and its conservation
8. Effective monitoring and evaluation of WSS projects and initiatives

The specific policy measures for implementation of the WSS initiatives revolve mainly around allocating property rights for surface and ground water to water users, develop a regulatory and institutional framework of the water utilities and facilitate and guide them towards long-term strategic interventions aimed at Strategic Urban Water Sector Planning and Management.

The policy measures are expected to be achieved by means of enforcing relevant Acts and Regulations, monitoring and impact assessment procedures, and employing socio economic instruments such as component sharing, performance based financing, user charges and subsidies. The implementation and monitoring will be carried out through specialised committees.

Punjab Drinking Water Policy

The policy has four policy targets:

1. Legislation

The Government of the Punjab, with the consensus of all stakeholders (provincial departments, elected representatives, and the civil society) will enact the Punjab Municipal Water Act. This Act would provide a statutory, independent, institutional setup that will regulate policy principles; standards and the performance of service delivery agencies in the light of this policy.

2. Institutional reforms in the Urban Water Service Providing Government Agencies

The Government will launch an institutional reform programme which will not only focus on improvement in service delivery but also address allied issues such as rationalisation of tariff, improvement in management of organisation and introduction of performance monitoring systems so as to ensure that the WASAs are transformed into a progressive; accountable and financially viable institution by the year 2016. By the year 2016, the WASAs would also ensure installation of consumer meters on 100% connections. The Government will adopt measures to promote various proven community participation approaches to ensure community involvement in various aspects of service delivery.

The Government of Punjab will invest in major wastewater treatment facilities in all the WASAs to ensure conservation of underground water aquifers as well as water bodies like rivers & canals. The reduction of non-revenue water and leakages which result in contamination of drinking water will be ensured by the year 2015.

3. Town / Tehsil Municipal Administrations

The Government of the Punjab invests in the Water & Sanitation infrastructure through the Public Health Engineering Department. It is, however, a common perception that the Town / Tehsil Municipal Administrations have serious capacity issues in operating & maintaining this infrastructure. The Government of the Punjab will take appropriate measures through legislation and administrative initiatives (with the help of private sector as well as donors) to ensure rationalisation of tariff and improvement of capacity in the TMAs.

4. Rural Water Supply Schemes

Less than 30% of Punjab's rural population is being served with piped and clean drinking water. Various studies indicate that water borne diseases are a major and growing cause of sickness in the rural population of the Province. Community Based Organisations are at present operating & maintaining more than 90% of the functional rural water supply schemes should be given administrative, technical and financial (in case of major repairs) support. The Government of Punjab will devise plans to provide training to rural Community Based Organisations through Local Governments and Public Health Engineering Departments.

To ensure that the planning process is geared toward maximising value creation for the public, the Drinking Water Policy emphasises adherence to the following cardinal principles:

- Technical and Operational feasibility, surveys and design
- Multi-year plans of districts
- Water Safety Plans, Operating plans, Service Improvement plans
- Setting of basic performance indicators for service providers
- Clarity of roles and responsibility during development cycle
- Economical, social, environmental and financial criteria

Draft Punjab Sanitation Policy

The key policy principles of the draft policy are shown below and apply to all population in rural and urban areas, and whether sanitation is for individual households or provided as a system for an entire community.

- Access to improved sanitation is a basic human right of the citizens of Punjab. An inclusive approach ensuring equitable distribution of resources shall be promoted on priority basis to address the sanitation coverage disparities in the Province, especially targeting excluded and marginalised areas (inter-district parity)
- An inter-sectoral approach would be used in designing and executing sanitation sector programs taking into account the challenge of protecting the environment and responding to climate change. Sanitation programs shall be integrated with those of water, environment, health and education sectors with a view to identifying and capturing synergies
- Undertake mapping/documentation and analysis of existing infrastructure to avoid duplication of services and to build it as a tool for planning of sanitation services
- Mobilise provincial and local resources especially tapping community investment to generate self-sustained development. The reliance on donor loans should be minimised and only should be taken in dire need. Support separate budget lines for sanitation to monitor finances
- Modify technical and engineering standards to make them affordable for the community. Technological solutions that are not only cost effective but also consistent with cultural

sensitivities of specific communities would be identified and steps would be taken to encourage prototyping and marketing of those solutions

- Institutionalise component sharing model in which community is responsible to construct lane and neighbourhood level sewers (internal development) on self-help basis and government focus on trunks, disposal and treatment unit (external development)
- Build capacity of local governments in technical and managerial aspects like mapping/documentation, technical designs, city level planning, social mobilisation for community involvement and monitoring & evaluation. Existing good practices can be used as training centres for the local government
- Existing roles of provincial departments i.e. HUD&PHED, LG&CDD, Environment Department, Health, Education, Social Welfare etc. would be re-examined in the light of this policy. Coordination amongst them would be increased to build an integrated approach to deal with sanitation
- Performance benchmarking would be gradually introduced and institutionalised
- Efforts will be made to gradually reach a stage where the O&M cost is recovered from the beneficiaries. Over all maintenance components would be defined for responsibility of community and government
- Steps will be taken to promote public-private partnership specially to strengthen the supply side of the sanitation market
- Good hygiene practices, i.e. hand washing with soap at critical times, use of latrine, safe water storage, food hygiene and good solid and liquid waste management should be promoted through implementation of appropriate awareness campaigns; and
- An independent monitoring & evaluation system will be established and maintained to track progress under the sanitation agenda and also to operationalize incentives envisaged in this policy

Pakistan Approaches to Total Sanitation, 2010

Pakistan Approaches to Total Sanitation (PATS) developed under the leadership of Climate Change Division of the Cabinet Secretariat, (former Ministry of Environment) has been successfully rolled out in Pakistan with the support of Provincial Governments, UNICEF and civil society partners. PATS underpins an Integrated Total Sanitation approach that seeks for sanitation demand creation, sustaining the demand through supply side interventions, promoting participatory hygiene, attaining 100% adequate drainage and wastewater treatments, linkages development with duty bearers and knowledge management and accountability. PATS extends an active social mobilisation strategy by building a cadre of human resources who inspire and empower the communities to construct technically sound and viable latrines which are connected to a secure disposal system and achieve total sanitation status, sustainably adopt hygiene practices and continuously use improved sanitation facilities.

PATS calls for a humanitarian-development nexus in sanitation programmes and includes sanitation marketing strategies to achieve total sanitation in an urban or rural human settlement. Large scale sanitation programmes following PATS approach have been implemented by sanitation sector partners in the aftermath of 2010 floods, which affected the whole country. Evaluation of these programmes and subsequent sanitation programmes in response to floods in 2011 and 2012 has helped refinement of programme design under PATS, especially in harmonising humanitarian-development interventions. It is estimated that more than 8 million people have achieved 'Open Defecation Free' (ODF) status as a result of at scale programmes under PATS since its launch in March 2011. Another achievement of PATS approach is that all sanitation sector partners have adopted it and sanitation programmes implemented under this approach at scale are being adopted by the government in terms of funding and implementation.

Community Led Total Sanitation

Community Led Total Sanitation (CLTS) methodology is an entry point to achieve "total sanitation" and not total sanitation in itself. CLTS is an effective approach for triggering action to change defecation behaviours at the community level and to create demand for improved sanitation facilities. Sanitation, as a whole is an entry point for greater social change and community mobilisation. The steps identified under CLTS include:

Pre-triggering: selecting community and developing a better-defined sense of community.

Triggering: educating the community regarding the consequences of living in a faecally contaminated environment until they come to the realisation that they are eating, washing in, and drinking each other's faeces. Some of the triggering activities include defecation area transect, mapping of defecation areas, calculations of faeces and medical expenses, triggering disgust and ignition. The "ignition" captures the moment when the community becomes mobilised to take collective action to stop the ingestion of each other's faeces and improve their poor sanitation.

Post-triggering: Once communities typically pledge to improve their sanitation by either becoming open-defecation free or by adopting improved sanitation technologies, there is a danger that these pledges do not come to fruition without follow-up work. Follow-up activities include immediate follow-up and encouragement, community action follow-up i.e. engaging with communities to agree furthering action plans to achieve other sanitation outcomes including external systems, participatory monitoring and indicators setting, verifying and certifying Open Defecation Free (ODF) status, celebrations and the monitoring and sustaining of ODF status.

School Led Total Sanitation

A significant component of PATS is School Led Total Sanitation (SLTS). The SLTS approach is used for promotion of good health practices where children largely helped in changing perceptions at community level. The usage of a forum like the teacher-student WASH club proves highly successful in imparting hygiene communication messages at scale. Additional enabling factors such as training programmes for schoolteachers, capacity building and awareness raising of village based development organisations, coordination and support for the district level government education department play significant roles in the programme's success. SLTS is being used as an opening intervention in PATS programme at scale in transition from humanitarian to development as it provides an opportunity to mobilise the disaster affected communities with dignity, pride and self-respect.

Solid Waste Management

Several legal rules and institutional framework deal with solid waste management in the country. These include Pakistan Environmental Protection Act (PEPA) 1997, the National Environmental Quality Standards (NEQS), Hazardous Substances Rules of 1999, Guidelines for Hospital Waste Management 1998, Hospital Waste Management Rules 2005, Hazardous Substances Rules 2003, and several other regulations, rules and standards.

Several legislations, regulations and rules are applicable to Solid Waste Management (SWM). These are summarised in **Table 8**.

Table 8 - Summary of legislation and regulations relating to solid waste management

Name of Regulation	Year	Major issues related to SWM
International Legislation		
Basel Convention on the Control of Transboundary movements of hazardous waste and their disposal	1994	○ Transboundary movement and management of hazardous and other wastes. ○ Hazardous and other waste ○ Control system
Federal Legislation		
The Factories Act	1935	○ Regulations on labour in factories ○ Disposal of waste and effluents has to be arranged
Pakistan Penal Code	1960	○ Penal Law ○ Handling and negligent conduct with respect to poisonous, toxic and hazardous waste is an offence. The code is to be monitored by the provincial government
Constitution	1973	○ Basic rights and duties of the Citizens and Government of Pakistan ○ Acquiring land for public interest
Pakistan Environment Protection Act PEPA	1997	○ Protection, conservation, rehabilitation and improvement of environment, prevention and control of pollution ○ Defines municipal waste, hazardous waste, hospital waste, industrial waste and agriculture waste, organic and inorganic matters and living organisms, buildings ○ Prohibits discharge of waste in an amount of concentration that violates the National Environmental Quality Standards (NEQS) ○ EPAS that are satisfied that the discharge of any waste in violation of the provisions of the Act is likely to occur or occurring are empowered to direct the responsible person to take necessary measures ○ Penalties for contraventions against the provisions of the Act
Pollution Charge for Industry Rules	1998	○ Calculation and Collection of charges
Provincial Sustainable Development Fund Rules	1998	○ Rules on constitution and meeting of the board
Environmental tribunal Rules	1999	○ Organisation and Procedure Rules
Review of IEE/EIA Regulations	2000	○ Regulation on Environmental Impact Assessments ○ Projects requiring an IEE/EIA ○ Waste disposal projects require IEE/EIA
National Environment Quality Standards NEQS	2000	Quality Standards for: ○ Municipal and liquid industrial effluents ○ Industrial gaseous emissions ○ Motor vehicle exhaust and noise
NEQS Regulations	2000	○ Certification of Environmental Laboratories
NEQS Rules	2001	○ Self monitoring and reporting by industrial units ○ Categories of industrial units ○ Monitoring report in addition to EIA approval
Environmental Sample Rules	2001	○ Procedure of inspection and taking samples
Public Procurement Regulatory Authority Ordinance	2002	○ Establishment of Public Procurement Regulatory Authority for regulating public procurement of goods, services and works in the public sector
Hazardous Substance Rules	2003	○ Management of Hazardous substances ○ Waste management plan pertaining to hazardous waste
Hospital Waste Management Rules	2005	○ Management of waste generated by healthcare institutions

Name of Regulation	Year	Major issues related to SWM
Provincial and Local Legislation		
Punjab Local Government Ordinance PLGO	2001	○ Local Governments establishments and scope of services ○ Solid waste management, treatment and disposal ○ Industrial and hospital hazardous and toxic waste treatment and disposal ○ Environment control including control of air, water and soil pollution in accordance with Federal and Provincial laws and standards. (Part D of First Schedule)
SWM Bye-Laws City District Government Lahore	2005	○ Solid Waste Management ○ Collection and Removal of Solid Waste ○ Night Soil/Waste and Manure ○ Prohibitions against depositing refuse, building material etc. in any public place ○ Insufficient and defective sanitary conveniences
Punjab Local Government Act PLGA	2013	

Draft WASH Behaviour Change and Communication Strategy

A draft Behaviour Change and Communication (BCC) strategy has been developed by HUD&PHED in collaboration with UNICEF. It focuses on change in community behaviour especially with regards to water, sanitation and hygiene. The strategy includes the following elements:

- Increase awareness regarding importance of clean water, cleanliness and hygiene for a better healthy life
- Encourage community members to construct household latrines and leave open defecation practices
- Educate mothers about the water borne diseases and how to prevent these especially in children
- Emphasise the use of soap and hand washing before meals and after use of latrine
- Encourage the community members to build in house latrines for better health
- Encourage community members to become partner with the government in development of sanitation infrastructure in the village
- Mobilise community members to reduce water wastage at household level. Encouraging CBOs and community members for installation of water meters would be a practical step in reduction of waste of water
- Mobilise community members to legalise water and sanitation connections and payment of tariff in time

Community awareness raising campaigns, school sanitation and hygiene promotion, mobilising communities with unsatisfactory sanitation practices to adopt Pakistan Approaches to Total Sanitation concept shall be delivered through this strategy.

In addition, the strategy will link up with adult literacy to incorporate water, sanitation and hygiene learning especially for women.

Local and mass media communications will be used as portals for dissemination of hygiene messages and encouraging positive behavioural change.

The BCC strategy aims to synergise with efforts to improve solid waste management and shall raise awareness about improving waste management practices in communities.

Punjab Growth Strategy 2018

Recently, the Planning and Development Board, Government of Punjab has developed a growth strategy for the province entitled “Punjab Growth Strategy 2018 - Accelerating Economic Growth and Social Outcomes”. The document endorses Punjab’s health sector vision and strategy, which emphasises improvement of water, sanitation and hygiene services to prevent communicable diseases. In addition, the Government has established the Punjab Saaf Pani Company to provide multiple modern water supply solutions across districts with more brackish and contaminated water, and will be expanded to all districts in a phased manner. The project will place special emphasis on maintenance of water supply solutions including filtration plants, by creating operation and maintenance frameworks and requiring the allocation of annual maintenance funds in the budget. The project is targeted to benefit more than 40 million rural population of the province in the next two-three years.

After the successful reforms in solid waste management (SWM) in Lahore, where the Lahore Waste Management Company was formed to provide a comprehensive and integrated SWM solution to the city, the Government intends to focus on integrated SWM across the Province to reduce the effects of poor sanitation on health.

The medium term objective of the Government is to provide Punjab's cities with basic urban services that make its cities more liveable, healthy and productive. Punjab currently does not have any facility for wastewater treatment, resulting in major damage to public health environment and productivity of our cities and downstream agriculture areas. Investment in these facilities will be made on a priority basis.

Strategy

Legislations, Regulations, Policies and Strategies			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Finalisation of drafted policies and strategies and their implementation	Approval of Draft Sanitation Policy and Strategy, Punjab Drinking Water Strategy, Draft Behaviour Change Communication Strategy and their implementation Develop and implement bye-laws of solid waste management at town and metropolitan level		
A legal framework that governs municipal water	Enactment and promulgation of the Punjab Municipal Water Act	City and Town master plans developed and incorporate zone-wise development of water supply, sewerage and drainage, and solid waste management	Industrial wastewater management regulations put into effect in industrial zones and curbs to stop pollution enforced
Punjab Water Commission that acts as a regulatory body	Establishment of the Punjab Water Commission	Tariff structure revised Minimum service delivery standards established for municipal services (water, sanitation, solid waste management) Ensure that each local government has a master plan on water, sanitation and solid waste management for its area of jurisdiction	Review water, sanitation hygiene and solid waste policies and strategies and update them accordingly
Municipal services duty bearers have necessary managerial and leadership skills for an integrated water supply, sewerage and drainage, and solid waste management programme	Capacity building programme of city, town and union council officials on application of regulations, policies and strategies in planning, development and delivery of municipal services	Capacity building programme of city, town and union council officials on planning for and implementing integrated water supply, sewerage and drainage, and solid waste management	Municipal services training and capacity building programme provides at least 75% or more coverage to TMA officials

Note: Although the PLGA 2013 has been enacted, the administrative and municipal services structure is still operating according to the PLGO 2001. While the term TMA has been used in various strategy tables to reflect the current situation, for future implementation it should be read as 'Legal Entity' to denote whatever legal structure will be operationalised once the PLGA 2013 is implemented.

WATER RESOURCES

Pakistan is considered to be a water-stressed country (rapidly moving to water-deficit) and many of its regions are categorised as arid. Pakistan lies in an arid and semi-arid climate zone. Most of Punjab receives less than 250 millimetres of rainfall a year. (By contrast, among nations of similar area, Nigeria receives more than 1,500 millimetres, Venezuela more than 900, Turkey nearly 700.)

Pakistan's Water Resources

According to the AQUASTAT database on water resources[35], the status in Pakistan is summarised below:

- Long-term annual average precipitation – 494 mm/year
- Surface water[36] produced internally – 47.4 km^3/year
- Ground water produced internally – 55 km^3/year
- Overlap[37] between surface water and ground water – 47 km^3/year
- Internal Renewable Water Resources (IRWR) – 55 km^3/year
- Total Actual Renewable Water Resources (TARWR) – 246.8 km^3/year
- Dependency Ratio – 78%
- TARWR per inhabitant in 2011 – 1396 m^3/year
- Proportion of TARWR withdrawn (MDG Indicator in 2006) – 74.35%

The World Water Report 2013[38] indicated that the total freshwater withdrawal in Pakistan was 183.5 km^3/year, with a Per Capita withdrawal of 993 m^3/person/year. About 5% of freshwater was withdrawn for domestic use, 1% of industrial use and 94% for agricultural use. About 52 m^3/person/year of freshwater is withdrawn for domestic use.

The Indus basin has a large groundwater aquifer covering a gross command area of 16.2 million Hectares (Ha).

In 2005, the total dam capacity was an estimated 23.36 km^3. Currently, there are three large hydropower dams and 50 smaller dams (no more than 15 m high), while 11 smaller dams are under construction[39].

The designed live storage capacity of the three large hydropower dams in the Indus basin is 22.98 km^3 (Tarbela 11.96 km^3, Raised Mangla 10.15 km^3, which includes recent raising of 3.58 km^3, and Chashma 0.87 km^3). The current live storage capacity of these three large hydropower dams is

[35] Water resource information by country/territory and MDG Water Indicator, FAO-AQUASTAT database, March 2013

[36] 1 Million Acre Foot (MAF) is equivalent to about 1.233 km^3

[37] Overlap is water shared by both the surface water and groundwater systems

[38] World Water Report 2013 – Data Table 2, Freshwater withdrawal by country and sector (2013 update)

[39] Irrigation in Southern and Eastern Asia in Figures. Aquastat Survey 2011. FAO, Rome, 2012

17.89 km^3, representing an overall loss of storage of 22%[40]. Pakistan can barely store 30 days of water in the Indus Basin Irrigation System (IBIS). Each km^3 of storage capacity lost means 1 km^3/year less water that can be supplied with a given level of reliability. There is an urgent need for storage just to replace capacity that has been lost as a result of sedimentation. Given the high silt loads from the young Himalayas, two large reservoirs are silting rapidly.

The designed live storage capacity[41] of 50 small dams is 0.383 km^3. The information related to sedimentation and loss of live storage of small dams is not available. It was assumed, therefore, that on average 25% of the live storage in these small dams has been lost as a result of sedimentation. This has led to the current live storage capacity of these small dams of 0.287 km^3. There are more than 1,600 mini dams (less than 15 m high), which were constructed for small scale irrigation, but the capacity of these mini dams is low because they are usually constructed for an individual farmer. The information on the live storage capacity of mini dams is not available. Storage of mini dams is negligible compared to that of small dams. According to certain estimates, the total designed capacity of these mini dams would be around 0.036 km^3.

Pakistan's population and economy depend heavily on water from various sources. These include:

- **Rainfall** - almost two-thirds of the rainfall is concentrated in the three summer months of July - September. The mean annual precipitation ranges from less than 100 mm in parts of the Lower Indus Plain to over 750 mm near the foothills in the Upper Indus Plain. The two major sources of rainfall in Pakistan are the Monsoons and the Western Disturbances
- **Glacier** - the Indus Basin catchment area contains some of the largest glaciers in the world. The glacial area of the upper Indus catchment is about 2,250 Km^2 and accounts for most of the river runoff in summer
- **Rivers and Dams** - over the years a number of reservoirs, dams, barrages and canals have been developed to regulate irrigation water and produce electricity in Pakistan. These include 3 major storage reservoirs, 19 Barrages, 82 Small dams, 57 major canals etc. two small/medium dams have been approved for construction in Punjab – Ghabir dam Chakwal and Papin dam Rawalpindi
- **Surface water** – most of the surface water comes from the Indus River and its tributaries, which on an average, bring 154 MAF of water annually. This includes 144.91 MAF from the three Western rivers and 9.14 MAF from the Eastern rivers. Most of this, about 104.73 MAF, is diverted for irrigation. 39.4 MAF flows to the sea and about 9.9 MAF is consumed by the system losses, which include evaporation, seepage and spills during floods. The Indus Basin Irrigation System feeds 23 canal systems in Punjab, and several water courses, farm channels and field ditches
- **Ground water** – almost four-fifths (79%) of the Punjab province has access to fresh groundwater. Some 9.78 million acres are underlain with groundwater of less than 1000 mg/l TDS, 3 million acres with salinity ranging from 1000 to 3000 mg/l TDS and 3.26 million acres with salinity more than 3000 mg/l TDS. Saline waters are mostly found in the central Doab areas. The Cholistan area in southern Punjab has highly brackish waters, which cannot be used for drinking purposes. Groundwater with high fluoride content is found in the Salt Range, Kasur, Mianwali and also in the Bahawalpur area. Groundwater samples from Jhelum, Gujrat

[40] Country Assistance Strategy, 2005. Pakistan's economy running dry. World Bank, Pakistan Resident Mission, Islamabad.

[41] Irrigation in Southern and Eastern Asia in Figures. Aquastat Survey 2011. FAO, Rome, 2012

and Sargodha districts have shown concentrations of arsenic that is well above the WHO guideline value of 0.05 mg/l (50 ppb)

Inadequately managed use of surface water for irrigation has led to unhindered ground water abstraction for agriculture purposes. The depth of the ground water table is estimated to be increasing by 2 feet/year implying a shrinking ground water reservoir (**Fig 4**). The construction of Thein dam on Ravi river in India has drastically reduced ground water recharge systems, especially for Lahore. There are an estimated 900,000 tube wells operating in Punjab[42].

The irrigation system provides an important recharge to ground water whose levels show stability in irrigated areas.

Rainfall also provides significant recharge to ground water in irrigated agricultural areas which varies from 10% to 24% of the total annual rainfall.

Annual rainfall, especially in urban areas, is reasonable and regular enough with respect to quantity but landscape development has been set up in a way, which promotes surface runoff towards sewerage and surface drainage systems in the cities. However, by adopting suitable building bye laws and redesigning landscape of parks, roads and other public as well as private buildings, considerable part of rainfall can be harvested and ultimately recharged to groundwater by diverting it to specifically designed open wells. If at least one fourth of the annual rainfall run-off can be harvested, declining groundwater trends in cities can be reversed[43].

Domestic and industrial liquid waste drains untreated into the sewage systems. This results in untreated water along with its pollution eventually joining the water table through deep percolation.

Furthermore, the Hudiara drain, a naturally occurring storm water channel, drains from India into the Ravi river. It carries with it huge amounts of industrial and sewage waste from both sides of the border and has also been found to be polluted by heavy metals. The watershed areas are continually being polluted and groundwater mining by adjacent settlements run a high health risk.

Ground water sustainability suffers a serious threat from over-exploitation, pollution and lack of proper management to match the demand and supply patterns of this natural resource base.

Nearly 40% of Pakistan's irrigated land is believed to be waterlogged, and 14% of it to be saline. Since more than 60% of the population is rural and depends on natural resources such as soils, water, rangeland and forests, the degradation of those resources puts the country's economic sustainability (dependent as it is on agriculture) under severe environmental threat.

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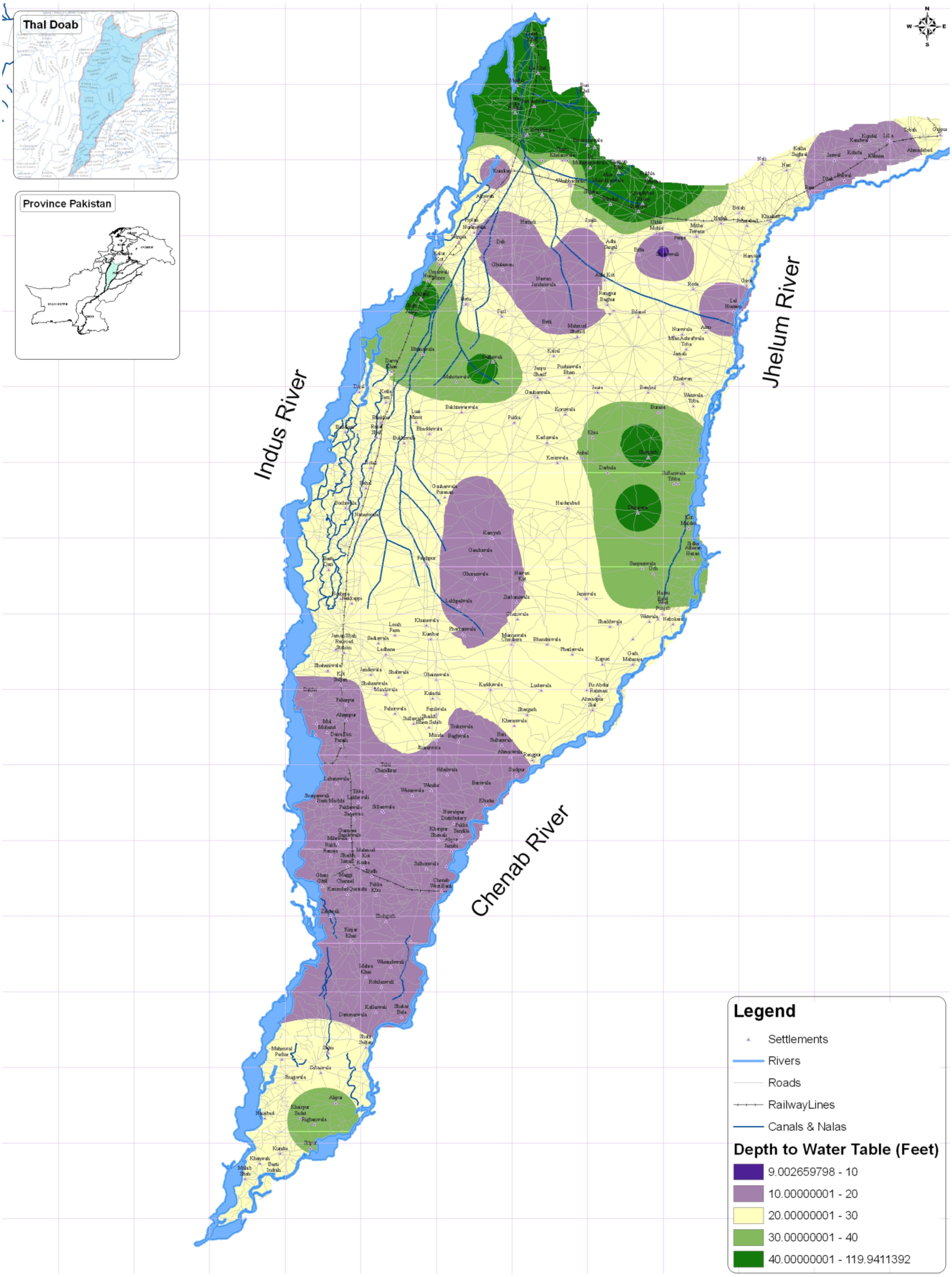
[42] Directorate General Monitoring and Evaluation, Planning and Development department, Government of Punjab, 2011

[43] Muhammad Basharat, Sultan Ahmad Rizvi, 2011. Groundwater extraction and waste water disposal regulation – is Lahore aquifer at stake with as usual approach?

Figure 4 - Groundwater quality zonation in Thal Doab – depth to water table

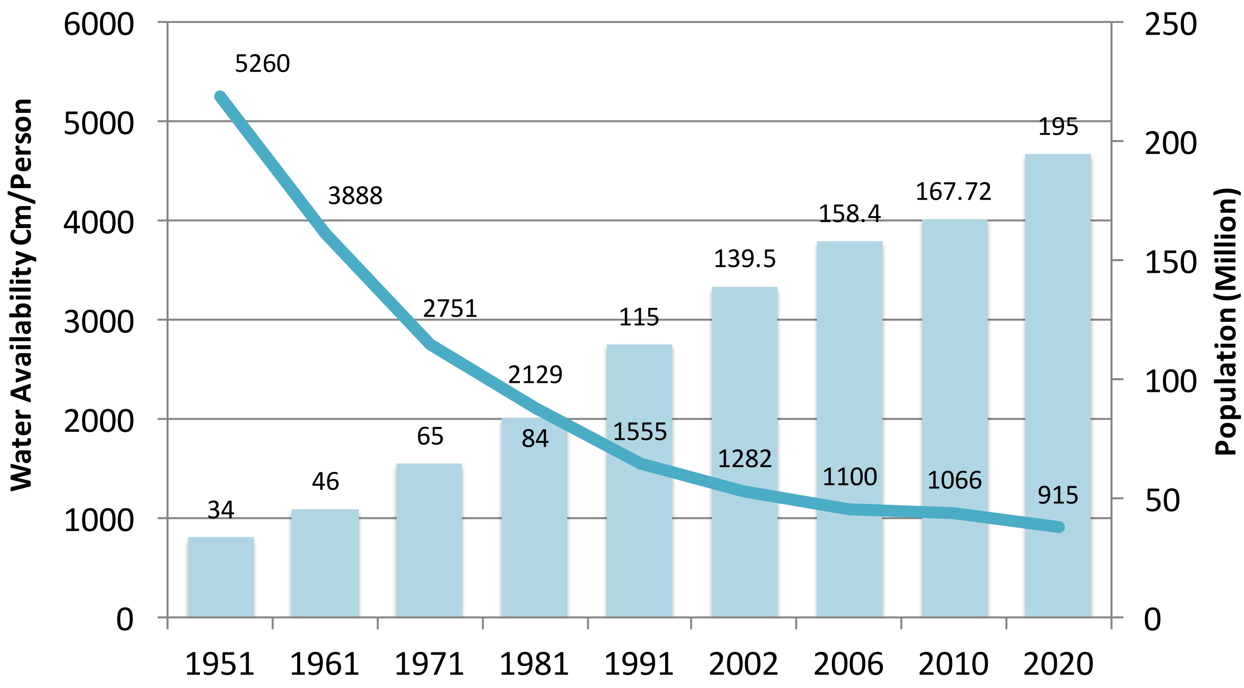


(Source: Pakistan Council of Research in Water Resources)

Per capita water availability has declined rapidly since 1951 and is currently only 1050 cubic meters/capita, which puts Pakistan in the category of a high water-stress country[44] (**Fig 5**). Data on the Indus River system over the past eight decades indicate that the watersheds of the Indus River yield about 138.7 Million Acre Feet (MAF) of water annually. The Indus alone provides 65% of the total river flows, while the Jhelum and the Chenab — the waters from which (together with that from the Indus) are assigned to Pakistan under the Indus Basin agreement — contribute 17% and 19% respectively. Water availability fluctuates a great deal during the year — the peak flows occur from June to August, i.e., the monsoon season. The flow during the Kharif (summer) season accounts for 84% of the total annual flow, while the Rabi (winter) season receives only 16%.

About 95% of water usage is for agriculture, 1% for industrial use, and 4% for domestic and municipal use[45].

Figure 5 - Water availability (cubic metres) and population growth



(Source: State of the Environment Report (draft) 2005. Ministry of Environment, Government of Pakistan)

Recent studies by the International Waterlogging and Salinity Research Institute (IWASRI) in Lahore have shown that the increasing deficit between groundwater recharge and extraction by tube wells is causing groundwater depletion to the tune of 0.15-0.55 m per year in central and lower parts of Bari Doab. On the whole Bari Doab basis, groundwater mining of 2.33 BCM (1.89 MAF) per year is going on owing to shortage of canal supplies. However, groundwater levels are relatively stable in rest of the irrigated areas of the Punjab province.

[44] State of the Environment Report (draft) 2005. Ministry of Environment, Government of Pakistan

[45] Pakistan Water Sector Strategy. National Water Sector Profile, Vol 5, 2002. Ministry of Water and Power, Government of Pakistan

The comprehensive report on ground water management[46] by IWASRI has made the following recommendations for Punjab:

- Evolve a groundwater recharge strategy for depleted irrigated and barani areas separately that can contribute through various kinds of recharge measures. There is an urgent need to utilise recharge potential in river beds of Sutlej and Sukh-Beas by diverting surplus supplies during Kharif season, particularly there should be proper planning and implementation for utilising such recharge potential during wet years. For the purpose, provision of environmental flows for eastern rivers under the umbrella of Indus Water Treaty of 1960 with India may be taken up
- Water withdrawal can be reduced by partly diversifying to low water-requiring crops, and employing water saving production technologies at a field scale. Large-scale adoption of rice-wheat system has been a major factor in over-exploitation of groundwater due to high ET requirements. In kharif, rice may be replaced with maize, pulses and oilseeds; whereas wheat may be replaced with oilseeds and gram
- To minimise waterlogging and groundwater depletion, a very detailed assessment of crop water requirement, cropping pattern and intensities, along with existing allocations is recommended for optimal canal water distribution amongst and within canal commands. However, based on the present analysis it is strongly recommended that: a) Supplies to UJC and Muzaffargarh canal commands may be reduced and; b) Correspondingly supplies to Pakpattan and Sidhnai commands may be increased
- During canal water re-allocation, depleting saline groundwater areas within the Doabs (e.g. lower central part of the Bari Doab) be given little higher canal supplies as compared to adjoining fresh groundwater areas; and
- Mandatory rain water harvesting in new larger constructions in relevant urban areas, as well as there is need to amend policy on design of road surfaces and infrastructure to enhance groundwater recharge

There has been a manifold increase in use of ground water for agriculture, and this has had a positive impact on ground water economy. There has been a 70%-150% increase in Punjab's cropping intensity and 150%-200% increase in crop yield. Estimates suggest that groundwater irrigation adds 2.5 times more to Pakistan's GDP than a cubic metre of canal irrigation[47]. However, with unregulated ground water mining, insufficient water recharge systems, system losses (through evaporation, unevenly distributed seepage and flood spills), untreated wastewater, inadequately lined canals, wasted opportunities for rainwater harvesting, and looming climatic changes, the environmental impacts are potentially devastating if the current state of affairs is not controlled and efficient systems and alternatives developed for agriculture, water storage, and water treatment.

Furthermore, declining ground water levels in Punjab and secondary salinization from irrigation necessitates more efficient and widespread use of surface water and preservation of the precious

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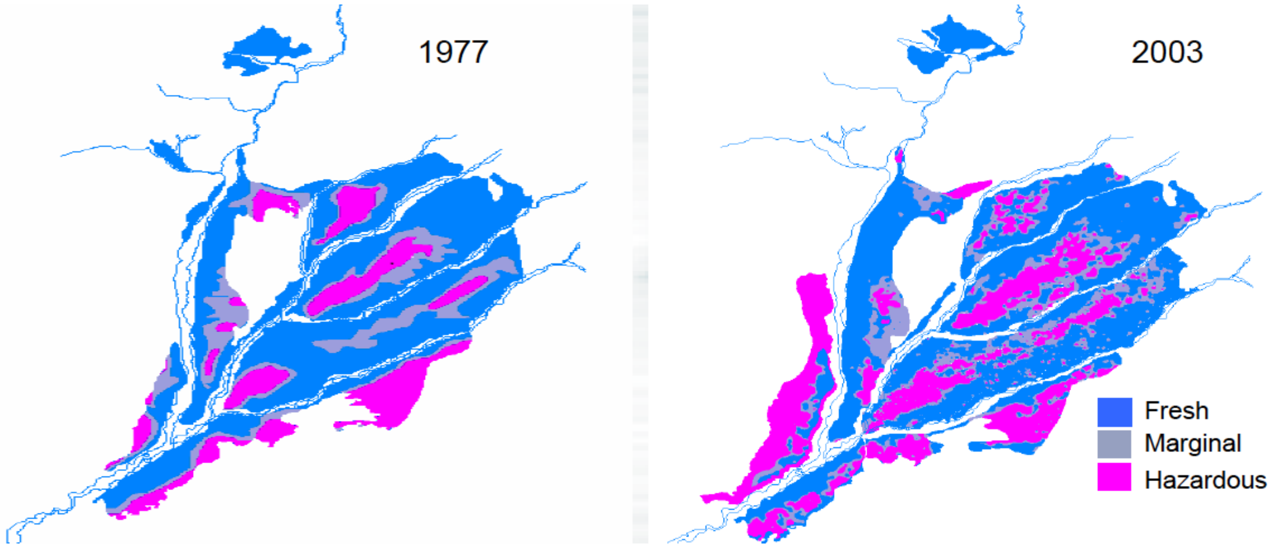
[46] Surface Water and Groundwater Nexus: Groundwater Management Options for Indus Basin Irrigation System. International Waterlogging and Salinity Research Institute. Pakistan Water and Power Development Authority, 2014

[47] Climate Change, Food and Water Security in South Asia: Critical Issues and Cooperative Strategies in an Age of Increased Risk and Uncertainty. Global Water Partnership and International Water Management Institute, 2011

ground water resource. Irrigation adds 1 ton of salts per hectare per year with the result that 22% of Punjab has highly saline ground water (**Fig 6**). Improved and efficient surface water management not only has major implications for agriculture but also for domestic and municipal water supplies.

Figure 6 - Freshwater and saline zones in Punjab



(Source: Asad Sarwar Qureshi (2011). Ground water management in Pakistan. International Water Management Institute)

Freshwater Footprints

Freshwater footprints[48] are reported in terms of water volumes consumed (evaporated or incorporated into a product) or polluted per unit of time. A water footprint has three components: green, blue, and grey. The "blue water" footprint refers to use of surface water and groundwater. The "green water" footprint is the volume of rainwater consumed, which is particularly relevant in agricultural production. The "grey water" footprint is a measure of freshwater pollution and is defined as the volume of freshwater required to assimilate a load of pollutants.

The water footprint of national consumption is defined as the total volume of freshwater that is used to produce the goods and services consumed by the inhabitant of the nation. It consists of two components: the internal and external water footprint of national consumption.

The internal water footprint is defined as the use of domestic water resources to produce goods and services consumed by the nation's population. It is the sum of the water footprint within the nation minus the volume of virtual-water export to other nations related to the export of products produced with domestic water resources. The external water footprint is defined as the volume of

[48] Mekonnen, M. M., and A. Y. Hoekstra. 2011. National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and Consumption. Value of Water Research Report Series No. 50. Delft, Netherlands: UNESCO-IHE Institute for Water Education.

water resources used in other nations to produce goods and services consumed by the population in the nation under consideration.

A study on national water footprints found that Pakistan had the following footprints for domestic and industrial sectors:

- Water Footprint of Domestic Water Consumption in millions of m^3/year
    - Blue water footprint – 327
    - Grey water footprint – 2943
- Water Footprint of Consumption of Industrial Products in millions of m^3/year:
    - Blue water footprint – 148.4 (126.9 internal; 21.5 external)
    - Grey water footprint – 2657 (2383 internal; 274 external)

By comparison, United Kingdom has a blue water footprint of 207 and grey water footprint of 242 for domestic water consumption; and an internal blue water footprint of 245.6 and grey water footprint of 117 for consumption of industrial products. This indicates the high degree of freshwater wastage in domestic and industrial sectors in Pakistan.

Climate Change

In the 2010 floods, some 20 million people were affected in Pakistan with economic losses estimated to be in the range of USD 10 billion. Human suffering was immeasurable while food lost due to land and crop damage has greatly heightened the issue of food security in Pakistan.

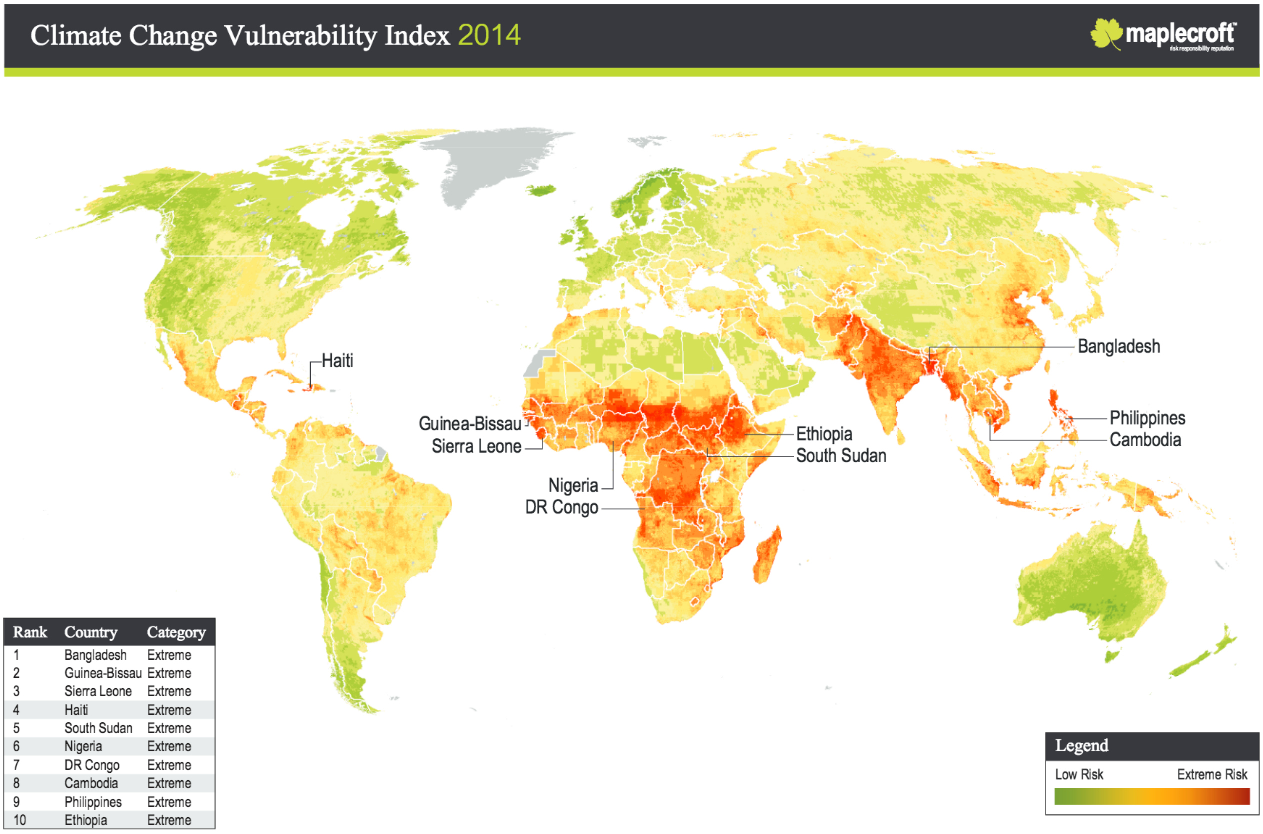
Pakistan lies in the zone that faces one of the highest risks of climate change in the world[49]. **Fig 7** illustrates that most of Pakistan lies in the high-extreme risk category. South Punjab falls within extreme risk while central and north Punjab are high risk. The negative effect of floods alone is estimated to be USD 6 billion per year. The Intergovernmental Panel on Climate Change (IPCC) has predicted that the Indus Basin is likely to face more frequent extreme events like floods and droughts of more severity and coverage. While climate change is likely to cause more floods, it is also likely to lead to a deepening water scarcity as well since the Indus system depends on glacier melt for about 45% of its flow, which is one of the highest dependency rates in the world.

Glacial melt is expected to increase river flows and flooding for about 50 years, after which there is an expected 30%-40% decline over the next 50 years[50]. A decline in rainfall may cause further severe water stress in arid and semi-arid areas, while rising mean temperature and depleting soil moisture would have a worsening effect on the country's agriculture and food security. A combination of declining river flows and reduced precipitation is likely to affect coastal ecology and increase desertification.

[49] http://reliefweb.int/sites/reliefweb.int/files/resources/Climate_Change_Vulnerability_Index_%202014_Map.pdf

[50] Climate Change, Food and Water Security in South Asia: Critical Issues and Cooperative Strategies in an Age of Increased Risk and Uncertainty. Global Water Partnership and International Water Management Institute, 2011

Figure 7 - Climate Change Vulnerability Index 2014



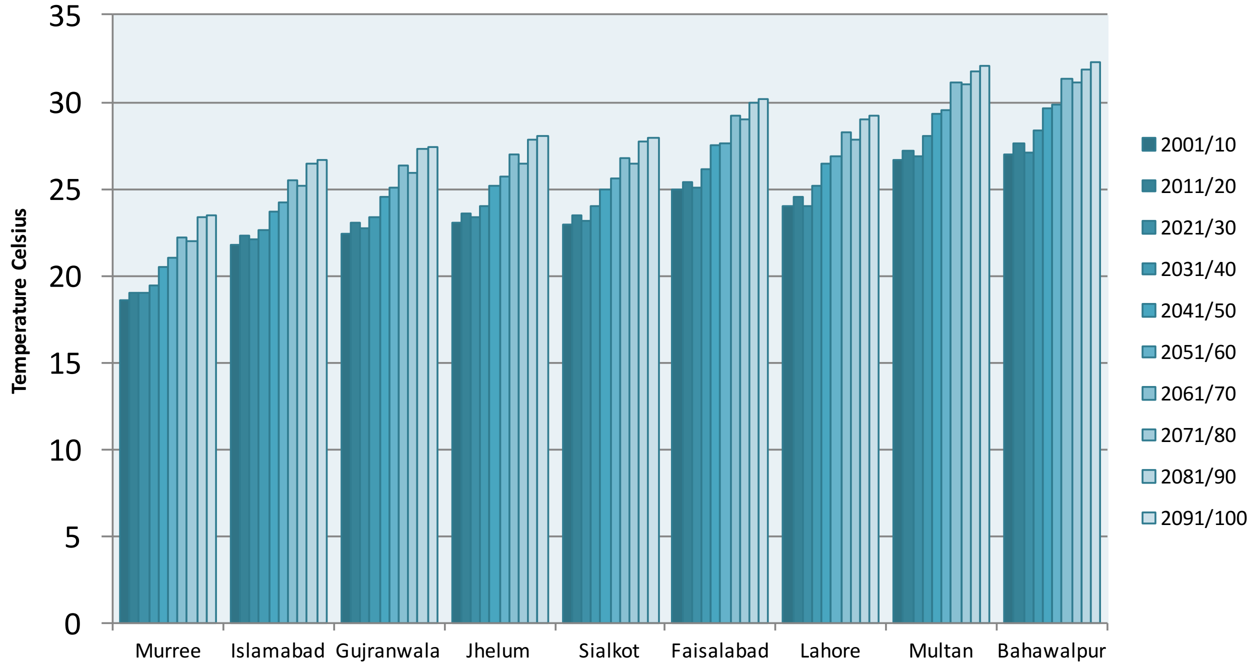
(Source: Maplecroft, 2014)

Pakistan is in desperate need for more water storage capacity to counter the effects of climate change and food insecurity as it currently only has enough water stored for 30 days to meet its water requirement. Presently, Pakistan has <10% capacity for water storage (12.5 MAF of its total water resources of 145 MAF)[51]. This extra storage capacity would need to come from more dams, revitalised irrigation systems, and reducing irrigation system losses.

Decadal temperature trends by the Pakistan Meteorological Department for selected cities/towns in Punjab illustrate (**Fig 8**) that by 2050 the average temperatures will have risen by 2.5^0 C and in 2100 by about 5^0 C. This is expected to have disastrous effects on water lost through evaporation, and subsequent increased groundwater mining, and reduction in agriculture yield thereby worsening food insecurity.

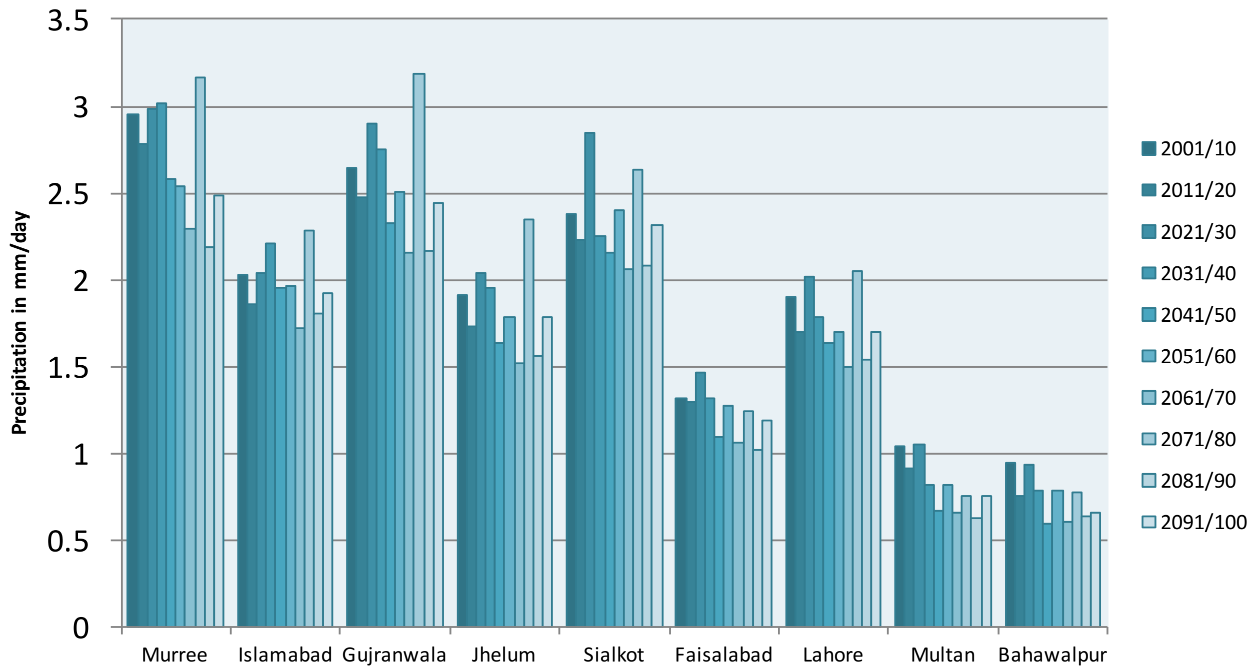
[51] Climate Change, Food and Water Security in South Asia: Critical Issues and Cooperative Strategies in an Age of Increased Risk and Uncertainty. Global Water Partnership and International Water Management Institute, 2011

Figure 8 - Decadal temperature projections of selected centres



(Source: Pakistan Meteorological Department – 25 km grid size using PRECIS Regional Climate Model)

Figure 9 - Decadal precipitation projections for selected centres



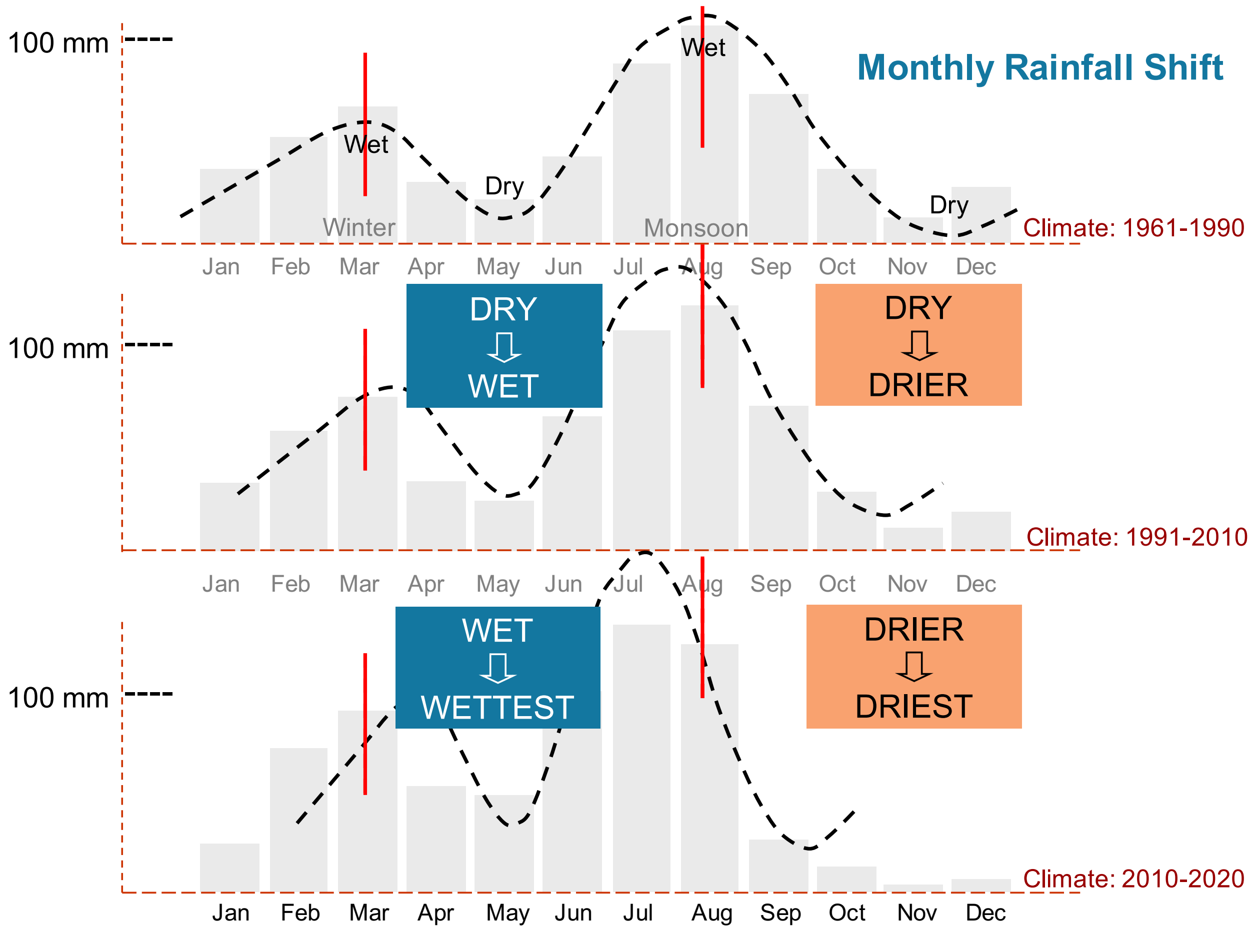
(Source: Pakistan Meteorological Department – 25 km grid size using PRECIS Regional Climate Model)

Decadal projections of precipitation (**Fig 9**) show that while there may be periods of varying rainfall, there is a general trend for mean rainfall per day to decrease over the next eighty years.

Rainfall patterns too have changed since the 2010 super floods. There has been a latitudinal redistribution of precipitation that has resulted in increased seasonal and annual precipitation and a westward shift (80-100 km) of Monsoonal rainfall. This means that rainfall over the catchment areas of the eastern rivers has decreased (moved away). Furthermore, the probability of occurrence of heavy rainfall events leading to flash floods/floods would be high over the western rivers instead of the eastern rivers in the future. This implies that the north-west parts of Punjab are extremely vulnerable to floods. **Fig 10 and 11** illustrate the monthly rainfall shift to more precipitation in non-conventional months and drier winter periods.

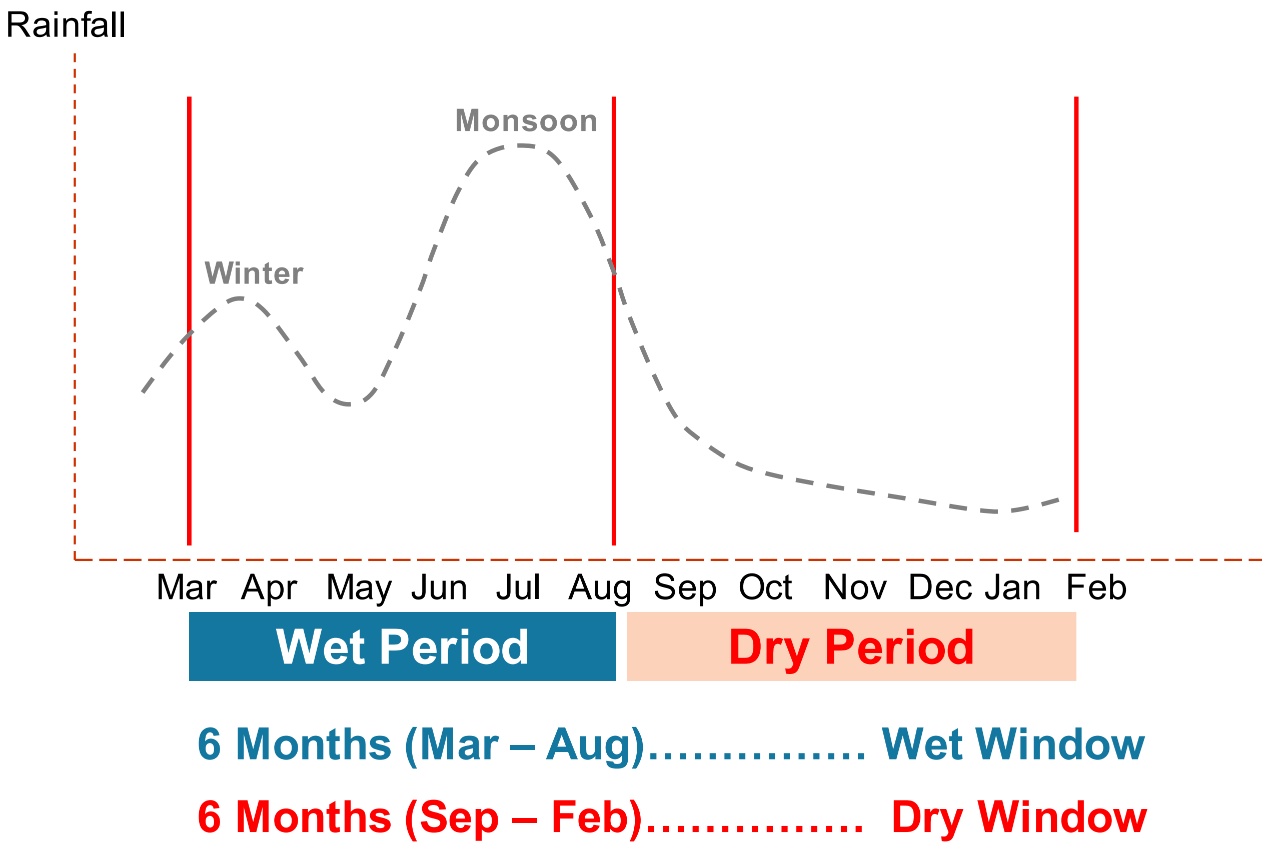
The latitudinal redistribution of Monsoonal rainfall westward, declining decadal projection of mean annual rainfall and rising decadal project of average temperatures have major implications for water resource management and agriculture on one hand, and the safety and sustainability of water and sanitation systems in the light of climatic events like floods on the other. Climate change adaptation of water and sanitation systems would be a critical need in the future.

Figure 10 - Monthly Rainfall Shift



(Source: Pakistan Meteorological Department)

Figure 11 - Projected climate 2020-2030



(Source: Pakistan Meteorological Department)

Vulnerability to Climate Change

Analysis of the recent evidence emerging from flood affected areas regarding the health, water and sanitation repercussions are of serious concern:

- Health facilities and sanitation infrastructure was severely damaged
- Access to safe water and sanitation was severely curtailed thereby increasing the vulnerability of people to infectious and water borne diseases such as diarrhoea, typhoid, intestinal worms and hepatitis. In many cases water pipes were contaminated with sewage water and the use of toilets in most flood affected districts dropped by 50 percent
- The incidence of cholera, malaria and polio increased over the past one year in Pakistan

A ranking of agro-ecological zones in Pakistan according to their vulnerability[52] to climate change shows the following:

- Balochistan is the most vulnerable region with high sensitivity and low adaptive capacity. The major threats posed by climate change in Balochistan include droughts and increase in mean temperature
- Low-intensity Punjab (mostly consisting of South Punjab) is the next most vulnerable region. The region is prone to floods as well as rise in temperature. The region has a high degree of sensitivity and low adaptive capacity
- Cotton/Wheat Sindh is the third most vulnerable region. It is vulnerable to both floods and droughts. The degree of sensitivity is high. However, the coping capacity falls in the 'medium' rank. The rain-fed (Barani) Punjab has a high degree of exposure to climate change due to its greater variability in precipitation, but relatively better adaptive capacity

In a situation where Pakistan is ploughing through a state of development deficiency, building its adaptive capacity to climate change is challenging to say the least. However, the formulation of the new National Climate Change Policy 2012 is an encouraging step. Decadal forecasts of increasing floods and droughts suggest that mitigation planning for 2030 and 2050 needs to begin now.

Rainwater Harvesting

According to international criteria established by Malin Falkenmark and later used by Gardner and Engelman[53], countries are ranked by the annual renewable fresh water resources per capita per year in m^3. When countries fall below 1700 m^3 per capita per year, they are said to be in a state of 'water stress'. When the level falls below 1000 m^3, they are then said to be in a state of 'water scarcity'. While there are limitations in the use of these criteria or definitions, as estimations of grey, white or green water may not be included, they provide a useful benchmark for countries to gauge their status. **Fig 5** shows that Pakistan has fallen in the 'water scarcity' level and is in need of serious water preservation and water resource management.

Continuous over-draft has led to unregulated ground water abstraction, which in turn has resulted in declining freshwater levels and up-coning of deep saline water.

Rainwater offers an available source of water that can be stored for future use and also be utilised to recharge groundwater in declining urban aquifers. There is presently very little if any utilisation of rainwater runoff in urban areas, which in most cases ends up in sewer or storm drains.

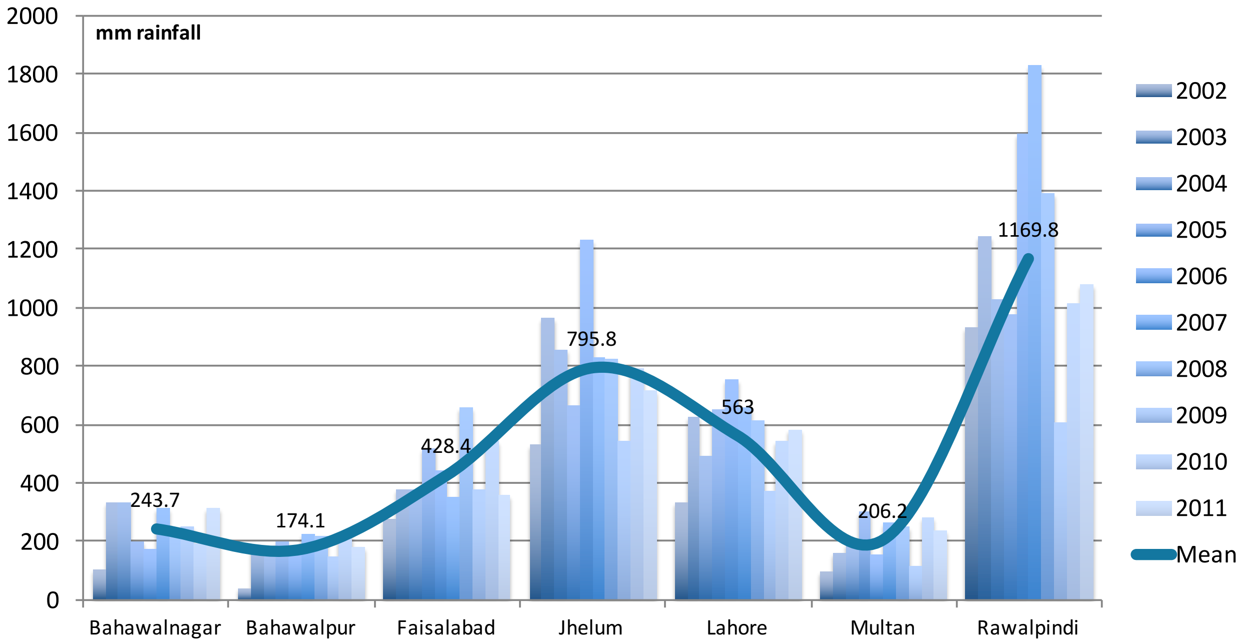
Fig 12 and 13 illustrate the decadal rainfall trends in selected cities showing moderate rainfall in Faisalabad, Jhelum and Lahore, and high rainfall in Rawalpindi. Bahawalpur and Multan are close to about 200 mm or less rainfall annually, while Bahawalnagar ranges between 250 to 300 mm.

[52] Malik SM, Awan H, Khan N: Mapping vulnerability to climate change and its repercussions on human health in Pakistan. Globalization and Health 8:31, 2012

[53] Tom Gardner-Outlaw and Robert Engelman (1997). Sustaining Water, Easing Scarcity – A second update. Population Action International

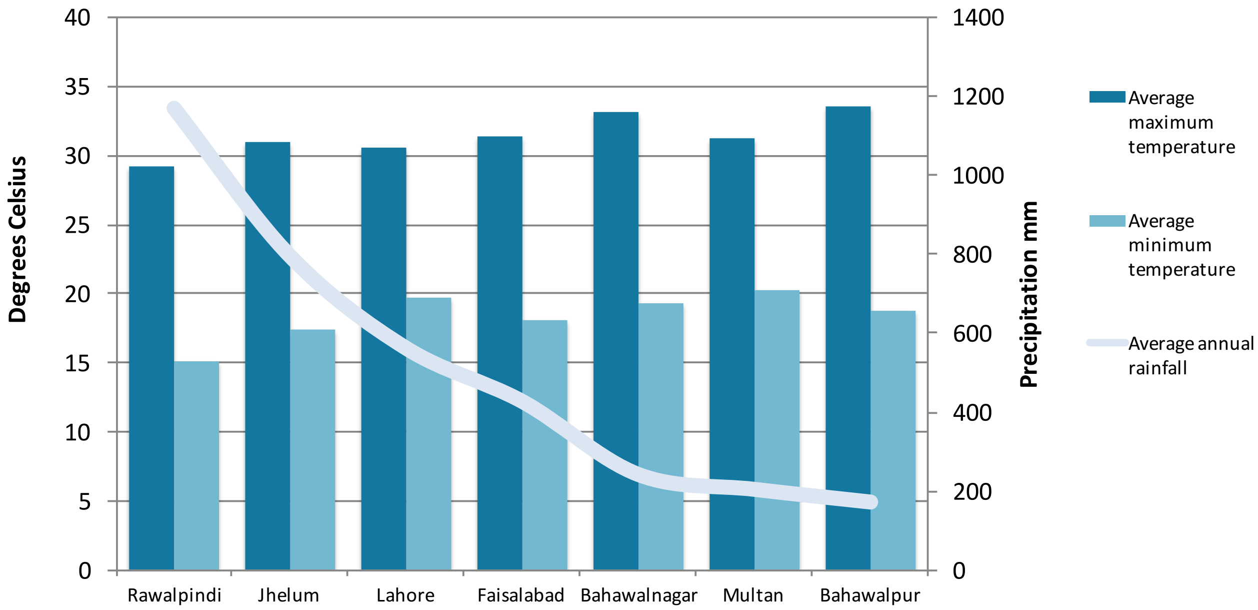
These data suggest that cities with ample rainfall have the potential to harvest significant amounts of rainwater for municipal and domestic use.

Figure 12 - Annual Rainfall Decadal Trend



(Source: Punjab Development Statistics 2013. Bureau of Statistics, Government of Punjab)

Figure 13 - Average temperature and rainfall 2002-2011 in selected centres



(Source: Punjab Development Statistics 2013. Bureau of Statistics, Government of Punjab)

The Pakistan Council of Research in Water Resources (PCRWR) has been conducting field tests on rainwater harvesting in Cholistan desert. These involve catchment of rainwater using different techniques and storage in ponds with capacities ranging from 3000 m^3 to 15,000 m^3. As a result of successful trials, PCRWR has constructed 92 rainwater harvesting systems in the Cholistan desert.

Analysis studies[54] of Lahore residential areas (Askari, Lahore Development Authority) indicate that 46.7 million litres (46,709 m^3) in Askari Phase 9 alone can be harvested to provide water for domestic use (cleaning, watering, washing etc.) to about 4500 people for about 3.5 months. Rainfall harvesting from Lahore Development Authority can collect 21.35 billion litres (21.35 million m^3) of water that would be available for domestic use to a population of about 1 million people for 3.2 months. Available data suggests that in urban areas, rooftop and slope run-off of rainwater can be successfully harvested for use, re-charging groundwater aquifers and stabilising groundwater levels[55].

There is need to amend building byelaws and enforce these for private and public buildings to achieve the maximum rainwater harvesting feasible to save groundwater and recharge groundwater aquifers.

[54] Rainwater Harvesting Potential - A contribution to sustainable water management strategy. The Urban Gazette. Special Issue March 2013. Pakistan Water Operators Partnership

[55] Basharat M & Rizvi SA. (2011). Groundwater Extraction and Wastewater Disposal Regulation: Is Lahore Aquifer at stake with as usual approach? Proceedings of Pakistan Engineering Congress on World Water Day

Strategy

Water Resources			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Sectoral capacity for climate change adaptation and mitigation developed	Sub-sector climate change adaptation and mitigation strategies developed	Piloting of climate change adaptation and mitigation in selected towns	Climate change mitigation capacities developed in phased manner in towns located in zones vulnerable to climatic events
Municipal services duty bearers fully conversant with climate change and its mitigation strategies	Need assessment of sub-sector human resources for climate change adaptation and mitigation	Capacity building programme of city, town and union council officials in pilot areas on climate change mitigation strategies	Capacity building programme of city, town and union council officials on climate change mitigation strategies extended to other areas
Mega and intermediate cities with ample precipitation have rainwater harvesting systems in place	Rainwater harvesting pilot projects evaluated and plan to extend to other feasible cities developed	In participating cities, rainwater harvesting provides at least 10% of water used for non-domestic municipal services and horticulture	In participating cities, rainwater harvesting provides at least 30% of water used for non-domestic municipal services and horticulture
Increase use of surface water for municipal services	Joint programme with Irrigation department to map potential areas for surface water use	Build water storage reservoirs and water treatment plants with distribution supply in viable areas	Incorporate surface water use in town planning and municipal services in selected areas
Artificial recharging of groundwater enhanced	Storm water management plan developed for cities and town with ample precipitation	Storm water holding areas developed in 25% of selected sites	Storm water holding areas developed in 50% of selected sites

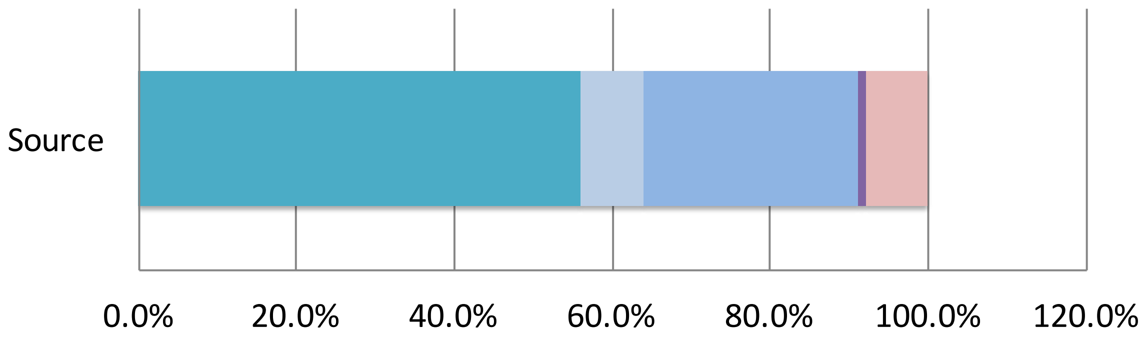
WATER SUPPLY

Urban Water Supply

Coverage

The recent PSLM 2012-13[56] survey shows that tap water is the prominent source of water supply in urban areas followed by motor pump (**Fig 14**).

Figure 14 - Sources of urban water supply in Punjab (PSLM 2012-13)



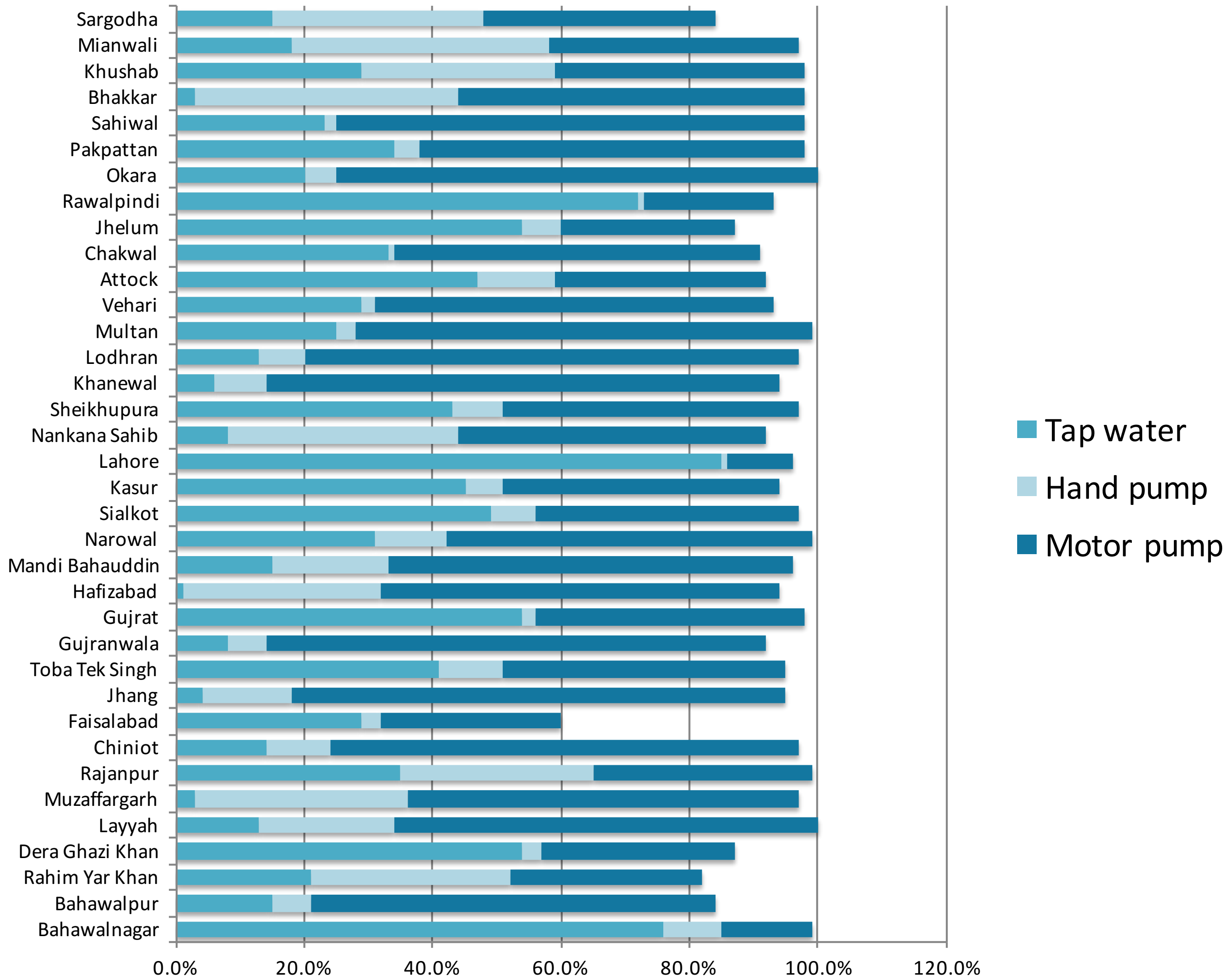
	Source
Tap water	56.0%
Hand pump	8.0%
Motor pump	27.0%
Dug well	1.0%
Others	8.0%

(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

Fig 15 shows that Lahore, Bahawalnagar and Rawalpindi had the highest percentages of tap water at 85%, 76% and 72% respectively. The lowest rates for tap water were found in Hafizabad (1%), Bhakkar (3%) and Muzaffargarh (3%).

[56] Pakistan Social and Living Standards Measurement Survey 2012-13. Pakistan Bureau of Statistics, Government of Pakistan

Figure 15 - District wise distribution of improved drinking water source in urban areas (PSLM 2012-13)

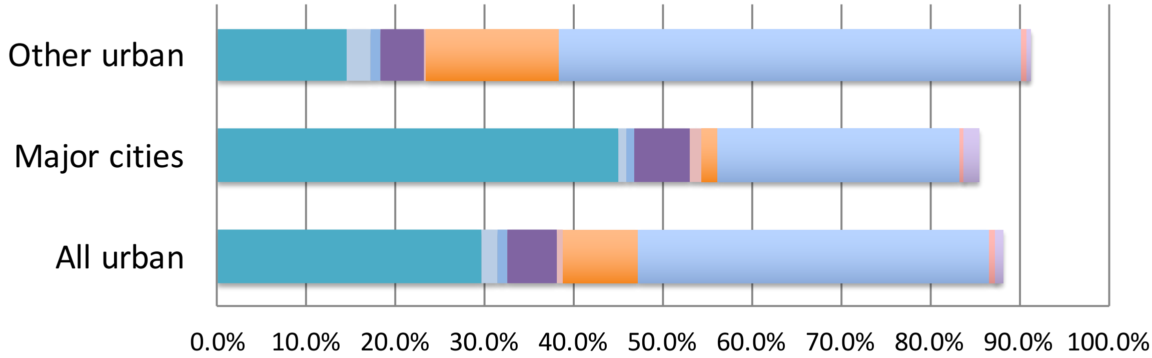


(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

The MICS 2011[57] of Punjab provides a more detailed and disaggregated analysis. **Fig 16** shows that in major cities, tap water accounts for 53.1% (without hand pump tap). If hand pump tap is included, the coverage comes to 55%. This is very similar to the 56% found by PSLM 2012-13. However, when one disaggregates to other urban areas, the coverage of tap water is 23.1% (without hand pump tap) and 38.2% if hand pump tap is included. This indicates marked variance in tap water coverage in major cities and other urban areas. The use of motorised pump is almost double (51.8%) for other urban areas compared to major cities (27.2%).

[57] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

Figure 16 - Sources of urban water supply in Punjab (MICS 2011)

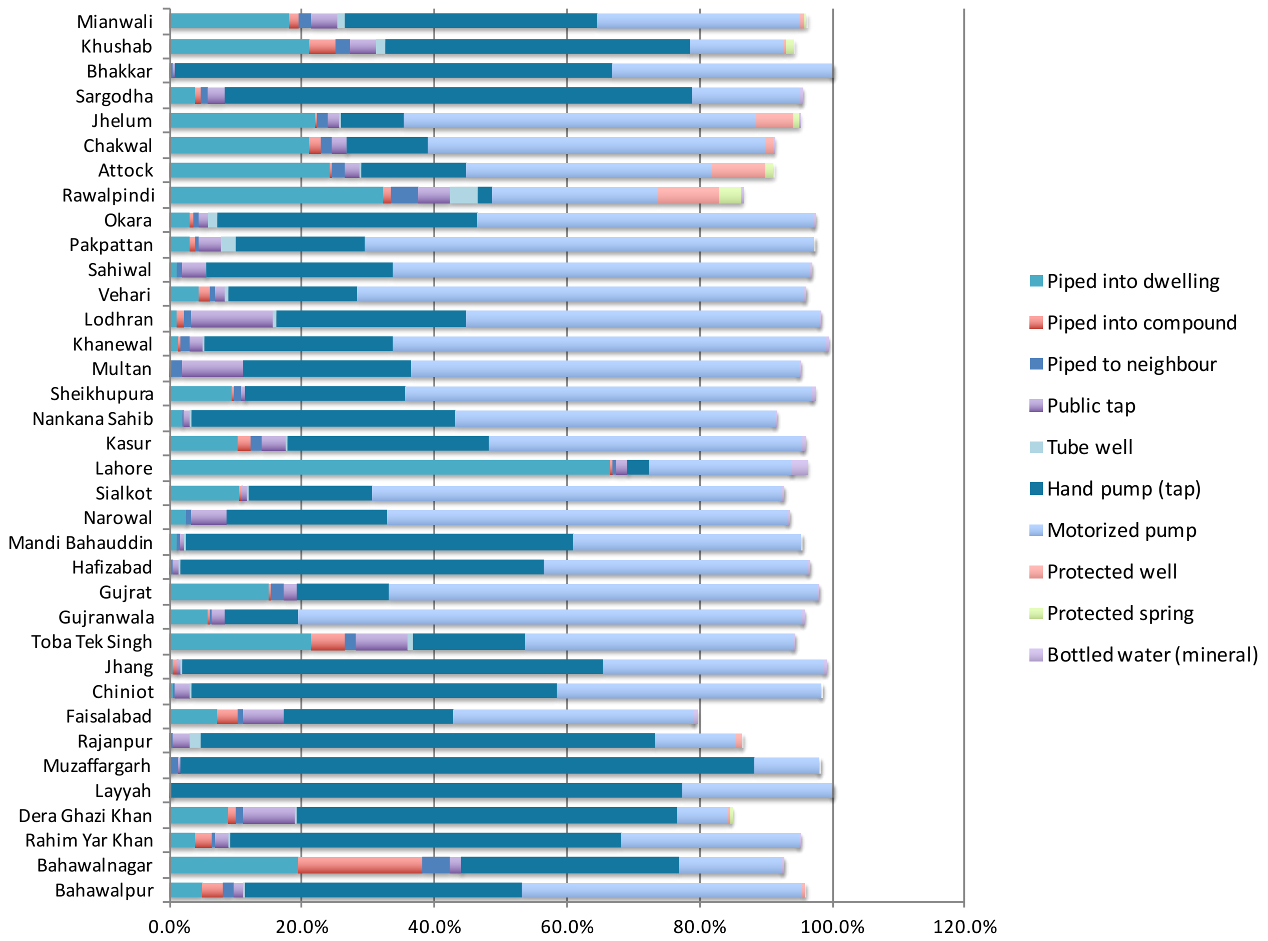


	All urban	Major cities	Other urban
Piped into dwelling	29.7%	45.0%	14.5%
Piped into compound	1.8%	0.9%	2.7%
Piped to neighbour	1.0%	0.9%	1.1%
Public tap	5.5%	6.3%	4.8%
Tube well	0.7%	1.2%	0.2%
Hand pump (tap)	8.5%	1.9%	15.1%
Motorized pump	39.5%	27.2%	51.8%
Protected well	0.5%	0.3%	0.6%
Protected spring	0.0%	0.0%	0.0%
Bottled water (mineral)	1.1%	1.8%	0.5%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Fig 17 indicates that most of Punjab relies on either the hand pump or motorised pump. Other than Lahore (66.4%), all the other districts have piped water in dwelling of less than 40% of households. This implies reliance on ground water mining due to inadequate water utilities.

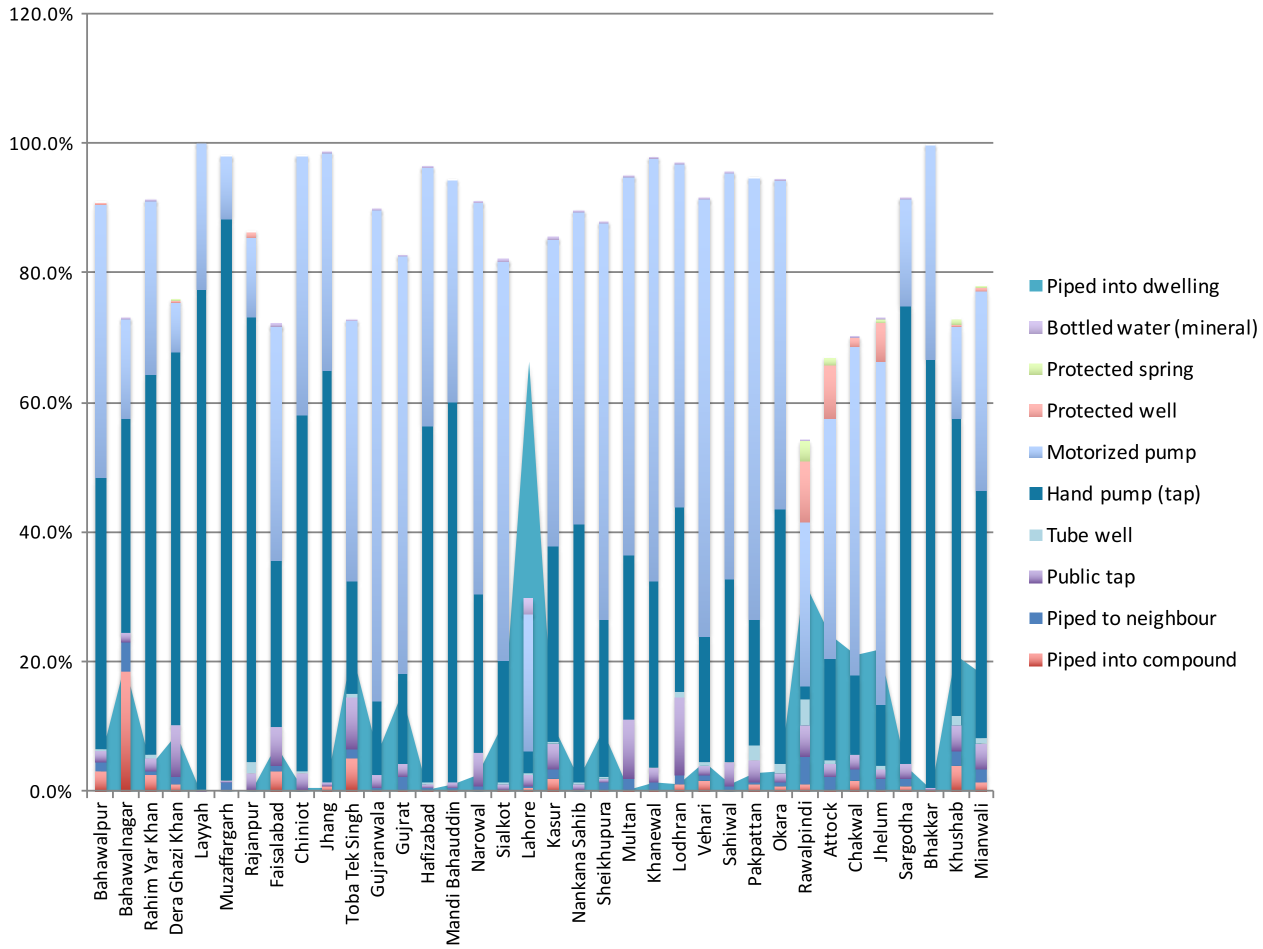
Figure 17 - District wise distribution of improved drinking water source (MICS 2011)



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Fig 18 demonstrates district trends with peaks of about 20% or more piped water in dwelling in Bahawalnagar, Toba Tek Singh, Lahore, and Khushab districts, and all of Rawalpindi division.

Figure 18 - District wise trends of improved drinking water source (MICS 2011)



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Some of the main barriers[58] to improved and sustained urban water supply include the following:

- Water level depletion due to excessive mining of underground water and decreasing recharge of aquifers due to shortage in the movement of water through river basins
- Wastage of sweet drinking water as a result of lack of awareness, absence of regulatory frameworks, non-existence of demand management tools like consumer meters and highly inappropriate tariffs
- Contamination of surface and underground water aquifers due to discharge of untreated industrial, domestic and commercial effluent
- Increase in arsenic levels and of other contaminants in the underground water aquifer
- Contamination of urban drinking water due to leakage in over aged water and sewerage pipes
- Water recharge is also affected by the growing and unbridled urbanisation which is resulting in concretization of land

[58] Salman Yusuf. Challenges and opportunities in urban water supply in Punjab province. 2011, HUD&PHED

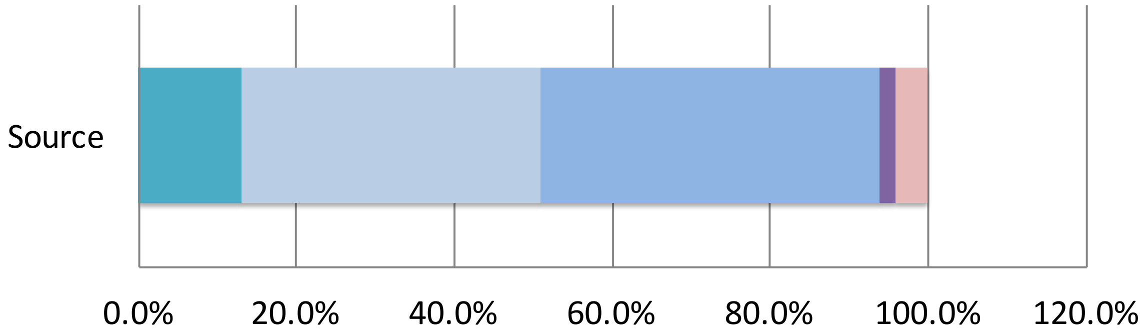
- Capacity of urban municipal institutions / WASAs at all levels in planning, implementation and monitoring of water supply programmes and sustainable operation and maintenance of water supply systems is deficient
- Absence of institutional mechanism to generate reliable data on water sector
- Resource allocation is not based on need assessment, criteria and data
- Unplanned and adhoc investment in the sector not yielding desired results

Rural Water Supply

In Punjab, PHED and LG&CD develop the schemes and these are then operated and maintained by Community Based Organisations (CBOs). The use of CBOs for operation of the systems results in greater ownership at the customer level with the expectation that this will increase sustainability. However, separation of development and operations activities between the PHED/LG and the CBO can mean that development remains engineering driven requiring the CBOs to take over schemes which may not be the most appropriate for their needs.

Coverage

Figure 19 - Sources of rural water supply in Punjab (PSLM 2012-13)



	Source
Tap water	13.0%
Hand pump	38.0%
Motor pump	43.0%
Dug well	2.0%
Others	4.0%

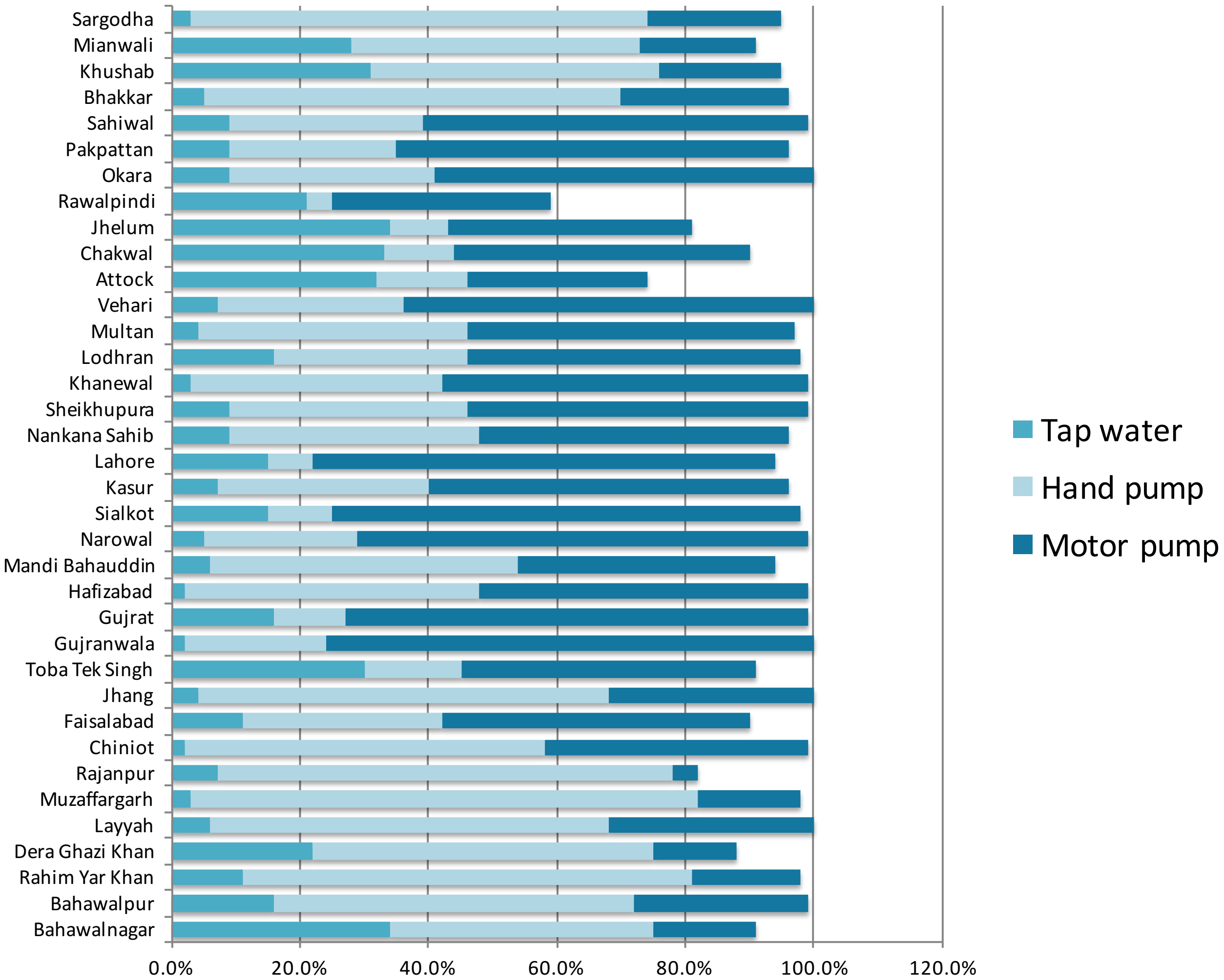
(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

The recent PSLM 2012-13[59] survey shows that motorised pump is the prominent source of water in rural areas followed by hand pump (**Fig 19**).

Fig 20 shows that Bahawalnagar, Jhelum and Chakwal had the highest percentages of tap water at 34%, 34% and 33% respectively. The lowest rates for tap water were found in Chiniot (2%), Gujranwala (2%), and Hafizabad (2%).

[59] Pakistan Social and Living Standards Measurement Survey 2012-13. Pakistan Bureau of Statistics, Government of Pakistan

Figure 20 - District wise distribution of improved drinking water source in rural areas (PSLM 2012-13)

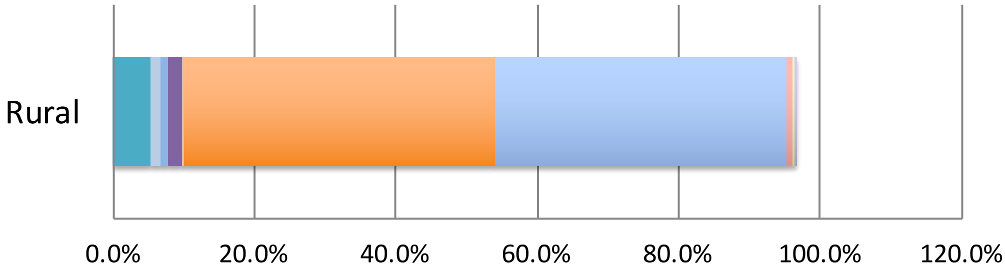


(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

Fig 21 shows that according to MICS 2011[60] of Punjab, in rural areas, tap water accounts for 9.7% (without hand pump tap). If hand pump tap is included, the coverage comes to 53.8%. Although PSLM 2012-13 shows tap water at 13%, however, when hand pump is combined, the prevalence increases to 51%, which is not too dissimilar to that found in MICS 2011.

[60] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

Figure 21 - Sources of rural water supply in Punjab (MICS 2011)



	Rural
Piped into dwelling	5.3%
Piped into compound	1.3%
Piped to neighbour	1.2%
Public tap	1.9%
Tube well	0.4%
Hand pump (tap)	44.1%
Motorized pump	41.2%
Protected well	0.7%
Protected spring	0.3%
Bottled water (mineral)	0.1%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Impact evaluation of rural water supply and sanitation projects

The Asian Development Bank conducted an evaluation[61] of two projects – Punjab Rural Water Supply and Sanitation Project (PRWSSP), and Punjab Community Water Supply and Sanitation Project (PCWSSP). The evaluation was conducted in 7 randomly selected districts of the 30 covered by the PRWSSP and the PCWSSP.

Overall, 80% of the water supply systems provided water to the beneficiaries and were functional. The proportion of functional schemes was greater under the PCWSSP (89%), than under the PRWSSP (68%). The functionality of water supply systems positively correlated with the lack of alternative water sources. Similarly, willingness to pay for water was found to be higher in areas with no alternative water sources. Water supply system efficiency varied widely and it could have been improved if sufficient attention had been given to basic management practices.

The projects took sufficient care in identifying water sources uncontaminated by heavy metals, but bacteriological contamination was found to be high in many locations. While chlorination kits were provided, these were not used in most of the subprojects. However, households widely

[61] Impact of Rural Water Supply and Sanitation in Punjab, Pakistan 2009. Asian Development Bank

practiced boiling water for drinking purposes. As a result, negative impact of bacteriological contamination on diarrhoea incidence was not found.

Some of the major findings include the following:

- 20% of the subprojects are non-functional
- only 43% of CBOs responsible for subprojects are functional
- cost recovery and capital replacement mechanisms are not built-in
- high fuel and electricity costs, and erratic power supply have the potential to bring operational subprojects to a halt
- CBOs capacity remains weak
- government commitment to continued support for subprojects is weakening
- participation of poor remains low due to upfront cash requirements; and
- operational link between the PHED and the tehsil municipal administrations remains very weak

The comprehensive study provides a set of five key lessons for future rural WSS operations.

First, rural WSS projects deliver significant gender benefits in terms of (i) reduced drudgery for women and girls engaged in fetching water, and (ii) increased girls' attendance particularly at the high school level.

Second, current rural WSS project designs largely focus more on improving water access to the households, and less on ensuing wastewater and solid waste management issues. Hence, the project designs need to (i) be based on lessons from past operations of ADB and other development partners and conceptual framework demonstrating clear linkages between planned development interventions and expected outcomes and impacts; (ii) include only directly relevant components and each component must be adequately resourced and implemented by the most appropriate agency; (iii) develop synergy between water supply and sanitation with strong commitment and focus supported by sizable investment in sanitation; (iv) make provision for a functional monitoring and evaluation arrangements with baseline data for the project and comparison (control) areas; (v) recognise the medium to long-term role of NGOs and private sector in supporting CBOs; (vi) make provision for additional mechanism for WSS to poorest of the poor and other disadvantaged groups because an upfront cash requirement for household connection limits their participation in conventional WSS projects and (vii) strengthen voices of females in the design and implementation arrangements.

Third, ADB need to proactively partner with other development partners in WSS specifically in the areas of (i) creating demand for sanitation investment; (ii) improving delivery of safe water; (iii) strengthening institutional capacity of CBOs, NGOs and private sector; (iii) strengthening institutional incentive structure for effective management and WSS services; and (iv) water demand analysis, water resource mapping and water use regulations.

Fourth, collecting valid baseline data on individuals, households, and communities along with valid counterfactuals (comparison groups) is critical for assessing results and conducting rigorous impact evaluations, which can assist in quantifying the impact of development interventions on household welfare.

Fifth, to maximise sustainability of project benefits (i) assistance may be required to bridge finance O&M in the initial years of operations even after project completion; (ii) the capacity of CBOs need to be strengthened to address technical, managerial and financial management issues; (iii) there is a need for an effective post-completion monitoring mechanism to ensure smooth operation of WSS systems; and (iv) the linkages between the CBOs with PHED, TMAs and private businesses must be strengthened.

Recent Initiatives for Water Supply in Punjab

Housing & Urban Development and Public Health Engineering Department

The Government of the Punjab is cognisant of its responsibility to ensure provision of safe drinking water and improved sanitation facilities for the entire population of the Province. Therefore, it is a commitment of the Government to create an enabling environment for the drinking water to ensure reliable, sustainable and affordable drinking water to its growing population. Improving the quality of life of all people, especially those that are underprivileged and under-served, those that are vulnerable, is the fundamental principle upon which modern day development is based. It is not only about poverty reduction, but rather about improving human security, empowering people and enhancing opportunities so that they can make choices in life. There is probably no greater basic human need and fundamental right than access to safe drinking water and clean environment.

The Government of the Punjab has taken a number of initiatives / actions (projects / policies / plans) to accelerate the progress towards achieving Millennium Development Targets. Some of these include the following:

Punjab Saaf Pani Company

The Government of Punjab, under the special initiative of the Chief Minister Punjab, has established the Punjab Saaf (Clean) Pani (Water) Company (PSPC) with a mandate to develop, design, plan and execute projects for providing safe drinking water solutions, prioritising under-served areas, especially rural and peri-urban areas of the province[62].

The Government of Punjab has launched a mega programme worth PKR 70 billion to provide safe and clean drinking water to rural and peri-urban communities of the province. The Annual Development Programme has approved an allocation of PKR 11.0 billion for 2015-2016 under its Medium Term Development Framework. The programme aims to ensure that the rural population has reasonable access to safe water supply solutions. Under this programme, PSPC envisages provision of at least 3 litres of safe drinking water per capita per day in programme areas. Punjab Saaf Pani Company is committed to adhering to WHO standards for provision of safe drinking water drinking water to the communities.

[62] http://www.saafpani.punjab.gov.pk/ accessed on 2nd September 2015

The Saaf Pani programme is expected to benefit more than 40 million population of the peri-urban and rural areas in the next three years. All the unserved and underserved areas of the province would be covered under the programme. The Saaf Pani programme is unique in that it would provide water supply solutions best suited and adapted to the needs and circumstances of various villages/settlements.

Different water supply solutions including installation of modern technology filtration plants, construction of new conventional water supply schemes and rehabilitation of existing water supply schemes and other best solutions shall be commissioned under PSPC. Furthermore, special interventions for scattered populations are also being planned.

Besides exploring different water supply solutions, a contract has been awarded for installation of water supply plants with multiple technology in Hasilpur tehsil of district Bahawalpur, Minchinabad tehsil of district Bahawalnagar, Lodhran tehsil of district Lodhran and Khanpur tehsil of district Rahim Yar Khan. Out of more than 900 identified locations, construction work has already commenced at more than 100 locations of the area.

A survey is currently underway to identify abandoned or dysfunctional schemes in rural Punjab, so that they can be rehabilitated with the most appropriate and 'best fit' solutions in the areas concerned. Following a transparent and competitive process under the law, PSPC has engaged highly experienced and reputable national and international engineering firms to undertake surveys, planning and detailed engineering design tasks to propose 'best fit' water supply solutions. In addition, international firms are also being engaged for Third Party Validation (TPV) to ensure execution of quality water supply schemes.

Survey, planning, engineering design and execution work in districts of Dera Ghazi Khan, Muzaffargarh, Rajanpur, Layyah, Faisalabad, Nankana Sahib, Toba Tek Singh, Kasur, Okara and Sahiwal is underway. The commissioning of the water supply solutions in these districts is scheduled to be completed within the next one year. Survey, planning and testing of water samples for the rest of the 22 districts of Punjab is expected to be commenced in November 2015 and scheduled to be completed within one and a half years including the commissioning.

The Punjab Saaf Pani Company is already in the process of undertaking some key activities. For instance, PSPC is planning a water supply solution in Pattoki tehsil for a population of 1.2 million, where the whole tehsil has been distributed into 11 large clusters with an average of 17 villages in each cluster. The pilot project is based on comprehensive engineering and social surveys, supported by primary and secondary water sampling results.

The Saaf Pani programme is underpinned by a strong social mobilisation component, which is being executed by highly experienced NGOs, hired through a competitive process. Village communities are being involved in every aspect of the planning process for the water supply solutions and they will be made integral stakeholders in the management of the plants to create ownership and promote long-term sustainability.

Saaf Pani Tanzeems are being formed in all the villages/settlements and at cluster level where water supply solutions would be provided. The objective of these Tanzeems is to make public sector water supply projects economically and socially feasible and sustainable.

Changa Pani Programme

In order to establish willingness in the community to operate & maintain rural water supply and sanitation schemes, the Government has taken an initiative to provide clean drinking water through need based water supply and sanitation schemes on the premise that 'External Component' will be executed by the Government Department and 'Internal Component' will be executed by the community itself. The Government has allocated PKR 1 billion for execution of this Programme.

Sustainable Operation & Maintenance Mechanism of Rural Water Supply Schemes

For the sustainable operation & maintenance mechanism of rural water supply schemes, the Chief Minister has allocated PKR 139.150 million for the year 2013-14 on the basis that PKR 50,000 will be allocated for each functional scheme which will be utilised for repair & maintenance, capacity building, technical support, or any other purpose prescribed by the Government.

Rehabilitation of dysfunctional water supply schemes

Currently, there are 1391 dysfunctional rural water supply schemes in Punjab[63]. According to an estimate, PKR 9189 million are required for their rehabilitation to benefit 8.4 million population.

However, in the first phase, PHED identified 199 dysfunctional RWSS for rehabilitation and conducted a Third Party Validation (TPV) to estimate the cost of rehabilitation and knowing about community willingness and cost sharing. In this regard TPV conducted a detailed survey and prioritised 170 RWSS for rehabilitation on cost sharing basis. It was estimated that PKR 1123 million is required to cover 1.01 million population. Such schemes have been prioritised on the basis of criteria like presence of scheme in sweet, brackish or barani area, cost sharing by the community, total cost required for rehabilitation and Open Defecation Free (ODF) status.

Rehabilitation of 135 rural water supply schemes in Dera Ghazi Khan, Rajanpur, Chakwal and Vehari is in process with the assistance of UNICEF.

Water Supply Schemes in Tehsil Phalia, District Mandi Bahauddin

PHED has completed the project "Provision of Water Supply System in the Villages Affected by the Affluent of Colony Sugar Mills of Tehsil Phalia, District Mandi Bahauddin" in collaboration with Korea International Cooperation Agency (KOICA) who provided Grant in Aid of PKR 400 million (USD 4.00 million). This project has enabled Government of Punjab to provide safe drinking water to a population of more than 90,000 in 25 affected villages of Tehsil Phalia.

Extension of Water Resources for Faisalabad city

This project will be executed by WASA-FDA, Faisalabad funded by the French to cover a population of 0.35 million with an estimated cost of PKR 5133.96 million. This will improve the distribution network.

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[63] Public Health Engineering Department, Government of Punjab

Local Government & Community Development Department

Installation of hand pumps

The LG&CDD installed 120 hand pumps in the flood affected Union Councils of district Rajanpur. The hand pumps have been installed for disaster risk reduction in flood prone areas by raising the platforms to 3.5 feet above ground level.

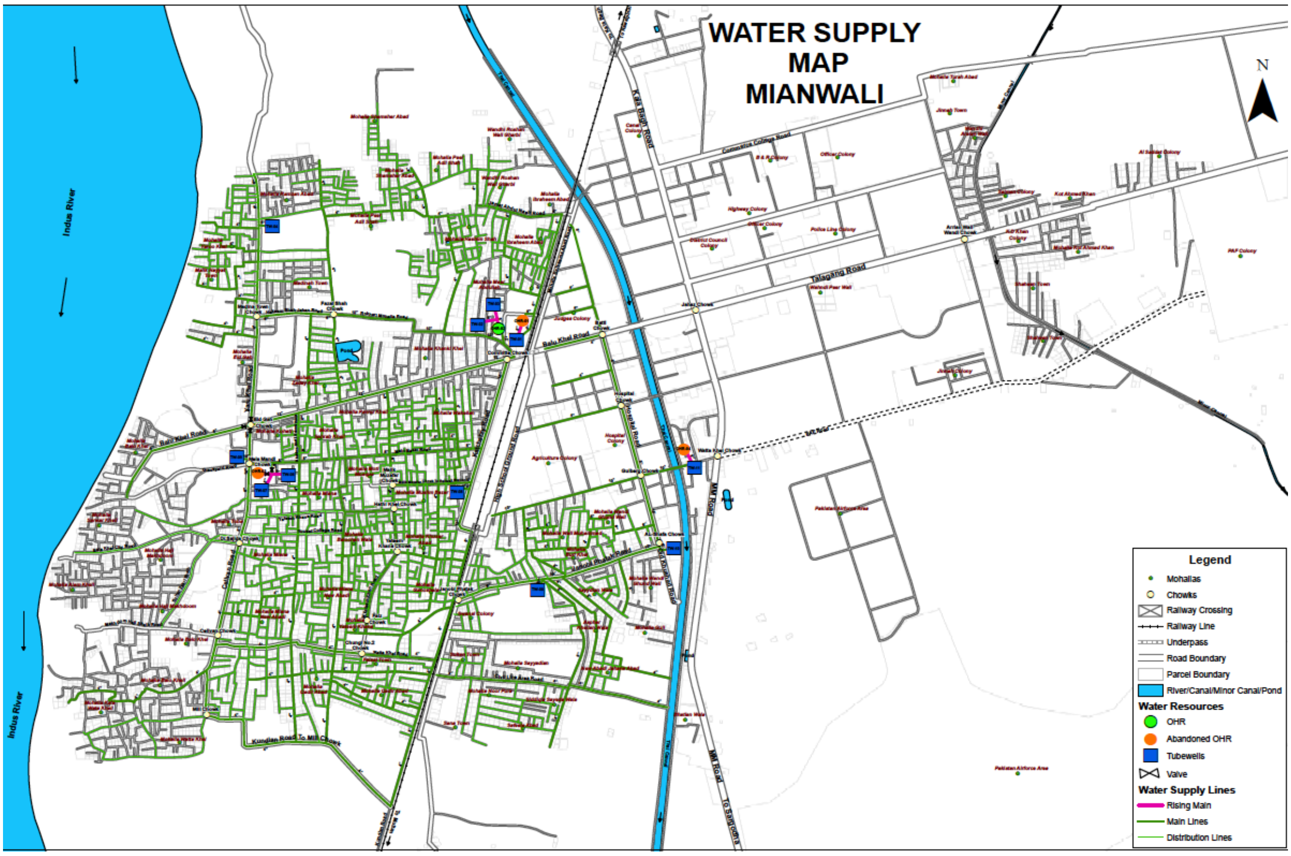
Punjab Municipal Development Fund Company

Water supply maps

The Punjab Municipal Development Fund Company (PMDFC), as part of the Punjab Municipal Services Improvement project funded by the World Bank, has developed GIS maps of water supply (with the assistance of Urban Unit) in all the TMAs. Furthermore, a performance management system monitors progress and coverage e.g. percentage of household connections to water supply.

An example of a GIS map for water supply in a TMA is shown in **Fig 22**. It illustrates the water supply lines (rising main, main lines and distribution lines). It also shows the location of overhead reservoir, any abandoned OHR, tube wells, valves and any river, canal, minor canal or pond.

Figure 22 - Sample water supply map



(Source: Punjab Municipal Development Fund Company)

Strategy

Water Supply			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All rural areas, cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 100% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Dysfunctional tube wells/schemes adequately rehabilitated and maintained	A phased plan for rehabilitation of dysfunctional tube wells/schemes developed according to district and TMA and implemented in a phased manner	At least 50% of dysfunctional tube wells/schemes rehabilitated and operational, and O&M system functioning	At least 100% of dysfunctional tube wells/schemes rehabilitated and operational, and O&M system functioning
Shallow tube wells replaced by deep tube wells	Mapping of shallow tube wells by districts and TMAs	Phased replacement plan for at least 10%	Phased replacement plan for at least 20%
Rehabilitation and replacement of old infrastructure	Each city and town has mapped out old infrastructure and leaky mains that need rehabilitation or replacement	At least 10% of old infrastructure in cities and 20% in towns replaced or rehabilitated as part of city or town development	At least 20% of old infrastructure in cities and 40% in towns replaced or rehabilitated as part of city or town development
Existing functional tube wells/schemes continue to perform optimally	Each district and TMA has a scheduled tube well/scheme maintenance plan	Tube wells/schemes perform at 80% or better functionality	Tube wells/schemes perform at 95% or better functionality
Energy efficient water supply schemes	Map areas that have persistent power shortage Introduce solar energy supported water supply schemes At least 20% of water supply schemes converted to solar energy All new water supply schemes are solar energy compliant where feasible	At least 40% of water supply schemes converted to solar energy	At least 60% of water supply schemes converted to solar energy
100% piped water coverage in cities and towns	Extend distribution networks and supply lines to provide 60% coverage in cities and towns	Extend distribution networks and supply lines to provide 70% coverage in cities and towns	Extend distribution networks and supply lines to provide 100% coverage in cities and towns
65% piped water coverage in rural areas	Extend distribution networks and supply lines to provide 20% coverage in rural areas (depending on baseline)	Extend distribution networks and supply lines to provide 40% coverage in rural areas	Extend distribution networks and supply lines to provide 65% coverage in rural areas

Enhanced coverage of filtration plants in zones with high hand/motor pump use	High prevalence hand/motor pump use areas mapped in all TMAS Filtration plants installed in 25% of areas with high hand/motor pump use	Filtration plants installed in 45% of areas with high hand/motor pump use	Filtration plants installed in 65% of areas with high hand/motor pump use
Water flows monitored at tube wells	Bulk flow meters and pressure gauges installed at 20% of tube wells	Bulk flow meters and pressure gauges installed at 40% of tube wells	Bulk flow meters and pressure gauges installed at 60% of tube wells
Additional water storage capacity developed	Storage capacity needs of cities and towns determined	At least 25% TMAs build extra overhead storage capacity	At least 50% TMAs build extra overhead storage capacity

WATER QUALITY

Technical Assessment

The technical assessment of water supply schemes in 21 districts in north and central Punjab[64], conducted by the Pakistan Council of Research in Water Resources in 2011 revealed the following:

- The maximum schemes (365) are in Rawalpindi district and minimum (17) are in Hafizabad district.
- 35% of the schemes are non-functional (of which 71% are temporarily closed)
- The commonest causes for non-functional (temporary closure) were community dispute/collection of O&M funds/non-payment of electricity bill and breakage in transmission/distribution network
- 88% of the population served use ground water
- 43% of functional schemes supplied water less than 5 hours per day, while 31% supplied between 5-10 hours per day
- In general, based on the observations of the survey teams, most of the distribution pipelines have been laid in the sewerage drains without using standard connecting accessories such as reducers, tee fittings, elbows and other pipelines fittings. It was observed physically, that the maintenance areas such as occasional cleaning, servicing of valves and hydrants, leak checking, repairs, disinfection of repaired section of the water distribution system, etc. are totally neglected by the operation staff of the water supply schemes
- 81% of the schemes have been constructed by PHED, 5% by TMAs, 1% by the community, 4% by non governmental organisations and 10% by multilateral donors
- 31% of the schemes are over 25 years old, 23% are between 20 to 25 years old, 16% are 15- 20 years old while 30% schemes are 10-15 years old
- In 80% of the schemes, there is no water treatment facility, while only 12% provide some treatment (chlorination, bleaching powder, potassium permanganate etc.)
- Water samples collected from the water sources of the functional water supply schemes indicates that 79% of the total collected samples are unsafe for drinking purpose because of microbiological and chemical contamination (iron, fluoride, nitrates) and physical problems (turbidity, hardness, total dissolved solids)
- Water samples collected from the houses of the consumers of the functional water supply schemes reveals that 88% of the total samples collected are unsafe for drinking purposes – the reasons are similar to those found at the sources

[64] Report on Technical Assessment of Water Supply Schemes Northern and Central Punjab (Volume-I), 2011. Pakistan Council of Research in Water Resources

Table 9 illustrates the very high level of bacterial contamination found in water sources of 11 major cities in Punjab. It highlights the issue of inadequate wastewater treatment and contamination of water reservoirs.

Table 9 - Bacterial contamination in 11 cities in Punjab

City	Bacterial Contamination Level %
Faisalabad	38-79%
Bahawalpur	52-76%
Gujranwala	29-71%
Gujrat	56-100%
Kasur	40-50%
Lahore	37-63%
Multan	31-87%
Rawalpindi	53-87%
Sheikhupura	27-55%
Sialkot	40-70%
Sargodha	75-92%

(Source: National Water Quality Monitoring Programme, Water Quality Status in Pakistan, Phase I-V, 2001-2006, Pakistan Council of Research in Water Resources)

Drinking water supply lines and open sewage drains in the streets are often laid side by side. As a result, water is frequently contaminated when pipes erode. Most main sewers are between 30-50 feet (roughly 9-15 metres) below ground level and are made of 10 feet (3m) cement sections linked without proper safety seals. Poor connections combined with deteriorating low quality sewer pipes cause a lot of leakage. The outflow from sewer mixes with the water table and the contamination is carried to deeper levels. Thus the groundwater which is considered safe becomes adulterated with everything from polychlorinated biphenyls (PCBs), lead, cyanides, mercury, solvents, and hydrocarbon compounds, to hospital and pharmaceutical industry waste. Domestic wastewater collects on the streets and in low-lying areas. The situation is further aggravated by the addition of untreated wastes from small-scale industries.

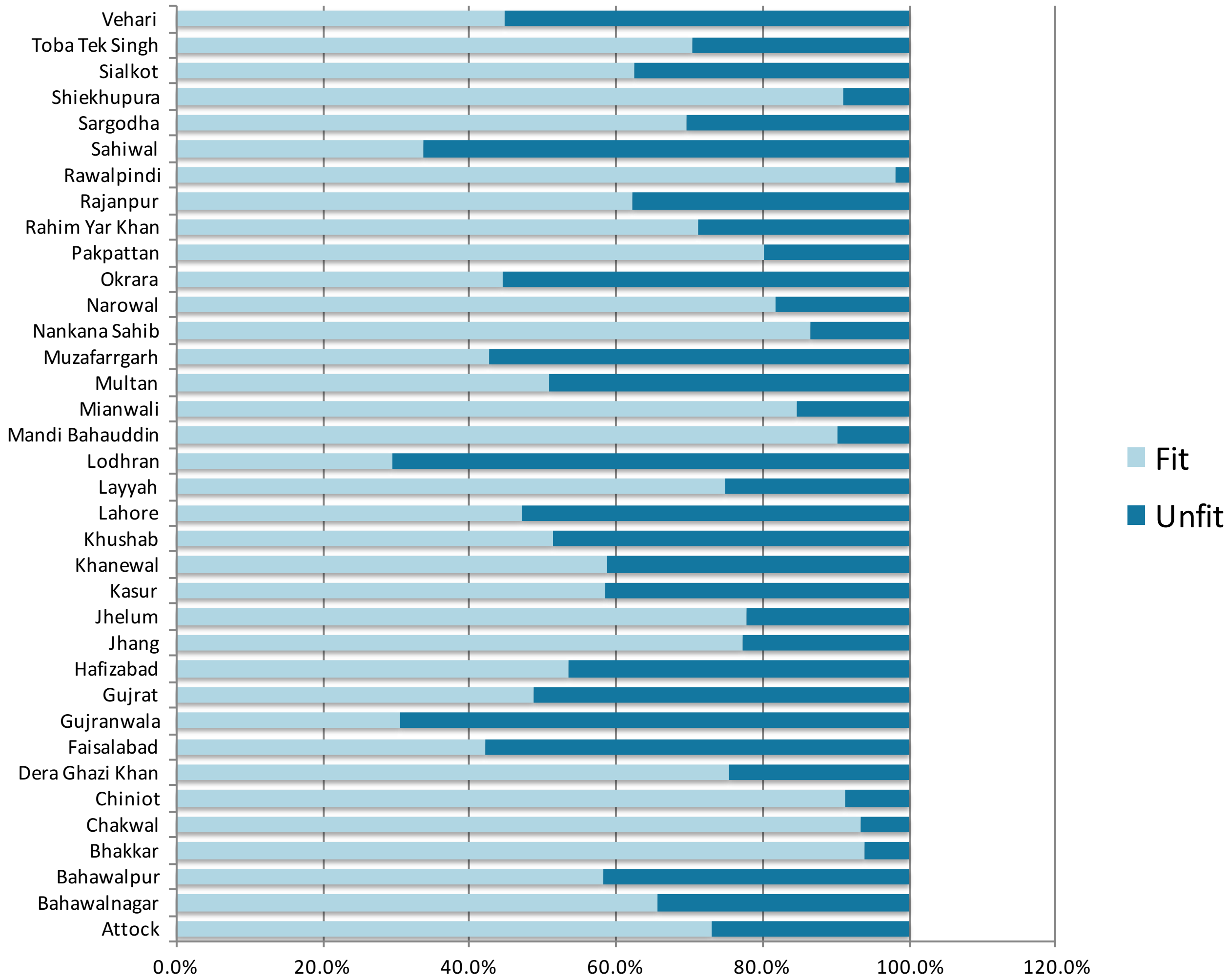
In 2012, PHED conducted water quality monitoring survey with the assistance of UNICEF of Punjab. Through this survey, 46,000 samples were collected from about 23,000 rural settlements to assess the water quality and to determine the future investment strategy in contaminated and brackish / barani areas.

A Third Party Validation of this survey is also being conducted through PCRWR. The report on water quality monitoring survey will be published soon. They tested the following parameters:

Physical	Chemical	Bacterial
▪ Total Dissolved Solids (TDS) ▪ Ph ▪ Colour ▪ Odour ▪ Taste	▪ Arsenic ▪ Fluoride ▪ Iron ▪ Nitrate ▪ Nitrite	Colonies per 100 ml

The results revealed that in 36.3% of villages the drinking water was chemically unfit and in 32.7% of villages it was bacterially unfit for human consumption. This indicates that about a third of all villages in Punjab have water that is unfit for drinking.

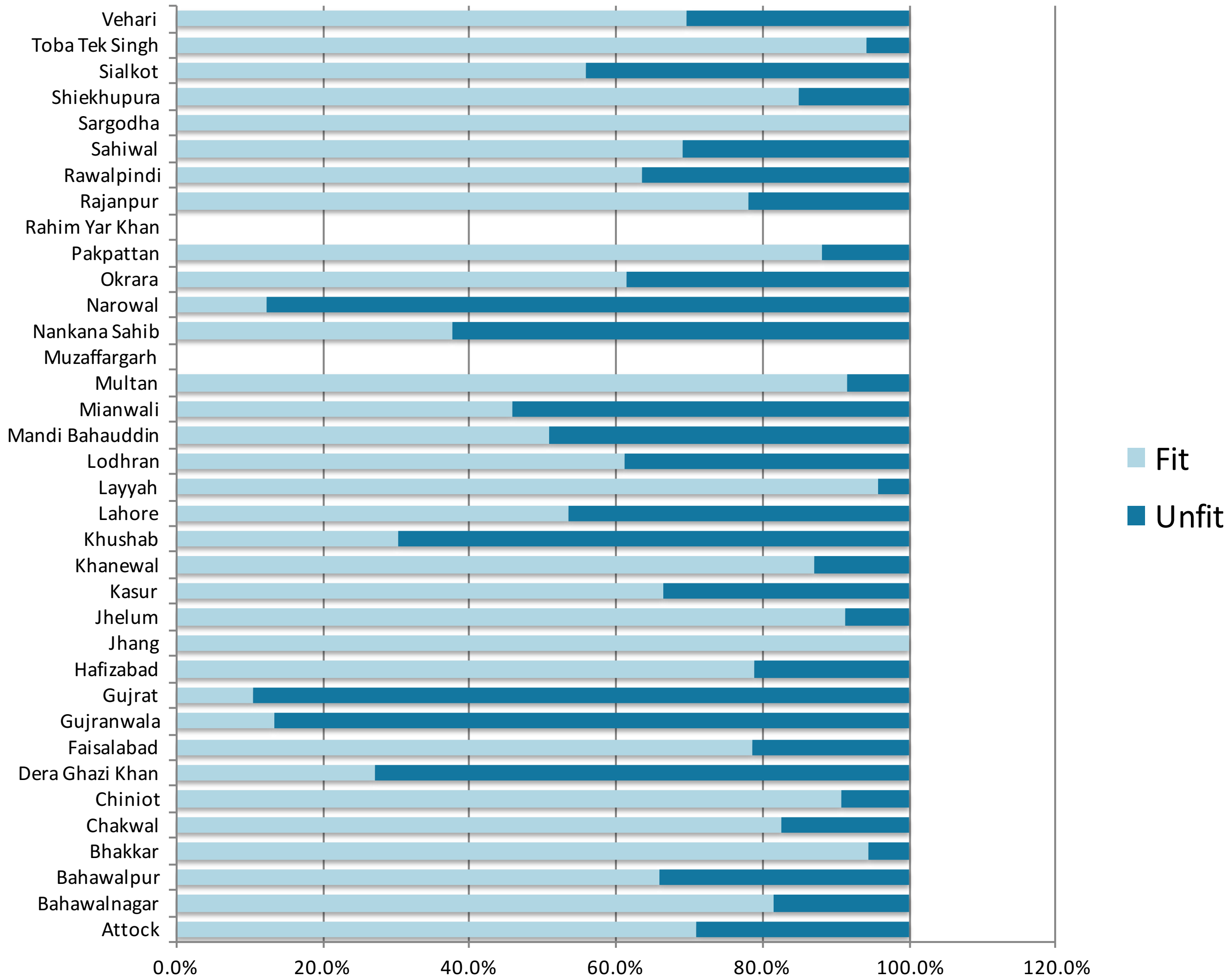
Figure 23 - Chemical quality of drinking water in Punjab



(Source: PHED and UNICEF, 2011-12)

Fig 23 illustrates the district situation with regards to the chemical quality of water. Over 60% of villages in Sahiwal, Lodhran and Gujranwala have chemically unfit drinking water. Only in Rawalpindi district did villages/settlements have over 98% water that was chemically fit for drinking. In Lahore, only 47.2% of samples were found chemically fit.

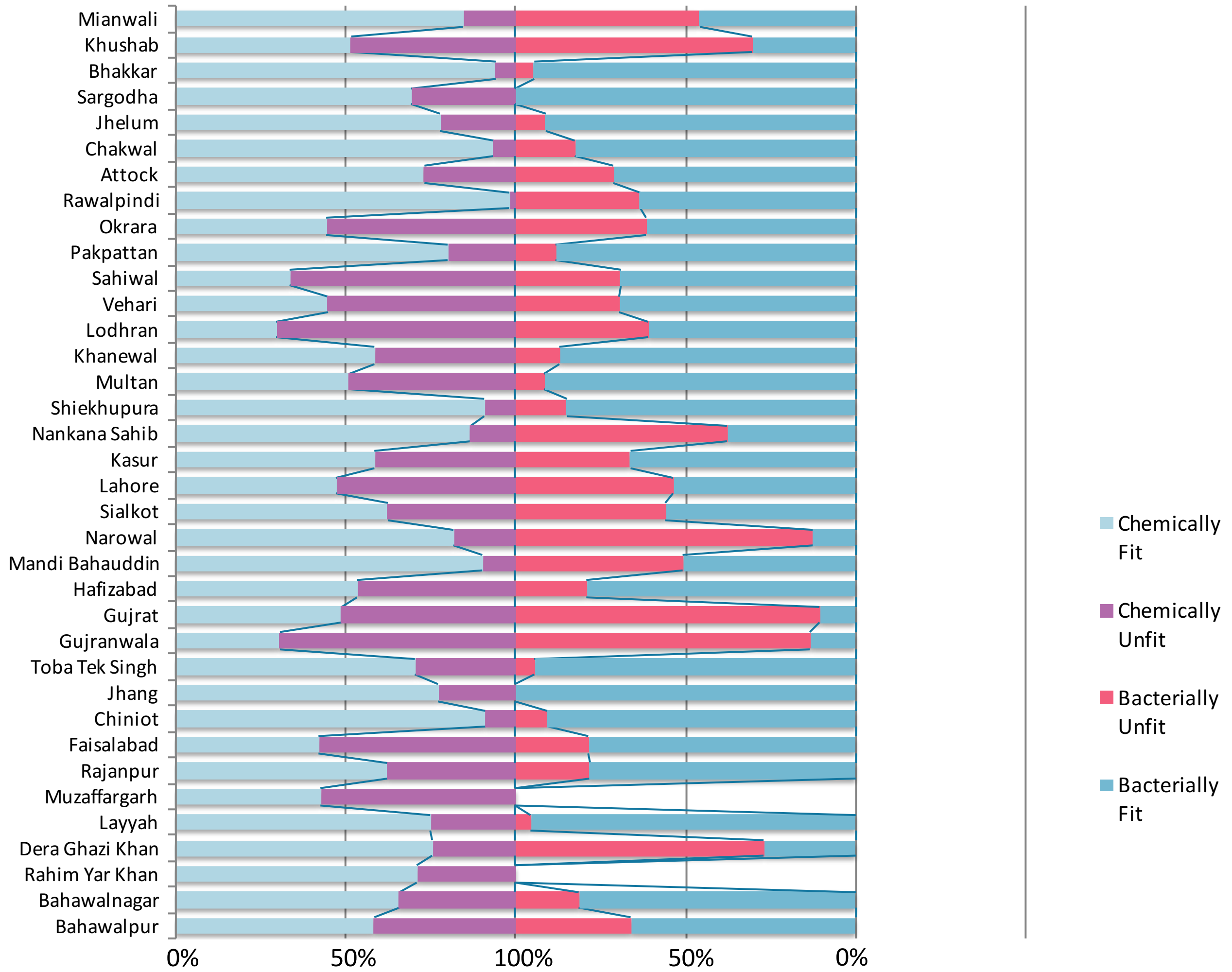
Figure 24 - Bacterial quality of drinking water in Punjab



(Source: PHED and UNICEF, 2011-12)

Fig 24 demonstrates that most districts had bacterially contaminated water for drinking. Only Jhang achieved a 100% score for no bacterial contamination. In Narowal, Gujrat and Gujranwala, over 80% of water samples were found to be bacterially contaminated. In Nankana Sahib, Khushab and Dera Ghazi Khan, over 60% of samples had bacterial contamination. No data was available for Rahim Yar Khan and Muzaffargarh.

Figure 25 - Drinking water quality status in districts in Punjab



(Source: PHED and UNICEF, 2011-12)

Fig 25 illustrates the combined status of chemical and bacterial quality in Punjab districts. The worst affected districts that had unfit drinking water for combined chemical and bacterial quality were Dera Ghazi Khan, Gujranwala, Gujrat, Khushab, Lahore, Lodhran, Narowal and Sahiwal.

The causes for contamination are likely to be multifarious, however, lack of proper wastewater treatment, seepage and infiltration of ground water by pollutants, and inadequate or absent water treatment after abstraction but before supply for domestic use are the prominent causative factors that need to be addressed.

Recent Initiatives for Water Quality in Punjab

Housing & Urban Development and Public Health Engineering Department

Water Testing Laboratories at District Headquarters

PHED also initiated a project of 'Establishment of 31 Water Testing Laboratories at District Headquarters of Punjab' in 2009. The project was evaluated in 2011[65]. The evaluation, while noting that the 31 water testing laboratories had been established with staff in place, it also made some observations, particularly:

Monitoring/Surveillance of drinking water sources in the respective districts - During evaluation, it was observed that no proper system is being maintained to use the data of monitoring as no lessons learnt or action is being taken on the basis of these reports. It is recommended that monthly water quality monitoring reports of districts should be published on the website of PHED for awareness of main beneficiaries and general public. There should be a proper Standard Operating Procedure for Monitoring of drinking water starting from field-testing up to dissemination of its report and recommendations. Department should develop SOP for the same.

Heavy Metals

Due to unavailability of machines and chemicals, not all laboratories are able to perform Heavy metal tests. At present, only 8 PHED laboratories have machinery for testing presence of heavy metals in water (Bahawalpur, DG Khan, Faisalabad, Gujrat, Lahore, Multan, Rawalpindi and Sargodha). Investment is required in machinery to upgrade the PHED laboratories to test for heavy metals as well.

Water Quality Monitoring Survey

The Department conducted a water quality monitoring survey of all villages of the Punjab during 2012 to assess the water quality and to determine the future investment strategy in contaminated and brackish / barani areas. Third Party Validation is in process and after its completion a report will be shared with all the stakeholders.

Surface Water Quality Monitoring

The Directorate of Land Reclamation, Irrigation and Power Department, Government of Punjab conducts periodic monitoring (usually annual) of surface water[66] (5 rivers, 27 major canals, 20 main drains) in Punjab. The main functions of the Directorate of Land Reclamation include:

- Groundwater Monitoring and Management in Punjab
- Monitoring of Water Sector Environmental Pollution

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[65] Evaluation report on project 'Establishment of 31 laboratories at district headquarters of Punjab'. Directorate General Monitoring and Evaluation, Planning and Development Department, Government of Punjab. 2011

[66] Surface Water Monitoring Data - Rivers, Canals and Drains 2011-2013. Directorate of Land Reclamation, Irrigation and Power Department, Government of Punjab

- On-farm Reclamation of Salt affected soils
- Field Research at Reclamation Research Stations
- Command Area Development of Small Dams
- Analysis of Soil and Water Samples and Basic Research

Strategy

Water Quality			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Monthly water quality testing at water source	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 25% of tube wells	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 50% of tube wells	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 75% of tube wells
Periodic water quality testing of distribution network	At least 30% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell	At least 60% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell	At least 90% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell
Periodic monitoring of water quality zones	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported Upgrade PHED laboratories to test for heavy metals	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported
All ground and overhead reservoirs supplied with chlorination treatment	Status of ground and overhead reservoirs in cities and towns determined Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 30% of reservoirs (or tube wells where storage capacity does not exist)	Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 60% of reservoirs (or tube wells where storage capacity does not exist)	Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 90% of reservoirs (or tube wells where storage capacity does not exist)

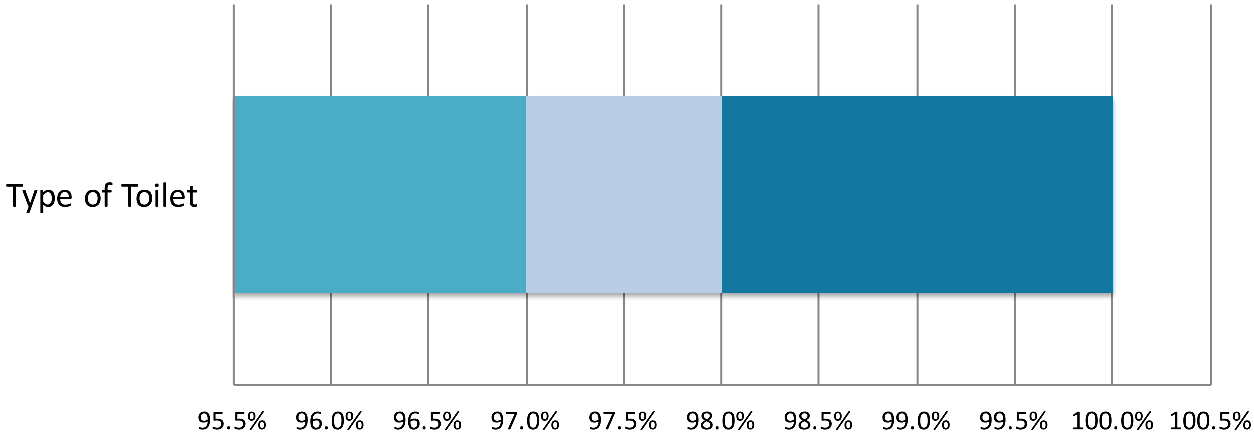
SANITATION

Urban and Rural Sanitation

Coverage

The recent PSLM 2012-13[67] survey shows that flush toilet is the prominent mode of sanitation in urban areas. No toilet was found in about 2% of households (**Fig 26**).

Figure 26 - Mode of urban sanitation in Punjab (PSLM 2012-13)



	Type of Toilet
Flush	97.0%
Non Flush	1.0%
No Toilet	2.0%

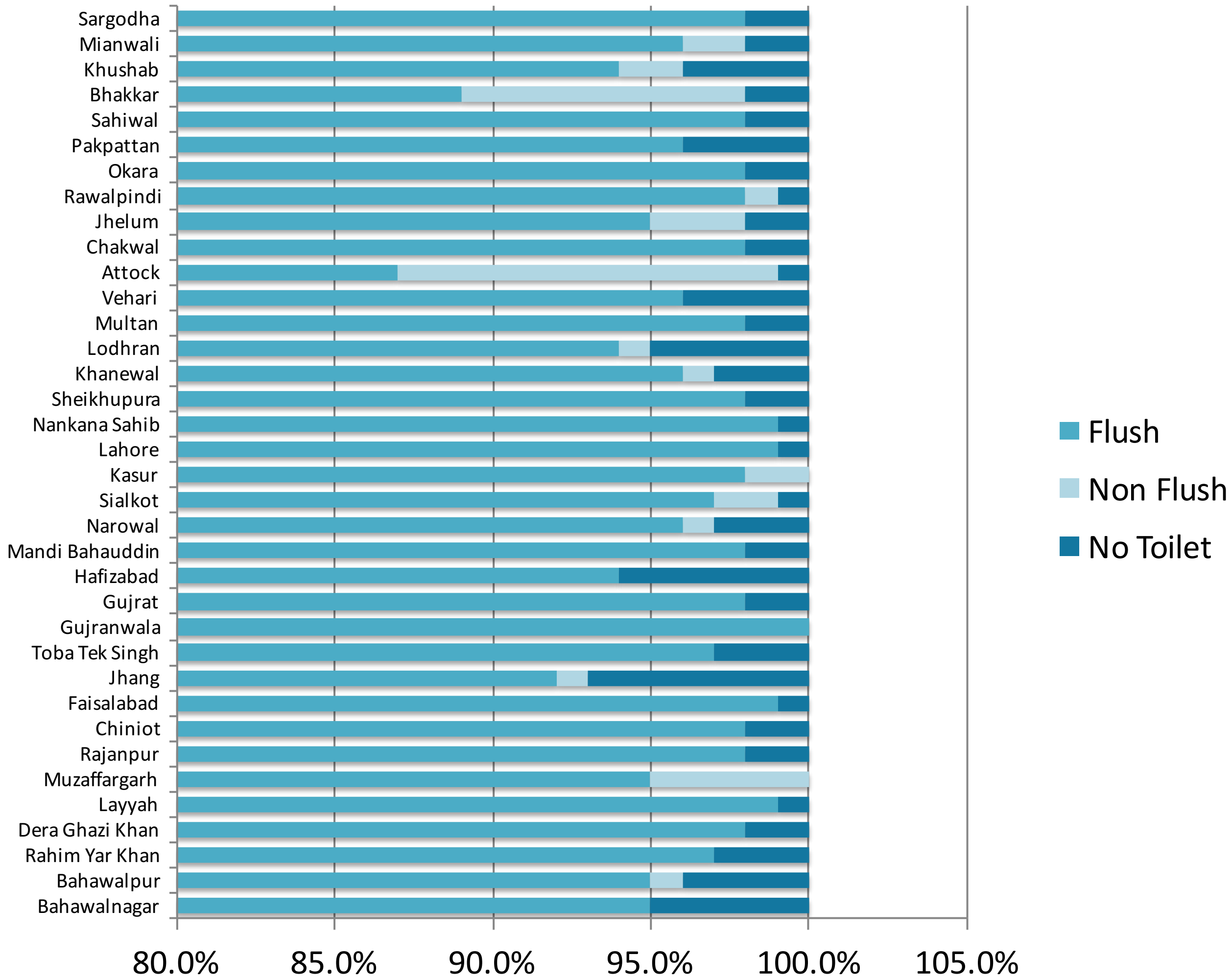
(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

Fig 27 shows that in urban areas, Jhang, Hafizabad, Bahawalnagar and Lodhran had the highest percentages of no toilet at 7%, 6%, 5% and 5% respectively. Gujranwala had the highest flush use at 100%.

In rural areas however, the rates of no toilet were over ten times as high at 26% as compared to urban areas (**Fig 28**). Furthermore, **Fig 29** shows that the highest percentages for no toilet were found in Chiniot (56%), Jhang (55%), Rajanpur (49%), Dera Ghazi Khan (49%) and Bahawalpur (45%).

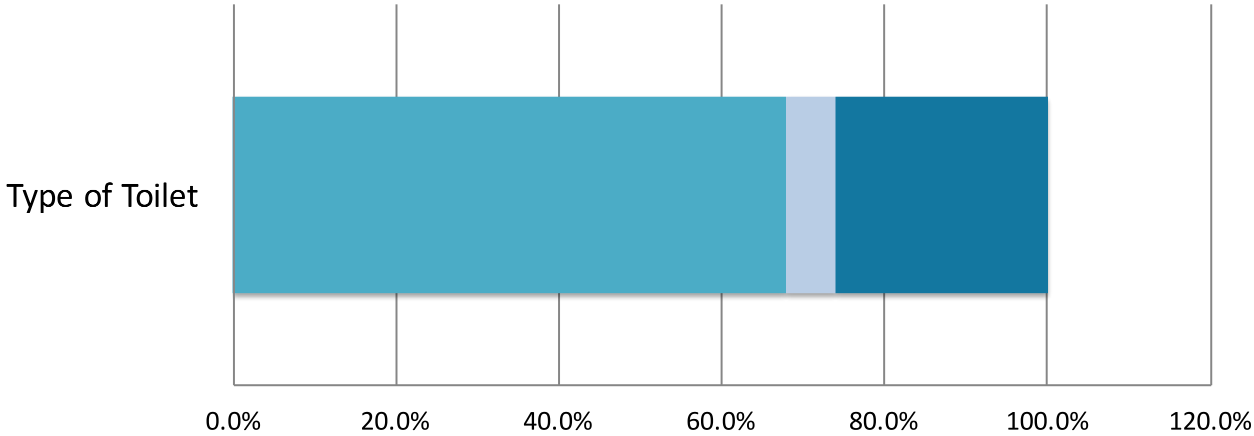
[67] Pakistan Social and Living Standards Measurement Survey 2012-13. Pakistan Bureau of Statistics, Government of Pakistan

Figure 27 - District wise distribution of mode of sanitation in urban areas (PSLM 2012-13)



(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

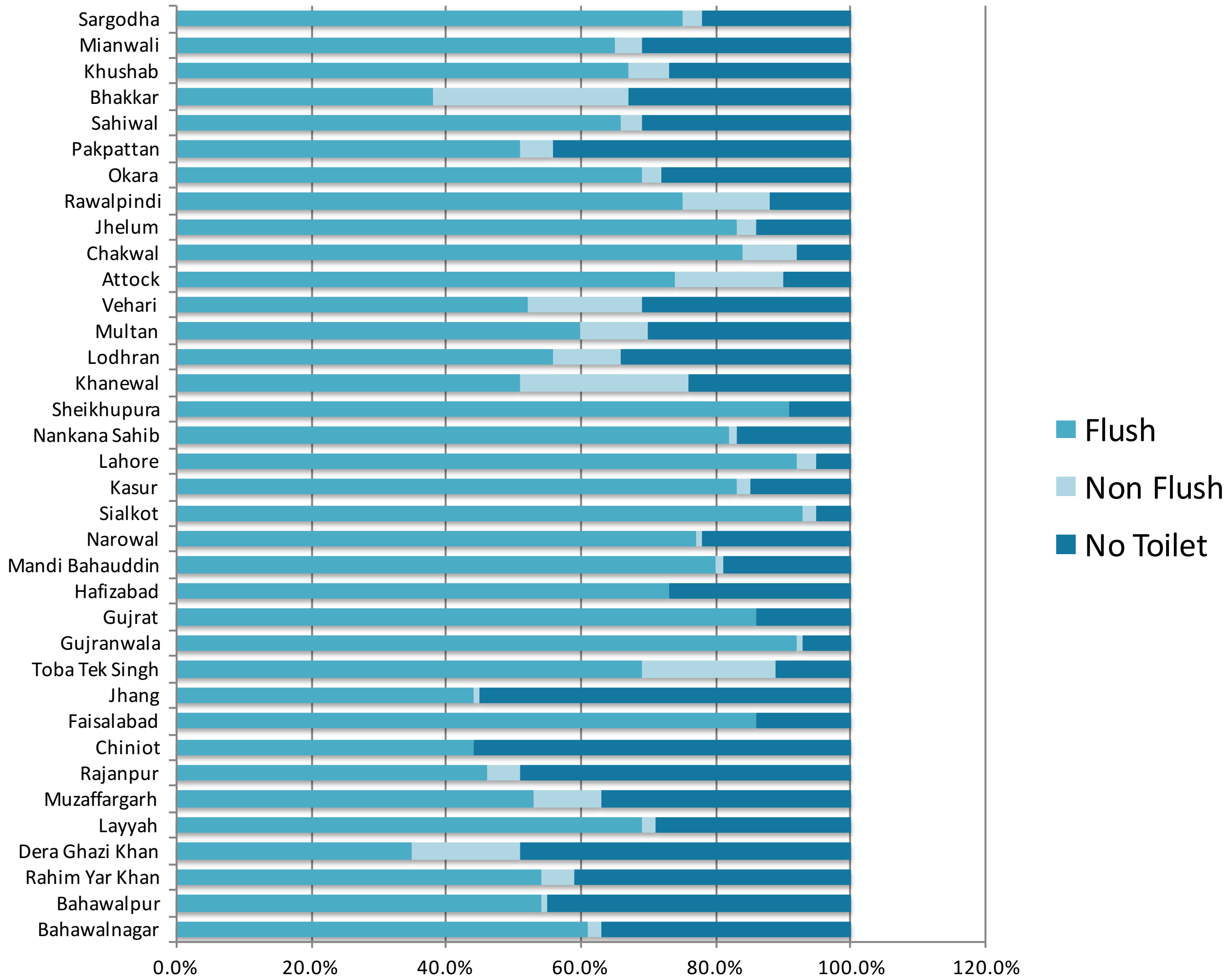
Figure 28 - Mode of rural sanitation in Punjab (PSLM 2012-13)



	Type of Toilet
Flush	68.0%
Non Flush	6.0%
No Toilet	26.0%

(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

Figure 29 - District wise distribution of mode of sanitation in rural areas (PSLM 2012-13)



(Source: Pakistan Social and Living Standards Measurement Survey, 2012-13. Pakistan Bureau of Statistics, Government of Pakistan)

The MICS 2011[68] of Punjab provides a more detailed and disaggregated analysis. **Fig 30** shows that in major cities, flush to piped sewer accounts for 81.2% and flush to septic tank accounts for 12.8%. If all flush categories are added, the total for flush use in urban areas comes to 91.6%, while in major cities it is about 94.6%. This is a little lower to the 98% found by PSLM 2012-13. However, when one disaggregates to other urban areas, the coverage of flush to piped sewer is 33.5% and flush to septic tank is 52.1% suggesting over four times as much use of flush to septic tank in other urban areas compared to major cities. This indicates marked variance in flush to piped sewer coverage in major cities and other urban areas.

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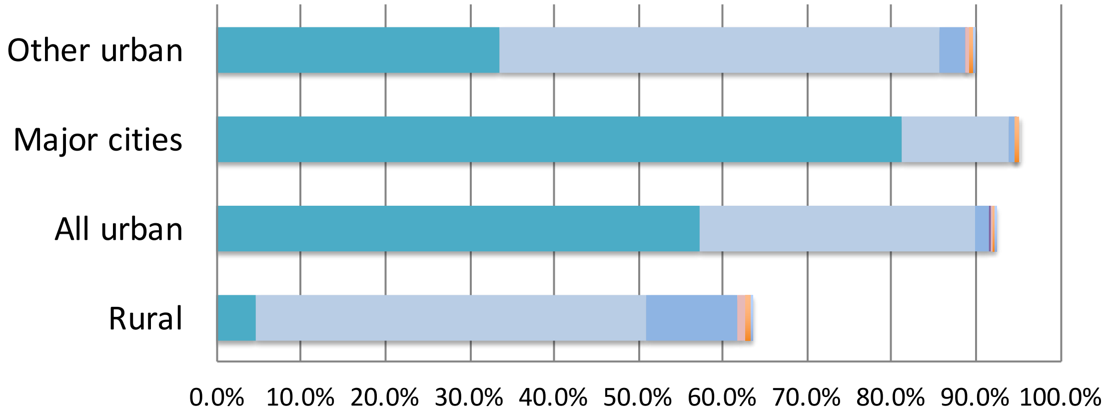
[68] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

Figure 30 - Mode of improved sanitation in urban and rural areas in Punjab (MICS 2011)

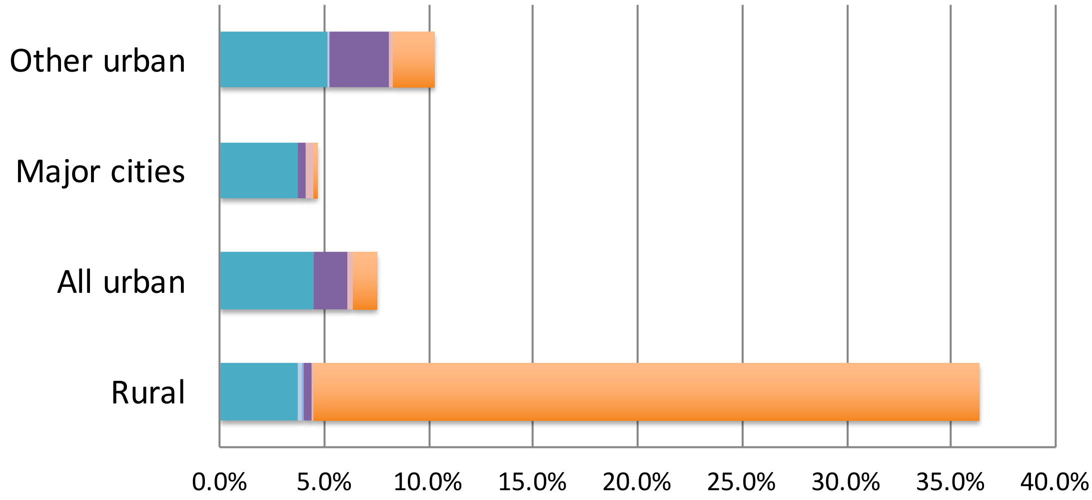


	Rural	All urban	Major cities	Other urban
Flush to piped sewer	4.5%	57.3%	81.2%	33.5%
Flush to septic tank	46.3%	32.5%	12.8%	52.1%
Flush to pit latrine	11.0%	1.8%	0.5%	3.1%
Flush to unknown place	0.0%	0.1%	0.1%	0.1%
Ventilated Improved Pit latrine	0.8%	0.2%	0.1%	0.4%
Pit latrine with slab	0.8%	0.4%	0.4%	0.4%
Composting toilet	0.2%	0.1%	0.0%	0.2%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Fig 31 illustrates that about a third (31.8%) of the rural population practices open defecation.

Figure 31 - Mode of unimproved sanitation in urban and rural areas in Punjab (MICS 2011)

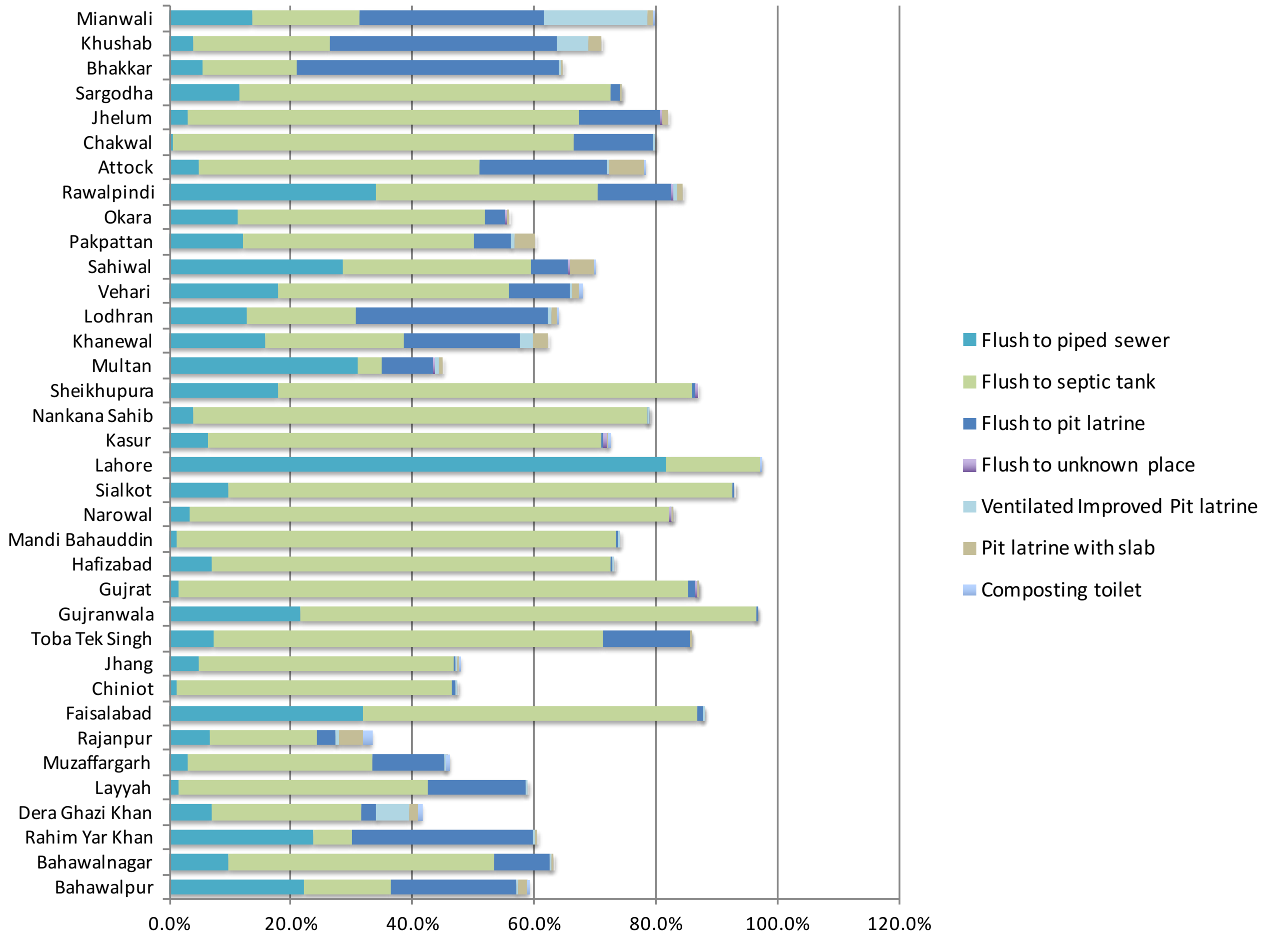


	Rural	All urban	Major cities	Other urban
Flush to somewhere else	3.7%	4.5%	3.7%	5.2%
Pit latrine without slab	0.2%	0.0%	0.0%	0.1%
Bucket	0.1%	0.0%	0.0%	0.0%
Other	0.4%	1.6%	0.4%	2.8%
Missing	0.1%	0.3%	0.4%	0.2%
Open defecation	31.8%	1.1%	0.2%	2.0%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

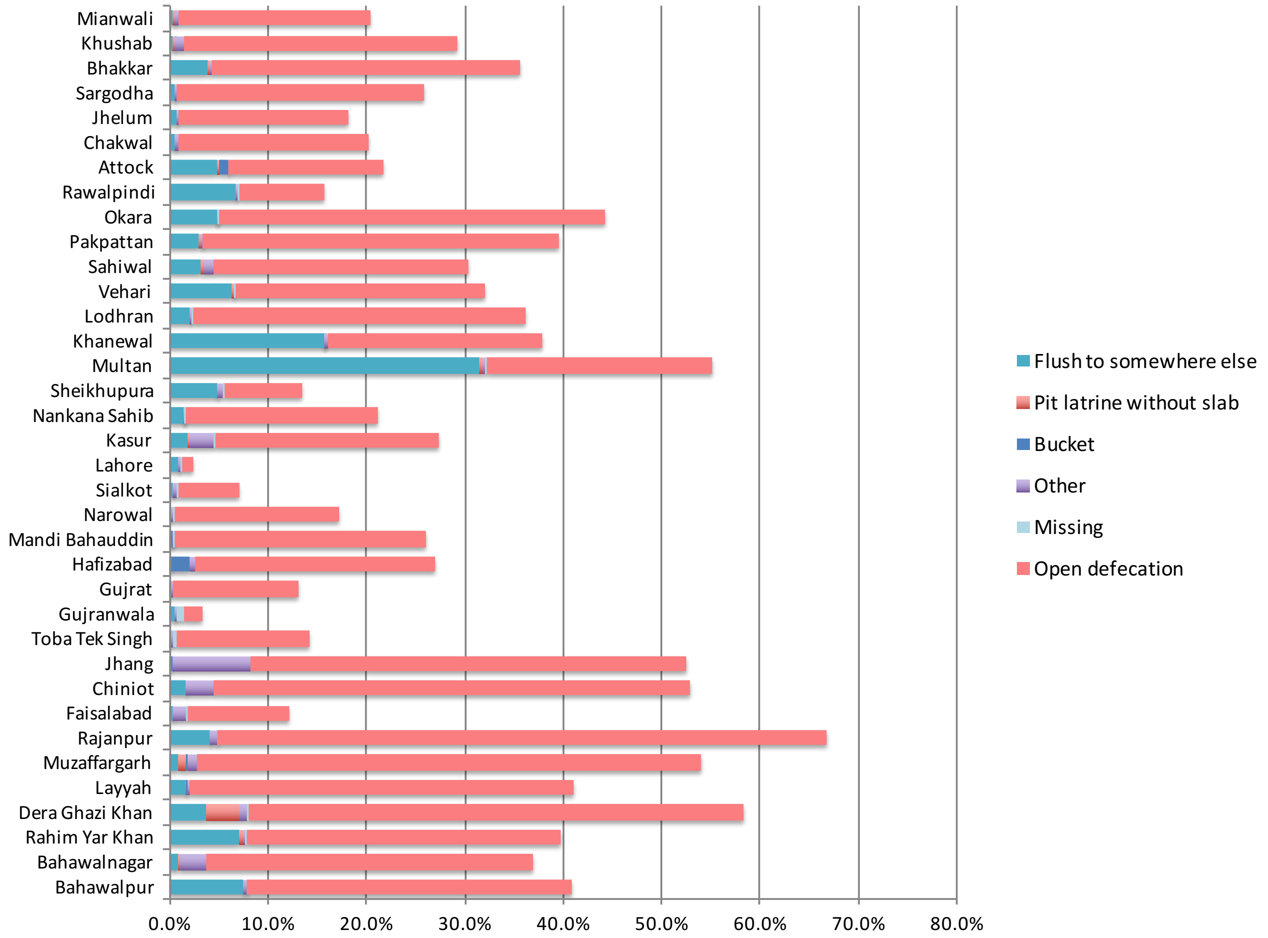
Fig 32 shows that most of Punjab uses the flush to septic tank mode of sanitation. **Fig 33** shows the status of unimproved sanitation in Punjab and the highest rates of open defecation were found in Rajanpur (61.8%), Muzaffargarh (51.2%), Dera Ghazi Khan (50.3%), Chiniot (48.4%) and Jhang (44.2%).

Figure 32 - District wise distribution of mode of improved sanitation in Punjab (MICS 2011)



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

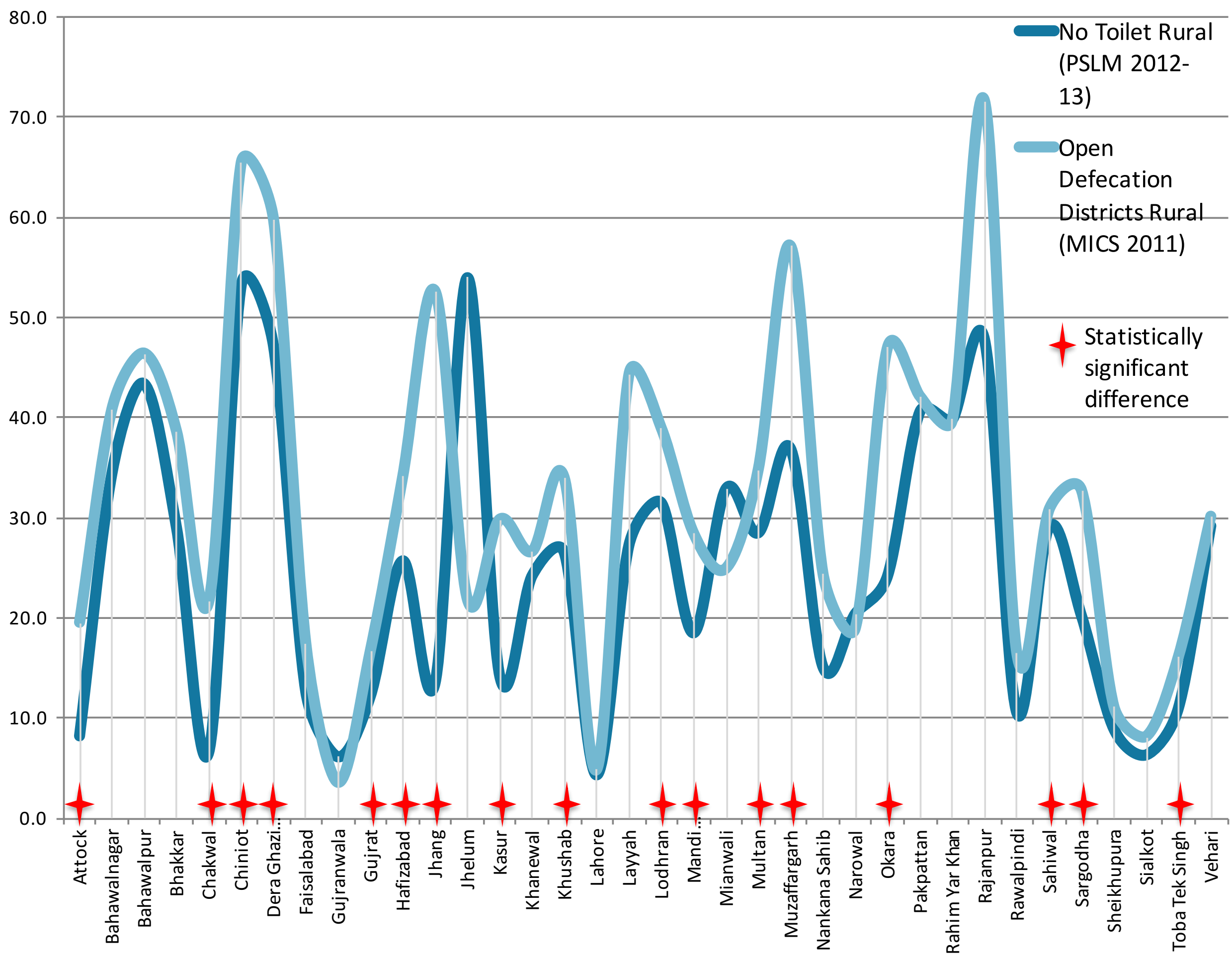
Figure 33 - District wise distribution of mode of unimproved sanitation in Punjab (MICS 2011)



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Fig 34 indicates that there is considerable similarity between district level trends observed for no toilet in PSLM 2012-13 rural and MICS 2011 for open defecation rural. Statistical analysis reveals that there is no significant difference in the rates in 19 out of 36 districts. The districts marked with a red star demonstrated a statistically significant difference in rates.

Figure 34 - District wise trends of PSLM 2012-13 for no toilet (rural) and MICS 2011 data for open defecation rural

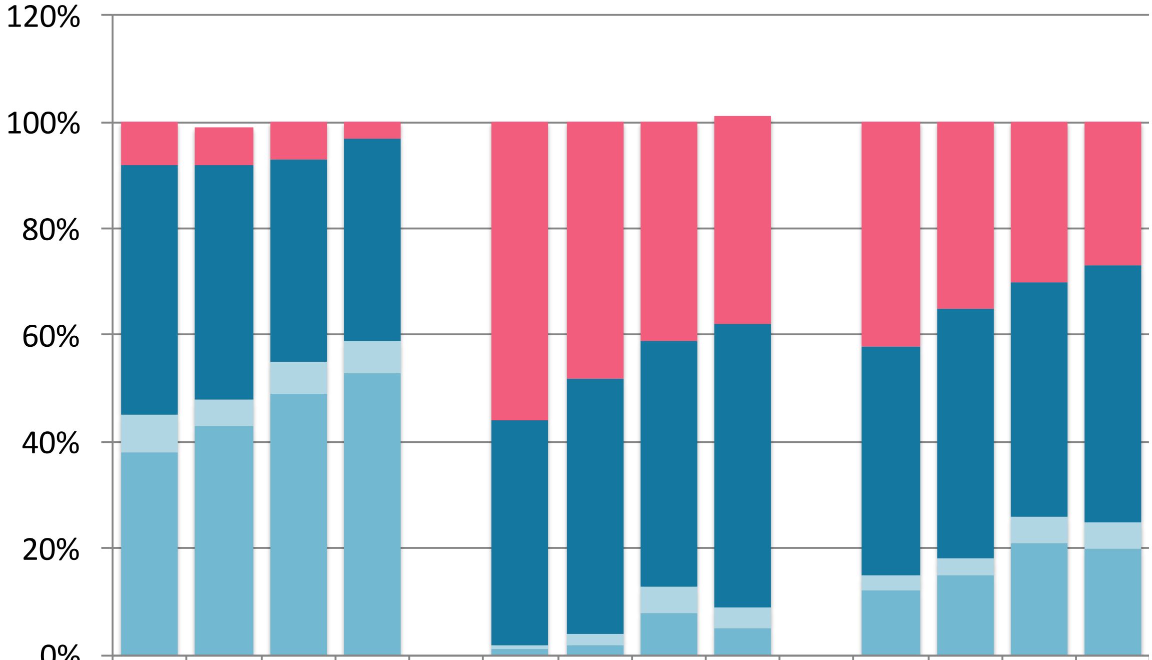


(Source: Pakistan Social and Living Standards Measurement Survey 2012-13 and Punjab Multiple Indicator Cluster Survey, 2011)

Fig 35 illustrates that there has been a gradual improvement in sanitation systems in the period of 2004-05 to 2011-12. Overall for Punjab, ‘No system’ has reduced from 42% to 27% and ‘underground drains’ has increased from 12% to 20%. However, ‘open drains’ have increased from 43% to 48% and there has been minimal increase of covered drains from 3% to 5%.

In urban areas, ‘underground drains’ have increased from 38% to 53%, and in rural areas ‘no system’ has reduced from 56% to 39%. At present, about half the rural population has ‘open drains’ while two-fifths have no sanitation system.

Figure 35 - Type of Sanitation system used in Punjab

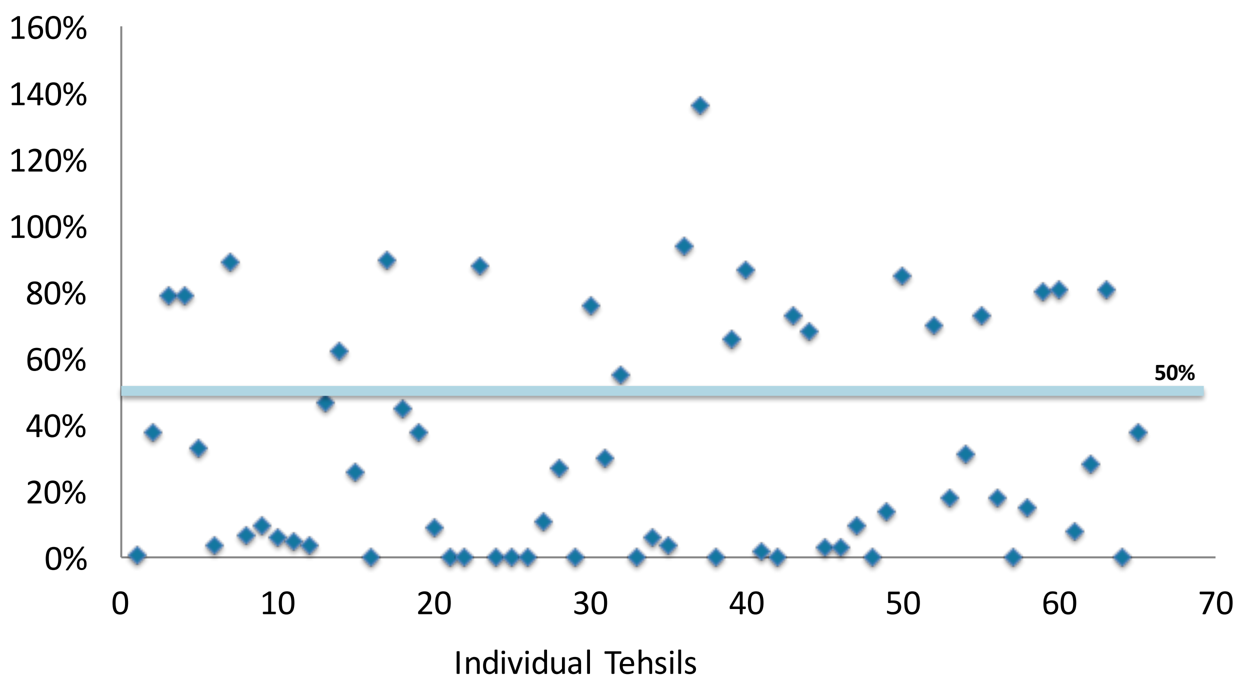


	04-05 Urban	05-06 Urban	07-08 Urban	11-12 Urban		04-05 Rural	05-06 Rural	07-08 Rural	11-12 Rural		04-05 Overall	05-06 Overall	07-08 Overall	11-12 Overall
No System	8%	7%	7%	3%		56%	48%	41%	39%		42%	35%	30%	27%
Open Drains	47%	44%	38%	38%		42%	48%	46%	53%		43%	47%	44%	48%
Covered Drains	7%	5%	6%	6%		1%	2%	5%	4%		3%	3%	5%	5%
Underground Drains	38%	43%	49%	53%		1%	2%	8%	5%		12%	15%	21%	20%

(Source: Pakistan Social and Living Standards Measurement Survey, 2004-05, 2005-06, 2007-08, and 2011-12)

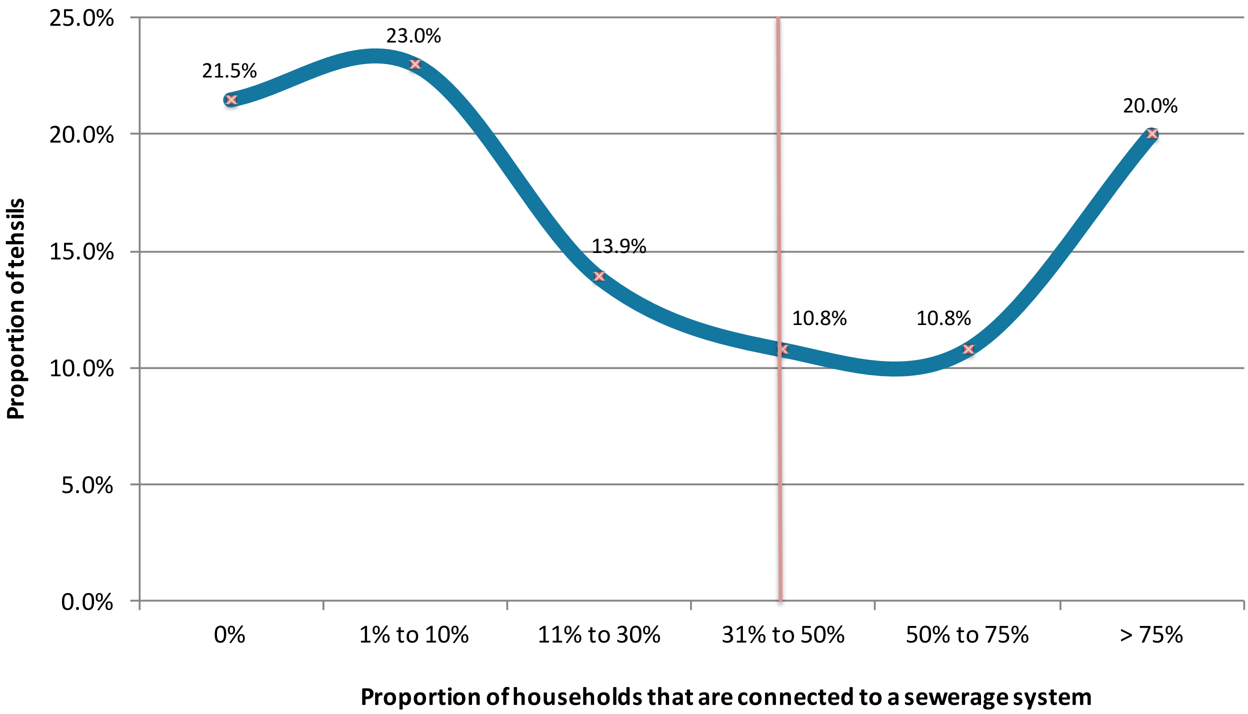
Analysis of data of 65 tehsils available from LG&CD department shows that in most tehsils (69.2%), less than 50% of households are connected to a sewerage system (**Fig 36**). **Fig 37** shows that in about a fifth (21.5%) of tehsils, no households are connected to any sewerage system. This is similar (although a little less) to the findings in PSLM 2011-12 that found an overall 27% of households not connected to a sanitation system. In another 23% of tehsils, only 1%-10% of households are connected to sewerage system. In only a fifth (20%) of tehsils were more than 75% of households connected to a sewerage system.

Figure 36 - Households connected with sewerage system



(Source: Punjab LG&CD Department 2012)

Figure 37 - Proportion of households connected to sewerage system in tehsils



(Source: Punjab LG&CD Department 2012)

Recent Initiatives for Sewerage in Punjab

Housing & Urban Development and Public Health Engineering Department

Pakistan Approach to Total Sanitation

About 1,045 villages have been certified as open defecation free, while work is in progress in a further 1171 villages in 8 districts of the Punjab i.e. Bahawalpur, Chakwal, Dera Ghazi Khan, Layyah, Muzaffargarh, Rajanpur, Rahim Yar Khan and Vehari. Different development partners including UNICEF, Plan International Pakistan, Water and Sanitation Programme (WSP), WaterAid, have provided technical and financial assistance, while PHED through its Community Development Unit, and other NGOs like Muslim Aid, Qatar Charity, AGAHE etc. have executed the projects. Fast track PATS intervention is required in about 11,904 villages in 21 priority districts to declare them ODF by 2017 (**Table 10**).

Table 10 - Priority Districts and Villages to be declared ODF

District	Number of villages to be declared ODF
DG Khan	623
Rahim Yar Khan	898
Bhakkar	457
Muzaffargarh	884
Bahawalnagar	1024
Jhang	622
Khanewal	579
Chiniot	261
Bahawalpur	698
Layyah	559
Multan	423
Mianwali	156
Lodhran	350
Okara	833
Khushab	218
Nankana Sahib	326
Hafizabad	322
Kasur	542
Rawalpindi	1138
Vehari	511
Pakpattan	480
Total	11904

(Source: PHED 2014)

Rewards for ODF Communities

In order to appreciate and recognise the efforts of communities and to motivate them for ensuring the sustainability of the project, the communities have been provided some rewards:

- Rehabilitation of rural water supply schemes
- Small scale sewerage treatment units and wet lands
- Water Ponds
- Afridev hand pumps
- WASH facilities in schools
- Latrine material to the poorest of the poor
- Hygiene / Water Kits
- Shield / Certificates for the Communities

Furthermore, in order to scale-up PATS, the Department has prepared district plans for covering the whole districts of the Rajanpur and Bahawalpur during 2013-17.

Up-Gradation of Mechanical System of WASA Faisalabad

This project will be executed by WASA-FDA, Faisalabad funded by JICA with an estimated cost of PKR 924.537 million. This will improve dislodging of storm water channels for smooth flow, removal of blockage of sewerage system, dewatering of pounding areas, removal of sludge from the city efficiently to dumping sites, and improvement in the environmental conditions in the service area of WASA.

Retrieval of Sewerage and Drainage System in Faisalabad

This project will be executed by WASA-FDA, Faisalabad funded by JICA with an estimated cost of PKR 498 million with an aim to reduce inundation and flooding of wastewater in low lying areas, reduction in blockages of sewer system, satisfaction of inhabitants of the service area as a result of quick response and redressal of complaints, the utilisation of wastewater for agriculture purposes and increase in yield/productivity of the agriculture sector.

Installation of Small Scale Sewerage Treatment Unit

A pilot project was done in 2 ODF villages of District Rahim Yar Khan through provision of solar based small scale sewerage treatment units. Each unit is serving a population of about 1000. The unit is a unique combination of aerobic treatment technologies with additional provision of disinfectant.

Local Government & Community Development Department

Elimination of ponds from major villages

The LG&CDD has undertaken an initiative to eliminate ponds from major villages in Punjab to improve sanitation and reduce the spread of vector borne diseases. These ponds receive wastewater from the villages. They are a health hazard for humans and livestock, promote mosquito breeding sites and therefore malaria, and the seepage/down percolation from these ponds has contaminated the sub-soil shallow water.

The project aims to plug the entry points of wastewater into these ponds and provide an alternative and ultimate disposal of wastewater.

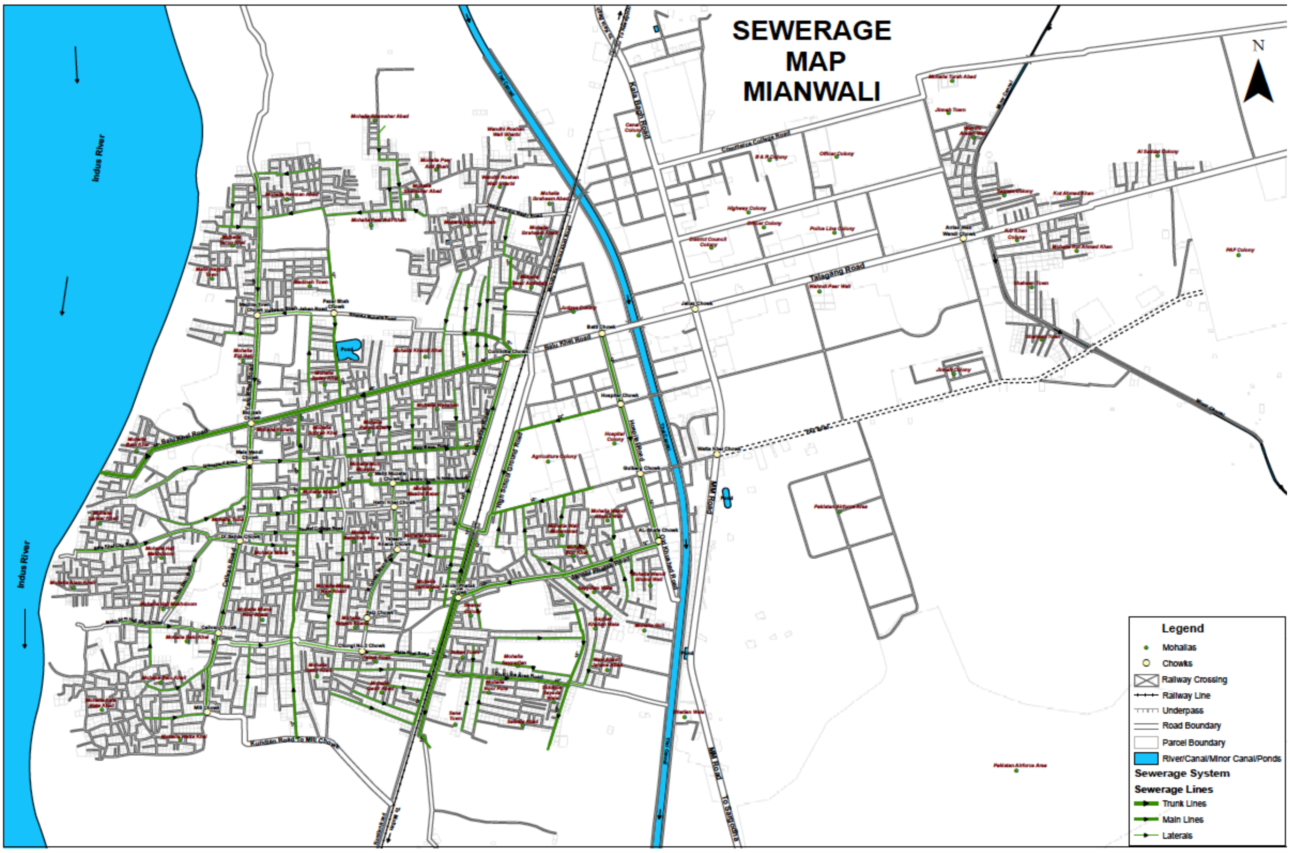
Punjab Municipal Development Fund Company

Sewerage system maps

The Punjab Municipal Development Fund Company (PMDFC), as part of the Punjab Municipal Services Improvement project funded by the World Bank, has developed GIS maps of sewerage services (with the assistance of Urban Unit) in all the TMAs. Furthermore, a performance management system monitors progress and coverage e.g. percentage of households connected to sewerage system.

An example of a GIS map for sewerage in a TMA is shown in **Fig 38**. It illustrates the trunk lines, main lines and laterals. It also shows the location of any river, canal, minor canal or pond. In the sample shown, one can note that the trunk line on Balu Khel Road in Mianwali is finally discharging into the Indus River.

Figure 38 - Sample sewerage system map



(Source: Punjab Municipal Development Fund Company)

Strategy

Sanitation (Sewerage and Drainage)			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 25% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Optimal sewage flow capacity maintained	Sewage flows determined for all cities and towns, and de-silting and cleaning of 30% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities	De-silting and cleaning of 60% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities	De-silting and cleaning of 90% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities
Optimal status of sewer maintenance equipment (sucking machine, jetting machine, sucking/jetting machine)	Status of equipment availability and functionality determined for each TMA and city zone At least 30% of TMAs and city zones equipped with sewer maintenance equipment	At least 60% of TMAs and city zones equipped with sewer maintenance equipment	At least 90% of TMAs and city zones equipped with sewer maintenance equipment
Adequate and functional collector and branch sewers	Status of collector and branch sewers in each city determined Phased replacement or laying of new lines instituted	Phased replacement of 25% non-functional collector and branch sewers or laying of new lines instituted	Phased replacement of 50% non-functional collector and branch sewers or laying of new lines instituted
Optimal functionality of pumping stations	Status of pumping stations in each city and TMA determined Phased rehabilitation plan instituted for at least 30% dysfunctional pumping stations	Phased rehabilitation plan instituted for at least 60% dysfunctional pumping stations	Phased rehabilitation plan instituted for at least 90% dysfunctional pumping stations
82% sewerage coverage in cities and towns	Extend sewerage system lines to provide 60% coverage in cities and towns	Extend sewerage system lines to provide 70% coverage in cities and towns	Extend sewerage system lines to provide 82% coverage in cities and towns
70% sewerage coverage in rural areas	Extend sewerage system lines to provide 10% coverage in rural areas	Extend sewerage system lines to provide 40% coverage in rural areas	Extend sewerage system lines to provide 70% coverage in rural areas
Replacement of open drains by sewers	Replace 10% open drains with sewers and install wastewater treatment with maintenance plan	Replace 25% open drains with sewers and install wastewater treatment with maintenance plan	Replace 50% open drains with sewers and install wastewater treatment with maintenance plan

Promote safe sanitation practices in high open defecation zones	Develop provincial and district level road maps on PATS/ODF for 11,904 villages in 21 priority districts Government allocates funds through its regular programme for soft component and facilitates 30% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery	Government allocates funds through its regular programme for soft component and facilitates 60% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery	Government allocates funds through its regular programme for soft component and facilitates 90% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery

WASTEWATER TREATMENT

The urban WSS schemes face several problems. These range from frequent blockage of sewers due to inadequate maintenance, to uncontrolled raw sewage generated by the households of low income areas that flows either directly into residential lanes, or into small open or covered drains, or into sewers along these lanes, or accumulates to form ponds, or percolates into shallow groundwater contaminating the aquifer often used by households for their water supply.

Pakistan, once a country with surplus water, is now rapidly becoming a water stressed to water scarce country. The water availability has decreased from 1,299 m^3 per capita in 1996 97 to 1,100 m^3 per capita in 2006 and is projected to less than 700 m^3 per capita by 2025. Therefore, to keep up with the needs for irrigation water for agriculture, wastewater has become an important resource. In Pakistan, it is estimated that around 2.000 billion gallons daily and 962.335 billion gallons[69] annually of wastewater is being produced and discharged to surface water bodies[70]. This domestic and industrial wastewater is either discharged directly to a sewer system, a natural drain or water body, a nearby field or an internal septic tank.

This wastewater is normally not treated and none of the cities have any biological treatment process except Islamabad and Karachi, and even these cities treat only a small proportion (<8%) of their wastewater before disposal. The wastewater used for irrigation is valued by farmers mainly because of its nutrient contents and reliability of supply. They argue its positive impacts on agriculture land values, households, monthly income and employment due to reuse of wastewater despite all the hazards of wastewater irrigation on the physical and chemical properties of soil in addition to contamination of the human food chain and related health risks. Farmers have limited availability of information in this regard and this is an area that requires attention.

Furthermore, research[71] in Faisalabad has revealed that untreated wastewater had a higher nutrient value and lower salinity as compared to effluent from waste stabilisation ponds and its use resulted in a substantially higher farm income. This is one of the reasons that farmers are reluctant to use treated wastewater. There is a need for farmers and wastewater managers to discuss and find mutually beneficial options to provide wastewater for agriculture while at the same time minimise the health related risks.

Table 11 shows the status of sewage and wastewater generation in the five WASAs and dismal level of wastewater treatment. Furthermore, **Fig 39** shows that over 1.683 billion m^3 of sewage is generated, and over 1.820 billion m^3 of wastewater is collected annually in the five WASAs.

The Pakistan Water Sector Strategy estimated in 2002 that the total wastewater produced annually in Pakistan was over 4.43 billion m^3. Of this, about 30% is industrial wastewater (1.37 billion m^3), while the major proportion comes from municipal wastewater (3.06 billion m^3)[72].

[69] 1 m^3 = 219.96 Imperial Gallons. 962.335 billion gallons is very close to that estimated by the Pakistan Water Sector Strategy i.e. 4.43 billion m^3 which is equivalent to 974.46 billion gallons

[70] Ghulam Murtaza and Munir Zia: Waste water production, treatment and use in Pakistan. 2013

[71] Alexandra E. V. Clemett and Jeroen H. J. Ensink. Farmer driven wastewater treatment: A case study from Faisalabad, Pakistan. 32nd WEDC International Conference, Colombo, Sri Lanka, 2006

[72] Pakistan Water Sector Strategy. National Water Sector Profile, Vol 5, 2002. Ministry of Water and Power, Government of Pakistan

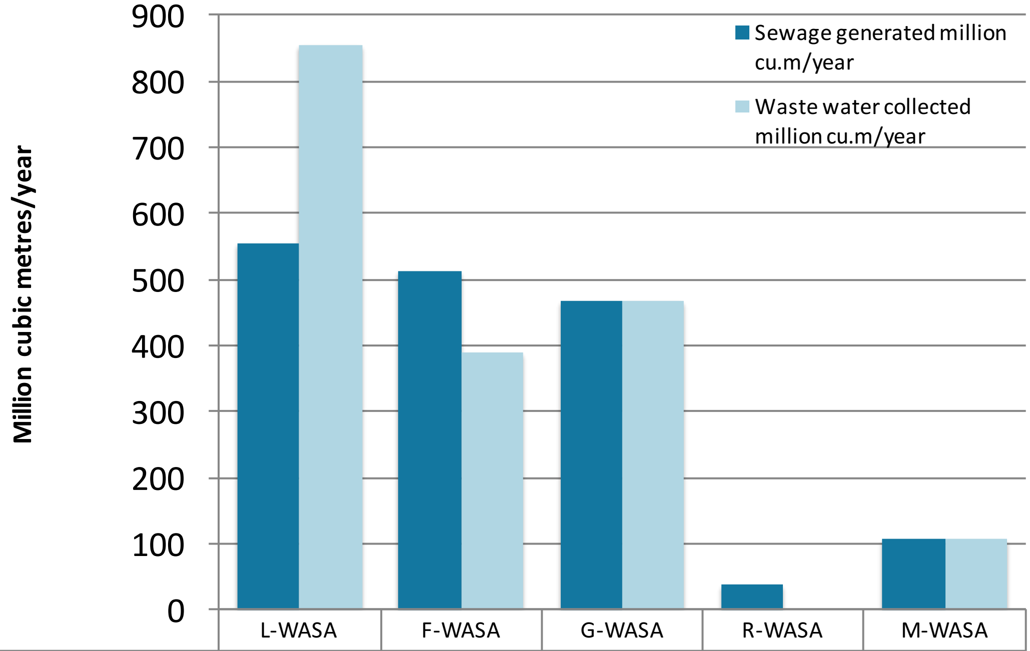
Industrial wastewater comes from textile, leather, chemical and other industries. Most of this is untreated and carries with it hazardous and toxic chemicals posing high risk to health, agriculture and fisheries. Lack of wastewater treatment is one of the pressing problems facing the sector today.

Table 11 - Status of sewage and wastewater in WASAs in Punjab

	L-WASA	F-WASA	G-WASA	R-WASA	M-WASA
Total population million	6.152	3.1	1.7	1.3	1.8
Total population served million	5.475	1.55	0.544	1.17	1.2
Sanitation coverage %	87.69	70	65	35	60
Total number of sewerage connections	583,532	217,002	97,236	38,437	175,615
Annual sewage generated million m^3 / year	556	514.31	468.3	38.4	107.58
Annual waste water collected million m^3 / year	855	390.88	468.3	Nil	107.58
Level of waste water treated million m^3 / year					
Primary	Screening	1.09	Nil	Nil	Nil
Secondary	Nil	1.09	Nil	Nil	Nil
Tertiary	Nil	Nil	Nil	Nil	Nil
Number of waste water treatment plants	Nil	1	Nil	Nil	Nil

(Source: Pakistan Water Operators Directory 2012)

Figure 39 - Waste water collection by WASAs in Punjab



	L-WASA	F-WASA	G-WASA	R-WASA	M-WASA
Sewage generated million cu.m/year	556	514	468	38	107
Waste water collected million cu.m/year	855	390	468	0	107

(Source: Pakistan Water Operators Directory 2012)

Industrial and Municipal Wastewater

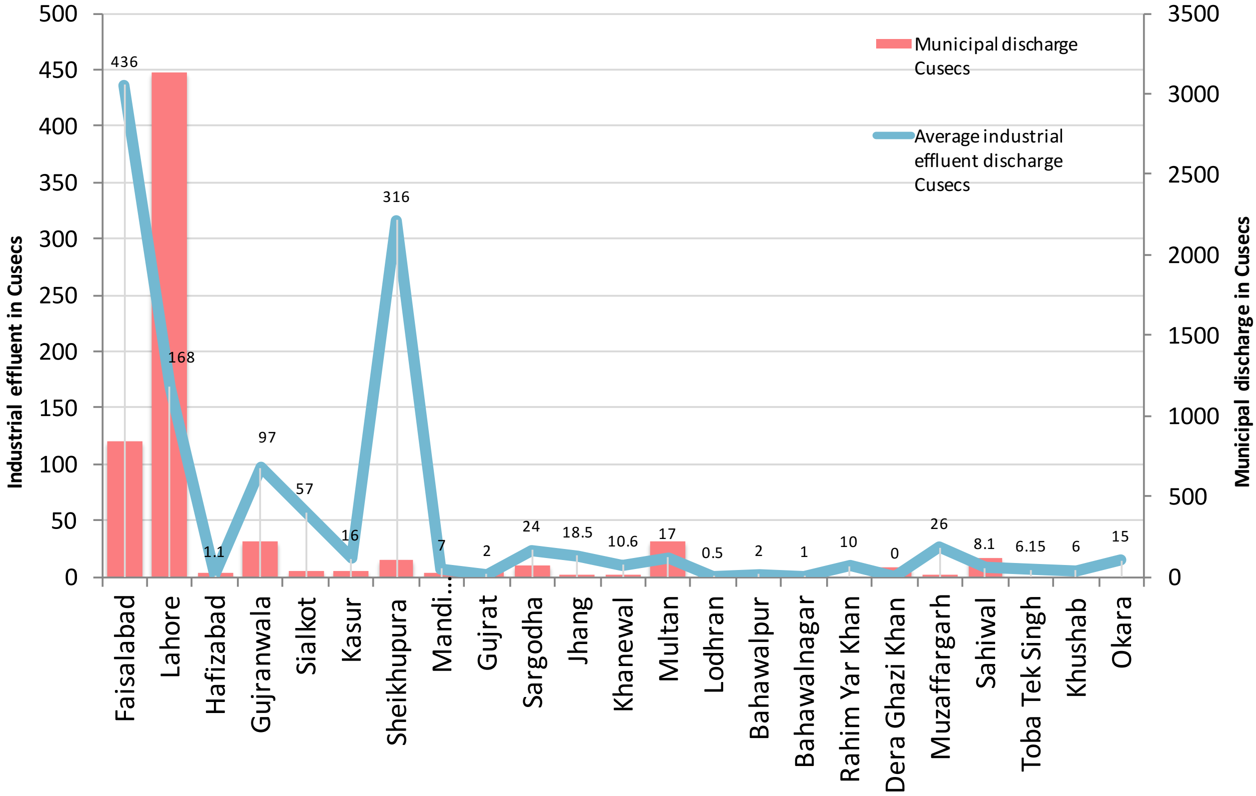
While industrialisation brings great socio-economic benefits to society, unregulated and untreated hazardous waste and chemical contaminants generated by these industries pose serious health and agriculture risks because they pollute water bodies, infiltrate and contaminate soil and ultimately affect the food chain of humans, plants, animals and aquatic life. Industrial effluent and municipal sewage are among the major sources of water pollution.

Industrial water pollution pours millions of gallons of toxic material into drains and canals that further pollute surface and groundwater. Owing to population growth rate and urbanisation, the pollution from municipal discharge is more than the industries.

Estimates indicate that about 9000 million gallons of wastewater having 20,000 tons of BOD loadings are discharged daily into water bodies from the industrial sector. Similarly, about 6.9 million wet tons of human excreta are produced annually in the urban sector of which around 50% finds its way into water bodies to pollute them.

A study undertaken by the Directorate of Land Reclamation, Punjab demonstrates that Faisalabad, Sheikhupura, Lahore, Gujranwala, Sialkot, Khanewal and Muzaffargarh have the highest load of industrial effluent (**Fig 40**). The same study also shows that out of 1085 industries surveyed, only 19 (1.75%) were treating their effluent properly (**Fig 41, Annex 3**). In Muzaffargarh, interestingly 5 out of 6 industries were treating their effluent adequately.

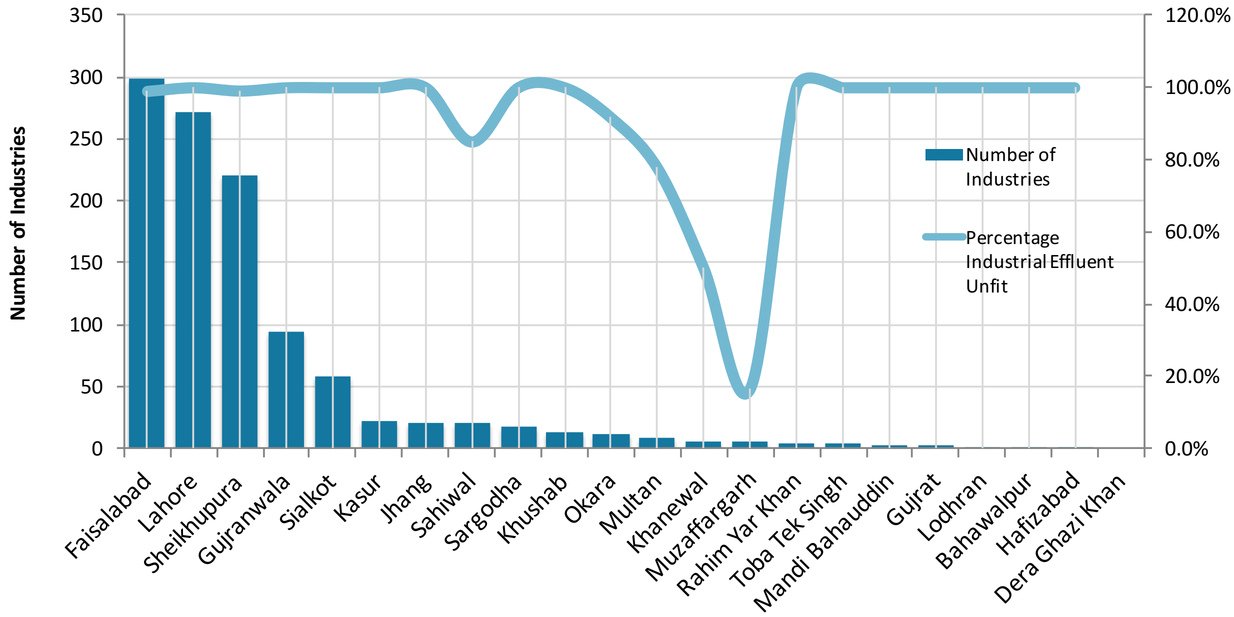
Figure 40 - Municipal and Industrial effluent in selected districts



(Source: Computation based on "An Atlas of Surface Water Industrial and Municipal Pollution in Punjab. Directorate of Land Reclamation Punjab, Irrigation and Power Department, 2008"; and "Surface Water Quality Monitoring Plan, Directorate of Land Reclamation Punjab, Irrigation and Power Department, revised 2007")

(1 cubic metre/second is equal to 35.3146662127 cusec. Cusec stands for Cubic feet per second and is a measure of water flow)

Figure 41 - Status of Industrial Effluent



(Source: An Atlas of Surface Water Industrial and Municipal Pollution in Punjab. Directorate of Land Reclamation Punjab, Irrigation and Power Department, 2008)

Wastewater Research and Development

Several pilot research initiatives are underway to determine cost-effective and scalable wastewater treatment and re-use options.

As part of a Pakistan-US science and technology cooperation programme, a Small Scale Sewage Treatment And Wastewater Reuse System For Pakistan is being tested at Quaid-i-Azam University in collaboration with George Washington University[73]. Four treatment systems are being evaluated – these include trickling filter, constructed wetland, dual digestion system and membrane process. A further goal of the project is to produce bio solids that can be reused as fertilizer for crop production.

Constructed Wetlands (CW) is a recent initiative that is gaining popularity as a low cost, eco-technological, biological and sustainable wastewater treatment option. CW initiatives are being implemented in Punjab (with the technical support of Sindhica Reforms Society) in the following areas:

- Ahsanpur – in the Engro Model Village project of Engro Foundation
- Okara – in Mitchell's Fruit Farms project
- Muzaffargarh – in Pakistan Settlement Flood Recovery Programme (PSFRP) in collaboration with UN Habitat and Government of Japan

[73] Small Scale Sewage Treatment and Wastewater Reuse System for Pakistan. Phase 4. Quaid-i-Azam University

The bioremediation laboratory of COMSATS Institute of Information Technology, Abbottabad conducted research on industrial wastewater collected from the combined drain at Hattar Industrial Estate, Hattar[74]. They studied the treatment strategy and how toxic effects of the pollutants could be avoided. For this purpose, they used Constructed Wetland for post-treatment of Anaerobic Bioreactor (ABR) for combined industrial wastewater. They found that the respective removal efficiencies of chemical oxygen demand (COD), biological oxygen demand (BOD), total solids (TS), nitrates, and ammonia were 80%, 78–82%, 91.7%, 88–92%, and 100% for original industrial wastewater treated in ABR. The post-treatment in CW resulted in reducing the metal concentrations to 1.95 mg/L, 0 mg/L, and 0.004 mg/L for Ni, Pb, and Cd which were within the permissible water quality standards for industrial effluents. The treatment strategy was effective and sustainable for the treatment of combined industrial wastewater.

Currently various methodologies are being tried and include Constructed Wetlands, Anaerobic Bioreactors, grey water reuse systems, Rapid Sand Filters, Wastewater Stabilisation Ponds, Infiltration Galleries etc.

Table 12 highlights some of the agencies/organisations that are actively involved in wastewater research.

[74] Bibi Saima Zeb et al. Combined Industrial Wastewater Treatment in Anaerobic Bioreactor Post-treated in Constructed Wetland. Volume 2013, Article ID 957853. BioMed Research International

Table 12 - Agencies and Organisations with research interests in wastewater

Agency/Organisation	Type	Interests
Pakistan Council of Research in Water Resources	Public Sector Research Organisation	Establishing a permanent water quality-monitoring network Environmental impacts of sewage water irrigation on ground water quality Mitigate environmental effects of wastewater in rivers
Pakistan Council of Scientific & Industrial Research	Public Sector Research Organisation	Infrastructure and analytical facilities for analysis of industrial effluents like toxic metals, cyanides, chlorides, nitrate, biological oxygen demand, and chemical oxygen demand. Provide facilities for analysis of Coliform and E. Coliform bacteria mainly in drinking water
Pakistan Environmental Protection Agency (plus provincial Chapter)	Government Organisation for National Policy Drafting	National environmental quality standards and self monitoring and reporting system Installations of wastewater treatment plants an integral part of all sewage schemes Master plans for treatment of municipal and industrial wastewater in urban and rural areas Cleaner production centres and cleaner production techniques and practices Reduction, recycling, and reuse of industrial and municipal wastewater National standards for land, water and air quality parameters with reference to pollution
Directorate of Land Reclamation, Irrigation and Power Department, Lahore	Government Department	Groundwater Monitoring and Management in Punjab Monitoring of Water Sector Environmental Pollution On-farm Reclamation of Salt affected soils Field Research at Reclamation Research Stations Command Area Development of Small Dams Analysis of Soil and Water Samples and Basic Research
Institute of Soil and Environmental Sciences, University of Agriculture Faisalabad	University/Research Institute	Effect of wastewater application in agricultural lands where mostly vegetables are grown Prediction of long term impacts of wastewater irrigation on soil chemical properties organic and inorganic amendments in immobilisation of heavy metals in wastewater irrigated soils
Centre of Excellence in Water Resources Engineering, and Institute of Environmental Engineering and Research, University of Engineering and Technology Lahore	University/Research Institute	Environmental impacts of the untreated wastewater irrigation Extent of groundwater contamination using wastewater irrigation and their effects on human health of the local community Constructed Wetlands, Anaerobic Bioreactors, grey water reuse systems, Rapid Sand Filters, Wastewater Stabilisation Ponds, Infiltration Galleries

Table 12 continued

Agency	Type	Interests
Institute of Soil Chemistry, Ayyub Agriculture Research Institute Faisalabad	Research Institute	Hazardous effects of sewage water on the environment: Focus on heavy metals and chemical composition of soil and vegetables Nutrient value of sewage water for crops and potential hazards to humans due to wastewater contaminants Long-term disposal of city sewage effluent on agricultural lands
Department of Soil Science, University of Arid Agriculture Rawalpindi	University/Research Institute	Quality of sewage for irrigation Heavy metals, soil salinity/sodicity and soil fertility status of soils and plants of some sewage-irrigated farms Heavy metal contents of vegetables irrigated by sewage/tube well water
Quaid-i-Azam University	University/Research Institute	Small Scale Sewage Treatment and Wastewater Reuse System
Department of Environmental Sciences, COMSATS Institute of Information Technology, Abbottabad	Research Institute	Constructed Wetlands and Anaerobic Bioreactors for industrial wastewater treatment
International Water Management Institute IWMI Lahore	International Institute/Research Centre	Health risks of irrigation with untreated urban wastewater Urban wastewater: a valuable resource for agriculture Use of untreated wastewater in peri-urban agriculture: Risks and opportunities Hookworm and intestinal nematodes infections among wastewater farmers and their families Role of wastewater irrigation in mosquito breeding Wastewater irrigated vegetables: market handling versus irrigation water quality Assessment of the use of wastewater for irrigation The use of untreated wastewater in agriculture: Strategies for Health Risk Management Mosquito-related health risks of wastewater treatment ponds in peri-urban areas
IUCN Pakistan	International Organisation Country Chapter	Integration of environment and development
WWF Pakistan	International Conservation Organisation	Conserve freshwater and marine biodiversity through reducing human water footprint

One of the major challenges at present is that there is no policy directed towards wastewater sustainability, although there is a national policy for environmental management. However, its implementation leaves a lot to be desired. Industries, whether from lack of financial incentives or inadequate knowledge and sensitisation about the hazards of untreated industrial waste, have made little effort to adopt technologies for environmental and health protection. While laws and regulations have been formulated for treatment and disposal of wastewater, capacities to implement these are lacking.

A concerted effort by civil society, water and sanitation service organisations, research agencies focusing on water and sanitation, environmental protection organisations, industries and farmers is vital to address the issue of pollution caused by untreated wastewater. This is one of the primary areas of concern that Punjab government needs to address.

Wastewater Treatment Facility in Tehsil Pattoki, District Kasur

Grant in Aid is being provided by the Korean International Cooperation Agency (KOICA) Government for a wastewater treatment facility in Tehsil Pattoki, District Kasur.

Strategy

Wastewater Management			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Elimination of stagnant ponds and prevention of pounding	Mapping of ponds in each TMA and categorise by size and level of risk Prioritise cleaning of large and high risk ponds At least 50% of mapped ponds eliminated and preventive measures instituted	At least 100% of mapped ponds eliminated and preventive measures instituted	Prevention measures in place to prevent recurrence of pounding
Water supply and sanitation schemes linked with wastewater treatment	At least 25% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes	At least 50% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes	At least 75% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes
Wastewater treatment plants for cities	Each mega city has at least one wastewater treatment plant functional	Each intermediate city has at least one wastewater treatment plant functional	Each large town (especially those that are discharging into surface water) has at least one wastewater treatment plant functional and wastewater recycled for reuse in agriculture and horticulture
Monitor contamination levels of industrial effluent	PHED, Land Reclamation department, PCSIR and Punjab Environment Protection Agency map major industrial wastewater flows in relevant districts and conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced	Hazard and risk GIS mapping of contaminated rivers and water bodies done Conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced	Conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced
Increased proportion of treated industrial wastewater	Set up Combined Effluent Treatment Plant (CETP) for cluster of industries where feasible focusing on Faisalabad, Lahore, Sialkot, Gujranwala, Sheikhupura and Rahim Yar Khan as priority districts	At least 3% - 5% of industrial wastewater treated Incentivise industries who set up wastewater treatment with a tax rebate	At least 6% - 10% of industrial wastewater treated Incentivise industries who set up wastewater treatment with a tax rebate

	Identify industries with high volume of untreated effluent and prioritise for enforcement of regulations Incentivise industries who set up wastewater treatment with a tax rebate		

SOLID WASTE MANAGEMENT

Waste in general may be classified into the following categories:

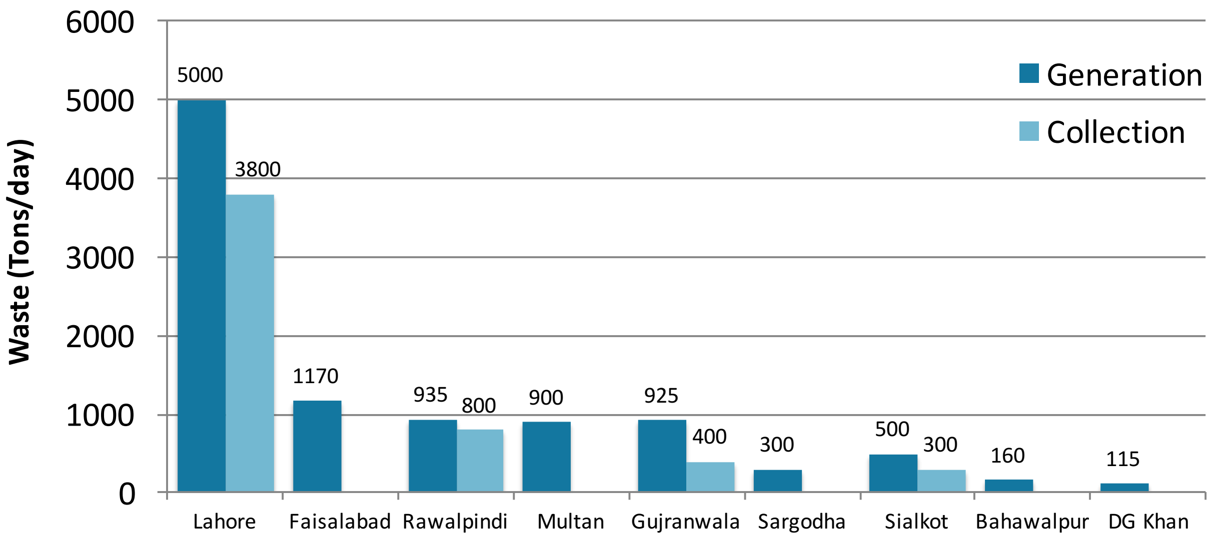
- Municipal solid waste (MSW)
- Industrial waste
- Hazardous and medical waste
- Construction and demolition waste
- Agricultural waste
- Slaughter waste

Waste is then further subdivided into organic, inorganic, combustible, hazardous and toxic, recyclable etc.

Waste Generation and Flow

Recent data of nine cities in Punjab shows that over 10,000 tons of waste is generated per day. Of this, only 5300 tons are collected per day (**Fig 42**). On an average, 0.6 kg/capita/day of waste is generated[75].

Figure 42 - Solid waste generation and collection in selected cities in Punjab



(Source: Pakistan Social and Living Standards Measurement Survey 2011-12)

[75] Punjab Solid Waste Management Reform, 2007. World Bank

Recent primary waste collection data from Sialkot[76] has shown that waste generation in an intermediate city like Sialkot ranges from 0.28 kg/capita/day in low income areas, 0.31 kg/capita/day in medium income areas, to 0.35 kg/capita/day in high income areas. In the period from 2010-2030, Sialkot would generate 4.3 million tons of solid waste. The recycling capacity averages at 15%-20%.

Information from Lahore indicates that the proportion of waste collected is now over 80%[77]. The Lahore Waste Management Company estimates that the other 8 cities generate about 5000 tons of solid waste per day, led by Faisalabad whose daily waste is double that produced by any of the other 3 leading cities (**Table 13**).

Table 13 - Waste generation in selected cities in Punjab

City	Number of Union Councils	Population in 2013 (Million)	Waste Generation (Tons / Day)
Faisalabad	113	2.90	1622
Gujranwala	64	1.58	887
Rawalpindi	62	1.46	818
Multan	61	1.23	947
Sialkot	16	0.52	265
Bahawalpur	18	0.70	350
Murree	01	0.08	32
TOTAL	**335**	**8.47**	**4921**

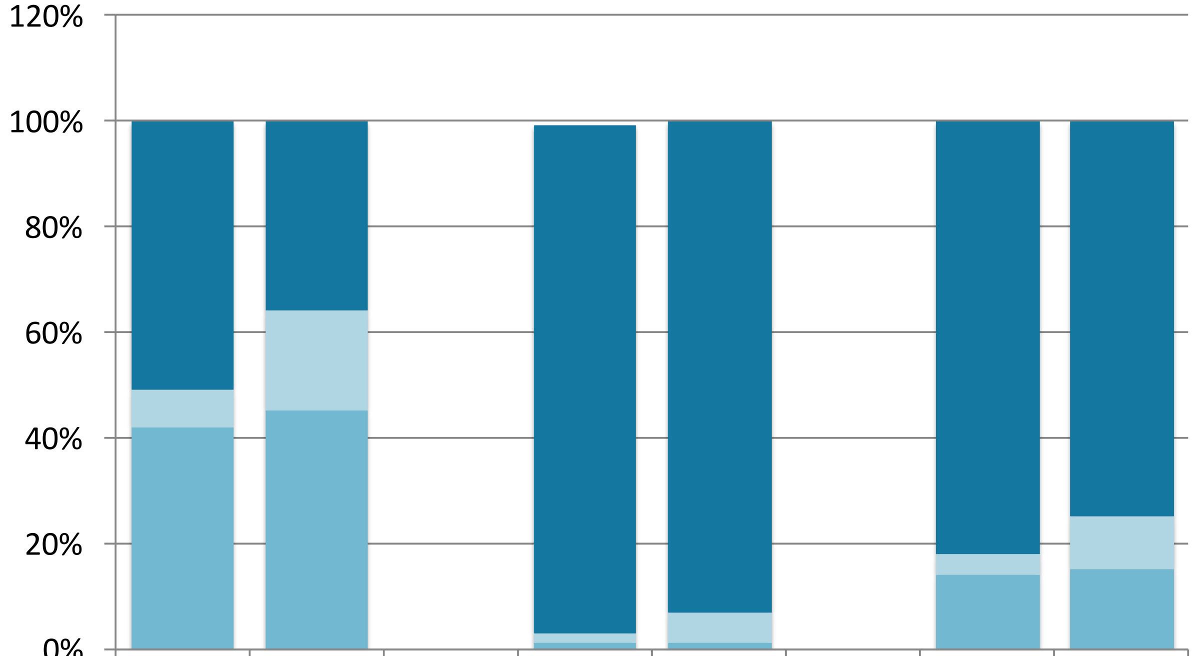
(Source: Lahore Waste Management Company, 2013)

In urban areas, about 64% of solid waste is collected by municipal services or privately. However, there is no solid waste collection and disposal system in 93% of rural areas (**Fig 43**).

[76] Sialkot Solid Waste Management Strategy and Action Plan 2010. Punjab Cities Improvement Investment Programme. Urban Unit, Government of Punjab

[77] Lahore Waste Management Company – www.lwmc.com.pk

Figure 43 - Status of solid waste system in Punjab



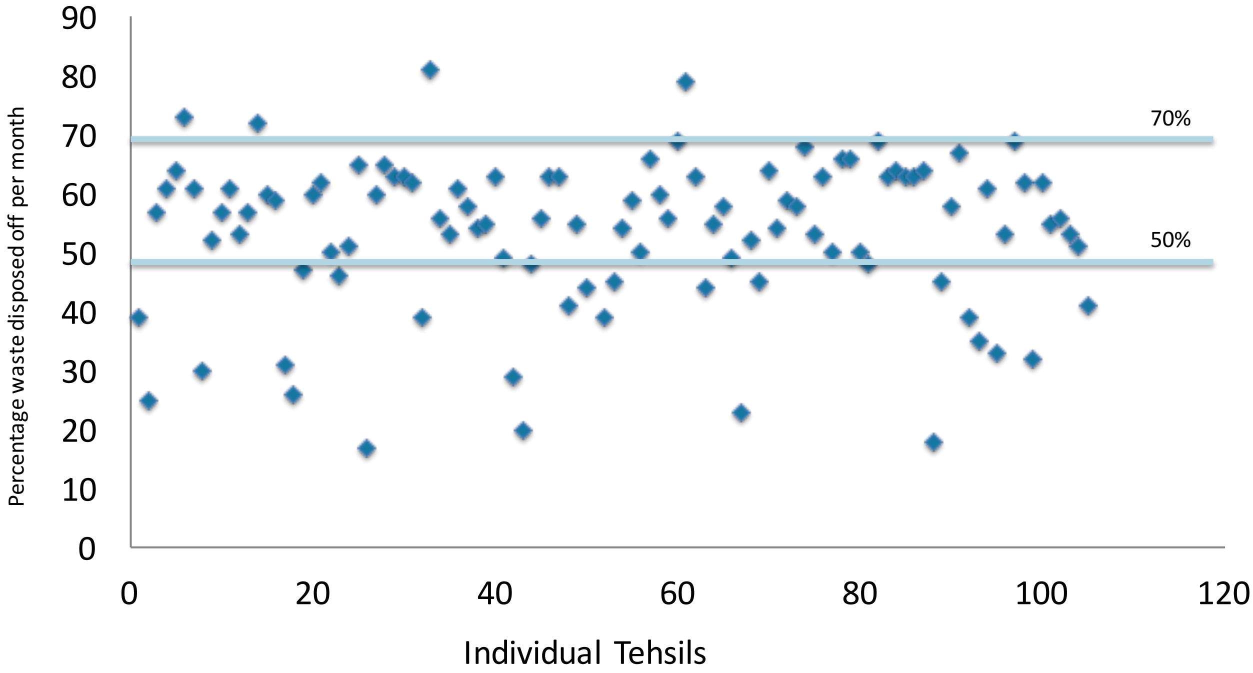
	07-08 Urban	11-12 Urban		07-08 Rural	11-12 Rural		07-08 Overall	11-12 Overall
No System	51%	36%		96%	93%		82%	75%
Privately	7%	19%		2%	6%		4%	10%
Municipality	42%	45%		1%	1%		14%	15%

(Source: Pakistan Social and Living Standards Measurement Survey 2011-12)

Data obtained from Tehsil/Town Municipal Administrations show that the percentage of waste that is disposed of per month ranges between 50% to 70% (**Fig 44**). However, there are still a significant number of TMAs whose performance is less than 50%. For cities and towns to remain clean, at least 75% of waste must be collected and disposed of[78].

[78] Punjab Solid Waste Management Reform, 2007. World Bank

Figure 44 - Percentage waste disposed of per month in Tehsils



(Source: LG&CD and Punjab Municipal Development Corporation 2012)

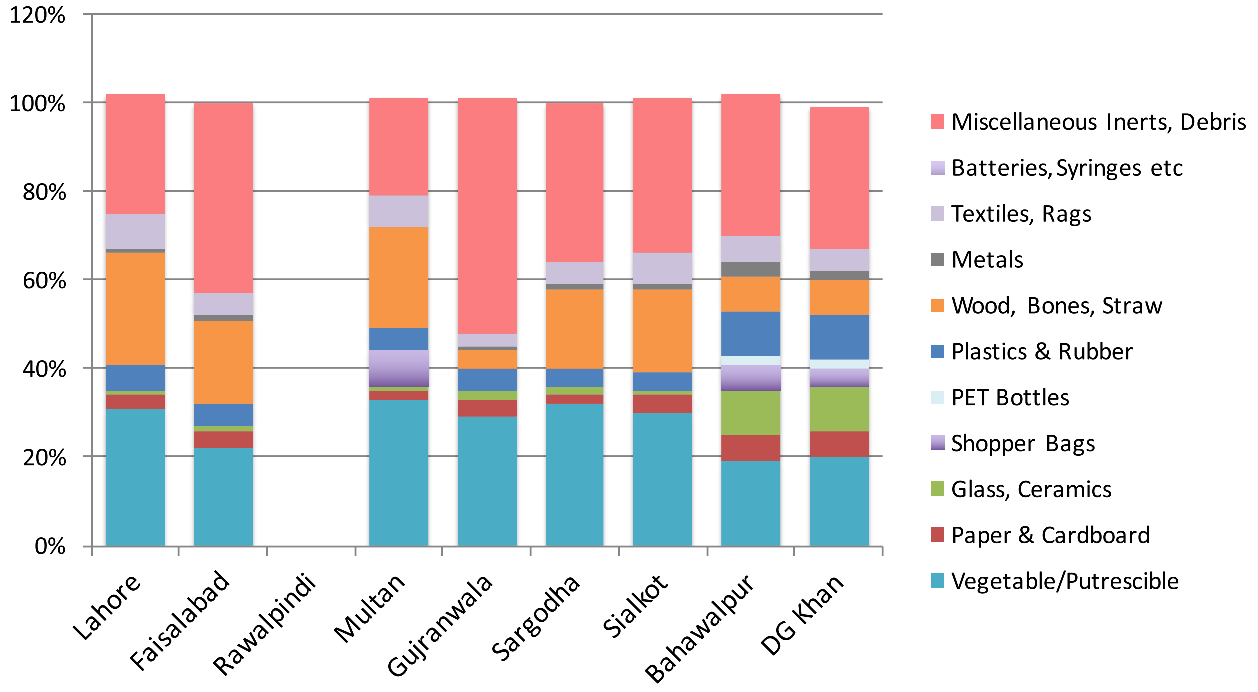
Waste Composition

Municipal waste is generally composed of vegetable/putrescible, paper and cardboard, glass and ceramics, different plastics and rubber, wood and bones, metals and miscellaneous inerts. The composition varies mainly with the area, to some extent with the season and also with existing recycling activities.

Composition of municipal waste from selected cities in Punjab (data was not available for Rawalpindi) shows that the two largest fractions encountered were vegetable/putrescible (between 20%-33%) and miscellaneous inerts and debris (sand, stones, ashes, bricks) (22% to 53%) introduced into the waste stream mainly through street sweepings (**Fig 45**).

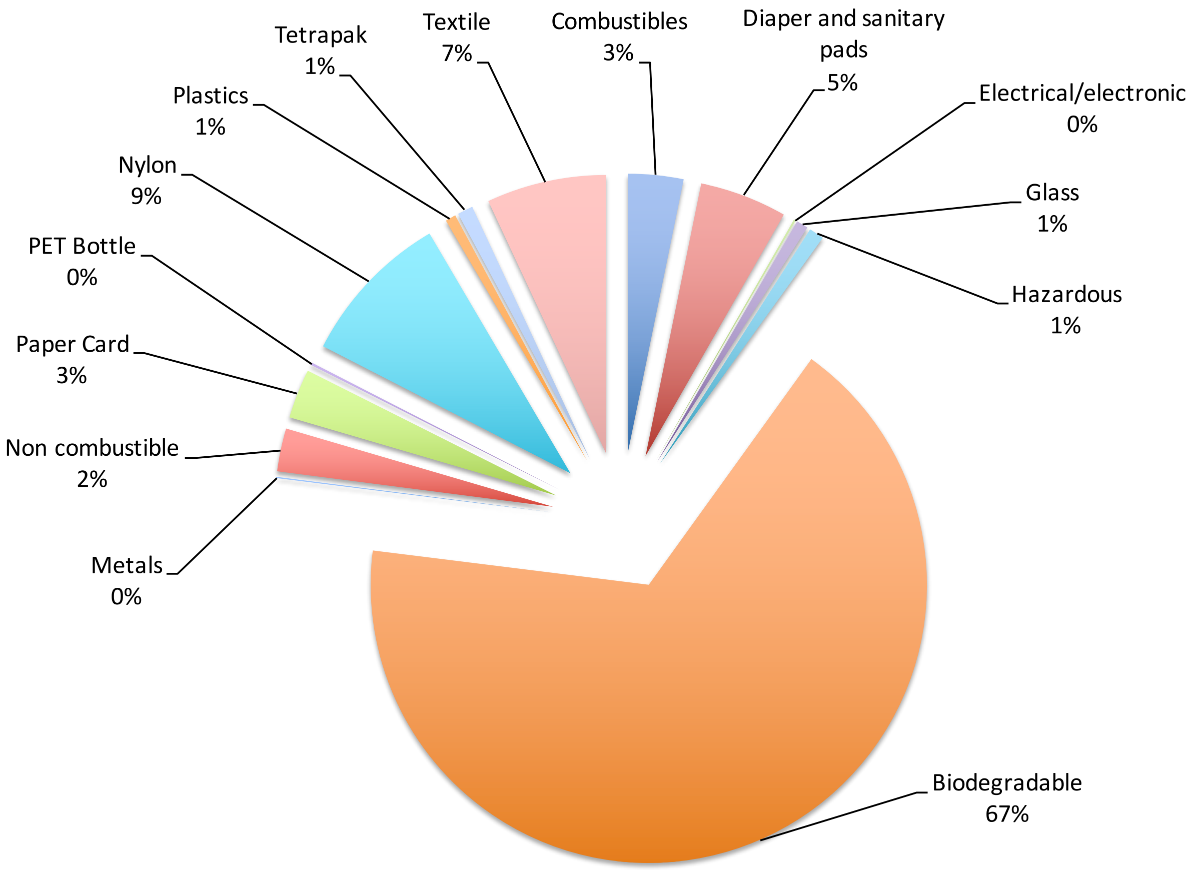
In Lahore, since the formation of the Lahore Waste Management Company, the waste composition has changed. Now about 67% is biodegradable (**Fig 46**).

Figure 45 - Composition of waste in selected cities in Punjab



(Source: Punjab Solid Waste Management Reform, 2007. World Bank)

Figure 46 - Waste characterisation in Lahore



(Source: Waste Characterisation Study, 2012. Integrated Solid Waste Management of Lahore City. ISTAC)

Waste Collection and Transfer

Most of the waste collection and transfer modalities in the nine cities include the following commonalities and is depicted in **Fig 47**.

Generation

- Households, commercial premises, public places, streets

Primary Collection

- Manual street sweeping
- Manual sweeping and collection
- Manual door to door collection
- Collection by Compactor

Storage/Transfer

- Container collection point
- Masonry collection point
- Open collection point

Transport

- Arm roll truck system
- Tractor trailer system
- Open trucks system

Final Disposal

- Official dumpsite
- Open dumps

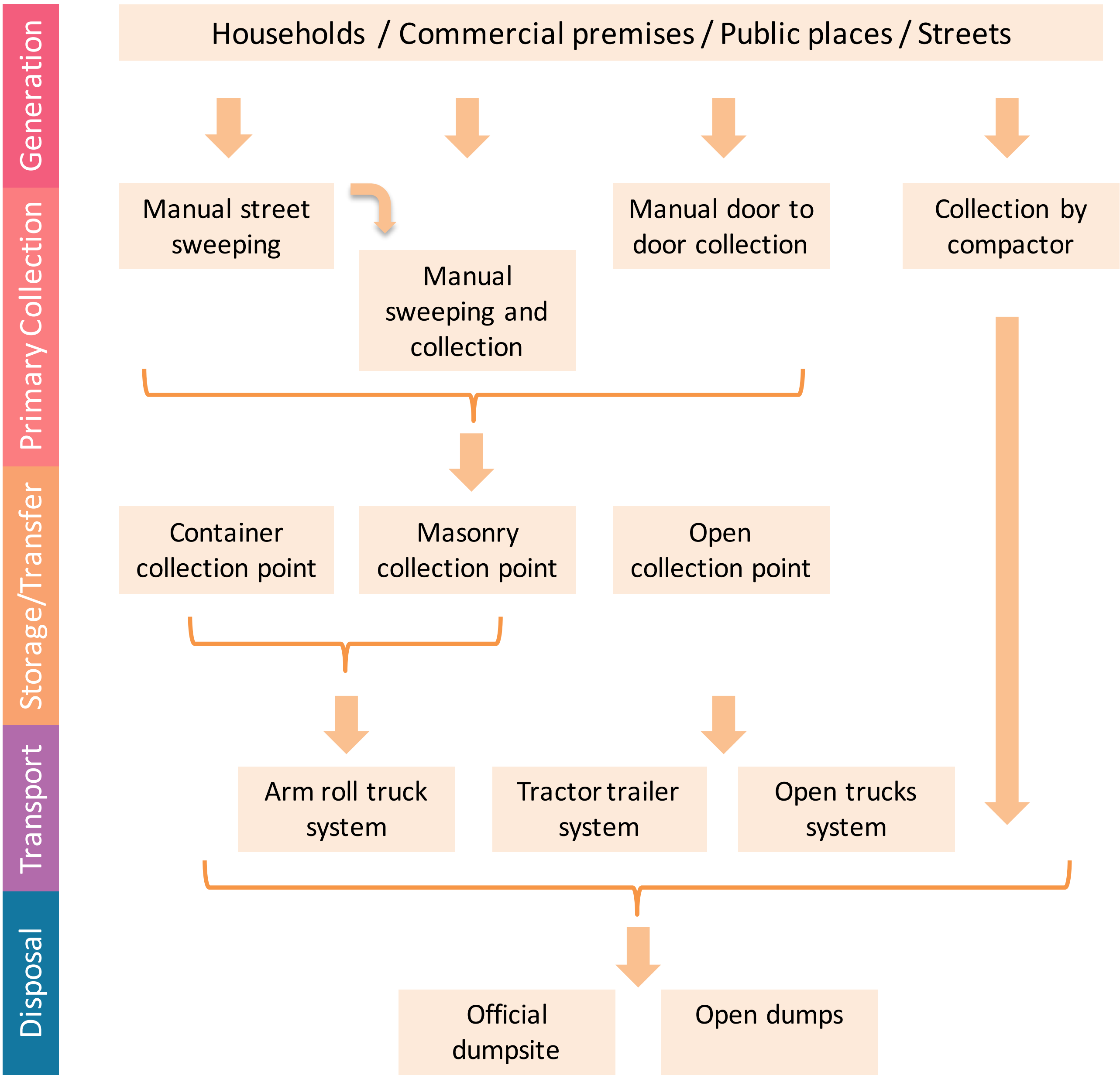
Main challenges faced in collection and transfer

There is insufficient collection of waste (40-70%) and insufficient transport of collected waste to official dumpsites (20-75%). The current mode of street sweeping approach for primary collection is inefficient as is the double-handling of waste at collection points.

The performance of transport is not monitored systematically. The present composition of the solid waste management fleet is such that too much time is spent on transport to long distances in small collection vehicles, which therefore contributes to poor performance. Furthermore, most of the transportation vehicles and equipment are either outdated or in need of repair and there is a shortage of adequately equipped maintenance workshops (**Table 14**).

Placing of collection points or any other SWM infrastructure within the cities and towns presents serious challenges, since SWM has not routinely been included in town planning.

Figure 47 - Prevailing practice of solid waste management in cities in Punjab



(Source: Adapted from Punjab Solid Waste Management Reform, 2007. World Bank)

Table 14 - Status of SWM equipment in selected cities in Punjab

Type of vehicle	Lahore	Faisalabad	Rawalpindi	Multan	Gujranwala	Sargodha	Sialkot	Bahawalpur	DG Khan
Compactors	20	2	0	0	0	0	0	0	0
Arm roll trucks ($7m^3$)	113	3	30	0	4	0	0	11	4
Mechanical sweeper	26	0	4	0	1	0	3	2	0
Tractor trolleys	26	17	0	40	44	12	42	10	11
Tractors with buckets	33	0	3	0	4	0	0	0	0
Open truck (dumper)	31	28	4	5	0	3	0	0	0
Open truck (pick-up)	99	0	14	2	0	3	0	0	0
Front end loaders		15	0	5	5	7	2	1	0
Donkey / bulla carts	0	0	0	0	0	0	0	0	27
Hand carts, wheel barrows	4500	0	>1000	100	200	50	0	140	100
Own workshop	Yes	No	Yes	Yes	No	No	No	No	No

(Source: Punjab Solid Waste Management Reform, 2007. World Bank)

The situation in Lahore since 2007 has now changed as the Lahore Waste Management Company has upgraded and modernised its fleet. Its service contract with two Turkish firms has resulted in an 'on the road' fleet of 434 vehicles (compactors, mechanical sweepers, mini dumpers, washing vehicles, loaders, dumpers etc.). Furthermore, 105 additional vehicles (chain arm roll, mini dumper, compactor, dumpers of various sizes, waste transfer trailers, tractor loaders) have been deployed, and a further 119 vehicles (chain arm roll, compactor, mini dumper, container washing machine, dumpers of various sizes, cycle rickshaws and washing vehicles) are planned for deployment.

Final Disposal

The final disposal is perhaps the major challenge in SWM in Punjab. The common practice is for open dumping usually in flood plains or ponds or wherever enough space is available. At present there is no properly designed and operated sanitary landfill site in Punjab.

There are no preventive measures in place for dumped garbage for neither the leakage infiltration into ground water, leakage collection and treatment nor collection and control or gas evacuation /

flaring system, which are the minimum requirements for safe and sanitary disposal. Furthermore, waste-pickers at the sites hamper safe waste disposal and have a high health risk.

Punjab has a large metropolis in Lahore, where a privatised venture in the form of Lahore Waste Management Company is proving to be a successful model. The other cities are either mega cities or intermediate cities and SWM is and will be a perpetual problem if not addressed in an effective manner.

The need to build sanitary landfill sites is of pressing importance and these must be planned for a lifetime of at least 15-20 years. There is also need to review options and determine whether a regional landfill site might be shared by 2-3 cities and how many transfer stations would be required.

Healthcare Waste Management

According to the Hospital Waste Management Rules 2005, hospitals and other healthcare institutions are deemed responsible for the proper management of risk and non-risk waste they generate till its final disposal.

The main types of healthcare waste (HCW) include the following:

- Non-risk wastes – these are similar to municipal solid waste
- Risk wastes – these include:
    - Chemicals
    - Genotoxic waste
    - Infectious waste
    - Pathological waste
    - Pharmaceutical waste
    - Sharps
    - Radioactive materials

According to the Hospital Waste Management Rules 2005, hospital waste means not only waste from hospitals but also wastes from all other healthcare establishments, which include: "clinic, laboratories, dispensary, pharmacy, nursing home, health unit, maternity home, blood bank, autopsy centre, mortuary, research institute and veterinary institutions, including any other facility involved in health care and biomedical activity".

There is insufficient data available regarding HCW. However, the Urban Unit has estimated that in Lahore, the total hospital waste generation is about 0.65 kg/bed and day, of which the share of risk waste is 0.19 kg/bed and day[79].

The WHO estimates that in low income countries, total waste generation is 0.5 – 3.0 kg/head of population. A rough estimate of hospital waste generation in Punjab is about 167,000 tons per

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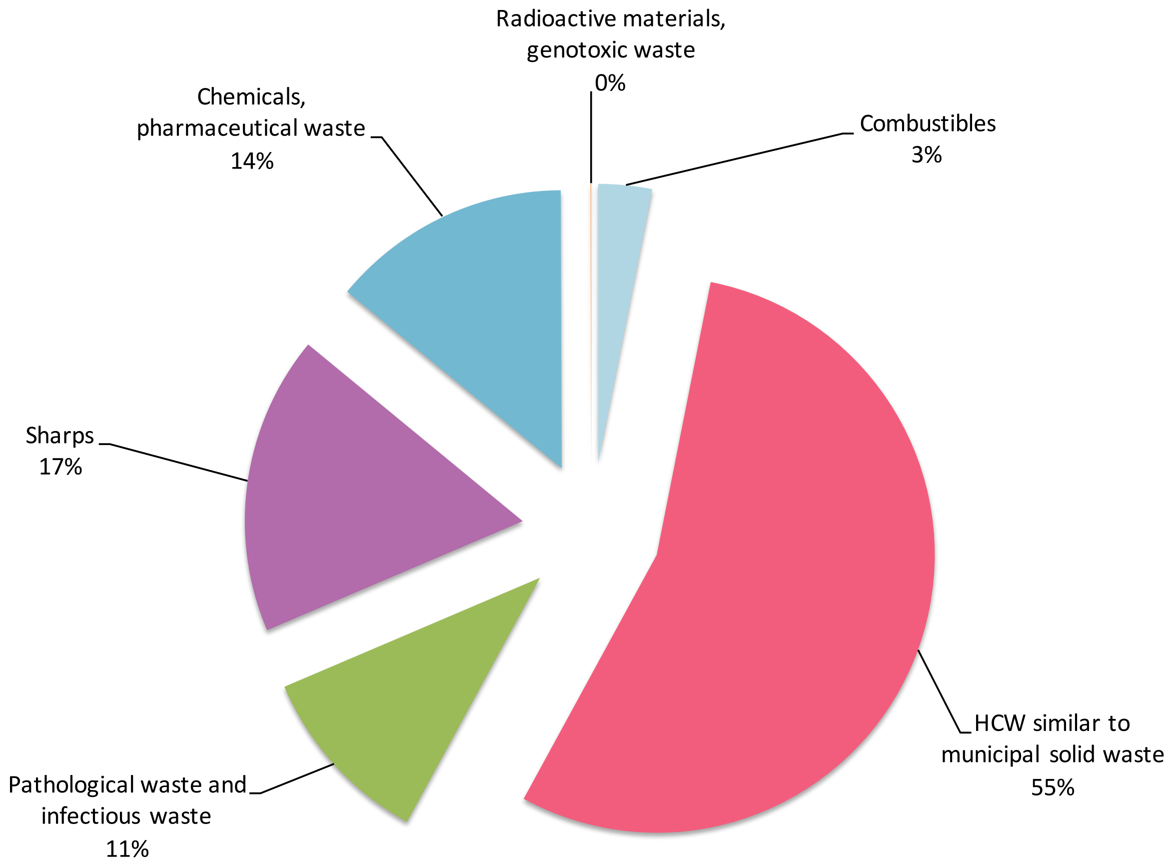
[79] Punjab Solid Waste Management Reform, 2007. World Bank

year, of which the risk waste accounts for about 49,000 tons per year. However, more reliable data is required for planning purposes.

Fig 48 illustrates the composition of HCW obtained from primary data collection and shows that about 55% of HCW in Lahore is similar to municipal solid waste, while risk waste accounts for about 45%.

Figure 48 - Composition of healthcare waste in Lahore



(Source: Punjab Solid Waste Management Reform, 2007. World Bank)

A recent study was conducted on hospital waste management in Faisalabad[80], which is the third largest city in the country and second largest in Punjab and has at least 32 big hospitals in the government, private and non-government sectors. The research revealed that an average of 1.12 kg/day/bed of hospital waste was generated daily. Of the 6 busiest hospitals studied, it was estimated that they alone generate about 2.9 tons waste/day, which contains about 12% infectious waste.

[80] Tahira Yasmeen et al. Assessment of hospital waste management constraints and related environmental issues in Faisalabad, Pakistan. International Journal of Advanced Research (2013), Volume 1, Issue 10, 482-494

Even though the Hospital Waste Management Rules 2005 provide clear guidelines, the common practice is to collect and dispose HCW together with municipal solid waste. Hospitals consider HCW the responsibility of local government. Segregation of high-risk and non-risk waste is not practiced routinely, although some hospitals take the effort to separate the two wastes. Sweepers of the hospitals collect garbage inside the hospital premises and put the waste in roadside dustbins and containers. The dustbins and containers are searched for recyclables by scavengers. Even used syringes are taken, washed and reused afterwards.

Private small hospitals and clinics do not take care of their waste. A few bigger hospitals have incinerators, but these are single chambers. In Lahore there are 40 hospitals in the public sector, out of which 4 hospitals have an incinerator for hazardous waste. Since there is a shortage of trained technical staff, sound operation of the incinerators is not guaranteed.

There is insufficient awareness among health staff about the Hospital Waste Management Rules 2005 and how these need to be implemented. Presently, there is no monitoring and no reliable data available of hospital waste management activities and waste streams. Furthermore, the incinerators do not meet the NEQS requirements.

The Planning Commission conducted a comprehensive survey on health care waste management in all the provinces[81]. They surveyed one tertiary care hospital in public and private sectors, two secondary care hospitals in both public and private sectors and four first level care hospitals in both public and private sectors. Of 78 hospitals surveyed, they found that only 30% had Health Care Waste Management (HCWM) teams in place, and only 27% had the plan for healthcare waste management (HCWM). Of these 27%, only 12% were applying the programme for assessing the HCW.

Construction, Industrial and Slaughter Waste Management

Common building construction waste and demolition materials are sand, bricks, tiles, building glass, cement, doors, windows, pipes, wood, etc.

Common waste products generated by slaughterhouses are hides, blood, bones, horns, dung, fat and body parts.

While there is general consensus that a significant proportion of construction waste and debris is reused in construction, there is very little data available on construction waste management.

Furthermore, there is hardly any quantifiable data available on slaughterhouse waste. Most if not all slaughter waste is disposed in MSW collected by TMAs.

[81] Fazli Hakim Khattak. Hospital Waste Management in Pakistan. Planning Commission, Government of Pakistan, Islamabad. 2009

Recent Initiatives for Solid Waste Management in Punjab

Local Government & Community Development Department

Development of Solid Waste Management system at village level

In response to Government of Punjab's aim for a 'Litter Free Punjab', LG&CDD has planned to launch a programme to develop a SWM system at the village level in rural areas. The programme will incorporate complete participation and management by the local people. Evidence shows that there is hardly any SWM system existing in the rural areas.

The project proposes two models –

- a managerial model in which a village SWM committee shall be formed who will arrange for the collection of solid waste of the entire village in communal containers to be placed at suitable locations in the village. The containers will then be transported by TMA to disposal or dumping sites
- a technical model for house and commercial waste for which small and large steel containers shall be placed at suitable locations in the village for use by village residents. A small number of sanitary workers shall be deployed to haul small containers to larger ones. The TMA or a private company shall transport the large containers to disposal or dumping sites

In addition, the community shall be urged to start anaerobic decomposition of animal dung and fodder/organic waste at individual level by digging pits of required volume and dumping the animal dung and fodder/organic waste into these pits with earth cover. In 5-6 months, this will have converted to excellent manure that can be used in the fields. This will save cost of fertilizer to the village farmers and is also environmentally safe.

Punjab Municipal Development Fund Company

Solid waste maps

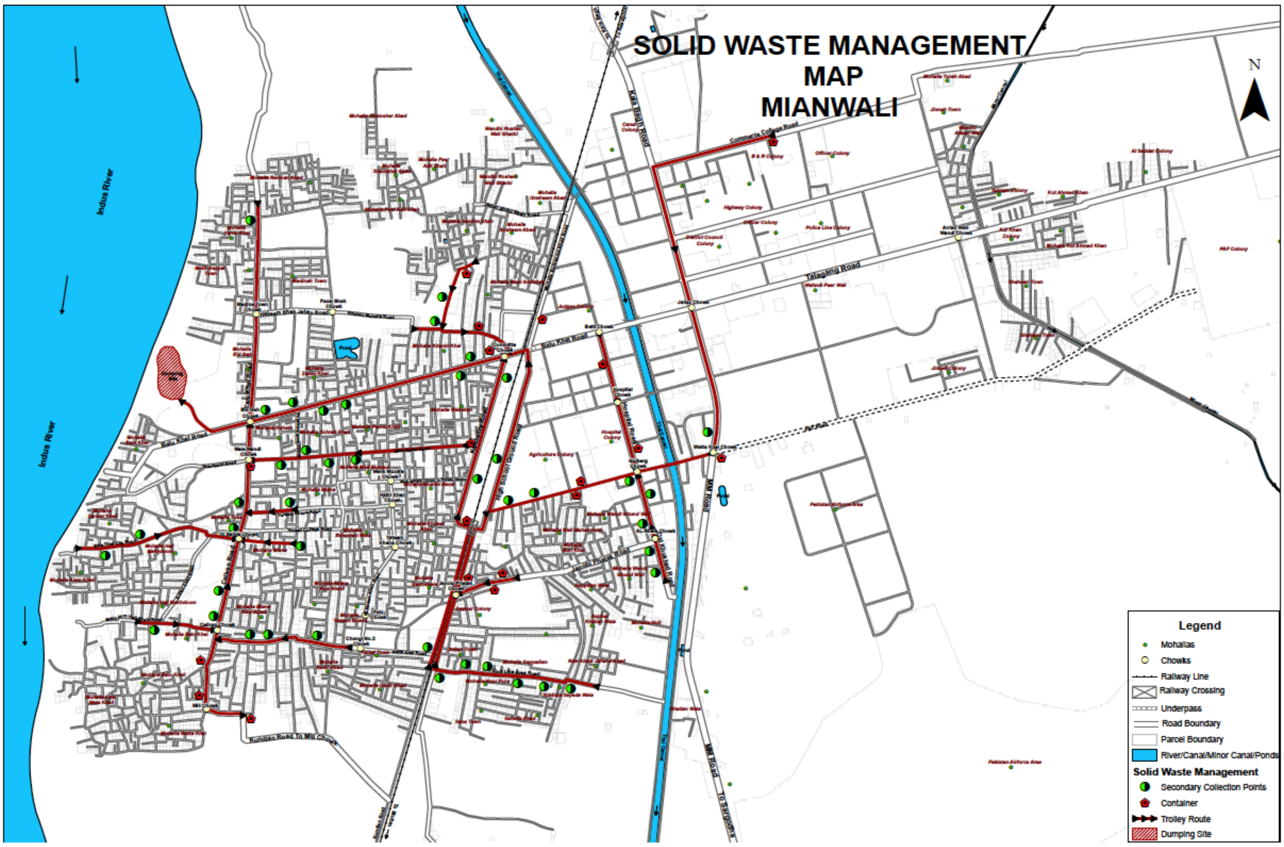
The Punjab Municipal Development Fund Company (PMDFC), as part of the Punjab Municipal Services Improvement project funded by the World Bank, has developed GIS maps of SWM services (with the assistance of Urban Unit) in all the TMAs. Furthermore, a performance management system monitors progress and coverage e.g. percentage of solid waste that is disposed of.

Furthermore, the human resource and equipment status for SWM in each TMA is now available.

As part of the Chief Minister's Special Initiative on Integrated Solid Waste Management for urban areas, complete and comprehensive situation analyses have been conducted for each TMA and proposed key actions for each TMA.

An example of a GIS map for SWM in a TMA is shown in **Fig 49**. It illustrates the main secondary collection points, location of containers, route of trolley, and dumping/disposal site. It also shows the location of any river, canal, minor canal or pond.

Figure 49 - Sample solid waste management services map



(Source: Punjab Municipal Development Fund Company 2014)

Lahore Waste Management Company

SWM in Lahore was plagued by a plethora of problems. These included insufficient collection and storage capacity, inadequate modern machinery and equipment, unreliable MIS management system, non existence of monitoring and evaluation mechanism, and system leakages.

Furthermore, there was an adverse environmental impact because of contamination of soil and water due to haphazard damping, emission of green house gases, contamination of ground water and increase in suspended particles.

To address these issues, several options were tried. These included provision of additional resources, vehicles and manpower to the City District Government Lahore (CDGL), but was unsuccessful due to management deficiencies and lack of professionally trained staff. A Project Management Unit was set up for SWM but was also unsuccessful because it was not integrated with operations. Attempts were made to privatise SWM services to foreign companies but were also unsuccessful due to faulty outsourcing approaches.

Finally, the Lahore Waste Management Company (LWMC) was established based on a Turkish model and is responsible for solid waste collection, transportation and disposal using modern corporate practices and an integrated SWM approach. Since its establishment, the collection efficiency has increased from 61% in the first quarter of 2011-12 to over 100% in the first quarter of 2013-14.

Lakhodair Waste Disposal Facility

Lahore had only one waste disposal site at Mehmood Booti, which by 2010 had accumulated about 6 million tons of waste. This site was creating air and groundwater pollution and was hazardous. A new sanitary landfill site is being developed in Lakhodair. The essential components of this facility include a liner system to restrict migration of leachate or gas to the surrounding soil and a leachate collection facility to collect and extract leachate from landfill and its treatment. In addition, it has a gas control facility to collect and extract gas, its treatment, flaring or use for energy recovery, and a final cover system to prevent migration of gas to the atmosphere; enhance surface drainage; intercept infiltrating water; and support surface vegetation.

Lahore Compost Project

This has been designed to receive 500 to 1000 tons of solid waste a day and to provide an environmentally safe waste disposal.

Sale of Waste

A contract has been signed with 3 companies for total waste handling of 3000 tons/day.

Refuse Derived Fuel Plant

At least 2000 tons of waste per day shall be delivered to a Refuse Derived Fuel (RDF) plant, which is under construction.

Waste to Energy Technologies

Several Waste to Energy (WTE) projects are in process of development and shall include the following:

- Sanitary landfill for capturing methane gas to run generators for electricity
- Incineration
- Anaerobic digestion
- Plasma technology
- Pyrolysis technology

Information Technology

LWMC is using the following systems for efficient waste management in Lahore:

- Vehicle Trip Counting System
- Vehicle Tracking and Management System
- Family of Android Based Digital Monitoring Systems
- MBS Attendance

- UC Based Attendance (Pilot Project)
- Field Operations Monitoring
- Complaint Redressal System
- Penalty Management System
- Video Wall (in deployment phase)

Outsourcing of SWM services in other cities of Punjab

The Lahore model has now been planned for replication in other cities of Punjab. A six cities project based on LWMC approach is under development for Rawalpindi, Gujranwala, Sialkot, Faisalabad, Multan and Bahawalpur districts.

Hospital Waste Management

A hospital waste management initiative has been planned that will include primary and secondary risk waste collection and involves 9 hospitals in Lahore (Shalamar hospital, Lady Wellington hospital, Children hospital, Gulab Devi hospital, Mayo hospital, Services hospital, WAPDA hospital, General hospital and Jinnah hospital).

A central/combined treatment facility is considered for installation at Lakhodair site so that it is both cost effective and has minimal health hazards. LWMC is working on the establishment of centralised hospital waste disposal facility based on Incineration technology. The Incinerator would be used for the hospital waste disposal until a long term plan is established. A feasibility for hospital waste management is in process.

De-silting of storm and wastewater drains

LWMC has identified three types of areas in Lahore – low, middle and high income, which are then further subdivided into zones. A comprehensive de-silting plan for storm and wastewater drains and gully grating of storm water drains was prepared and initiated in June-September 2013 to be repeated periodically every year according to a maintenance schedule. About 592 tertiary drains of total approximate length of 413 km are cleaned under this plan.

The proposed human resource requirement of sanitary workers used is as follows:

- Low income area – 150 m per sanitary worker
- Middle income area – 200 m per sanitary worker
- High income area – 250 m per sanitary worker
- Rural areas – 1 team of 10 sanitary workers per Union Council
- Storm water drains gully grating – 4 teams

All sanitary workers will be obliged to use health safety gadgets provided by LWMC.

City District Government Faisalabad

As part of technical support from the Urban Unit and financial assistance of PKR 150 million, the City District Government in Faisalabad (CDGF) has revamped its SWM system and developed an integrated SWM. As a result of this initiative, it has introduced door to door and shop to shop waste collection as a pilot project. It has also constructed mini transfer stations for waste storage, introduced an efficient waste transportation system, and is now improving the existing dumpsite.

CDGF has upgraded its equipment and now has the following:

- Arm roll trucks – 15
- Waste storage containers – 100
- Waste sprinklers – 3
- Mechanical sweepers – 5
- Tractors toed mechanical sweepers – 5
- Roadside waste bins – 100
- Mini transfer stations – 5
- Handcarts - 550

Punjab Municipal Services Improvement Project (PMSIP) II

The government of Punjab is currently developing a PMSIP II, which is expected to address solid waste management issues among other municipal services. This is still in the pipeline.

Recent Initiatives by Department of Health for Medical Waste Management in Punjab

Environmental and Medical Waste Management Plan (EMWMP)

The Punjab Health Sector Reforms Unit, now changed to the Policy and Strategic Planning Unit (PSPU), reviewed the situation of hospital waste in the province. The Department of Health has now developed an Environmental and Medical Waste Management Plan[82], based on the Hospital Waste Management Rules 2005, that describes institutional arrangements, development and implementation of waste management plans, options for waste disposal and capacity building.

Implementation of the EMWMP will be carried out in close coordination with the implementation of Infection Control Management Project (ICMP), since both waste management and infection control aspects are inherently linked with each other.

Under the Phase I of the national Infection Control Management Project, infection control protocols have already been prepared. Under the Phase II of this project, these protocols are being implemented on pilot basis in one district each of Khyber Pakhtunkhwa, Punjab and Sindh provinces. Gujranwala district has been selected in Punjab for this purpose.

The Department of Health has also developed a Proforma[83] for inspection of Tehsil and District Headquarter Hospitals. One of the components of this inspection proforma is on hospital waste management and includes the following items for inspection:

- Segregation of hospital waste as per guidelines
- Hospital waste lying open
- Burned by –
    - Incinerator
    - Other means
- Buried
- Carried away by municipality
- Any other

[82] Environmental and Medical Waste Management Plan. Punjab Health Sector Reforms Support Project. Department of Health, 2013

[83] Proforma for THQ and DHQ Inspection. Health Department, Government of Punjab. Chief Minister's Monitoring Force

Strategy

Solid Waste Management			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 25% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Solid waste collection and disposal	At least 70% of solid waste generated is collected and disposed of per day At least 30% TMAs providing door to door collection service Village based solid waste management piloted in selected villages	At least 80% of solid waste generated is collected and disposed of per day At least 40% TMAs providing door to door collection service Village based solid waste management scaled up to 10% villages in Punjab	At least 90% of solid waste generated is collected and disposed of per day At least 50% TMAs providing door to door collection service Village based solid waste management scaled up to 30% villages in Punjab
Effective solid waste management	Establish water and sanitation companies in large and intermediate cities whose mandate includes solid waste management and specify service zones Develop a minimum standards list of hardware and equipment for solid waste management and upgrade in 30% of TMAs Establish an Enforcement Wing to ensure effective solid waste management	Upgrade the hardware and equipment for solid waste management in 60% of TMAs	Upgrade the hardware and equipment for solid waste management in 90% of TMAs
Efficient Solid waste disposal and recycling	At least 30% TMAs establish transfer stations to reduce disposal time Recycle at least 10% of solid waste by systematic separation Regional sanitary landfill options identified for 2-3 TMAs where feasible	At least 60% TMAs establish transfer stations to reduce disposal time Recycle at least 15% of solid waste by systematic separation At least 20% of TMAs served by sanitary landfill sites	At least 90% TMAs establish transfer stations to reduce disposal time Recycle at least 20% of solid waste by systematic separation At least 40% of TMAs served by sanitary landfill sites
Waste to Energy	Formalise contracts with companies for waste to energy options	At least each mega city has a WTE option in place	At least each intermediate city has a WTE in place

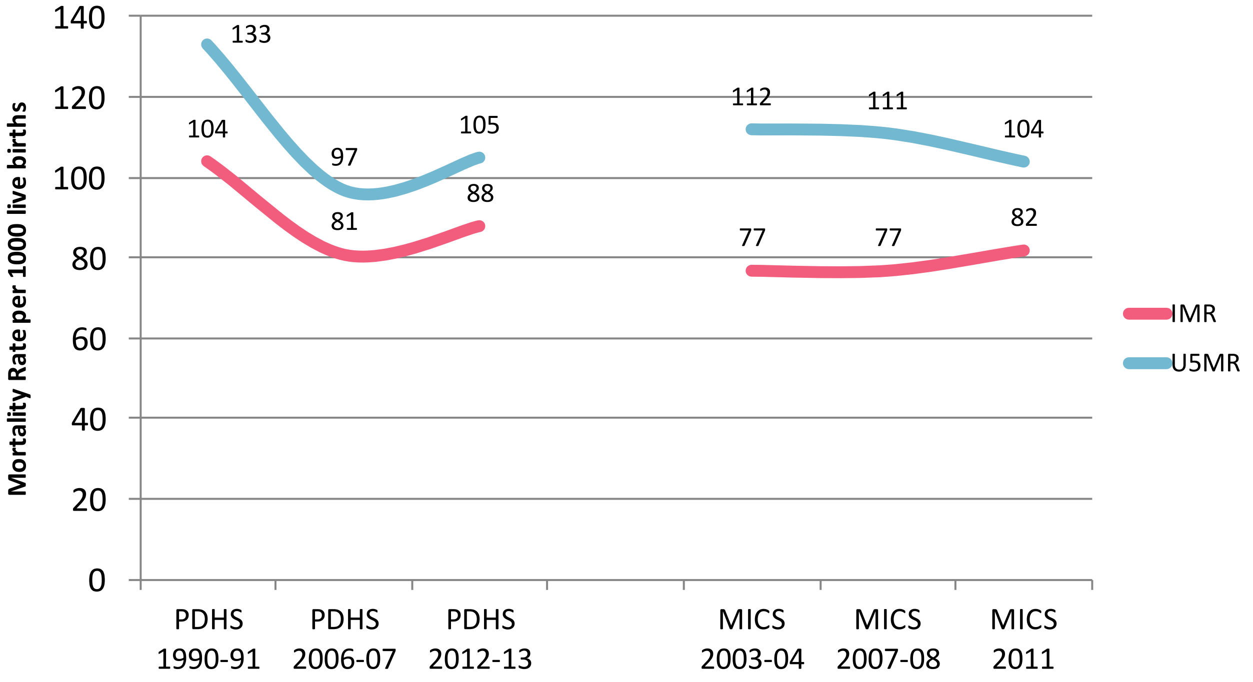
Safe hospital high risk waste disposal	TMAS and Department of Health orient each hospital waste management committee oriented on Environmental and Medical Waste Management Guidelines, municipal solid waste and high risk waste and their separate disposal Each mega city and intermediate city has a centralised and functional high risk hospital waste disposal facility At least 50% of hospital high risk waste disposed of safely	Each TMA has a centralised and functional high risk hospital waste disposal facility At least 60% of hospital high risk waste disposed of safely	At least 90% of hospital high risk waste disposed of safely
Safe and hygienic Slaughterhouses	Update status of slaughterhouses in each TMA and prioritise those for rehabilitation, solid waste and wastewater management Develop slaughterhouse safety and hygiene practice guidelines and orient 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 30% of municipal services dispose of slaughterhouse solid waste safely	Provide refresher training on slaughterhouse safety and hygiene practice guidelines to 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 60% of municipal services dispose of slaughterhouse solid waste safely	Provide refresher training on slaughterhouse safety and hygiene practice guidelines to 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 90% of municipal services dispose of slaughterhouse solid waste safely
Efficient and effective management of Industrial Solid Waste	Determine the current status of industrial solid waste production and disposal	Develop strategies and actions for efficient and effective management of industrial solid waste	

HEALTH AND HYGIENE

Child Mortality

Infant Mortality Rate (IMR) and Under 5 Mortality Rate (U5MR) remain high in Punjab. The MICS 2011 has found an IMR of 82 per 1000 live births and U5MR of 104 per 1000 live births. Decadal trends show that improvements in child mortality rates have not been impressive (**Fig 50**).

Figure 50 - Decadal trends of Infant and Under 5 Mortality Rates in Punjab



(Source: Pakistan Demographic and Health Surveys 1990-91, 2006-07, and 2012-13; and Multiple Indicator Cluster Surveys Punjab 2003-04, 2007-08 and 2011)

Evidence suggests that pneumonia, diarrhoea and malaria cause about 50% of all deaths in children in Pakistan. Diarrhoea alone accounts for almost 19%-23% of all child deaths[84]. In Pakistan, 53,000 children die every year from diarrhoea[85]. WHO and UNICEF estimate that in Pakistan, the rates of child mortality due to diarrhoea are in the range of 100 - <500 per 100,000 children[86].

[84] Jai Das and Zulfiqar Bhutta. Scale-up plan for essential medicines for child health – Diarrhoea, Pneumonia and Malaria. Aga Khan University, 2012

[85] Pakistan Demographic and Health Survey 2012-13

[86] Liu L, Johnson HL, Cousens S, et al. Child Health Epidemiology Reference Group of WHO and UNICEF. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. Lancet. 2012;379(9832)

Punjab has a high Under 5 mortality rate of 114 per 1000[87]. The Pakistan Demographic and Health Survey 2012-13[88] found that 21.9% of children under five years of age in Punjab had an episode of diarrhoea during the two-week period preceding the survey, and 2.5% had diarrhoea with bloody stool indicating an infection acquired from contaminated water or food. An earlier survey[89] found that children aged 6-11 months were the most vulnerable and were three times more likely to have had diarrhoea than children aged 48-59 months. 11% of all deaths in children under 5 years of age and 18% of all child deaths were due to diarrhoea.

According to the Pakistan Social and Living Standards Measurement survey 2010-11[90], 10% of children under 5 years in Punjab had diarrhoea within 30 days preceding the survey. In Dera Ghazi Khan and Layyah, the rates were very high at 25% and 30% respectively.

On comparing the pattern of child mortality rates with sources of water supply, a suggestive trend emerges with households that have piped water in dwelling (**Fig 51**). The peaks of child mortality rates coincide with troughs of piped water in dwelling (where piped water in dwelling rates are low). About 33.4% of households in the highest quintile and 15.7% in the fourth quintile had piped water in dwelling.

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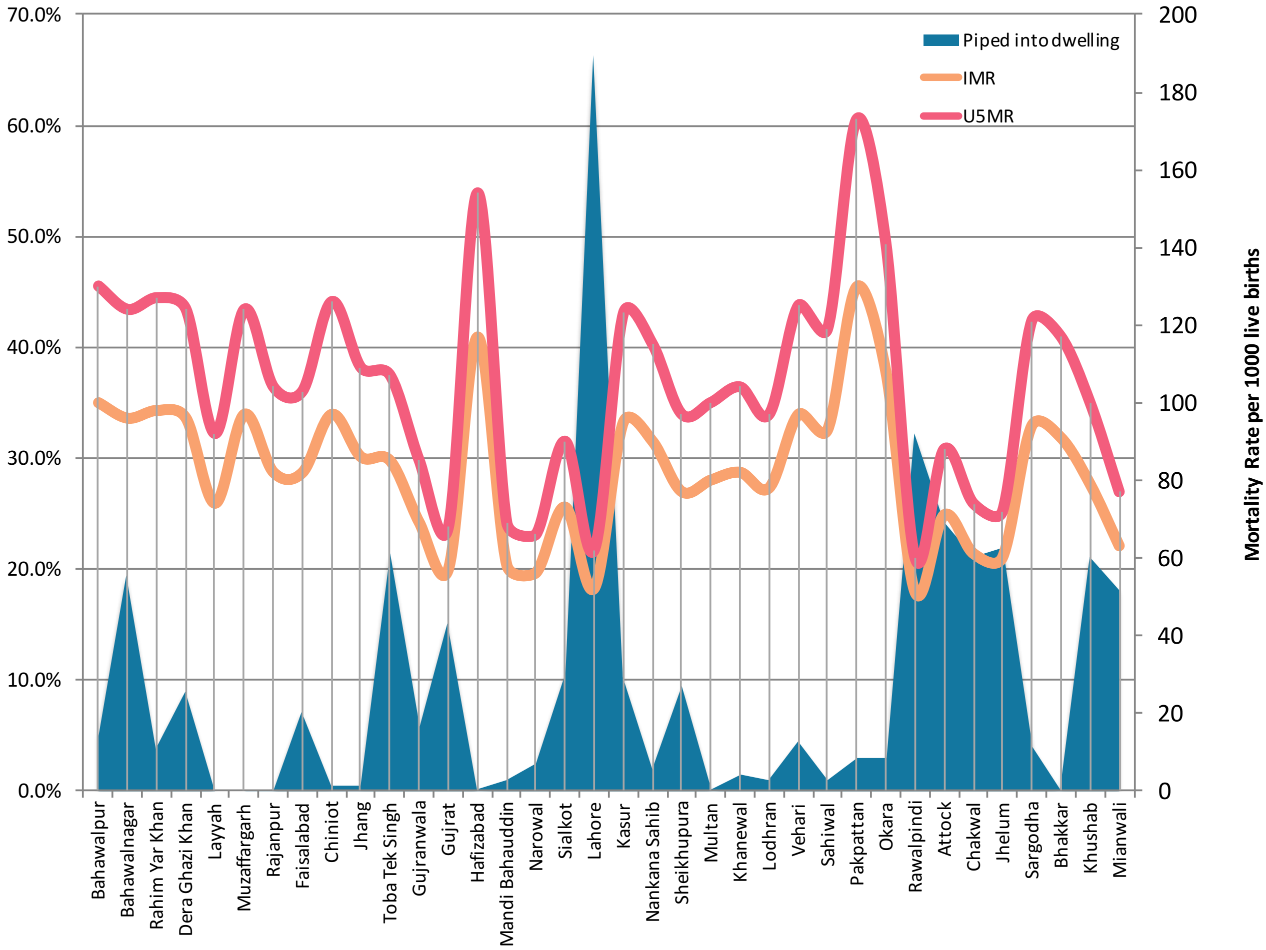
87 Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

88 Pakistan Demographic and Health Survey 2012-13

89 Pakistan Demographic and Health Survey 2006-07

90 Pakistan Social and Living Standards Measurement Survey 2010-11. Pakistan Bureau of Statistics, Government of Pakistan

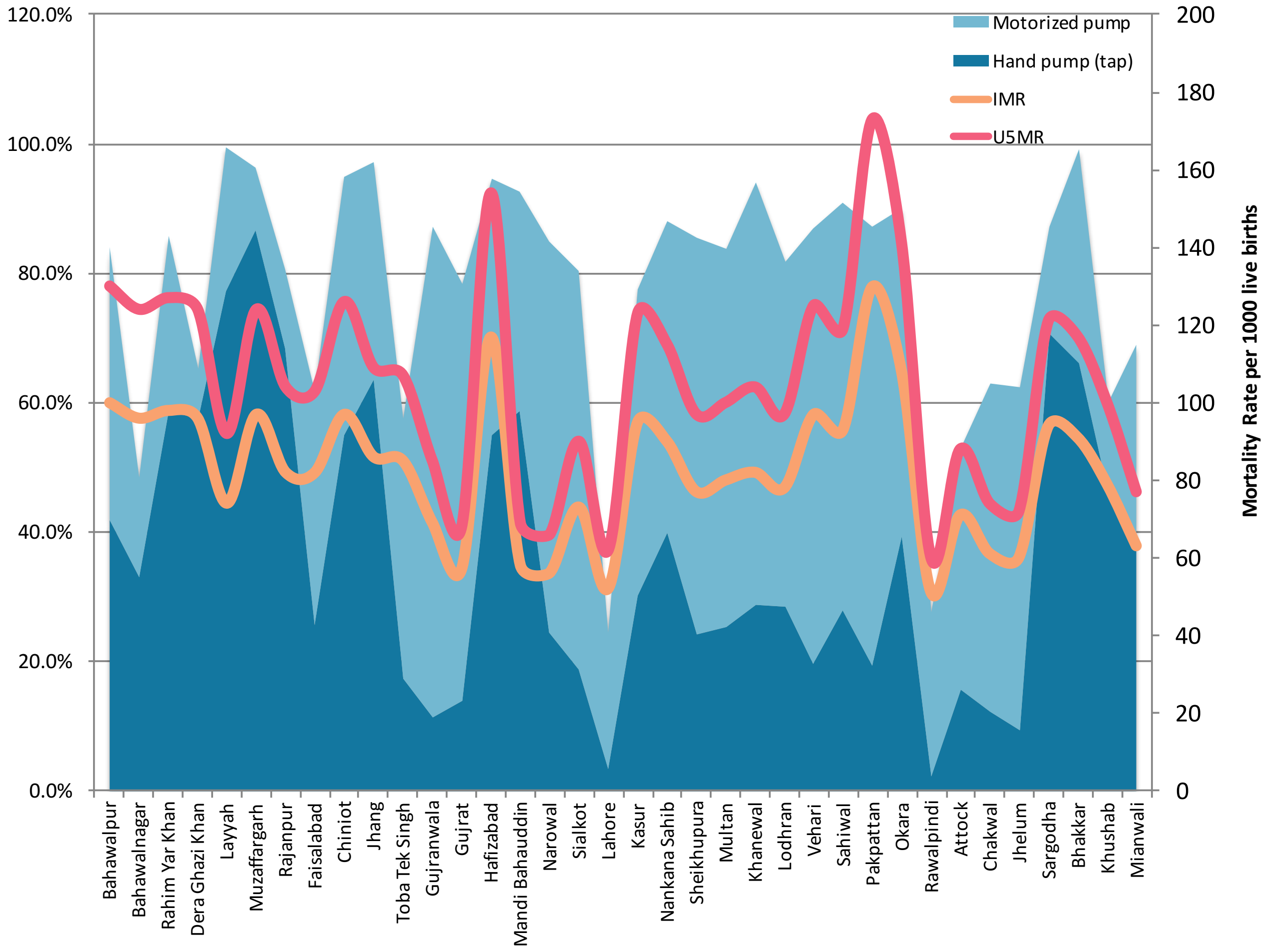
Figure 51 - Child mortality and piped water in dwelling patterns



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

While there is some similarity in patterns of child mortality rates when both motorised pump and hand pump are taken together (**Fig 52**), the trend becomes even more visible when one looks at hand pump alone (**Fig 53**) suggesting that hand pump may be an improved source but not necessarily a safe one.

Figure 52 - Child mortality and motorised and hand pump patterns



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

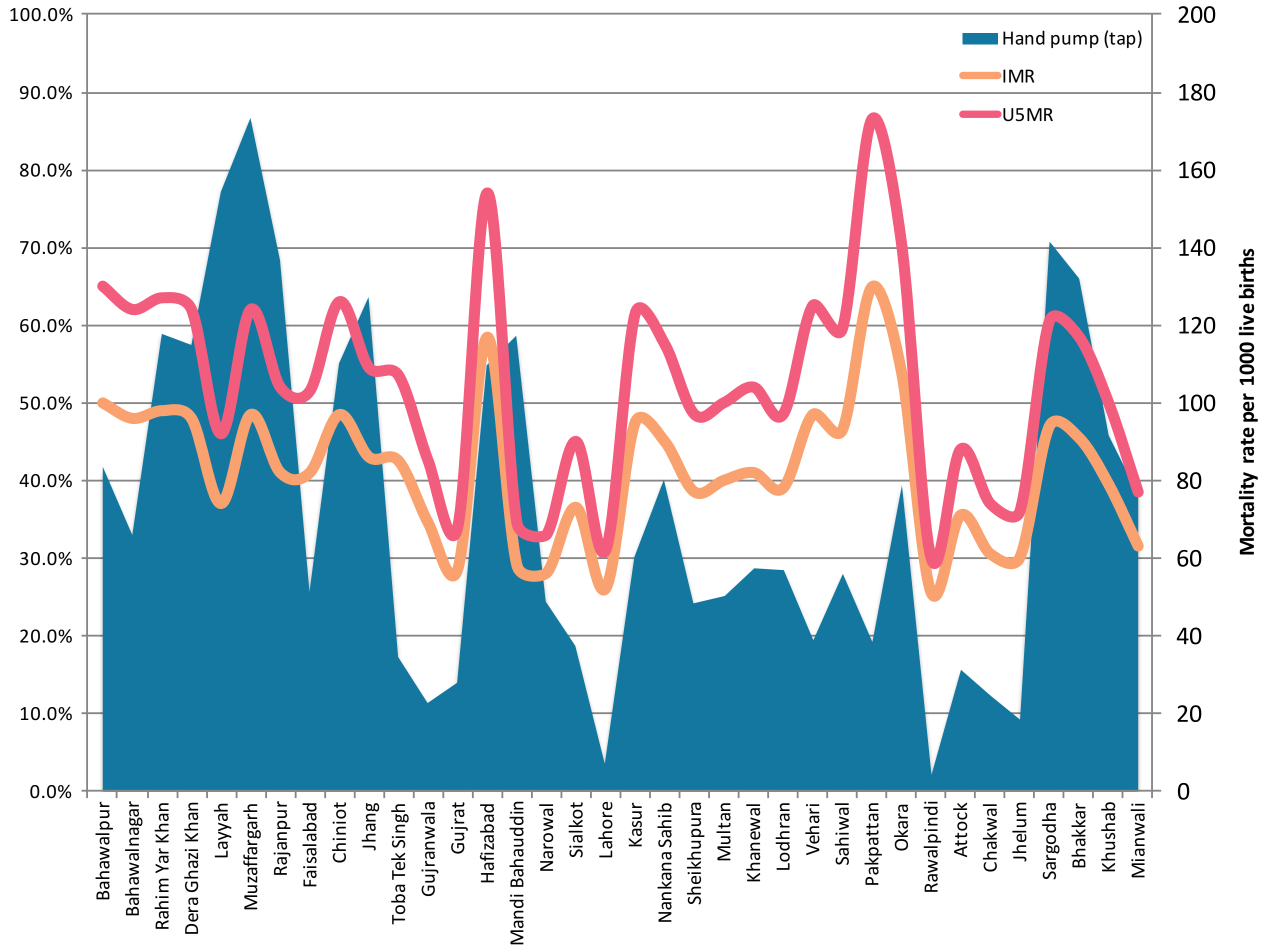
Based on data available, an estimated 55,000 children die annually in Pakistan due to diarrhoea[91]. This means that 100-150 children die every day because of diarrhoea.

An estimated 25 million children and 50 million adults suffer from diarrhoeal morbidity annually in Pakistan. A further 27,000 people die from Typhoid/paratyphoid related diarrhoea, while 1.35 million have Typhoid/paratyphoid morbidity. Diarrhoea results in an estimated 2.5 million Disability Adjusted Life Years (DALYs) in Pakistan[92].

91 Pakistan Strategic Country Environmental Assessment – World Bank 2006

92 Pakistan Strategic Country Environmental Assessment – World Bank 2006

Figure 53 - Child mortality and hand pump patterns



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Communicable Diseases and Sanitation Practices

Pakistan is also one of the priority countries for control of Neglected Tropical Diseases[93], especially Trachoma, which is an avoidable blinding condition that is perpetuated in poor communities with inadequate water, poor sanitation especially open defecation, overcrowding and dry and dusty environments. A district based prevalence of Trachoma survey is currently underway to identify priority districts with high prevalence of active and blinding trachoma.

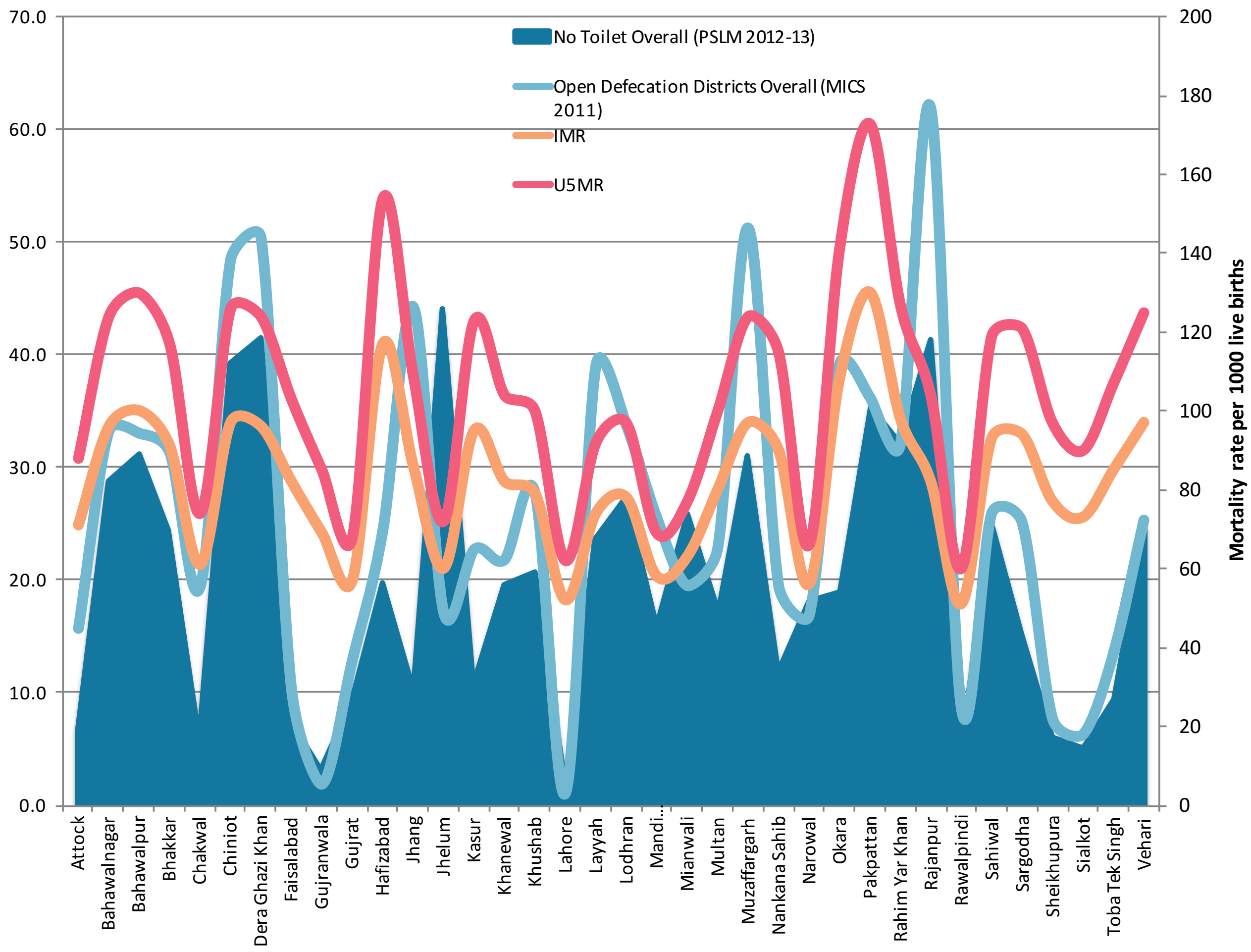
The outbreaks of Dengue in Punjab and other provinces are a wake up call. Dengue flourishes in small water collections in and around the house, in particular in drinking water vessels. Piped drinking water can prevent the exacerbations from Dengue. In Punjab, over 12,000 people were infected and close to 300 people died from Dengue. Hospital beds were full of infected patients.

[93] WHO Report on Neglected Tropical Diseases 2010

The recent resurgence of polio in Pakistan, especially following the floods suggests pollution of water reservoirs as one causative factor. In Lahore recently, environmental samples have detected polio virus. In 2013, there was a 60% increase in the number of polio cases in Pakistan compared to 2012 and all were due to a single strain 'Wild Polio Virus' Type 1[94]. Pakistan may be left as the last global outpost in the control of polio. Hepatitis A and E are now endemic due to contamination of drinking water by faecal matter[95].

Child mortality rates in Punjab also share a common pattern with 'no toilet'/'open defecation' rates as found in both PSLM 2012-13 and Punjab MICS 2011 (**Fig 54**). The trends are suggestive of poor sanitation practices being a contributory factor to child mortality in the province.

Figure 54 - Child mortality and 'no toilet'/'open defecation' patterns



(Source: Punjab Multiple Indicator Cluster Survey 2011; and Pakistan Social and Living Standards Measurement Survey 2012-13)

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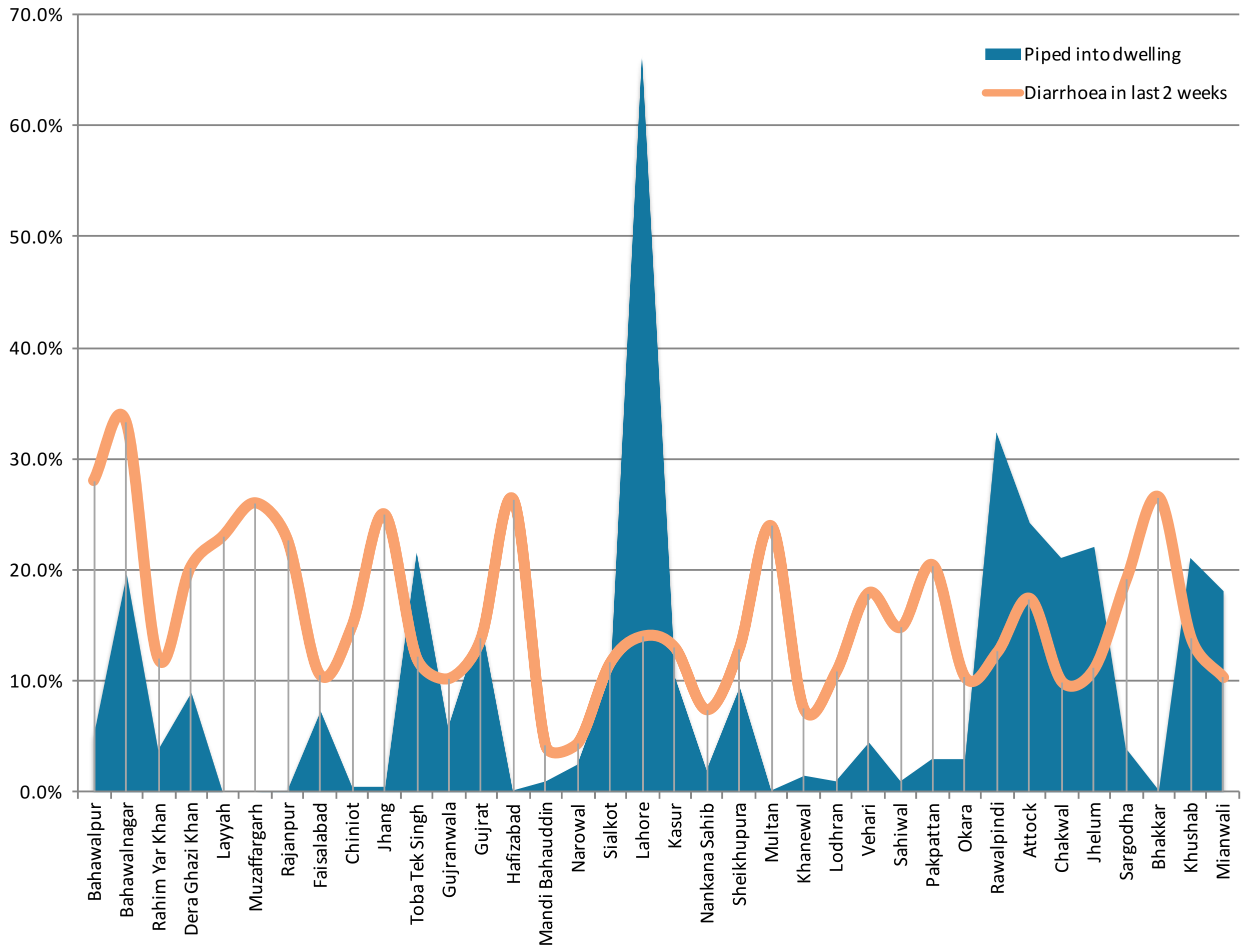
94 Poliomyelitis: intensification of the global eradication initiative. Report by the Secretariat. Sixty-seventh World Health Assembly. A67/38 21 March 2014

95 Malik IA, Tariq WZ: Hepatitis E in Pakistan. EMHJ 2, 1:121-128, 1996

Diarrhoea

The Punjab MICS 2011 indicates that patterns of diarrhoea in the last two weeks in children under 5 years show peaks in households generally that have low rates of piped water in dwelling. Bahawalnagar appears to be an outlier with high diarrhoea rates compared to other districts with similar rates for piped water in dwelling (**Fig 55**).

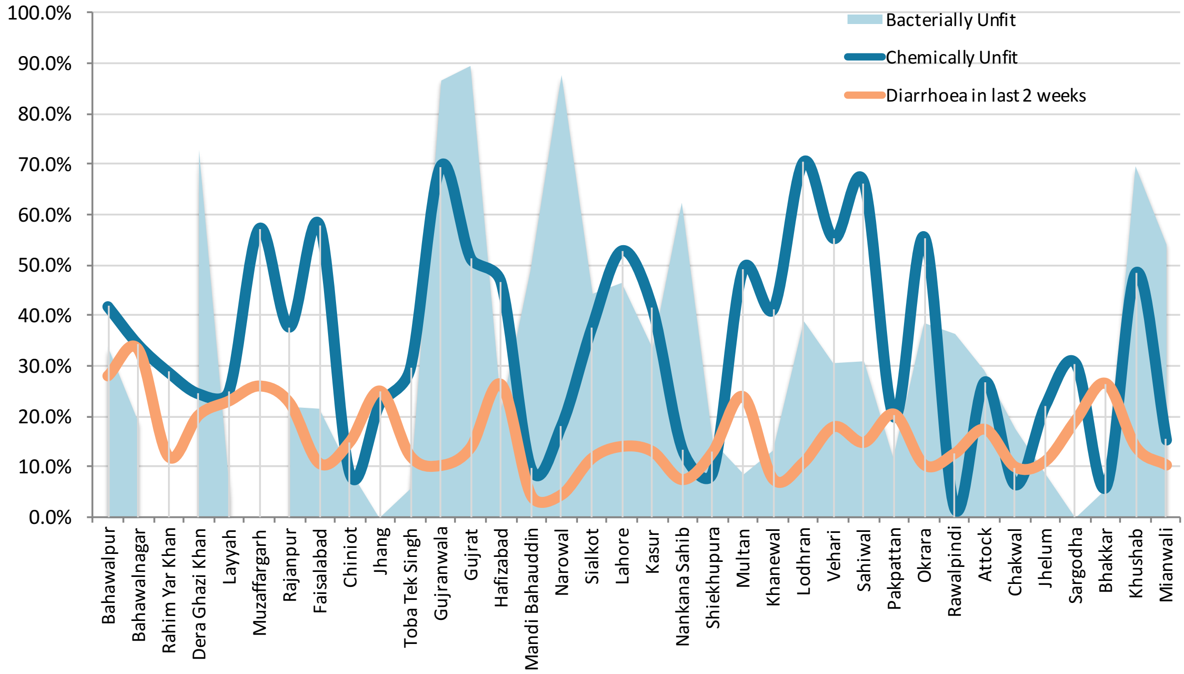
Figure 55 - Diarrhoea in last two weeks and piped water in dwelling patterns



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

On analysis of water quality and rate of diarrhoea in the last two weeks, the patterns suggest that diarrhoea was more frequent in areas where either the water was chemically or bacterially unfit or both (**Fig 56**). However, there were some distinct differences as well. For instance, in Jhang, the bacterial contamination was very low but there was high chemical contamination, and similarly in Sargodha suggesting that chemical contamination may also be a causative factor for diarrhoea. Data on bacterial contamination in Rahim Yar Khan and Bahawalpur were not available.

Figure 56 - Diarrhoea in last two weeks and water quality patterns

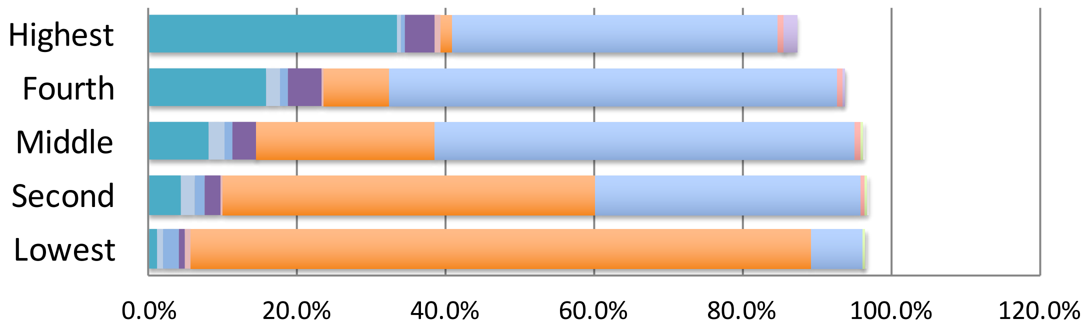


(Source: Punjab Multiple Indicator Cluster Survey 2011, PHED and UNICEF 2011-12)

Both **Fig 57** and **Fig 58** show that 83.5% of hand pump use and 82% of all 'open defecation' was found in the lowest quintile. This quintile is also the most at risk for child mortality.

These finding indicate that the lowest quintile is the most vulnerable to health risks and has the least access to safe water and adequate basic sanitation.

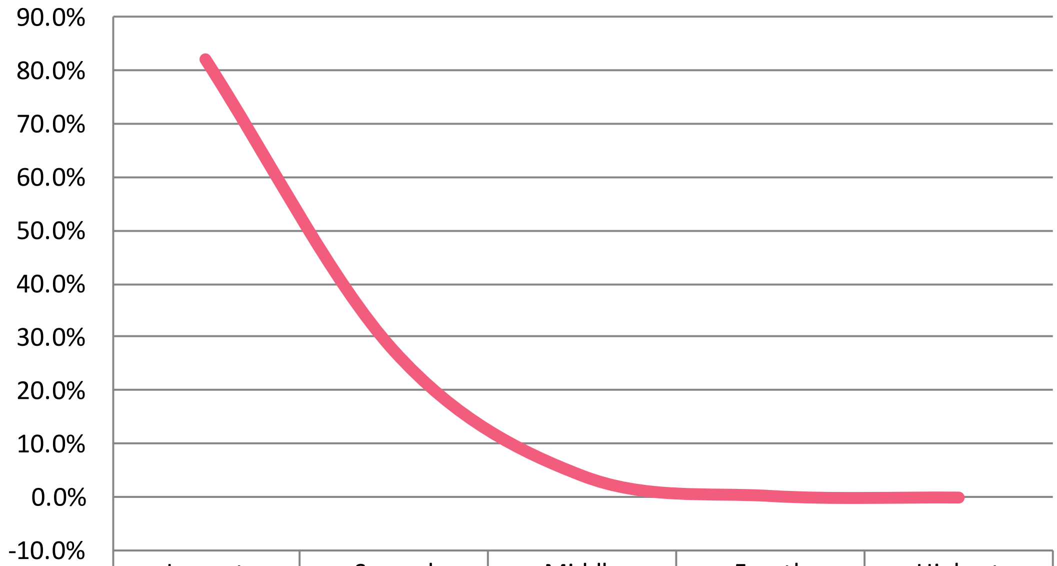
Figure 57 - Water supply and economic quintiles



	Lowest	Second	Middle	Fourth	Highest
Piped into dwelling	1.0%	4.2%	8.0%	15.7%	33.4%
Piped into compound	0.9%	1.9%	2.2%	1.9%	0.6%
Piped to neighbour	2.1%	1.4%	1.0%	1.0%	0.4%
Public tap	0.9%	2.1%	3.1%	4.6%	4.2%
Tube well	0.8%	0.3%	0.2%	0.4%	0.7%
Hand pump (tap)	83.5%	50.2%	24.1%	8.8%	1.6%
Motorized pump	6.9%	35.8%	56.5%	60.3%	43.9%
Protected well	0.2%	0.6%	0.9%	0.8%	0.8%
Protected spring	0.2%	0.3%	0.3%	0.1%	0.0%
Bottled water (mineral)	0.0%	0.0%	0.0%	0.1%	1.8%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Figure 58 - Open defecation and economic quintiles



	Lowest	Second	Middle	Fourth	Highest
Open defecation	82.0%	27.5%	4.1%	0.3%	0.0%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Economic Impacts

The cost of diarrhoeal health impacts is determined using the human capital approach since both diarrhoeal and typhoid mortality predominantly affects children. The cost of morbidity includes the cost of illness (medical treatment, medicines, and value of lost time). About 50% of these costs are associated with the value of time lost to illness (including care giving), and another 50% are from cost of treatment and medicines[96].

2.5 million DALYs are lost annually from diarrhoeal mortality and morbidity associated with inadequate water, sanitation and hygiene. The annual economic loss was estimated at PKR 114 billion by the World Bank in 2006[97].

A study[98] on cost and impact analysis of water supply and environmental sanitation in Pakistan revealed that if water supply facilities are available to 90% of households and latrine facilities available to at least 60% of households in villages, the Benefit to Costs ratio is 2.7 at 6% discount rate and 1.75 at 12% discount rate.

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96 Pakistan Strategic Country Environmental Assessment – World Bank 2006

97 Pakistan Strategic Country Environmental Assessment – World Bank 2006

98 Cost and impact analysis of water supply and environmental sanitation in Pakistan. Pakistan Institute of Development Economics, 2002

Recent data from the Economics of Sanitation Initiative supported by WSP suggests that the economic impact of poor sanitation and water in Pakistan may be as high as 3.94% of GDP[99].

A report from the World Bank on water and sanitation to reduce child mortality[100] found that 25 deaths or more per 1000 children born could be prevented by investing in water and sanitation infrastructure. This difference accounts for about 40% of the gap between current child mortality rates and the 2015 target set in the Millennium Development Goals. For Pakistan, the cost per Life Year Saved relative to GDP per capita (in 2007) is about 20%, which is highly cost-effective.

The report also found that the average cost per life-year saved ranges between 65% and 80% of developing countries' annual gross domestic product per capita. The results suggest that investment in water and sanitation is a highly cost-effective policy option, even when only the mortality benefits are taken into consideration. Taking into account the additional expected benefits, such as reduced morbidity, time spending, and environmental hazards, would further increase the benefit-cost ratio.

The WHO estimates that the return on USD 1 investment is in the range USD 5 to USD 36, with a global average of USD 8[101]. Using meta-analysis, a reduction in diarrhoea frequency include:

- Improved hygiene - 37% reduction
- Improved sanitation - 32% reduction
- Improved water supply - 25% reduction
- Improved water quality - 31% reduction
- Multiple - 33% reduction

Economic benefits that arise from water and sanitation improvements include:

- Direct economic benefits of avoiding diarrhoeal disease - less expenditure on treatment of diarrhoeal disease and related health seeking costs
- Indirect economic benefits related to health improvement - value of avoided days lost at work or school, impact on school attendance of girls, avoided time lost of caretaker of sick children, and economic contribution of a saved life due to diarrhoeal disease
- Non-health benefits related to water and sanitation improvement - time savings related to water collection or accessing sanitary facilities; benefits to agriculture and industry of improved water supply; more efficient management of water resources

A per capita annual economic benefit of at least USD 15 is achieved, if universal coverage for combined water and sanitation interventions is done.

[99] Pakistan Briefing: Economic impact of water and sanitation. Sanitation and Water for All, 2012

[100] Water and sanitation to reduce child mortality, World Bank 2011

[101] Economic and health effects of increasing coverage of low cost household drinking water supply and sanitation interventions to countries off-track to meet MDG target 10. World Health Organization, 2007

Hygiene

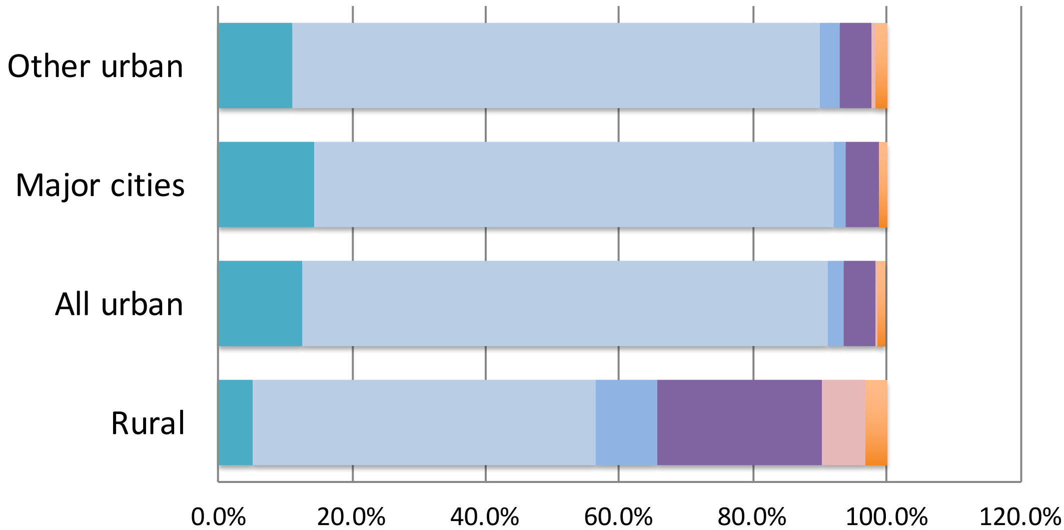
Data from the recent MICS 2011 in Punjab shows that in rural areas (**Fig 59**), about a fourth (24.7%) of children aged 0-2 years had their faeces thrown as solid waste in the garbage and for about 6.4% it was left in the open.

About half (50.6%) the children aged 0-2 years (overall in urban and rural) whose faeces were thrown as solid waste and 15.6% of those (overall in urban and rural) that was left it in the open were in those households that practiced open defecation.

Furthermore, about two-thirds (64.8%) of the children aged 0-2 years (overall in urban and rural) whose faeces were thrown as solid waste and 20.2% of those (overall in urban and rural) that was left it in the open were in those households that fell in the lowest and second economic quintiles.

Overall in Punjab, about 66.1% of children aged 0-2 years had their faeces disposed in a safe manner.

Figure 59 - Place of disposal of child's faeces



	Rural	All urban	Major cities	Other urban
Child used latrine	5.2%	12.6%	14.3%	10.9%
Put or rinsed into latrine	51.3%	78.5%	77.9%	79.2%
Put of rinsed into drain or ditch	9.1%	2.4%	1.8%	3.0%
Thrown as solid waste	24.7%	4.8%	5.0%	4.7%
Left in open	6.4%	0.3%	0.0%	0.6%
Other	3.3%	1.3%	1.1%	1.6%

(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

In Punjab, over 95% of households have a place for hand washing[102]. However, there was wide variation of availability of soap at the place of hand washing. **Fig 60** shows that Dera Ghazi Khan, Faisalabad, Sargodha and parts of Multan and Rawalpindi divisions which had high rates of lack of soap at the place of hand washing also had moderate to high rates of diarrhoea in the last two weeks. While there may be other causes of diarrhoea as has been seen earlier, there is a suggestive trend between lack of soap for hand washing and occurrence of diarrhoea. There is a positive correlation between 'water available, but no soap' and diarrhoea in last two weeks (r = 0.3075) and a negative correlation between 'water and soap available' and diarrhoea in last two weeks (r = - 0.3900) suggesting that districts with higher use of water and soap for hand washing tend to have lower rates of diarrhoea.

The World Health Organization[103] states that 'reductions in diarrhoea incidence have reached 5% for water supply at source, 19% for water quality interventions (results after 12 months), 36% for sanitation interventions, and 47% for hand washing with soap (estimates from pooled analyses)'[104,105].

In almost half of the households in the lowest quintile (48.2%) and just over a fourth in the second quintile (27.2%), there was water but no soap at the place of hand washing. Furthermore, where there was lack of soap at the place of hand washing, 13.2% of households in the lowest quintile and 4.6% in the second quintile had no soap in the household.

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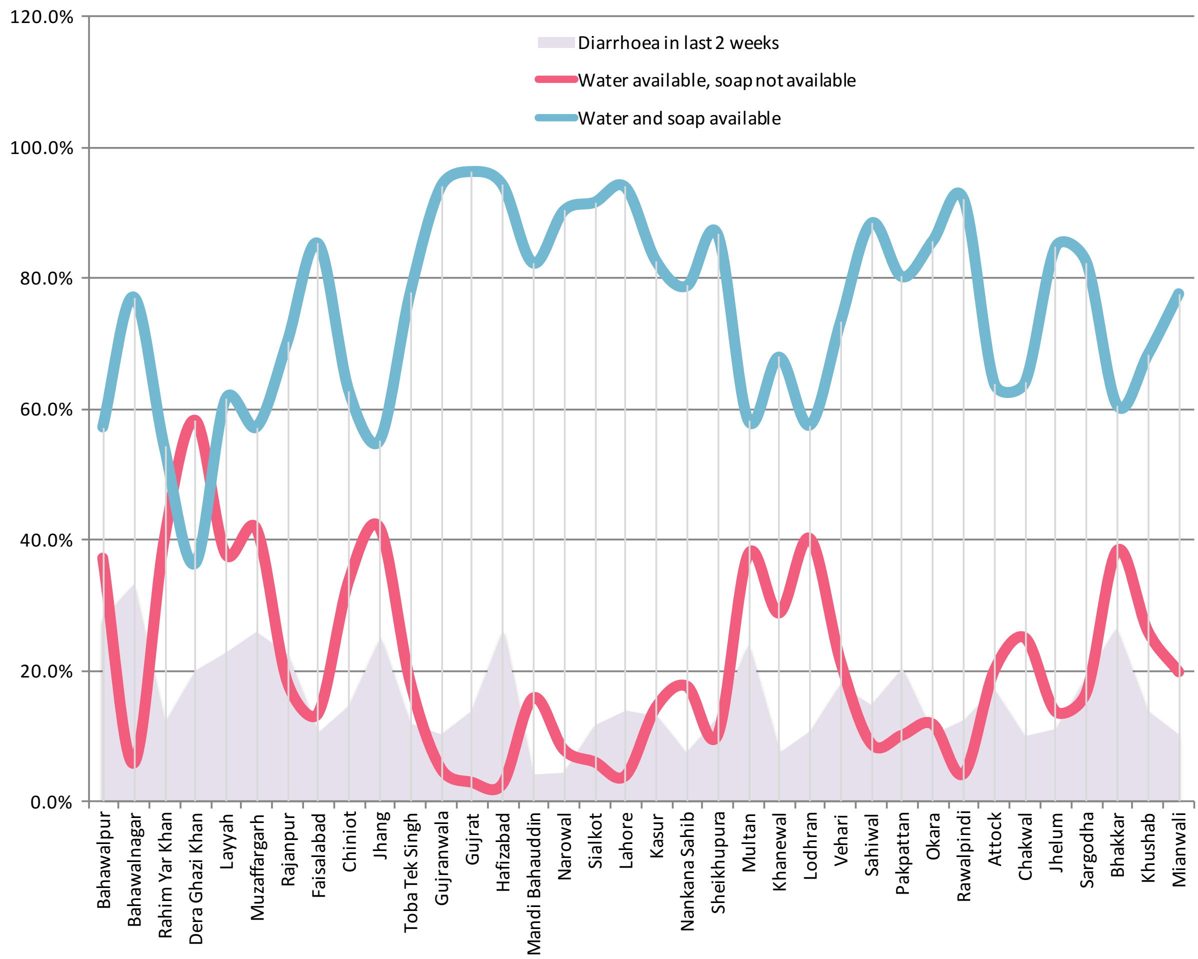
[102] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

[103] http://www.who.int/elena/titles/bbc/wsh_diarrhoea/en/ accessed on 21 May 2015

[104] Waddington H et al. Water, sanitation and hygiene interventions to combat childhood diarrhoea in developing countries. The International Initiative for Impact Evaluation (3ie), 2009

[105] Cairncross S, Valdmanis V. Water supply, sanitation, and hygiene promotion. In: Jamison D et al., eds. Disease control priorities in developing countries. New York, World Bank and Oxford University Press, 2006

Figure 60 - Hand washing facilities and diarrhoea



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

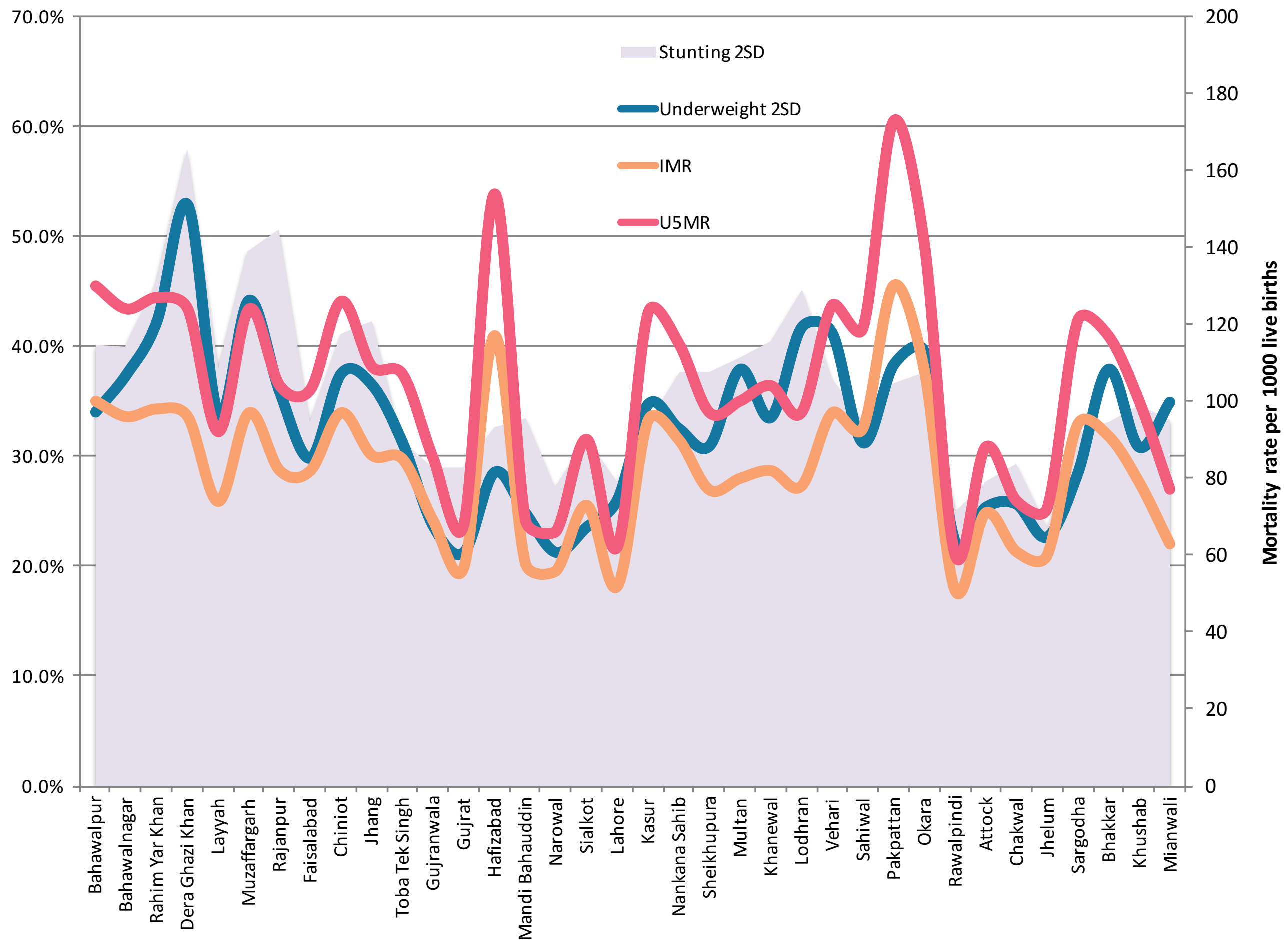
Nutrition and Diarrhoea

Recent data from the Punjab MICS 2011 has shown that 32.6% of children under 5 years are underweight, 36% are stunted and 15.7% are wasted (all figures to 2 standard deviation). Analysis of data shows that districts that have high child mortality rates also have high rates of children who are underweight or stunted (**Fig 61**). There is a strong positive correlation between underweight and child mortality (IMR: r = 0.6458; and U5MR: r = 0.6443); and also between stunting and child mortality (IMR: r = 0.5018; and U5MR: r = 0.4992).

A recent report by UNICEF states that 'nearly half of all deaths in children under 5 are attributable to undernutrition'[106].

[106] http://data.unicef.org/nutrition/malnutrition accessed on 21 May 2015

Figure 61 - Nutritional status and child mortality



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

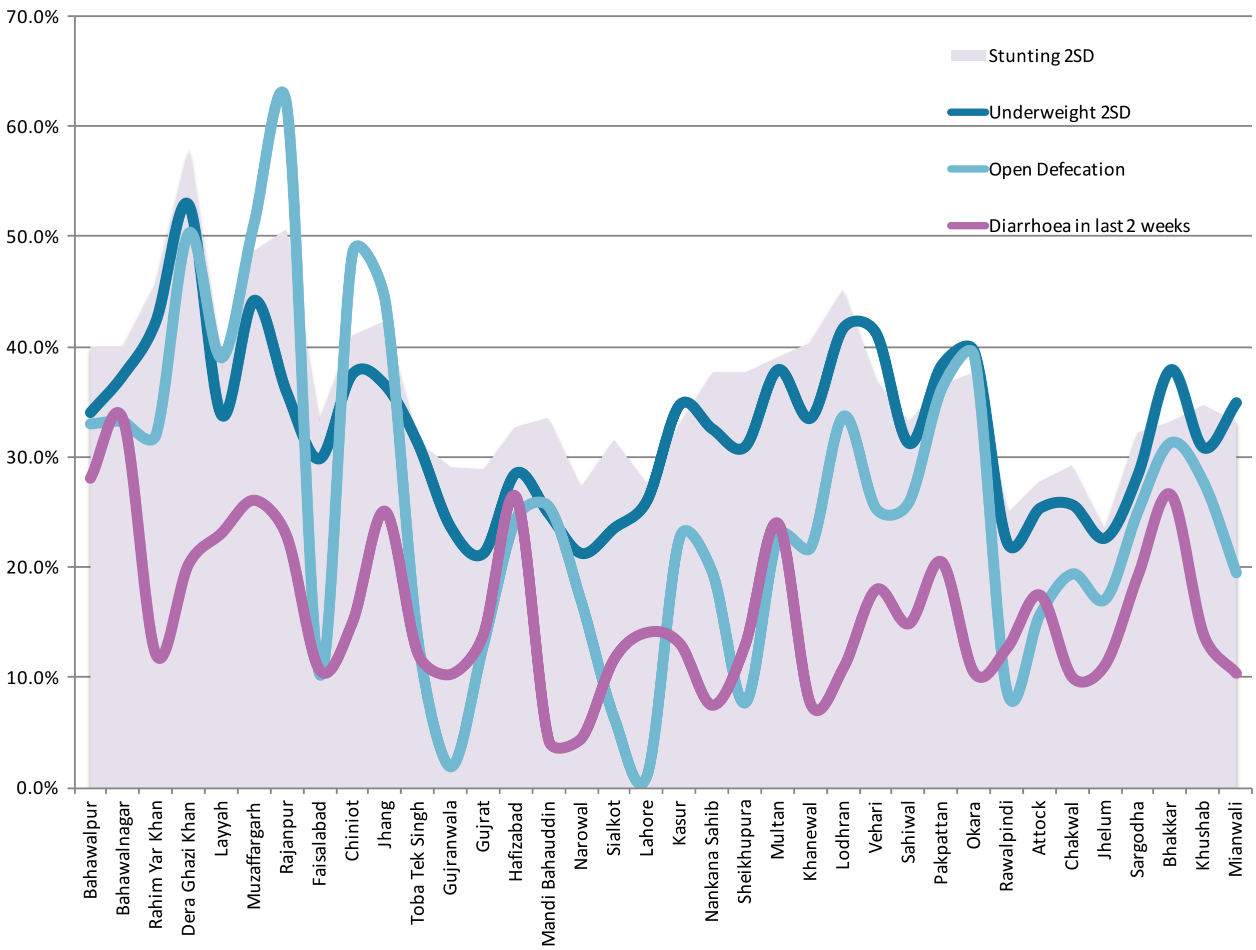
Districts that have high rates of diarrhoea in the last two weeks show a similar picture to underweight and stunting patterns (**Fig 62**). Furthermore, a similar pattern is seen in districts that have high 'open defecation' rates. The findings indicate that poor sanitation, diarrhoea and nutritional status have a close correlation.

There is a strong positive correlation between underweight and diarrhoea in last two weeks (r = 0.4309); open defecation and diarrhoea in last two weeks (r = 0.5060); and also between stunting and diarrhoea in last two weeks (r = 0.3860).

The draft Multi-Sectoral Nutrition Strategy[107] for Punjab has highlighted the importance water, sanitation and hygiene as intervention areas to improve the nutritional status of children.

[107] Draft Multi-Sectoral Nutrition Strategy – For addressing under-nutrition in Punjab. 2014

Figure 62 - Nutritional status, diarrhoea in last 2 weeks and open defecation



(Source: Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

These findings are supported by evidence from studies around the world.

- Improvements in **sanitation** were associated with increases in height ranging from **0.8 cm to 1.9 cm**[108]
- Odds of stunting at 24 months of age increase by a factor of **1.05 with each episode of diarrhoea**[109]
- **Hand washing** reduced the risk of diarrhoea by **30%**[110]
- **WASH interventions** reduced the frequency by diarrhoea by almost **a third** – hygiene (37%); sanitation (32%); water supply (23%); water quality (31%); and multiple (33%)[111]

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[108] Steven Esrey. Water, waste and well being. Am J Epidemiol Vol 143 No 6:608-623, 1996

[109] William Checkley et al. Multi-country analysis of the effects of diarrhoea on childhood stunting. Int J Epidemiol. Aug 2008; 37(4): 816–830

[110] Zulfiqar Bhutta et al. What works? Interventions for maternal and child undernutrition and survival. Published Online January 17, 2008 DOI:10.1016/S0140-6736(07)61693-6

[111] Prüss-Üstün A, Bos R, Gore F, Bartram J. Safer water, better health: costs, benefits and sustainability of interventions to protect and promote health. World Health Organization, Geneva, 2008

Maternal Mortality and Hygiene

Pakistan has a high Maternal Mortality Ratio of 170[112] per 100,000 live births and is one of seven countries that account for over half of all maternal deaths worldwide[113]. The Maternal Health Task Force of the Women and Health Initiative, Harvard School of Public Health[114], has identified availability of clean water and adequate sanitation as essential to reduce preventable maternal deaths from infections. It is estimated that about 15% of maternal deaths[115] are caused by poor hygienic conditions, and lack of clean water and adequate sanitation. Similarly, research done at Liaquat University Hospital, Hyderabad in Sindh[116], Ayub Medical College in Abbottabad[117], and Lahore General Hospital[118] has shown that infection due to poor hygiene and unsanitary conditions is one of the main causes of maternal mortality.

Therefore, provision of safe and clean drinking water and adequate and improved sanitation is vital for reduction in maternal and child mortality.

Minimum Service Delivery Standards in Health

The backbone of any healthcare system is primary health care (PHC). PHC has recognised adequate supply of safe water and basic sanitation as fundamental to health of communities. The minimum service delivery standards[119] for primary and secondary health care specified by Government of Punjab include the following:

Under Promotive services – Health Education

- Awareness and information regarding safe water
- Basic hygienic practices to prevent various types of communicable diseases (personal hygiene, proper cleaning of kitchen utensils, boiled water, proper disposal of human waste, etc.)

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112 World Health Organization, UNICEF, United Nations Population Fund and The World Bank, Trends in Maternal Mortality: 1990 to 2013, WHO, Geneva, 2014

113 World Health Organization, UNICEF, United Nations Population Fund and The World Bank, Trends in Maternal Mortality: 1990 to 2013, WHO, Geneva, 2014

114 http://www.mhtf.org/2011/08/22/wash-for-mothers-water-sanitation-and-maternal-health-inter-dependent-systems-challenges/ accessed on 7 September 2014

115 Elizabeth Goodburn, Oona Campbell. Reducing maternal mortality in the developing world: sector-wide approaches may be the key. BMJ 2001;322:917–20

116 Chandra Madhudas, Farkhunda Khurshid, Pushpa Sirichand. Maternal Morbidity and Mortality Associated with Puerperal Sepsis. JLUMHS September-December 2011; Vol 10: No. 03

117 Shamshad Begum, Aziz-un-Nisa, Iqbal Begum. Analysis of Maternal Mortality in A Tertiary Care Hospital to determine causes and Preventable factors. J Ayub Med Coll Abbottabad 2003;15(2)

118 Saadia Cheema, Saadia Tariq, Tariq Masood Tipu, Farah Yousaf, Madeeha Rashid, Tariq Saeed. Maternal Mortality at Lahore General Hospital. http://pjmhsonline.com/JanMarch2012/maternal_mortality_at_lahore_geneneral_hospital.htm

119 Minimum Service Delivery Standards for primary and secondary health care in Punjab. Punjab Devolved Social Services Programme. 2008

Department of Health Initiatives

Primary Health Care

Clean and safe drinking water and sanitation is one of the eight basic components of Primary Health Care (PHC). The Government of Pakistan has been supporting the National Programme for Family Planning and Primary Health Care with deployment of 100,000 Lady Health Workers (LHWs) across the country with a key focus on the rural population. This programme has now been devolved to the provinces. In Punjab, the LHW programme has been merged with Mother Newborn and Child Health Programme as one Integrated Reproductive Mother Newborn and Child Health (IRMNCH) programme – the Lady Health Worker, Community Midwife (CMW) and Nutrition programmes have been merged together under IRMNCH.

A LHW is responsible for 1000-1200 population or nearly 125-150 households. She visits 5-6 households each day to provide necessary health education in the areas of family planning, reproductive health, infectious diseases and child health issues. She generates a monthly progress report of her work, which feeds into the Health Management Information System (HMIS). The knowledge about hand washing and sanitation is provided in the training conducted for LHWs at the time of induction and later on during the refresher courses.

The experiences of many of the early recovery programmes in the post-floods phase demonstrated that LHWs could play a significant role in creating demand for the construction of latrines. Recent experience from Faisalabad has shown that awareness raising campaigns run by LHWs have helped to improve sanitation and health for both farmers and consumers[120]. There is need to review the current training material and techniques for improved sanitation imparted to the LHWs. An alignment will not only help institutionalise sanitation in the primary health care programme but also strengthen the surveillance for diarrhoea.

The IMNCH programme can be an effective modality to convey health and hygiene messages to mothers and children in communities.

Punjab has recently developed its Essential Package of Primary Health Care Services[121], which includes a specific component on 'hygiene promotion, water and sanitation'. Under this component, primary health care staff in communities and at first level care facilities (CMW, LHW, BHU, RHC) will advise on the following:

- Hand washing with soap
- Proper toilet use and hand washing practices
- Problems related to open defecation
- Advice on safe water techniques, storage and consumption

In addition, health education material relating to hygiene shall be made available at primary health care facilities (BHUs and RHCs). The IRMNCH programme has incorporated elements of hand washing and sanitation practices in the revised health education material in collaboration with UNICEF.

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120 Mobilizing Lady Health Workers for safer food in Faisalabad, Pakistan. International Water Management Institute 2011

121 Essential Package of Health Services for Primary Health Care in Punjab - Technical Component, 2013. Department of Health

Health Education and Nutrition Education and School Health Services Programme

The Department of Health (DoH) conducts regular outreach activities for screening of diseases, health education and surveillance. There is potential to synergise efforts for surveillance and sensitisation about sanitation and hygiene issues.

The DoH runs a Health Education and Nutrition Education (HENE) programme. So far, 260 HENE officers have been deployed and the curriculum is under development. The HENE programme is linked with the School Health Services Programme (SHSP) run under the Policy and Strategic Planning Unit (PSPU).

The SHSP has deployed a School Health and Nutrition Specialist (SHNS) at each Basic Health Unit (BHU). So far, SHNS are working at 1754 BHUs. The role of the SHNS is to visit each primary and middle school in the catchment area at least once a month to provide lectures on health education and healthy lifestyle, conduct screening of children for eye, hearing, dental and skin problems. Children identified with any health problem are then referred to the next appropriate level of health care.

The development partners involved with this programme include PSPU, Health Department, Education Department, District Government, National Commission for Human Development (NCHD), UNICEF and UNESCO.

District Health Information System

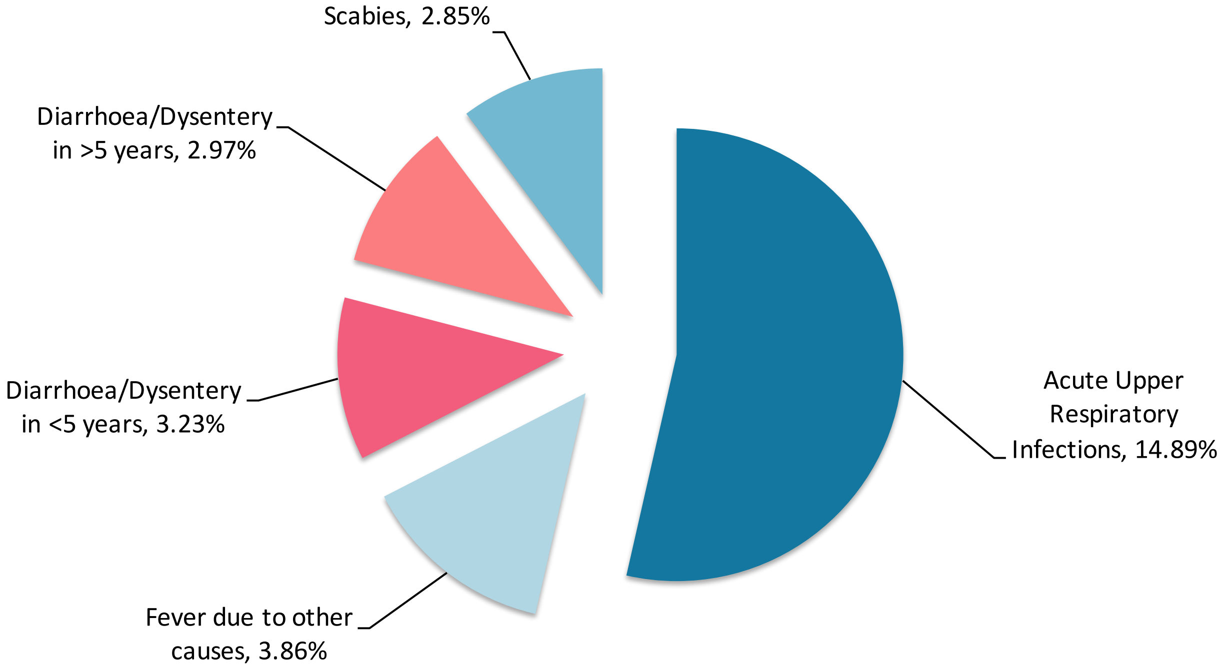
The District Health Information System (DHIS) is an improvement to the earlier Health Management Information System and now collects and reports health data from all districts. District data for 2013 shows that the top five diseases include acute upper respiratory infections, fever due to other causes, diarrhoea/dysentery and scabies. Diarrhoea/dysentery alone accounts for about 6.2%, which is the single largest category after acute upper respiratory infections (**Fig 63**).

Fig 64 illustrates that diarrhoea/dysentery account for 22% of all communicable diseases seen in outpatients. If one includes worm infestation and scabies, then water sanitation and hygiene related diseases account for over a third (35.6%) of all communicable diseases.

At least a third (33% in children <5 years and 30% in those >5 years) of all patients with diarrhoea/dysentery and 16% of those with enteric/typhoid fever seen as outpatients required hospital admission (**Fig 65**). This indicates a significant inpatient burden due to diseases related to water sanitation and hygiene.

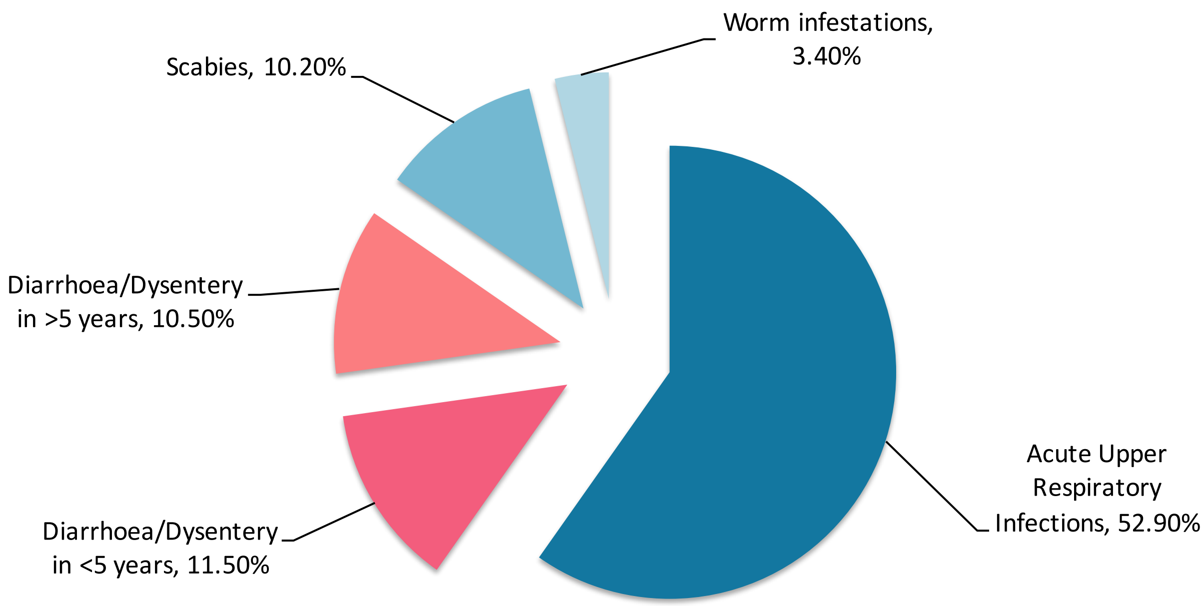
While these figures may vary from quarter to quarter, they illustrate the high proportion of patients with water sanitation and hygiene related diseases and are a proxy indicator of the effectiveness of WSS and hygiene initiatives.

Figure 63 - Top five diseases seen as outpatients in Punjab



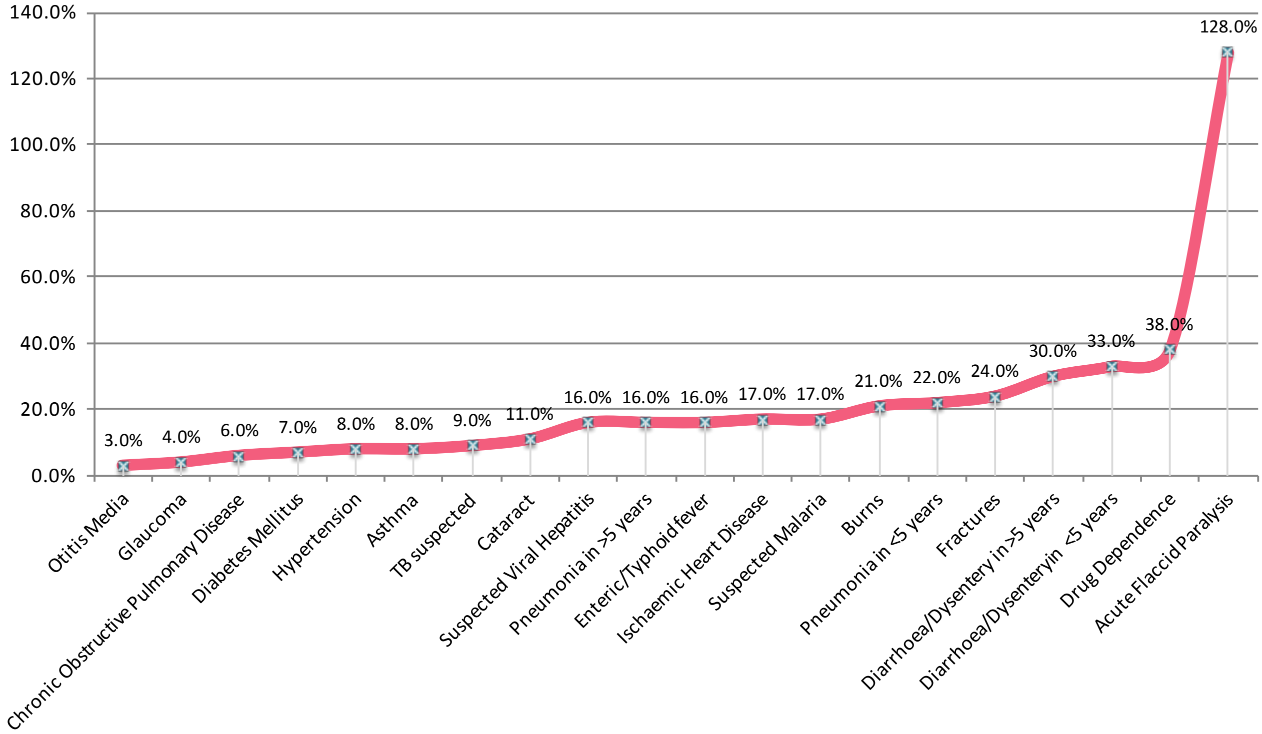
(Source: District Health Information System Report, Second Quarter 2013. Directorate General Health Services)

Figure 64 - Top five communicable diseases seen as outpatients in Punjab



(Source: District Health Information System Report, Second Quarter 2013. Directorate General Health Services)

Figure 65 - Hospital admissions as percentage of outpatients of same disease in Punjab



(Source: District Health Information System Report, Second Quarter 2013. Directorate General Health Services)

The DHIS plans to upgrade the DHIS Cell into the 'Punjab Health Information, Monitoring & Evaluation Unit (PHIMU)'. Furthermore, the DHIS also plans to update its reporting indicators and also collect some qualitative indicators as well. The use of Smartphone for monitoring shall be scaled up to all 36 districts in collaboration with the Punjab Information Technology Board and PSPU.

One of the challenges facing health information systems is the fragmented management information systems (MIS) currently running separately for DHIS, MNCH, LHW, EPI, TB DOTS, Malaria, Dengue, DEWS, DSS etc. The DHIS plans for integration of these disparate MIS.

These present opportunities for synergy to collect and synthesise WASH related health data and to plan and monitor priority interventions accordingly.

District Health Plans

As part of the Punjab Health Sector Reforms Project, each district has developed 3 year rolling district health plans. These make specific reference to quarterly meetings with TMAs to review and plan for hygiene and control of diarrhoea. These plans however need to be updated.

Punjab Health Sectoral Plan 2014-18

The Health Department of Government of Punjab has recently developed a 'Punjab Health Sectoral Plan 2014-18: Building a Healthier Punjab', which has identified improvement of water, sanitation and hygiene (WASH) services by increasing investment in sanitation especially in rural areas as a sub-sectoral priority for reducing child and maternal mortality[122].

Recent Initiatives of Local Government and Community Development Department

Disease Surveillance and Control Cell

In 2013, the Local Government and Community Development Department Punjab established a Disease Surveillance and Control Cell (DSCC) to monitor key waterborne diseases. The Cell is linked with the Punjab Information Technology Dashboard, which generates information for each district of Punjab with the support of the health department. The DSCC extracts information for each Tehsil Municipal Administration and transmits it to relevant TMAs along with disease alerts for key deviations. Regular follow up and monitoring is done by the LG&CDD. Presently, a capacity development plan for TMAs is underway to extract and extend online information for retrieval at TMA and provincial levels.

[122] Punjab Health Sectoral Plan 2014-18: Building a Healthier Punjab. Department of Health, Government of Punjab

Strategy

Health and Hygiene			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
WASH integrated in health promotion in primary health care	WASH health education module added to curriculum of Lady Health Workers with supporting training material Master trainers, district trainers and facility trainers oriented in key WASH messages and LHWs provided training on WASH health promotion and hygiene At least 100% of LHWs trained in WASH health promotion and hygiene	At least 60% of LHWs receive refresher training in WASH health promotion and hygiene	At least 100% of LHWs receive refresher training in WASH health promotion and hygiene
WASH integrated in health campaigns and health weeks	WASH component of health promotion and hygiene integrated in mother and child health weeks At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events	At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events	At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events
Effective disease surveillance cell	Dissemination of health alerts linked with TMAs using mobile technology At least 50% TMAs have a technology system to receive health alerts	At least 100% TMAs have a technology system to receive health alerts	
Fully functional water and sanitation services in health facilities	TMAs collaborate with district health administration to ensure all health facilities have functional water and sanitation services, soap and hand sanitizers At least 50% of first level health facilities have usable water and sanitation services	At least 100% of first level health facilities have usable water and sanitation services, soap and hand sanitizers	
School health promotes WASH	WASH integrated into school health programme run by School Health Nutrition Supervisors	At least 50% of schools receive WASH health promotion and hygiene	At least 75% of schools receive WASH health promotion and hygiene

	At least 25% of schools receive WASH health promotion and hygiene		

EDUCATION

National Sanitation Policy 2006

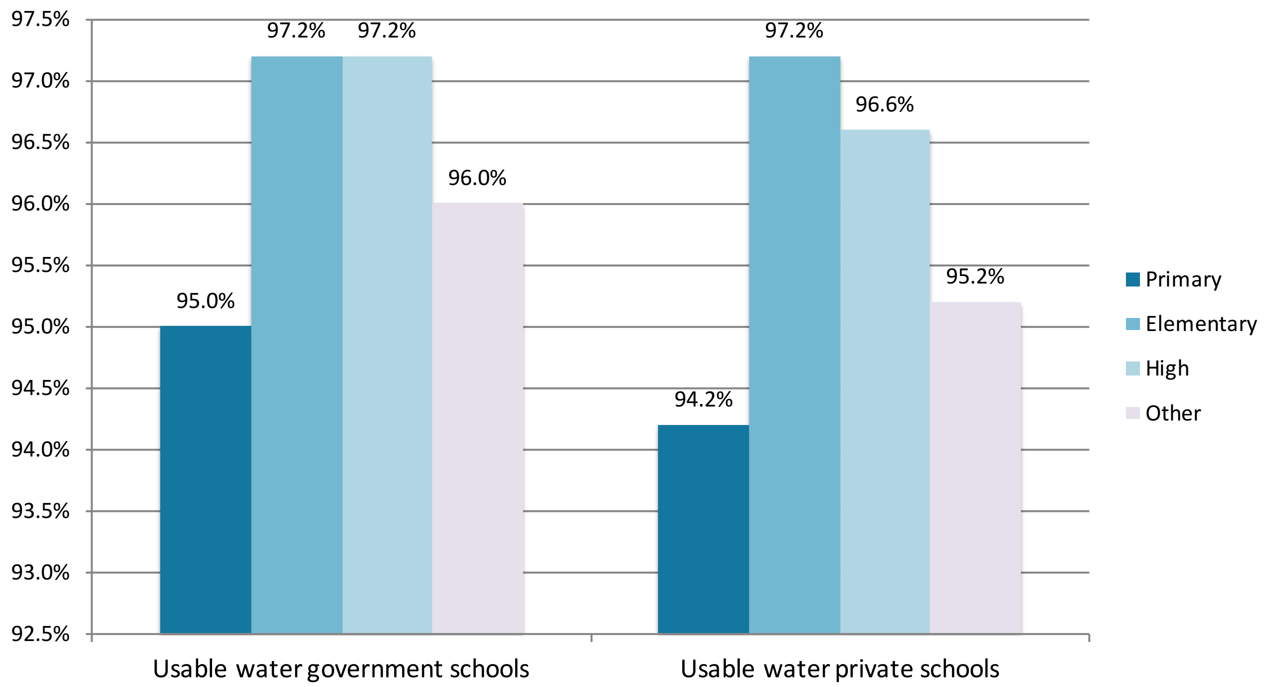
The National Sanitation Policy 2006 of Pakistan recommends a sanitation training/awareness raising programme at all educational and teachers training institutes. The National Education Policy 2009 lays emphasis on a school health programme along with health education.

With the support of United Nations Programme for Pakistan, the school health initiative has been piloted in selected districts of four provinces, and school health education materials have been developed. The materials include the importance of hand washing and clean drinking water. However, these training materials have not been institutionalised in pre-service and in-service teachers training curriculum as envisaged in both national policies.

Punjab School Education Sector Plan 2013 - 2017

Under the Punjab Education Sector Reforms Programme, one of the main objectives includes replenishment of missing facilities (electricity, drinking water, usable latrines, boundary wall etc.). The Annual Status of Education Report 2013[123] for Punjab shows that 95% or more of rural schools have availability of usable drinking water (**Fig 66**).

Figure 66 - Status of school facilities (usable water) in Punjab rural

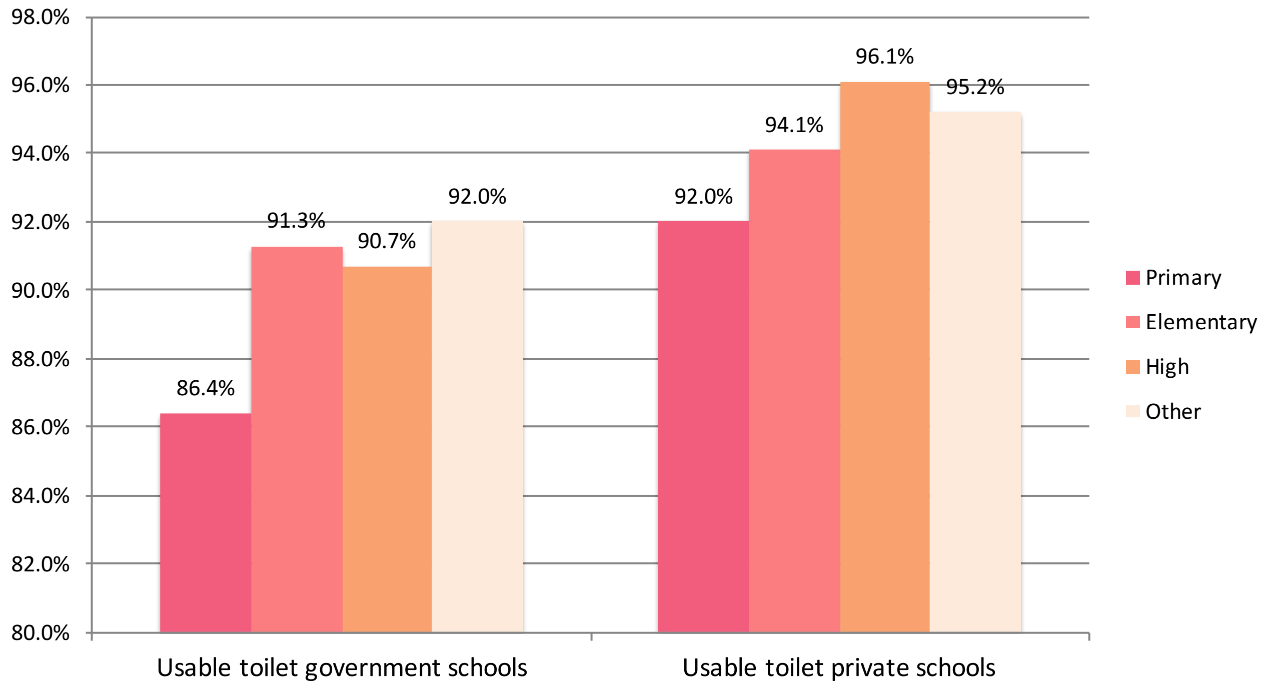


(Source: Annual Status of Education Report. ASER-Pakistan 2013. District Directory (Provisional)

[123] Annual Status of Education Report. ASER-Pakistan 2013. District Directory (Provisional)

The same report also illustrates that while 90% and above of middle and high schools have usable toilets, 14.6% government schools in rural areas do not have usable toilets (**Fig 67**).

Figure 67 - Status of school facilities (usable latrines) in Punjab rural



(Source: Annual Status of Education Report. ASER-Pakistan 2013. District Directory (Provisional)

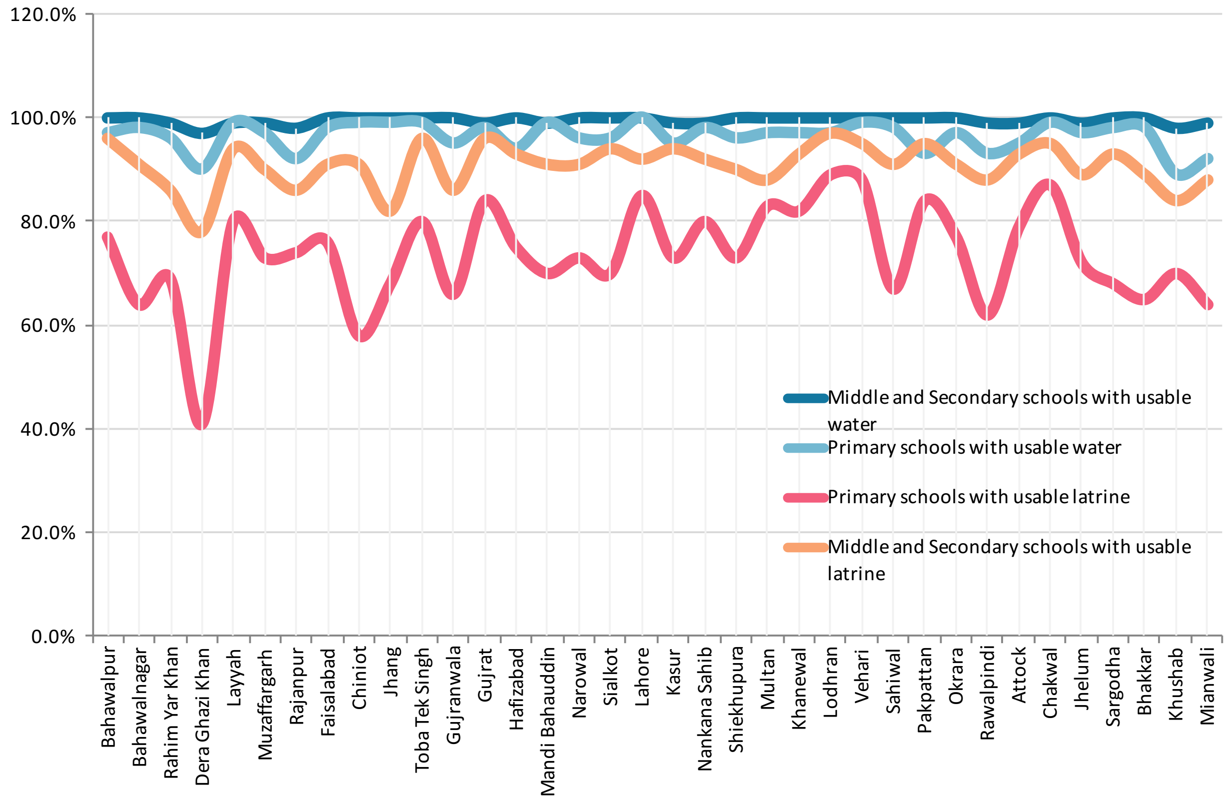
The Pakistan Education Atlas 2013[124] was launched recently and is a joint project between National Education Management Information System (NEMIS), Academy of Educational Planning and Management (AEPAM), Ministry of Education, Trainings and Standards in Higher Education, Government of Pakistan and Vulnerability Analysis and Mapping (VAM) Unit, United Nations World Food Programme (WFP) Pakistan in collaboration with UNESCO and UNICEF.

The atlas shows that in Punjab (government schools) usable water for drinking is well provided in most schools (Fig 68), although the situation in middle and high schools is better than primary schools.

However, the situation of usable latrines is different with middle and high schools having usable latrines in the range of 80% and above, while most primary schools fall in the range of 60%-80% for usable latrines (**Fig 68**). Some districts like Dera Ghazi Khan go as low as 41%.

124 Pakistan Education Atlas 2013. National Education Management Information System (NEMIS), Academy of Educational Planning and Management (AEPAM), Government of Pakistan and Vulnerability Analysis and Mapping (VAM) Unit, United Nations World Food Programme (WFP) Pakistan

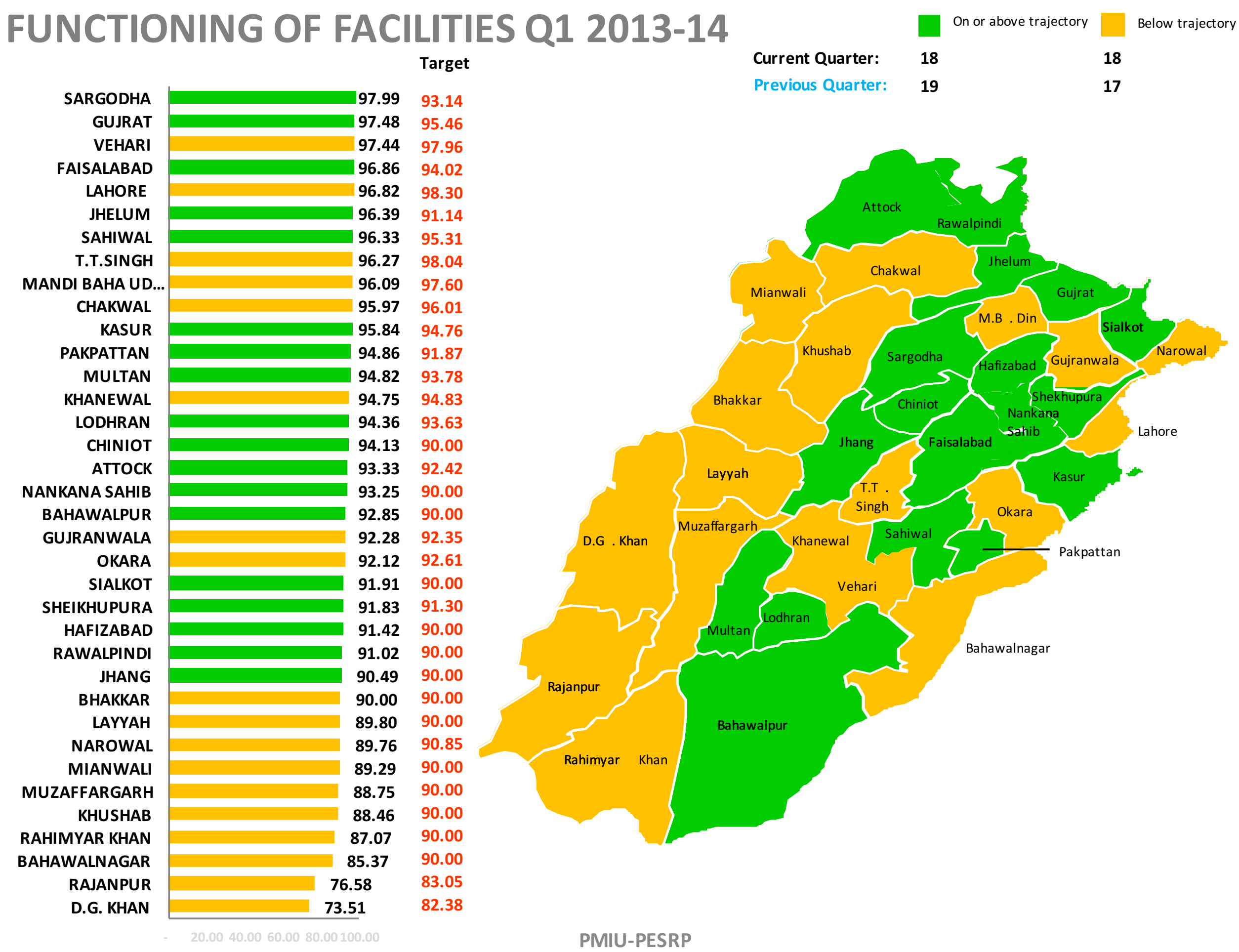
Figure 68 - Status of school facilities in government schools



(Source: Pakistan Education Atlas 2013. National Education Management Information System (NEMIS), Academy of Educational Planning and Management (AEPAM), Government of Pakistan and Vulnerability Analysis and Mapping (VAM) Unit, United Nations World Food Programme (WFP) Pakistan)

The monitoring report of Programme Management Implementation Unit (PMIU) for Punjab Education Sector Reforms Programme for the first quarter of 2013-14 shows that most districts are on track to achieve full functioning of facilities (**Fig 69**). Some districts, particularly those that are also low performing districts in terms of educational performance are lagging behind with Rajanpur and Dera Ghazi Khan at the bottom of the list.

Figure 69 - Functioning of school facilities



(Source: PMIU-PESRP, Department of School Education, Punjab)

School Councils are directed to ensure that at least 50% of schools must have the facility for safe drinking water by 2020 and should meet the costs of this through their non-salary budget. Furthermore, they should ensure 100% provision of toilets in all public schools by 2014-15, with an aim that at least 50% children of public schools have a facility of toilets at the ratio of 40 students to 1 toilet. According to UN standards[125, 126], there should be one latrine per 25 girls and one for female staff; one latrine plus one urinal (or 50 cm of urinal wall) per 50 boys, and one for male staff.

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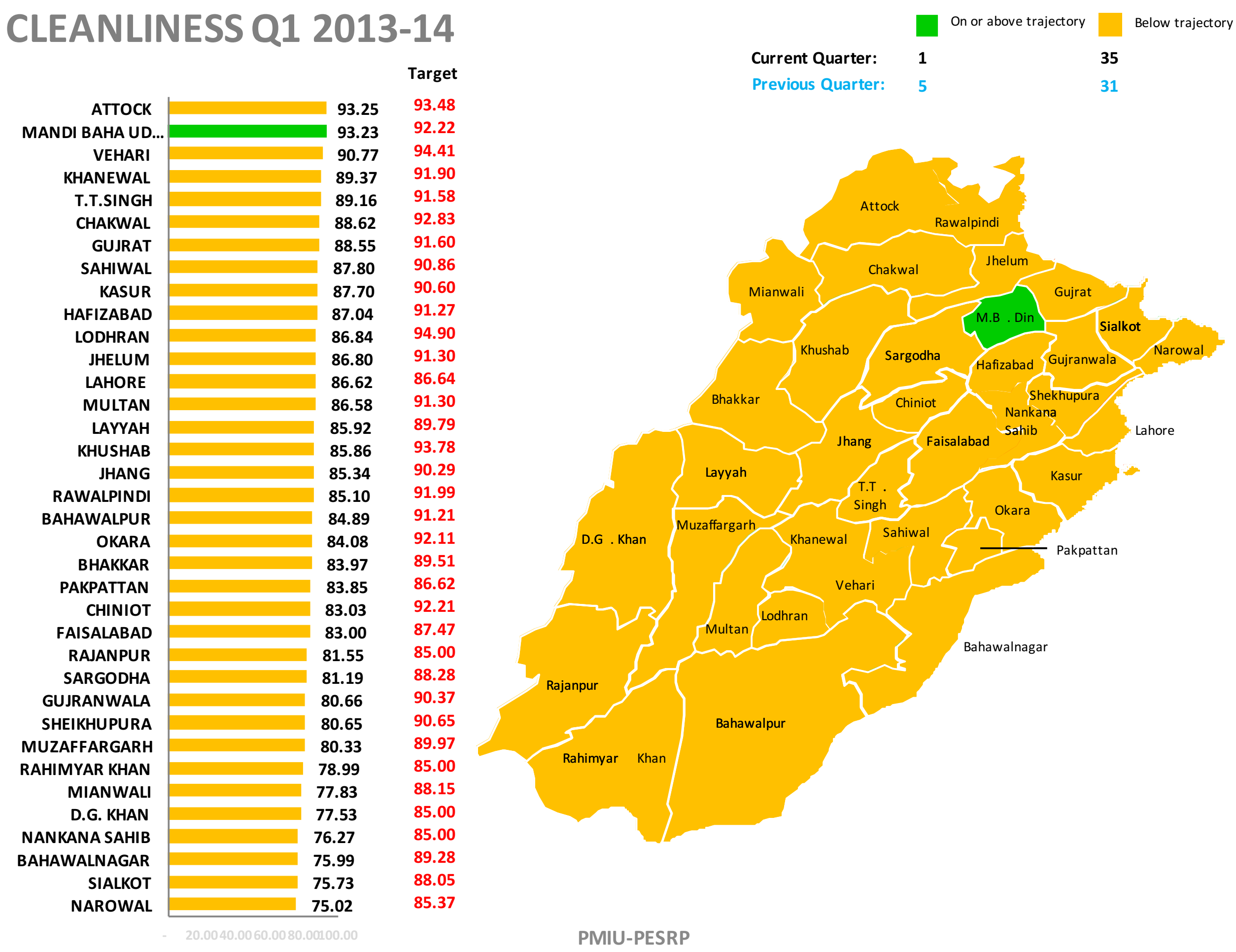
[125] John Adams, Jamie Bartram, Yves Chartier, Jackie Sims. Water, sanitation and hygiene standards for schools in low-cost settings. World Health Organization, 2009

[126] Water, Sanitation and Hygiene (WASH) in Schools. A companion to the Child Friendly Schools Manual. UNICEF, July 2012

Similarly, the monitoring report for first quarter 2013-14 for cleanliness of the school shows that while most schools are in the range of 80% or above, they are almost all short of their intended individual targets (**Fig 70**).

Figure 70 - School cleanliness



(Source: PMIU-PESRP, Department of School Education, Punjab)

Health and Hygiene Education

One of the key strategies identified under the School Education Sector Plan is to design and prepare material on Health, Hygiene and Nutrition for teachers, head teachers and school councils.

For improving the school environment, the objective of the plan is to develop a physical and social environment in schools that helps children enjoy the learning process. One of the strategies to achieve this objective is for the schools to introduce health/hygiene programme for students. The plan further proposes that school health and hygiene education are included in continuous professional development (CPD) of teachers.

The Directorate of Staff Development (DSD) is the principal structure for in-service training of teachers. It cascades its training of teachers as follows:

- DSD – trains Master Trainers (MTs) and Education Managers
- District Training and Support Centre (DTSC) – MTs train Teacher Educators (TE) and Teacher Trainers (TT) who are allowed to hire Subject Specialists (SS) as required
- Cluster Training and Support Centre CTSC) – TE/TT train District Teacher Educators (DTE) who cover a cluster of 12 schools and train their Primary School Teachers (PST)

DTEs visit the cluster schools twice a month – on the first visit, they assess classes 3, 4 and 5; and on the second visit they observe lessons and provide feedback to PSTs.

Every month, a Professional Development (PD) day is held at DTSCs for training DTEs and CTSC heads, and at CTSCs for PSTs. The turn of every school comes after three months.

One of the areas that can have a sustained impact on long term sustainability of improved hygiene and sanitation practices is by institutionalising the teacher training in WASH throughout the Directorate of Staff Development (DSD) chain.

Menstrual Hygiene Management

A study[127] conducted at the national level showed WASH facilities in schools are not supportive to menstrual hygiene management (MHM); majority of the girls rely on mothers and sisters for MHM related information; and little information is provided or discussed at school level. Most girls reported using reusable torn cloth during menstruation, but reported difficulties in washing and drying the cloth due to lack of privacy.

The Integrated Rural Support Programme (IRSP) Pakistan in collaboration with Fresh Water Action Network South Asia (FANSA) conducted a situation analysis[128] on MHM in several districts in the country, which included Faisalabad, Sargodha, Lahore and Multan in Punjab. Some of the key findings from this study were as follows:

- About two-thirds (65.6%) of the girls/women used a cotton cloth during menses, and only 16.8% used a sanitary pad
- About a third (30%) did not wash their hands after changing the cloth
- About half (49.3%) reused the cloth
- About a fifth (19.3%) reused the cloth for 2 months, while a fourth (25%) reused it for 3 months or more
- Just under a third (28.7%) burnt the cloth after washing, while about half (47.5%) threw it in the rubbish after washing it

[127] Menstrual Hygiene Management for Adolescent School Girls in KP and PAK, Pakistan, May 2013, UNICEF Pakistan

[128] Menstrual Hygiene Management – a neglected right of Pakistani women. IRSP-Pakistan, 2013

The Government of Pakistan initiated a dialogue related to Menstrual Hygiene Management (MHM) in selected schools, primarily to understand the scope of education impacts and challenges across cultural backgrounds.

While the issue of MHM relates more to reproductive health, it is an important hygiene and solid waste issue especially at schools and in communities. MHM needs to be integrated in health education and reproductive health programmes and communities sensitised about sanitary waste disposal of pads and cloths used during the menstrual periods. Furthermore, dissemination of information about preparation of low cost home made sanitary pads needs to be disseminated through hygiene education for girls.

Strategy

Education			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
WASH integrated in teacher training programme	Collaborate with Curriculum Wing and incorporate WASH hygiene promotion in teacher training programme WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 25% schools receive training in WASH hygiene	WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 50% schools receive training in WASH hygiene	WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 75% schools receive training in WASH hygiene
WASH integrated in schools curriculum	Collaborate with Textbook Board for inclusion of topics on water, sanitation and hygiene in curriculum for classes 1 to 12		
All schools have usable drinking water and usable latrines	Collaborate with PMIU PESRP on status of missing facilities in schools More than 80% of schools have usable drinking water and usable latrines	More than 90% of schools have usable drinking water and usable latrines At least 50% public schools have 1 latrine for 25 girls and 1 latrine for 50 boys	100% of schools have usable drinking water and usable latrines At least 50% public schools have safe drinking water At least 90% public schools have 1 latrine for 25 girls and 1 latrine for 50 boys
Chief Minister’s Water Ambassadors Programme	In collaboration with School Education department and school health programme, launch a Chief Ministers Water Ambassadors Programme for primary and middle school children. Children leaders trained to act ambassadors for water conservation and family hygiene At least 30% of schools have Water Ambassadors	At least 60% of schools have Water Ambassadors	At least 90% of schools have Water Ambassadors

Menstrual hygiene management integrated in health and hygiene for girls	WASH hygiene promotion module incorporates menstrual hygiene management for girls At least 25% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion	At least 50% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion	At least 75% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion

SECTOR EFFICIENCY

Urban Water and Sanitation Services

Provision of continuous 24/7 water supply does not exist in any city in Punjab. Current estimates show that Lahore receives water supply for 17 hours a day, while Faisalabad, Multan and Rawalpindi receive for 8 each. Households have to contend with an intermittent supply. People seek alternative sources of water supply by installing ground or roof tanks for storing water when it is available, buying water from tankers, or using bore holes, shallow wells and/or river water. The frequent power outages are one reason for intermittent water supply. Furthermore, high levels of leakage lead to rationing of water supplies.

A review of selected WASAs below illustrates the high percentage of non-revenue water (NRW) and high operational cost.

Water and Sanitation Agencies

A sector survey conducted in 2009[129] on water supply planning had the following key findings:

Gujranwala WASA (GWASA)

GWASA is currently working with a total staff of 448 against the approved strength of 638. As such, about 30% different slots are vacant.

GWASA is seriously constrained for qualified staff. There are only five graduate engineers to look after the technical affairs of utility. The low quality of human resource and allied inefficiencies affect quality of service delivery.

GWASA has reported a very high percentage of non-revenue water of about 58 %. This is mainly due to illegal connections, insufficient recovery (only 40 % of the billed amount) and inadequacy of recording water generation, consumptions and system losses.

The operating ratio for GWASA is also high (1.61) due to low recovery and high operational cost. As an average utility it suffers a short fall of PKR 62 million per annum in operating expenses only. GWASA does not have development plans based on current trends and future land use patterns. GWASA has identified 5 water supply projects, which are proposed to be implemented in short, term during next 2 to 3 years. The total estimated cost of identified projects is PKR 467 million.

Multan WASA (MWASA)

The approved staff strength of MWASA is 1,547 of varying cadres. Currently, MWASA is working with a total staff of 1,037; including regular employees (504), staff on contract (517) and also some on deputation (16). About 37% slots are still vacant.

[129] Ahmad ZS: Sector survey on water supply planning in Pakistan. JICA, 2009

There is an independent water supply directorate headed by one Director and assisted by 3 senior engineers of deputy director ranks.

MWASA has reported a figure of 30% as non-revenue water. The operating ratio for MWASA is very high (1.5) due to low recovery and high operational cost.

Faisalabad WASA (FWASA)

FWASA is currently working with a total staff of 2,091. These include 1,405 regular, 293 on contract while 393 are employed on work charge basis. It has been reported that around 250 sanctioned / budgeted seats of varying cadres are lying vacant due to multiple reasons including budgetary constraints.

FWASA has reported non revenue water of about 24% on account of system losses through leakages and pilferage of water through illegal connections. FWASA is maintaining a relatively good operating ratio (0.99).

Rawalpindi WASA (RWASA)

RWASA is currently working with 1,020 staff of varying cadres. Of these, more than 750 staff are responsible for the development, operation and maintenance of water supply system.

RWASA has reported 37% unaccounted for water and 39% non-revenue water. RWASA shares similar reasons of high value of non revenue water that includes illegal connections, insufficient water recovery and inadequacy of recording water consumptions and system losses.

Table 15 summarises the current situation in 2009 of different WASAs and highlights the deficit in production capacity versus demand, and the significant proportion of non-revenue water.

Table 15 - Status of WASAs in 2009

	FWASA	GWASA	RWASA	MWASA
Population in service area (millions)	2.8	1.6	2.1	1.9
Water supply coverage %	53%	28%	70%	65%
Average hours water availability per day	6	14-16	6-8	6-8
Current water demand (MGD)	130	64	44	170
Actual water production capacity (MGD)	45	29	42	104
Number water connections	107805	30125	88710	36396
Non revenue water %	24%	58%	39%	30%

(Source: Ahmad ZS: Sector survey on water supply planning in Pakistan. JICA, 2009)

Table 16 illustrates the situation in WASAs in 2010-11, while **Table 17** presents the current situation in 2012-13.

Table 16 - Status of WASAs in 2010-11

	L-WASA	F-WASA	G-WASA	R-WASA	M-WASA
Total population million	6.152	3.1	1.7	1.3	1.8
Total population served million	5.475	1.55	0.544	1.17	1.2
Water coverage %	89	50	32	90	60
Total number of water connections	587,595	110,452	29,375	92,468	43,996
Annual water production million m^3	655	87.10	91.771	97.74	35.51
Average monthly water consumption per household m^3	54.072	25.85	?	78.83	48.6
Water availability (hours/day)	14-18	7	14	8	5
Per capita water consumption L/day		112.5	227	150	225
Average water bill per month per connection (Rs)	287.4	291.56	100	135	60
Number of water treatment plants	Nil	2	Nil	1	Nil
Sanitation coverage %	87.69	70	65	35	60
Total number of sewerage connections	583,532	217,002	97,236	38,437	175,615
Annual sewage generated million m^3 / year	556	514.31	468.3	38.4	107.58
Annual waste water collected million m^3 / year	855	390.88	468.3	Nil	107.58
Level of waste water treated million m^3 / year					
Primary	Screening	1.09	Nil	Nil	Nil
Secondary	Nil	1.09	Nil	Nil	Nil
Tertiary	Nil	Nil	Nil	Nil	Nil
Number of waste water treatment plants	Nil	1	Nil	Nil	Nil
Total revenue million Rs (FY 10-11)	1977	735	276	494	298
Total expenditure million Rs (FY 10-11)	5772	1700	284	565	1371
Accumulative arrears (consumers) million Rs	2167	2217	335	266	663
Non Revenue Water %		31	35	31	22
Average unit production cost Rs/m^3	6.73	4.71	0.109	5.79	4.14
Billing efficiency %		92	25	100	30.9
Collection efficiency %	98	51	40	75	88.6
Metering Ratio %	7.75	1.47	Nil	Nil	Nil
Average capital expenditure per connection per year Rs	2330	2687	110.57	200	3028
Total staff	4269	2692	638[130]	1098	1271
Professional (BPS 17 and above)	208	99	25	35	34
Other (BPS 4-16)	4061	2593	242	1063	1237
Staffing Ratio (staff per 1000 water and sewerage connections)	4	8	5	8	6

(Source: Pakistan Water and Sanitation Operators Directory 2012)

130 The disaggregated data available is incomplete

Table 17 - Status of Efficiency of WASAs in 2012-13

	L-WASA (Q4 2013 data)	R-WASA (Q3 2012 data)	G-WASA (Q3 2013 data)	F-WASA (Q4 2012 data)	M-WASA (Q2 2012 data)
SERVICE COVERAGE					
Water Coverage %	91.58	66.98[131]	23.08	77.93	122.08
Sewerage Coverage %	58.15	18.22[132]	36.99	57.4	61.04
CONSUMPTION AND PRODUCTION					
Water Production L/capita/day	369.69	N/A	279.36	92.76	37.24
Water Consumption L/capita/day	1952.21	220.11[133]	247.86	66.97	37.78
NON REVENUE WATER					
Non Revenue Water %	N/A	N/A	14.33	28.2	20.28
Unaccounted For Water %	N/A	N/A	11.28	27.8	-1.44
METERING PRACTICES					
Metering Level %	3.97	0	0	0	0
Metered Water Sold %	3.82	0	0	0	0
NETWORK PERFORMANCE					
Pipe Breaks-Burst/km	0.15	0.03	0.1	0.07	0.05
Sewer System Blockages/km	1.01	4.81	8.62	1.03	2.23
Pipe Leakages/km	0.17	0.16	0.85	0.21	0.41
Replacement of Manhole Covers %	100	4.89	1.5	1.43	1.54
Cleaning/Desiltation of Manholes %	100	0.49	10.21	38.98	11.32
Cleaning/Desiltation of Sewers %	40.45	1.2	39.21	0.17	11.07
Storm Water Drain Used as Sullage Carrier %	10.7		100	14.52	N/A
Sewer Collapse/Crown Failure %	0.36			0.51	0.98
COST AND STAFFING					
Unit Operating Cost – Water Consumption Rs/m^3 water consumed	0.8	12.43	16.62	21.21	7.93[134]
Unit Operating Cost – Water Production Rs/m^3 water produced	4.2	N/A	14.75	15.31	8.07[135]
W&WW Staff Per 1000 W&WW Connections	2.24	7.38	4.9	6.78	4.08
Water Staff Per 1000 Water Connections	1.94	8.45	8.71	9.28	4.24
Waste Water Staff Per 1000 Waste Water Connection	2.69	4.54	3.53	5.64	4.03
Salary Cost as % of Total Operating Cost	67	24.62	34.16	48.5	89.77[136]
Electricity Cost as % of Total Operating Cost	19.36	37.09	55.75	46.52	8.42[137]
Maintenance Cost as % of Total Operating Cost	2.64	3.73	4.56	4.99	1.81[138]
Contracted Out Cost as % of Total Operating Cost	0	14.89	4.42	0	0

[131] Jan-Mar 2012
[132] Jan-Mar 2012
[133] Jan-Mar 2012
[134] Jan-Mar 2012
[135] Jan-Mar 2012
[136] Jan-Mar 2012
[137] Jan-Mar 2012
[138] Jan-Mar 2012

Table 17 continued

	L-WASA (Q4 2013 data)	R-WASA (Q3 2012 data)	G-WASA (Q3 2013 data)	F-WASA (Q4 2012 data)	M-WASA (Q2 2012 data)
QUALITY OF SERVICE					
Continuity of Service per day	14	8	12	7.5	4
Chemical Unfit Source(s) %				10.1	
Biologically Unfit Source(s) %		9.88	5.63		
Chemically Unfit at Taps %					
Biologically Unfit at Taps %	19.7	12.77	10.83	1.48	
Water Quality – % of Required Residual Chlorine Test	100	36.72	N/A	2720	N/A
Water Quality – Samples Passing On Residual Chlorine %	100	255.32	N/A	96.32	N/A
Complaints About W&WW Services % of total connections	0.28	2.23	0.78	1.29	2.07
Waste Water Treatment – Primary Level %	N/A	0	0	6.46	0
Waste Water Treatment – Secondary Level %	N/A	0	0	6.46	0
BILLING AND COLLECTION					
Average Revenue Water and Waste Water Rs/m^3 water sold	0.73	2.98	12.43	21.47	3.41[139]
Collection Period days	118.65		43.89	26.19	
Billing Efficiency %	47.15	3.57[140]	7.26	19.01	14.92
Collection Efficiency (Physical) %	60.74	77.74[141]	8.44	30	31.1
Collection Efficiency (Financial) %	31.12	80.53[142]	23.68	95.31	22.39[143]
FINANCIAL PERFORMANCE					
Operational Cost Coverage (ratio)	0.91	0.24	0.75	1.01	0.43[144]
Working Ratio	1.09	4.17	1.34	0.99	2.32[145]
Debt Servicing %	N/A	N/A	N/A	N/A	N/A

N/A – Data Not Available
(Source: Pakistan Water Operators Network)

[139] Jan-Mar 2012
[140] Jan-Mar 2012
[141] Jan-Mar 2012
[142] Jan-Mar 2012
[143] Jan-Mar 2012
[144] Jan-Mar 2012
[145] Jan-Mar 2012

Status of Efficiency of WASAs

Table 17 presents the status of efficiency of WASAs in 2012/2013. Some of the highlights are indicated below.

Service Coverage

Three WASAs show reasonable coverage of 50% and above. However, R-WASA has low coverage at 18.22%.

Consumption and Production

There is marked variation in production and consumption in L/capita/day. The production in L-WASA is 370 L/capita/day, while the consumption is 1952 L/capita/day. The other WASAs show a range between 38-248 L/capita/day consumption patterns. G-WASA, F-WASA and M-WASA show good correlation between production and capacity with 70%-100% consumption being matched by production.

This raises a critical issue of how much minimum production capacity should be available to address the feasible demand. Presently, PHED uses a figure of 50 gallons/capita/day, which is equivalent to about 228 L/capita/day.

In 2010-11, at least 4 out of 5 WASAs had a consumption rate between 112 to 227 L/capita/day with 2 WASAs at 150 L/capita/day or less. Analysis of consumption patterns in 2010-11 and 2012-13 show that:

- F-WASA had a reduced consumption by 40.18% to 66.97 L/capita/day
- G-WASA had an increased consumption by 8.81% to 247 L/capita/day
- M-WASA had a reduced consumption by 492.11% to 37.78 L/capita/day
- R-WASA had an increased its consumption by 46.67% to 220 L/capita/day

The data from F-WASA, which has the best operating ratio of all WASAs, and has a low per capita per day rate of 66.97 L. It does not meet the current PHED estimate of about 228L/capita/day. The production rate of 370 L/capita/day in L-WASA is probably on the extravagant side (even when allowing for about 20% NRW/UAW) and needs to be reduced.

Water consumption rates in litres per person per day are shown below for selected countries [146]:

- Germany – 193 L/capita/day
- Brazil – 187 L/capita/day
- Philippines – 164 L/capita/day
- United Kingdom – 149 L/capita/day
- India – 135 L/capita/day
- China – 86 L/capita/day

[146] http://www.data360.org/dsg.aspx?Data_Set_Group_Id=757 accessed on 16 August 2014

This shows that the median consumption rate is about 156 L/capita/day, and when about 20% is added for NRW/UAW, the figure comes to about 187 L/capita/day. This is equivalent to about 40 gallons per person per day.

The water needs per person per day are estimated to be about 120 L/capita/day[147] as shown below:

- Drinking – 5 litres
- Food preparation – 10 litres
- Bathing – 25 litres
- Sanitation – 45 litres
- Laundry – 35 litres

This is about 26 gallons per person day.

In view of the compelling need to preserve precious groundwater, water production would probably need to be brought in the range of 136 L/capita/day (or 30 gallons per person per day) to allow for about 20% NRW and UAW (which would also need to be attenuated), and therefore a consumption rate of 114 L/capita/day (or 25 gallons per person per day).

Non Revenue Water

This still ranges between 14% to 28%. WASAs should strive to bring this close to 20% or lower where feasible. L-WASA shows marked improvement and has made determined efforts to reduce leakages by 428%.

Metering Practices

Metering practices are dismal and even the highest figure of L-WASA is less than 4%.

Network Performance

Cleaning and de-silting of drains and sewers varies from WASA to WASA. Higher cleaning rates of about 40% are noted in L-WASA and G-WASA. However, factors like gravity, pumping house functionality, and overall O&M probably determine need and frequency for cleaning. Periodic maintenance of sewers and drains at least twice or three times a year would suggest a rate of about 30%.

Cost and Staffing

The Water staff per 1000 connections varies in the WASAs with L-WASA at 1.94 and F-WASA at 9.28. The Wastewater staff per 1000 connections ranges from 2.69 in L-WASA to 5.64 in F-WASA. The desired rate should be closer to 2-3 staff per 1000 connections.

Quality of Service

The quality of water shows that 'biologically unfit at source' is generally less than 10%. However, 'biologically unfit at taps' ranges between 10% and 20%, with significantly better situation in F-WASA at 1.48%.

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[147] Adapted from Arlene B. Inocencio, Jose E. Padilla and Esmyra P. Javier. Determination of Basic Household Water Requirements. February 1999. Philippine Institute for Development Studies

Billing and Collection

While the collection period at other WASAs is generally in the range of one to one and a half months, in L-WASA the collection period is almost 4 months. On the positive side, it has the highest billing efficiency at 47%, but falls short again in its financial collection efficiency of 31%. F-WASA has a low billing efficiency of 19% but high financial collection efficiency of over 95%.

Financial Performance

The operating cost coverage ratio is best at F-WASA with 1.01, and also the best working ratio of 0.99. R-WASA has the highest working ratio of 4.17. Optimal financial performance requires for the operating cost coverage ratio to be more than 1.0 and working ratio to be less than 1.0.

Rural Water and Sanitation Services

Various studies and situation analysis reports have shown that about a third or more of rural water supply schemes are dysfunctional or non-functional[148]. Some of the main reasons for this in Punjab are:

- Source failure - 25%
- Major defects in machinery / rising main / distribution network - 24%
- No payment of WAPDA dues or disconnection - 17%
- Theft of major components like electric motor, transformer - 9%
- Community conflict, poor service delivery, poverty - 25%

The causes of dysfunction or non-function may be classified as technical reasons (half the cases) and financial and management or social in a quarter of cases each. The TMAs do not have sufficient capacity to operate and maintain rural water supply schemes.

Presently, the PHED Technical and Community Development staff provide technical and management support to Community Based Organisations (CBOs) who are operating and maintaining functional rural water supply schemes on self-help and self-financing basis.

While the provincial governments are investing substantial amounts in development of new rural water supply schemes, there is a pressing need to rehabilitate dysfunctional schemes where feasible, and ensure that there is adequate administrative, financial and technical support to communities for completed schemes.

Recent data compiled by the World Bank[149] (updated by PHED in 2014) shows that there are about 4216 WSS schemes under construction, 2825 existing functional schemes and 1391 non-functional schemes (about 33%).

Table 18 summarises the current situation in TMAs and shows the following main findings:

[148] National Water Quality Monitoring Programme, Water Quality Status in Pakistan, Phase I-V, 2001-2006, Pakistan Council of Research in Water Resources

[149] Pakistan Water Supply and Sanitation Study. Vol II. Rural Water Supply and Sanitation. World Bank 2012; and updated by PHED in 2014

- The average for households connected to a water supply is 32% with a median of 24%, and range of 0% to 96%
- The total income from the selected tehsils was PKR 139,768,433, while the total revenue during the same period was PKR 17,717,132 giving a working ratio of 7.88 (which is almost 4 times as high as that found in WASAs)

PSLM 2011-12[150] revealed that overall in Pakistan, 29% of households were connected to piped water supply, and that 67% of these households were paying for the utilities at an average rate of PKR 149 per month. Provincial disaggregation was not available.

These findings suggest that both setting of tariffs and revenue collection are inadequate and exacerbate the inefficiency in the system.

Table 19 illustrates that that the average time for which water is supplied to the households is 5 hours, with a median of 5.3 hours and mode of 3.3 hours.

Table 18 - Water supply data 2012-13 for selected Tehsils

Sr No	Tehsil	Coverage (% of HH Connected with Water Supply)	Cost On Water Supply Per Annum (PKR)	Revenue Collected Per Annum (PKR)
1	Bahawalnagar	69%	4007343.00	400215.00
2	Chishtian	56%	6283906.00	149049.00
3	Fort Abbas	31%	979752.00	94561.00
4	Haroonabad	40%	1929517.00	267048.00
5	Minchinabad	39%	348419.00	14053.00
6	Bahawalpur - City	3%	1997106.00	183931.00
7	Hasilpur	34%	1768666.00	188922.00
8	Khairpur Tamewali	17%	436582.00	53482.00
9	Yazman	56%	1647167.00	143627.00
10	Liaquatpur	47%	1831406.00	Not provided
11	Rahim Yar Khan	14%	2845770.00	384115.00
12	Sadiqabad	32%	4458583.00	401666.00
13	Taunsa	54%	2431750.00	164792.00
14	Layyah	1%	201958.00	7600.00
15	Rajanpur	3%	606934.00	7530.00
16	Chiniot	3%	510217.00	93482.00
17	Ahmad Pur Sial	5%	277219.00	415.00
18	Jhang	1%	555798.00	7623.00

150 Pakistan Social and Living Standards Measurement Survey 2011-12. Pakistan Bureau of Statistics, Government of Pakistan

Table 18 continued

Sr No	Tehsil	Coverage (% of HH Connected with Water Supply)	Cost On Water Supply Per Annum (PKR)	Revenue Collected Per Annum (PKR)
19	Kamalia	12%	1003779.00	6083.00
20	Gujrat	65%	8085212.00	135250.00
21	Kharian	34%	337701.00	61678.00
22	Hafizabad	15%	749235.00	69037.00
23	Malakwal	7%	83597.00	3300.00
24	Mandi Bahauddin	3%	520781.00	27999.00
25	Phalia	38%	280285.00	133979.00
26	Narowal	49%	1742425.00	477545.00
27	Shakargarh	22%	521823.00	83542.00
28	Daska	21%	4335240.00	787909.00
29	Pasrur	52%	1771389.00	757416.00
30	Sialkot	62%	11499958.00	5266114.00
31	Kasur	44%	7674552.00	1756230.00
32	Nankana Sahib	24%	2006098.00	137083.00
33	Sangla Hill	17%	350572.00	12500.00
34	Shah Kot	0%	11593.00	Not provided
35	Ferozewala	95%	4335240.00	787909.00
36	Muridke	16%	2626546.00	226992.00
37	Sharaqpur	73%	814282.00	348179.00
38	Sheikhupura	22%	8853207.00	365017.00
39	Kabirwala	8%	486524.00	6456.00
40	Kehror Pacca	6%	348114.00	34252.00
41	Vehari	29%	2952041.00	40251.00
42	Attock	92%	4816422.00	1045194.00
43	Fateh Jhang	65%	1166852.00	Not provided
44	Hassanabdal	84%	2010928.00	554522.00
45	Hazro	15%	490172.00	Not provided
46	Jand	56%	296770.00	Not provided
47	Pindi Gheb	22%	551487.00	Not provided
48	Chakwal	24%	1578855.00	Not provided
49	Choa Saidan Shah	54%	244566.00	Not provided
50	Talagang	32%	805371.00	Not provided
51	Jhelum	39%	1704583.00	291666.00
52	Sohawa	59%	317500.00	125000.00
53	Depalpur	49%	1042900.00	92323.00
54	Okara	13%	1780302.00	47503.00
55	Renala Khurd	18%	623455.00	76253.00
56	Arifwala	56%	2681353.00	Not provided
57	Pakpattan	13%	1462183.00	116366.00

Table 18 continued

Sr No	Tehsil	Coverage (% of HH Connected with Water Supply)	Cost On Water Supply Per Annum (PKR)	Revenue Collected Per Annum (PKR)
58	Sahiwal	21%	4924891.00	Not provided
59	Bhakkar	5%	928840.00	116666.00
60	Darya Khan	4%	456519.00	19008.00
61	Klaur Kot	7%	156895.00	7916.00
62	Mankera	15%	200502.00	20818.00
63	Khushab	45%	3141276.00	238750.00
64	Noorpur Thal	25%	167583.00	14066.00
65	Isa Khel	96%	648621.00	153142.00
66	Mianwali	55%	6350520.00	285326.00
67	Piplan	10%	325777.00	9319.00
68	Bhalwal	28%	298026.00	48488.00
69	Kot Momin	3%	120322.00	1048.00
70	Sahiwal - Sgd	1%	118894.00	402.00
71	Sargodha	12%	5082255.00	263919.00
72	Shahpur	37%	351310.00	70001.00
73	Sillanwali	21%	414216.00	32604.00

(Source: Department of LG&CD, Punjab and Punjab Municipal Development Fund Company)

Table 19 - Average hours of water supplied per day in selected Tehsils 2012-13

Sr. No.	Tehsil	Average hours supplied to HH
1	Bahawalnagar	2.72
2	Chishtian	3.25
3	Fort Abbas	1.16
4	Haroonabad	1.55
5	Minchinabad	5.48
6	Bahawalpur - City	6.07
7	Hasilpur	4.4
8	Khairpur Tamewali	4.37
9	Yazman	2.2
10	Liaquatpur	5.38
11	Rahim Yar Khan	7.25
12	Sadiqabad	1.08
13	DG Khan	6.5
14	Taunsa	0.47
15	Chubara	2.73
16	Layyah	2.87
17	Alipur	5.37
18	Muzaffargarh	2.92
19	Jampur	3.19
20	Rajanpur	3.43
21	Rohjan	6.8
22	Chiniot	6.03
23	Ahmad Pur Sial	0.75
24	Jhang	1.41
25	Gojra	2.44
26	Kamalia	6.89
27	Gujrat	9.5
28	Kharian	7.97
29	Sarai Alamgir	7.19
30	Hafizabad	6.97
31	Malakwal	3.25
32	Mandi Bahauddin	7.5
33	Phalia	6.46
34	Narowal	7.88
35	Shakargarh	5.5
36	Daska	11.73
37	Pasrur	7.81
38	Sialkot	10.5
39	Chunian	5.09
40	Kasur	8.36
41	Pattoki	5.28
42	Nankana Sahib	7
43	Sangla Hill	2.42

Table 19 continued

Sr. No.	Tehsil	Average hours supplied to HH
44	Ferozewala	7.45
45	Muridke	9.4
46	Sharaqpur	7.44
47	Sheikhupura	7.04
48	Jahanian	3.77
49	Kabirwala	4.79
50	Khanewal	6.22
51	Mianchannu	2.79
52	Dunyapur	4.03
53	Kehror Pacca	1.59
54	Lodhran	4.18
55	Burewala	4.95
56	Mailsi	3.65
57	Vehari	1.4
58	Attock	7.07
59	Fateh Jhang	0.49
60	Hassanabdal	1.12
61	Hazro	5.93
62	Jand	5.82
63	Pindi Gheb	6.29
64	Chakwal	8.41
65	Choa Saidan Shah	8.68
66	Talagang	5.87
67	Dina	5
68	Jhelum	8.25
69	Pind Dadan Khan	1.3
70	Sohawa	0.11
71	Depalpur	8.57
72	Okara	8.94
73	Renala Khurd	6.62
74	Arifwala	7.53
75	Pakpattan	6.29
76	Chichawatni	5.48
77	Sahiwal	6.91
78	Bhakkar	4.42
79	Darya Khan	3.56
80	Klaur Kot	3.89
81	Mankera	4.11
82	Khushab	10.75
83	Noorpur Thal	1.42
84	Isa Khel	3.66
85	Mianwali	8
86	Piplan	1.47
87	Bhalwal	3.37

Table 19 continued

Sr. No.	Tehsil	Average hours supplied to HH
88	Kot Momin	3.77
89	Sahiwal - Sgd	4.82
90	Sargodha	2.62
91	Shahpur	6.66
92	Sillanwali	5.57

(Source: Department of LG&CD, Punjab and Punjab Municipal Development Fund Company)

Table 20 - Sanitation data for selected tehsils 2012-13

Tehsil	Percentage of Waste Disposed of Per Month	Cost on Solid Waste Disposed of Per Annum (PKR)	% of HH connected with Sewerage system
Ahmad Pur Sial	39	706379	-
Ahmadpur East	25	5693969	1%
Alipur	57	2530364	-
Arifwala	61	3866091	38%
Attock	64	3478364	79%
Bahawalnagar	73	5163043	79%
Bahawalpur - City	61	10690937	33%
Bahawalpur – Sadar	30	260941	4%
Bhakkar	52	4507573	89%
Bhalwal	57	1142969	-
Burewala	61	14034416	-
Chakwal	53	3489227	7%
Chichawatni	57	2434248	-
Chiniot	72	2278534	10%
Chishtian	60	4127674	6%
Choa Saidan Shah	59	362949	5%
Chubara	31	353515	-
Chunian	26	2604830	-
Darya Khan	47	241381	4%
DG Khan	60	32515303	-
Daska	62	4794803	47%
Depalpur	50	459193	62%
Dina	46	-	-
Dunyapur	51	1128157	26%
Fateh Jhang	65	1009337	No Sewerage
Ferozewala	17	-	-
Fort Abbas	60	1386834	90%
Gojra	65	3271666	-
Gujrat	63	12165526	-
Hafizabad	63	4420007	45%
Haroonabad	62	5328052	38%
Hasilpur	39	2960811	9%
Hassanabdal	81	1147076	No Sewerage
Hazro	56	1885125	No Sewerage
Isa Khel	53	471744	88%

Table 20 continued

Tehsil	Percentage of Waste Disposed of Per Month	Cost on Solid Waste Disposed of Per Annum (PKR)	% of HH connected with Sewerage system
Jhelum	61	-	-
Jhanian	58	-	-
Jampur	54	2863133	-
Jand	55	382261	No Sewerage
Jatoi	63	1253862	-
Jhang	49	8661916	-
Kabirwala	29	1119257	-
Kallar Kahar	20	129991	No Sewerage
Kamalia	48	2837665	-
Karor Lal Eisan	56	1994412	-
Kasur	63	11093658	No Sewerage
Kehror Pacca	63	2303719	-
Khairpur Tamewali	41	1654274	11%
Khanewal	55	2456231	-
Khanpur	44	5319553	27%
Kharian	39	1323251	No Sewerage
Khushab	45	2433333	76%
Klaur Kot	54	1884521	30%
Kot Addu	59	5665989	-
Kot Momin	50	714426	-
Layyah	66	6165250	-
Liaquatpur	60	1477304	55%
Lodharan	56	-	-
Mailsi	69	1539199	No Sewerage
Malakwal	79	1176155	6%
Mandi Bahauddin	63	2720125	4%
Mankera	44	655825	94%
Mianwali	55	-	136%
Mianchannu	58	-	-
Minchinabad	49	220601	No Sewerage
Muridke	23	4254930	66%
Muzaffargarh	52	13025492	-
Nankana Sahib	45	1667311	87%
Narowal	64	1898043	2%
Noorpur Thal	54	462725	No Sewerage
Okara	59	10017474	73%

Table 20 continued

Tehsil	Percentage of Waste Disposed of Per Month	Cost on Solid Waste Disposed of Per Annum (PKR)	% of HH connected with Sewerage system
Pakpattan	58	5321556	68%
Pasrur	68	1406757	3%
Pattoki	53	13212313	-
Phalia	63	1427669	3%
Pind Dadan Khan	50	-	10%
Pindi Bhatian	66	1089213	No Sewerage
Pindi Gheb	66	1228802	14%
Piplan	50	822132	85%
Rahim Yar Khan	48	10458587	70%
Rajanpur	69	2765587	-
Renala Khurd	63	1339809	18%
Rohjan	64	3740480	-
Sadiqabad	63	6711253	31%
Safdarabad	63	1177219	-
Sahiwal	64	2031561	73%
Sahiwal - Sgd	18	895435	-
Sangla Hill	45	202900	18%
Sarai Alamgir	58	1055477	No Sewerage
Sargodha	67	12876029	15%
Shah Kot	39	1276798	-
Shahpur	35	845916	-
Shakargarh	61	1021146	-
Sharaqpur	33	1557880	80%
Sheikhupura	53	10065612	81%
Shorkot	69	1175615	8%
Sialkot	62	22810452	28%
Sillanwali	32	2033333	81%
Sohawa	62	708166	No Sewerage
Talagang	55	1794971	-
Taunsa	56	1979968	-
Toba Tek Singh	53	4177750	-
Vehari	51	5237272	-
Yazman	41	863535	38%

(Source: Department of LG&CD, Punjab and Punjab Municipal Development Fund Company)

Table 20 shows that on average, about 53.6% of solid waste is disposed of per month, with a median of 56%, mode of 63%, minimum of 17% and maximum of 81%. For towns and cities to remain clean, at least 75% of solid waste must be collected and disposed of every day.

The average cost incurred on solid waste disposed of per annum was PKR 3,787,439, with a median of PKR 1,987,190, minimum of PKR 129,991 and maximum of PKR 32,515,303.

The data also shows that only 42% of households are connected to the sewerage system, with a median of 33% and mode of 38%. This suggests that TMAs have only achieved about 65% of the MDG target (of 65%) set by Government of Punjab in its Medium Term Development Framework 2013-16.

Punjab Municipal Services Improvement Project

The Punjab Municipal Services Improvement Project (PMSIP) is being implemented by the Punjab Municipal Development Fund Company (PMDFC) and is funded by the World Bank. It is designed to improve the viability and effectiveness of urban services provided by Tehsil Municipal Administrations (TMAs). The project has been active since 2006.

The Infrastructure development component has made investments in TMAs to enhance municipal services. Till date, investments have been made in 41 sub-projects (out of which 39 have been completed) with a total cost of PKR 3,043 million since the start of the project. Investments include rehabilitation, improvement, and coverage expansion in Water Supply, Roads and streets, Solid Waste Management, Sewerage, Parks and Firefighting.

In order to determine the effectiveness of completed sub-projects and to assess the beneficiaries' perception of service delivery improvements, PMDFC undertook a survey in selected TMAs.

The main findings from the beneficiary perception survey[151] with regards to water supply included the following:

Improvement in Quantity of water

- Quantity of water
  - 54% of respondents said that the quantity improved or significantly improved. The remainder said that there was no change

- Pressure of water
  - 56% of respondents said that the pressure of water supply improved or significantly improved. The remainder said that there was no change

- The most frequent complaints were low water flow (i.e. low pressure) and improper timing

- 20% of respondents said that there was some reduction in use of private motor/pump after water supply sub-project

The findings of the sites surveyed for perception about improvement in quantity of water supply are shown in **Fig 71**.

Improvement in Quality of water used for drinking

- Overall Result
  - 56% of respondents said that the quality of water for drinking improved or significantly improved. The remainder said that there was no change

- TMA water supply is the primary source of drinking water for 70% of the households surveyed

- Perception of improvement is better for those using TMA water as primary source: Perception of improvement increased to 71% compared to 50% overall

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[151] Beneficiary perception survey of PMSIP infrastructure sub-projects. Punjab Municipal Development Fund Company and the World Bank. 2013

- Significant switching to TMA supply as primary source of drinking water: 49% used private bore/hand pump as the primary source before sub-project. Out of these, 71% now use TMA water supply as the primary source

- Beneficiaries facing fewer problems in drinking water: Among those who use TMA supply as the primary source, 31% reported problems. In comparison, 50% of non-beneficiaries reported problems

Improvement in Quality of water used for household purposes (washing, bathing etc.)

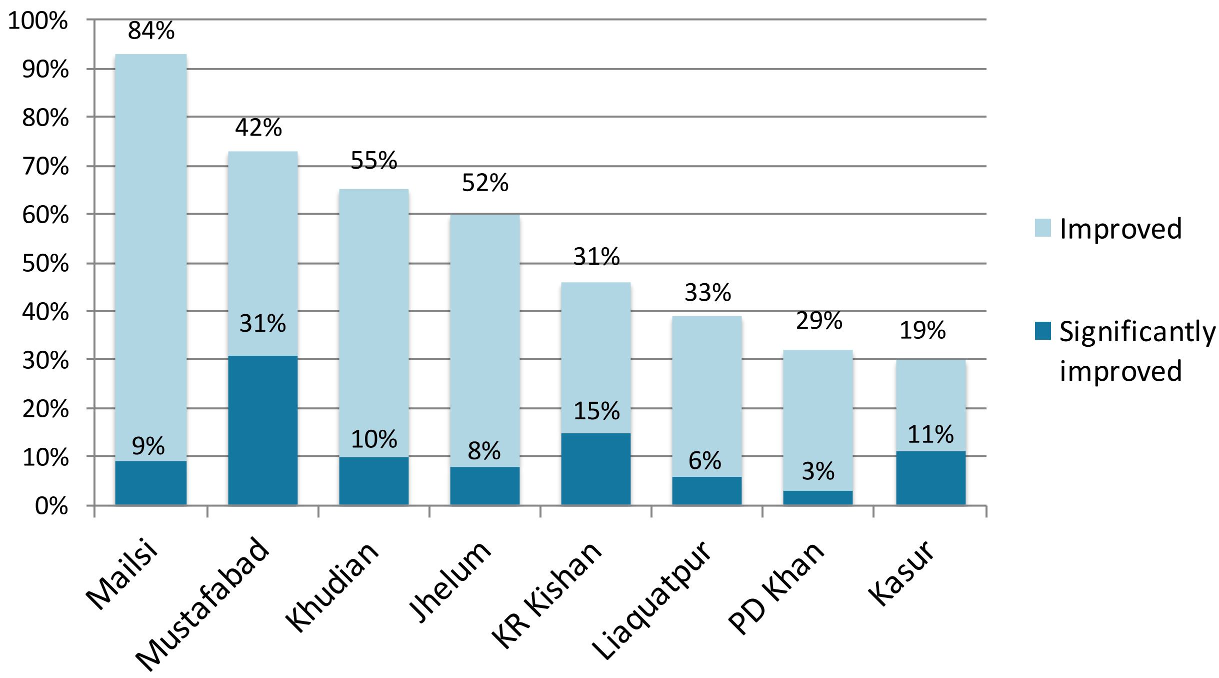
- Overall Result
  - 61% of respondents saying that improved or significantly improved. Remainder said no change

- TMA water supply is the primary source for household purposes for 74%

- Significant switching to TMA supply as primary source of water for household use: 64% used private-bore/hand pump as the primary source before sub-projects. Now, 74% use TMA water supply as the primary source

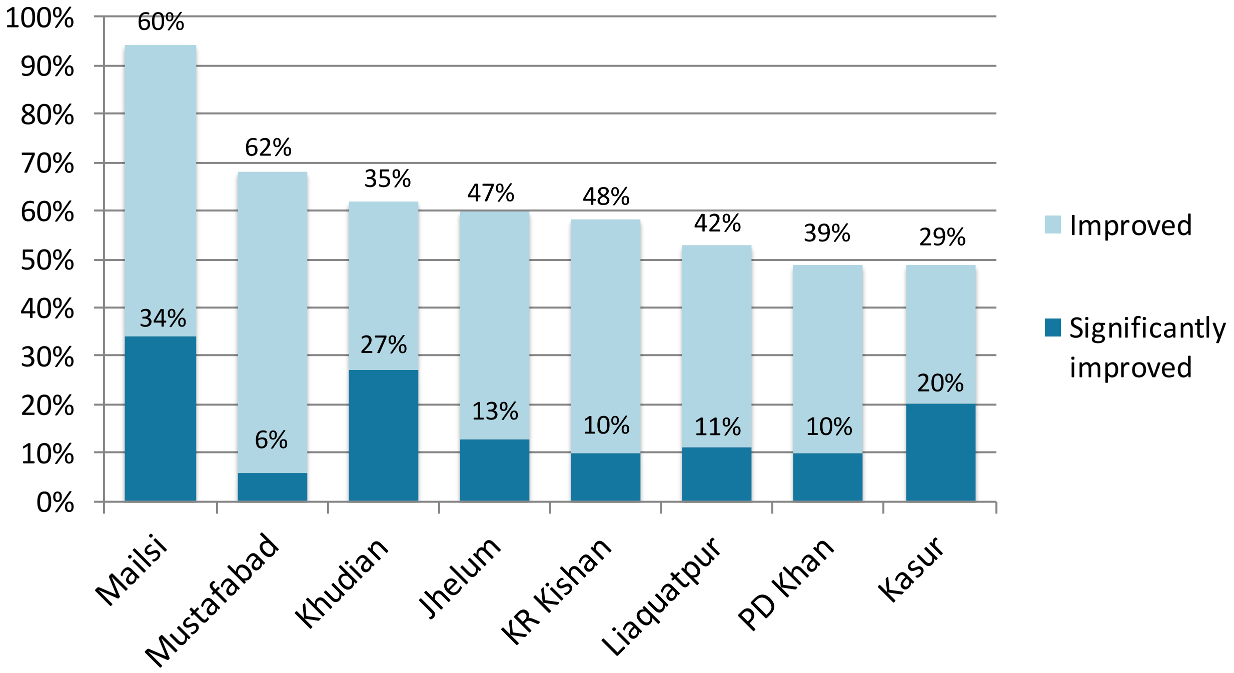
The findings of the sites surveyed for perception about improvement in quality of water for household usage are shown in **Fig 72**.

Figure 71 - Perception about improvement in quantity of water supply



(Source: Beneficiary perception survey of PMSIP infrastructure sub-projects. Punjab Municipal Development Fund Company and the World Bank. 2013)

Figure 72 - Perception about improvement in quality of water for household usage



(Source: Beneficiary perception survey of PMSIP infrastructure sub-projects. Punjab Municipal Development Fund Company and the World Bank. 2013)

Strategy

Sector Efficiency			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved and efficient use of Water Production	Public education campaign launched about water conservation In areas with production of more than 200 L/capita/day, reduce water production to 136 L/capita/day (30 gallons/capita/day) In areas with production of 100-200 L/capita/day, maintain at 136 L/capita/day (30 gallons/capita/day) Revise 50 gallons per capita per day formula and reduce to 30 gallons per capita per day and use for all new schemes	Public education campaign maintained about water conservation Maintain water production at 136 L/capita/day or less (30 gallons/capita/day)	Public education campaign maintained about water conservation Maintain water production at 136 L/capita/day or less (30 gallons/capita/day)
Improved water conservation through improved water consumption practices	In areas with consumption of more than 200 L/capita/day, reduce water consumption to 114 L/capita/day (25 gallons/capita/day) In areas with consumption of 100-200 L/capita/day, maintain at 114 L/capita/day (25 gallons/capita/day)	Reduce and maintain water consumption at 114 L/capita/day or less (25 gallons/capita/day)	Reduce and maintain water consumption at 114 L/capita/day or less (25 gallons/capita/day)
Reduced systems leakages of Non Revenue Water and Unaccounted for Water	Reduce to 20% or less Outsource at least 25% of revenue collection	Reduce to 20% or less	Reduce to 20% or less
Increased household water metering	Introduce water metering in phases All new connections to be metered At least 100% of high income areas have metering in place All commercial and business premises have water metering	At least 10% of medium income areas have metering in place	At least 20% of medium income areas have metering in place

Water flows monitored at tube wells	Bulk flow meters and pressure gauges installed at 20% of tube wells	Bulk flow meters and pressure gauges installed at 40% of tube wells	Bulk flow meters and pressure gauges installed at 60% of tube wells
Cost and Staffing efficiency	Water staff rate reduced to 2-3 per 1000 connection Wastewater staff rate reduced to 2-3 per 1000 connections	Water staff rate maintained at 2-3 per 1000 connection Wastewater staff rate maintained at 2-3 per 1000 connections	Water staff rate maintained at 2-3 per 1000 connection Wastewater staff rate maintained at 2-3 per 1000 connections
Efficient Billing and Collection	Collection period reduced to less than 30 days Billing efficiency increased to 50% Financial collection efficiency increased to 50% Outsource billing and collection	Collection period reduced to less than 15 days Billing efficiency increased to 75% Financial collection efficiency increased to 75%	Collection period maintained at less than 15 days Billing efficiency increased to 90% and above Financial collection efficiency increased to 90% and above
Enhanced and sustainable Financial Performance	Operating cost coverage ratio of 0.5 achieved Working ratio reduced to 2.0 or less	Operating cost coverage ratio of 0.75 achieved Working ratio reduced to 1.5 or less	Operating cost coverage ratio of 1.0 or more achieved Working ratio reduced to less than 1.0
Enhanced and sustainable financial performance by TMAs	At least 30% of TMAs have a working ratio of 4.0 or less	At least 60% of TMAs have a working ratio of 3.0 or less	At least 90% of TMAs have a working ratio of 2.0 or less
A functional Biometric tracking system in all cities and TMAs	All mega cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 50% of intermediate cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 30% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles	At least 50% of intermediate cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 60% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles	At least 90% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles

SECTOR CAPACITY

WASAs

Staffing at management level in WASAs is generally comprised of provincial officials. Most of the technical/professional staff have a background in engineering. There is a requirement for the Managing Director of a WASA to have a technical background. Most officials are usually deployed from the Public Health Engineering Department.

TMA staff on the other hand may originate from different provincial government departments or local government bodies. This may have an implication on which service rules apply to them.

The highly technical nature of PHED work has necessitated training in design and construction. However, TMAs on the other hand have been lacking in this capacity for planning and construction and therefore have to rely upon PHED. PLG Ordinance 2001 also reinforced the role of PHED for development of new schemes while O&M was handed over to TMAs and CBOs.

Table 21 - Staffing at WASAs

STAFFING AT WASAs	L-WASA (Q4 2013 data)	R-WASA (Q3 2012 data)	G-WASA (Q3 2013 data)	F-WASA (Q4 2012 data)	M-WASA (Q2 2012 data)
Total Staff	**4269**	**2692**	**638**[152]	**1098**	**1271**
Professional (BPS 17 and above)	208	99	25	35	34
Other (BPS 4-16)	4061	2593	242	1063	1237
W&WW Staff Per 1000 W&WW Connections	2.24	7.38	4.9	6.78	4.08
Water Staff Per 1000 Water Connections	1.94	8.45	8.71	9.28	4.24
Wastewater Staff Per 1000 Wastewater Connections	2.69	4.54	3.53	5.64	4.03

(Source: Pakistan Water Operators Network)

Table 21 shows that labour productivity per 1000 connections varies from 2.24 in L-WASA to 7.38 in R-WASA for water and wastewater staff. Generally, R-WASA, G-WASA and F-WASA have higher ratios for water staff, while all WASAs have lower ratios for wastewater staff. Internationally recommended benchmarks suggest between 2-5 labour productivity ratios per 1000 connections[153].

[152] The disaggregated data available is incomplete

[153] Tynan N and Kingdom W. 2002. Effective Water Service Provision. World Bank

A skills and resource assessment[154] found that the sector faced some common challenges with human resource capacities and the technical and managerial skills. These included the following:

- Management staff is only appointed (sometimes for a limited period) to positions in the WASA from a "home" department and turnover is rapid. This type of secondment to WASA tends to create incentives for higher-level staff more related to their employment in the department rather than based on performance of their duties at WASA. In general, performance does not have much influence on advancement of career officers.
- Ban on recruitment of personnel in force for several years leading to vacancies
- Staff planning is generic and inflexible, does not meet the needs. Staffing plans are old and do not contain such skills as IT specialists
- Management staff is not well trained in operation and maintenance
- In-house training is rarely carried out. There is only one training centre in Punjab for WSS (in Lahore WASA) and this is used infrequently
- The lack of written and enforced procedures means that on-the-job training is ineffectual even if it is carried out
- There is a lack of incentives and sanctions to encourage good work due to the rules of public service employment. Good or poor performance has little or no influence on advancement
- There is no evidence of any commercial skills being imparted to WASA managers
- Absenteeism: Lower level staff is hired involving nepotism and corruption. People hired in such circumstances are not at their posts but have second jobs
- TMA were not given enough staff when the services were taken over from the PHED in some cases
- Public sector salaries are not competitive in general

Local Government

In 2013, the LG&CD department commissioned a training needs assessment of its administrative and managerial staff and capacity assessment of its main Punjab Local Government Academy (PLGA) at Lala Musa to identify gaps and recommendations for future action[155]. Data was collected from randomly selected ten districts of Punjab province (Lahore, Lala Musa, Multan, Bahawalpur, Rahim Yar Khan, Lodhran, Faisalabad, Sargodha, Attock and Rawalpindi) through focus group discussions, in-depth interviews and quantitative data collection. The main findings are as follows:

Training Needs Assessment

- No pre or on-job training system exists
- Only 5% were the women amongst the respondents
- 25% of the respondents have more than 15 to 20 years, and 20% have more than 25 years of experience of work experience

[154] Urban Water Supply and Sewerage Reform Strategy, 2006. Government of Punjab and World Bank

[155] Training Needs Assessment and Capacity Assessment Punjab Local Government Academy. 2013. LG&CD Department

- 72.5% of the respondents said they didn't attend any on-job training while a very limited number of respondents replied positively. Less than 1% of respondents received training from PLGA at Lala Musa
- 69.2% of the respondents did not attend any training before their present job. 10% received training under the Asian Development Bank project, 6.7% attended training from PLGA, 1.7% from PCRWR, 1.7% from Finance Department and 1.7% from PEPRA Islamabad
- Most of the on-job trainings were regarding finance and finance related (almost 20%) followed by computer training (9%), and PMDFC (6%). A very minimal number (1.5%) have gone through refresher courses arranged by PLGA
- Responding on the question of existence of training need assessment process within the departments, 44% said yes and 56% replied in negative
- Overall, 45.8% of the respondents highlighted project management, 42.5 financial management, 31.7% communication skills, 21.7% leadership, 20% team building and only 14.2% highlighted community management and local government systems and operations as their required training needs
- Almost 100% of the respondents in all districts never requested their departments to nominate them for any training related to their professional growth and development
- 87% of the employees have never been trained in community handling and public dealing
- Only 5.8% of the respondents recommended PLGA for their required trainings

Local Government Academy Lala Musa

- PLGA has inadequate systems and procedures for hiring its faculty and staff. Most of the faculty also has "additional charge" which adds to their workload
- 24 positions are vacant including director research
- There is a lack of training environment (only two rooms (with the capacity of 50 people) with one conference room (with the capacity of 50 people) is available for trainings
- There is no hostel facility for women participants, no transportation facility for participants to conduct study tours and visits
- The academy has serious gaps in its standard training strategy with no media and communication strategy, no networking and liaison building strategy. Information management is grossly inadequate
- The academy does not have any standard training material (training manual, modules or IEC material for conducting training courses). The instructors, facilitators, trainers and resource person have their own notes, presentations or slides to run their sessions. This is one of the reasons for lack of standard knowledge within the government departments
- The academy faces the issue of approval of annual training calendar and budgetary provisions for proposed activities
- There is no regular and proper budget allocation for training which is one of the key reasons of training not being mainstreamed

- Presently, there is no link of PLGA professional development with recruitment and selection, promotion policy, placement, reward and recognition. As a consequence, there is very little interest of the local government officials and officers in training activities
- The residential blocks need immediate attention of the policy makers with renovation, white washing and reconstruction

The assessments highlight an unsatisfactory professional development process which only exacerbates the limited technical capacities of Local Government in the sector, call into question their role of community development when more than four-fifths of the officials and technical staff have no training in community mobilisation and development, and where the leading local government training institution is inefficacious from a technical standpoint and focused mainly on administrative matters.

Solid Waste Management

The staffing patterns in Solid Waste Management in nine cities are shown in **Table 22**.

Table 22 - Staffing for Solid Waste Management in nine cities in Punjab

Staffing for SWM	Lahore	Faisalabad	Rawalpindi	Multan	Gujranwala	Sargodha	Sialkot	Bahawalpur	DG Khan
Separate department for SWM	Yes	Yes	Yes	Yes	Yes	No	No	No	No
MSC Engineering / Management	0	0	0	0	0	0	0	0	0
Medical Doctors	0	4	1	0	0	0	0	0	0
BSc Engineering	3	0	0	0	0	0	0	0	0
Diploma Engineers	6	0	0	1	0	0	0	0	0
Chief Sanitary Inspectors	12	13	4	1	2	2	1	1	1
Sanitary Inspectors	76	29	15	20	10	4	2	2	4
Supervisors	150	72	58	69	40	26	29	32	1
Drivers	282	52	42	53	47	8	19	25	15
Mechanics in workshop	118	0	6	0	0	1	8	0	0
Sanitary workers	7,897	3,116	1,662	1,973	1,500	882	1047	308	299
Scavengers	15,000	00	1,000	500	500	300	300	200	200

(Source: Punjab Solid Waste Management Reform, 2007. World Bank; Sialkot Solid Waste Management Strategy and Action Plan 2010. Punjab Cities Improvement Investment Programme. Urban Unit, Government of Punjab)

The situation in Lahore since 2007 has now changed as the Lahore Waste Management Company, a privatised initiative of Government of Punjab, has a service contract with two Turkish firms for Lahore. The SWM staff of the City District Government have been deployed under this service arrangement.

However, for other cities, there is an obvious shortage of qualified staff at middle and senior positions especially for planning and management. Although the ratio of sanitary workers is close to the ratio of 1:1000 inhabitants with the existing population, the overall productivity is much less since the coverage of SWM services is considerably less than 100%. No door-to-door-collection, inappropriate equipment and routing as well as widespread double-handling of waste, are the main reasons for not achieving more efficient and effective primary collection.

The World Bank has proposed the following indicative benchmarks for SWM staffing (**Table 23**). Table illustrates the gap in Sialkot TMA, which is used as an example.

Table 23 - SWM benchmark and current staffing in Sialkot

SWM Staff	Benchmark numbers	Approximate requirements	
		Benchmark	Current
Superintending Engineer	1 per city	1	0
Executive Engineer	1 per million population	(1)	0
Assistant Executive Engineers	1 per 500,000 population	1	0
Assistant Engineers	1 per 250,000 population	2	0
Qualified Diploma Sanitary Inspector	1 per 100,000 population	5	1
Qualified Sanitary Inspectors	1 per 50,000 population	10	2
Qualified Sanitary Supervisor	1 per 15,000 population	33	29
Sanitary Workers	1 per 1000 population	500	1,047

(Source: Punjab Solid Waste Management reform, 2007. World Bank; Sialkot Solid Waste Management Strategy and Action Plan 2010. Punjab Cities Improvement Investment Programme. Urban Unit, Government of Punjab)

Community Based Organisations

An impact evaluation study[156] was conducted in Punjab Province of Pakistan and covered two sector projects, the Punjab Rural Water Supply and Sanitation (Sector) Project (PRWSSP) and the Punjab Community Water Supply and Sanitation (Sector) Project (PCWSSP), both funded by ADB. The purpose of the study was to assess project performance and identify lessons for maximising the development effectiveness of WSS interventions, which address basic human needs, such as WSS. The sustainability analysis also focused on the capacity of CBOs responsible for the operation and maintenance of subprojects.

The PRWSSP aimed to provide least-cost and low-technology water supply and drainage schemes to selected communities in seven districts in rural Punjab. It had three components: (i) water supply and drainage construction in about 300 communities, (ii) a hygiene education programme,

[156] Impact of Rural Water Supply and Sanitation in Punjab, Pakistan 2009. Asian Development Bank

and (iii) institutional strengthening support to PHED. It hoped to serve 900,000 residents in those communities.

The goal of the PCWSSP was to reduce poverty and improve living conditions and the quality of life in rural settlements in Punjab with water scarcity and/or brackish groundwater. The PCWSSP sought to (i) extend through a community-based and demand-driven approach water supply, drainage, and sanitation coverage to poor villages that did not have access to organised water supply and were located in brackish and dry land (barani) areas of Punjab; (ii) strengthen newly constituted TMAs and build their capacity to organise community-based water supply and drainage schemes and improve related management functions; (iii) implement a hygiene education programme, including helping selected beneficiaries in the project tehsils construct household latrines through a revolving fund; and (iv) implement a social-uplift and poverty eradication (SUPER) programme to help use the time saved not fetching water in productive livelihood activities, particularly for women, through a microcredit system and by constructing additional classrooms in schools where enrolment had increased because children were released from the chore of fetching water. The PCWSSP covered 30 districts of Punjab and had planned to serve 750 communities—500 of them with new construction and 250 by rehabilitating inoperative schemes—servicing approximately 2.3 million people.

Some of the main findings of the impact evaluation as related to CBOs included the following:

- The overall assessment found that: (i) 20% of the subprojects are non-functional; (ii) only 43% of CBOs responsible for subprojects are functional; (iii) cost recovery and capital replacement mechanisms are not built-in; (iv) high fuel and electricity costs, and erratic power supply have potential to bring operational subprojects to a halt; (v) CBOs capacity remains weak; (vi) government commitment to continued support for subprojects is weakening; (vii) participation of poor remains low due to upfront cash requirements; and (viii) operational link between PHED and TMAs remains very weak.

- The findings suggest that 26% of the subprojects had no CBO at the time of the survey, while another 32% had a nominal CBO that was deemed non-functional. Only 49 of the 115 subprojects assessed had a partly or fully functional CBO. Two thirds of the functional CBOs had no change in their memberships. Functional CBOs tended to be more closely involved in planning, designing, and operating subprojects. Strong but inclusive leadership, regular meetings, and effective water tariff collection enhanced CBOs' capacity. Nearly three fourths of the functional CBOs considered their involvement in the process adequate, in contrast to the 35% of the non-functional CBOs who had no involvement in any form.

- While both projects were designed as integrated WSS and hygiene-promotion interventions, and dedicated community-development and hygiene-promotion staff were hired, the information, education, and communication materials were considered less useful to the communities, and subsequent training was assessed as having little effect. Only 2% of the communities recalled participating in health- and hygiene-related training. Similarly, very few CBOs received support in linking with other service providers and microfinance institutions.

- Investment in improving access to water supply alone is not adequate for delivering health outcomes and impacts, and requires strengthening synergy between water supply and sanitation. This can be achieved only with strong commitment and focus supported by sizable investment in sanitation covering improvements of drainage and street pavements, minimising sanitation hazards in and around water supply systems, and managing solid waste and waste water at both household and community levels effectively.

- The formation of CBOs to operate rural WSS does not necessarily guarantee success of subprojects unless the concerned CBOs are capable of managing, operating and maintaining WSS systems in an equitable and sustainable manner. At the same time, the executing and implementing agencies tend not to have required skill mix particularly those relevant to CBO operations. Local NGOs and private sector entities tend to be in a better position to provide such support. Experience shows that they need to be recognised as local development partners and need to be engaged on a medium to long-term rather than short-term basis and hence project designs need to have provisions for such engagement and a sustainable outcome. The engagement of NGOs and private sector entities, however, must be based on performance results.

- In order to ensure sustainability of project benefits, there is a need to assist non-functional or partly functional CBOs to become fully functional through capacity building by engaged competent NGOs and private sector entities. The study identified for a separate mechanism to strengthen subproject CBOs. The role of NGOs and private sector entities should be more than just social mobilisation and the conduct of training. They should be able to provide other services, such as water quality monitoring, sanitary inspections, technical analysis, developing financial sustainability, and continued capacity building of CBOs, both during and after the project. To ensure service delivery, these NGOs and private sector entities can be contracted for the duration of the project for defined needs, but their contract should be reviewed annually based on actual performance. Measuring CBO attributes, including their financial sustainability, would improve their effectiveness, efficiency, and sustainability.

Recent Initiatives for Capacity Development in Punjab

Housing & Urban Development and Public Health Engineering Department

Punjab Water and Sanitation Academy, Lahore

This project will be executed by WASA LDA Lahore assisted by JICA. The project will result in a training institute for capacity building of professionals of 5 WASAs and engineering staff of PHED.

Punjab Municipal Services Improvement Project

The Government of Punjab initiated the Punjab Municipal Services Improvement Project (PMSIP) with the assistance of the World Bank through the Punjab Municipal Development Fund Company (PMDFC). The objective of the project is to improve the viability and effectiveness of urban services provided by the participating TMAs and to make such improvements sustainable and replicable in other TMAs through the creation of a performance based management framework at both TMA and Provincial levels.

PMSIP has two components - Institutional Development and Infrastructure Development. Under the Infrastructure Development component, design and execution of sub- projects for improvement of municipal services are being undertaken. The Institutional Development component is concerned with implementing a number of interventions including establishment of Performance Management System (PMS), Complaint Tracking System (CTS), and Computerised Financial Management System (CFMS) along with TMA Website Development. The project has also introduced an IT culture at TMA offices through provision of basic and advanced computer trainings and provision of requisite hardware, Urban Planning, and Development of Geographical Information System (GIS) based service delivery maps also form important components of Institutional Development interventions.

Initially, 37 TMAs were selected in two phases using performance based selection criteria. After review by the Government of Punjab, the project was then scaled up to cover all the 105 TMAs.

Performance Management System (PMS)

It is a system of regularly developing, collecting and reporting indicators so as to have a better understanding of TMA services to the public and using the information in policy making, resource allocation and service delivery.

PMS provides updated real-time data related to:

- coverage of municipal services e.g. % households connected with water supply, % households connected with sewerage system, % solid waste disposed of etc.
- level of municipal services e.g. average hours of water supply to households daily, number and type of complaints for each municipal service etc.
- informed decision making – why, where and when the resources should be allocated and spent
- improved transparency and accountability

PMS has been introduced in 6 sectors including water supply, solid waste collection, streetlights, roads, parks and sanitation in Phase-I (37) & Phase-II (68) partner TMAs.

Complaint Tracking System (CTS)

The CTS allows the citizens to make their complaints by telephone or a written application. Each complaint is given a number and it is tracked from registration to redressal. Analysis of complaints from 37 TMAs showed that the commonest complaint was about solid waste (35%), followed by sewerage (25%), street lights (20%), water supply (17%) and other (3%).

Computerised Financial Management System (CFMS)

The financial management system is an integrated system that has the following modules:

- Book-keeping
- Cash Book and Bank Reconciliation
- Budget Allocation
- Demand and Collection Register
- Contracts Follow-up

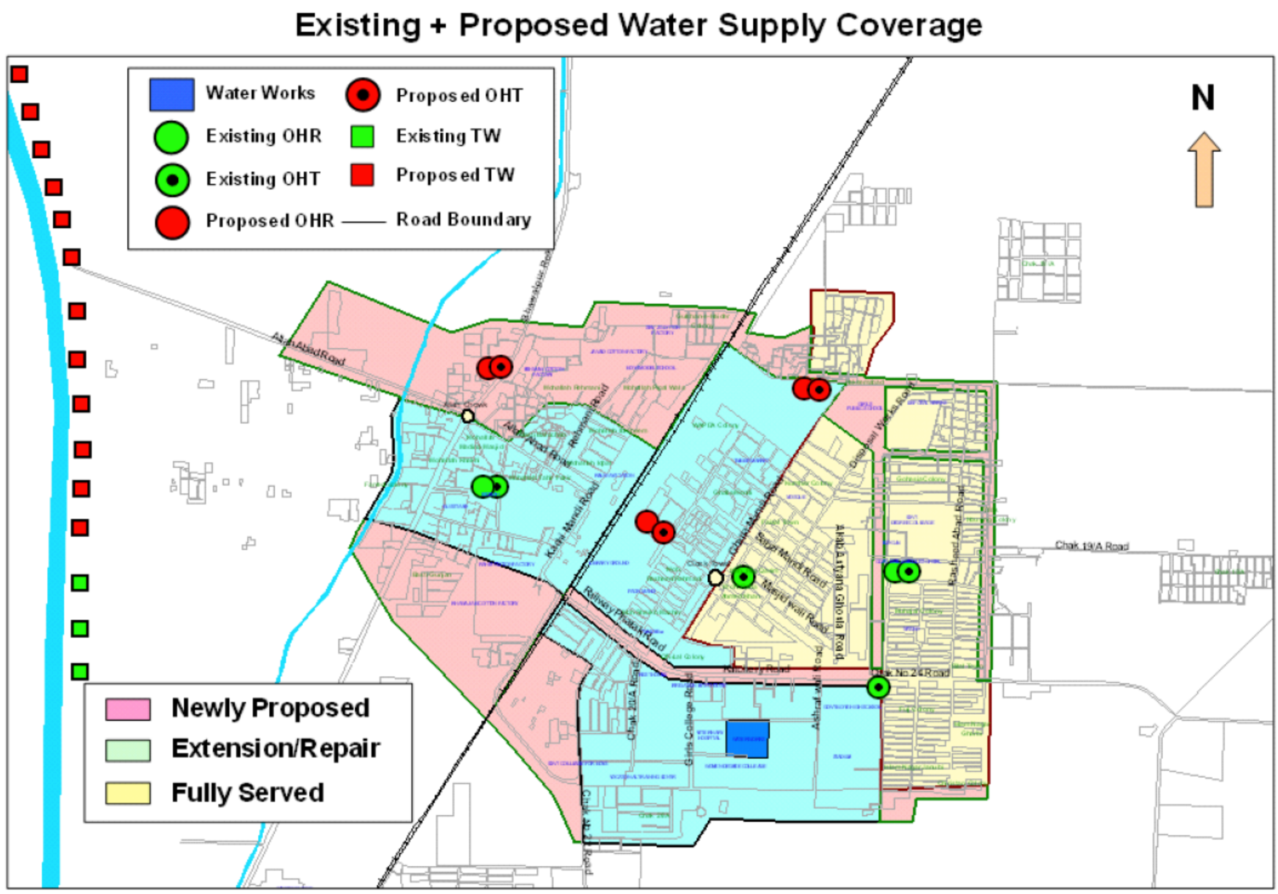
All modules are integrated with the Cash Book.

Urban Planning

As part of the PMSIP, TMAs were introduced to the concepts of planning/urban planning. The aim is to link planning with engineering and other components, develop a viable list of infrastructure projects for financing in coming years, and to synthesise technical and stakeholder aspirations. The TMAs developed their planning reports, which provide a status of their TMA and present a clear prioritisation of municipal and other sectors for development and resource allocation[157].

GIS maps have been produced for base maps, land use maps, water supply maps, sewerage system maps, and solid waste services maps. **Fig 73** illustrates an example of a water supply map that has helped identify fully served areas, other areas where extension or repair is needed and new areas where water supply is proposed.

Figure 73 - Sample planning map for water supply



(Source: Punjab Municipal Development Fund Company)

157 Planning Report Vehari 2008. Punjab Municipal Development Fund Company. Punjab Municipal Services Improvement Project

Training

Training is one of the pillars of the PMSIP. Three main types of training are covered under the project.

- Computer training – so far 387 TMA staff have received basic IT training while 29 have received advanced IT training
- Hands-on training – 208 staff have received training in PMS and 242 have been trained in CTS, while 58 have been trained in updating websites
- Technical training – 42 TMA staff have been trained in automatic level machine training

TMA Websites

One of the activities under the Institutional Development component was development of TMA websites. Websites have now been developed for all the TMAs and are functional with a registered web domain name (www.tma*name*.com) e.g. www.tmavehari.com. The use and application of the TMA website depends on the TMO to a great extent and it is reassuring to note that many TMOs are regularly updating their respective websites.

Environment and Social Policy

Punjab Municipal Development Fund Company (PMDFC) has devised an environmental and social policy to promote municipal infrastructure development sub-projects. For this purpose, an Environmental and Social Policy Framework Vol 1 is available for grantees of PMDFC grants, and an Environmental and Social Policy Framework Vol 2, which is an environmental and social information package for grantees of PMDFC grants.

Operation & Maintenance

O&M guidelines have been developed for all the municipal sectors. O&M piloting (for computerised billing and recovery system, technical training, and maintenance of stores through term contracting) using the guidelines has begun in Kasur, Jhelum and Chiniot and a rollout in another 10 TMAs is underway.

Challenges and Progress

Overall, the project has achieved many of its stated objectives[158, 159, 160, 161]. The project however faces some challenges, which include among others:

- Insufficient TMA staff with high turnover
- Shortage of professionally trained staff
- Informal business processes
- Inadequate operation & maintenance practices
- Little or no experience of TMA staff in execution of big infrastructure projects and contract management
- Gradual shift from manual to computerised system

On the positive side, the TMAs now have updated maps for 105 towns of Punjab – base maps, land use maps and municipal services maps. There is also updated coverage data for 105 towns, a standardised complaint tracking system and computerised financial management system in all TMAs with a pool of trained TMA staff.

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[158] Evaluation report on project 'Institutional Development Component Punjab Municipal Services Improvement Project'. Directorate General Monitoring and Evaluation, Planning and Development Department, Government of Punjab. 2013

[159] Assessment Report on Institutional Development Interventions of the Punjab Municipal Services Improvement Project. Vol 1. Punjab Municipal Development Fund Company and the World Bank, 2011

[160] Assessment Report on Institutional Development Interventions of the Punjab Municipal Services Improvement Project. Vol 2. Punjab Municipal Development Fund Company and the World Bank, 2013

[161] Completion Report - Institutional Development Interventions, PMSIP. Punjab Municipal Development Fund Company. 2013

Strategy

Sector Capacity			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved human resource development and management	Each sub-sector covering cities and TMAs conducts a human resource development assessment, need for professional staff placements and develops an action plan	At least 30% of human resource development actions implemented in cities and TMAs	At least 60% of human resource development actions implemented in cities and TMAs
Establish a Punjab Municipal Services Institute	A municipal services institute established for professional and technical training of TMA staff Core curricula and faculty development plan formulated Professional and continuing education programmes launched	At least 30% of TMA professional staff undergo continuing professional development in defined technical areas At least 30% of professional staff placements in TMA subsectors achieved At least 30% of TMAs prepare their budgets according to TMA development plans	At least 60% of TMA professional staff undergo continuing professional development in defined technical areas At least 60% of professional staff placements in TMA subsectors achieved At least 60% of TMAs prepare their budgets according to TMA development plans
Local Government Academy upgraded	Infrastructure and capacity development plan developed for Local Government Academy at Lala Musa Administration training curricula reviewed and updated Core package of administration and soft skills training developed Upgradation plan initiated	At least 30% of TMA staff trained in core package of administration and soft skills	At least 60% of TMA staff trained in core package of administration and soft skills
Improved performance of WASAs	Complete process of capacity and performance assessment of all WASAs	All WASAs implement at least 75% of all critical capacity and performance improvement measures	All WASAs implement at least 75% of all essential capacity and performance improvement measures
Establish a Water and Sanitation Academy for WASA staff	Water and Sanitation Academy established Core curricula and faculty development plan formulated Professional and continuing education programmes launched	At least 30% of WASA professional staff undergo continuing professional development in defined technical areas At least 30% of professional staff placements in WASAs achieved	At least 60% of WASA professional staff undergo continuing professional development in defined technical areas At least 60% of professional staff placements in WASAs achieved

CBOs capacities strengthened	Strengthen CBO through their capacity building and registration under the Government Act	Strengthen CBO through their capacity building and registration under the Government Act	Strengthen CBO through their capacity building and registration under the Government Act

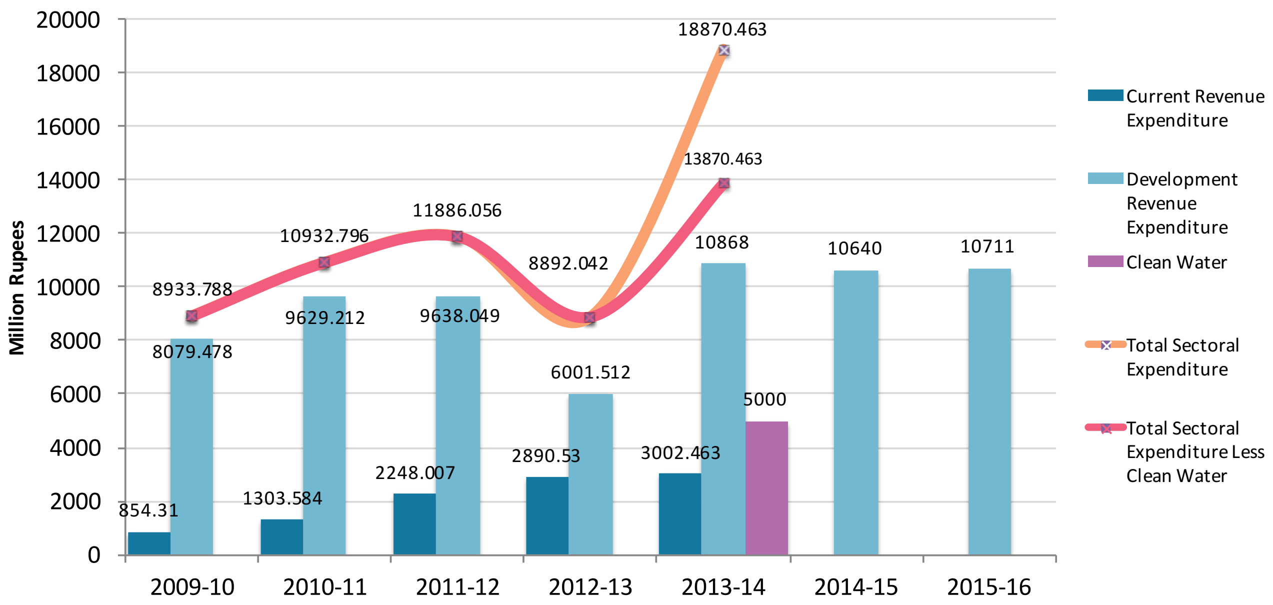
SECTOR FINANCING

Sectoral Expenditure Overview

The Government of Punjab has steadily been increasing its investments in water supply and sanitation, despite major emergencies and disasters in 2010 floods. **Fig 74** illustrates the investment trends from PKR 8.9 billion in 2009-10 to PKR 18.8 billion in 2013-14. Current revenue expenditure has also increased during this period, a significant proportion of which is due to salaries and utilities.

The Government of Punjab has set aside PKR 5 billion for clean water in 2013-14 as part of special projects, excluding which the total sectoral allocation is PKR 13.8 billion. Overall, the increase in development revenue expenditure has been modest from PKR 8 billion in 2009 to an allocation of PKR 10.8 in 2013-14, with similar allocations for 2014-15 and 2015-16.

Figure 74 - Current, development and total expenditure in water supply and sanitation

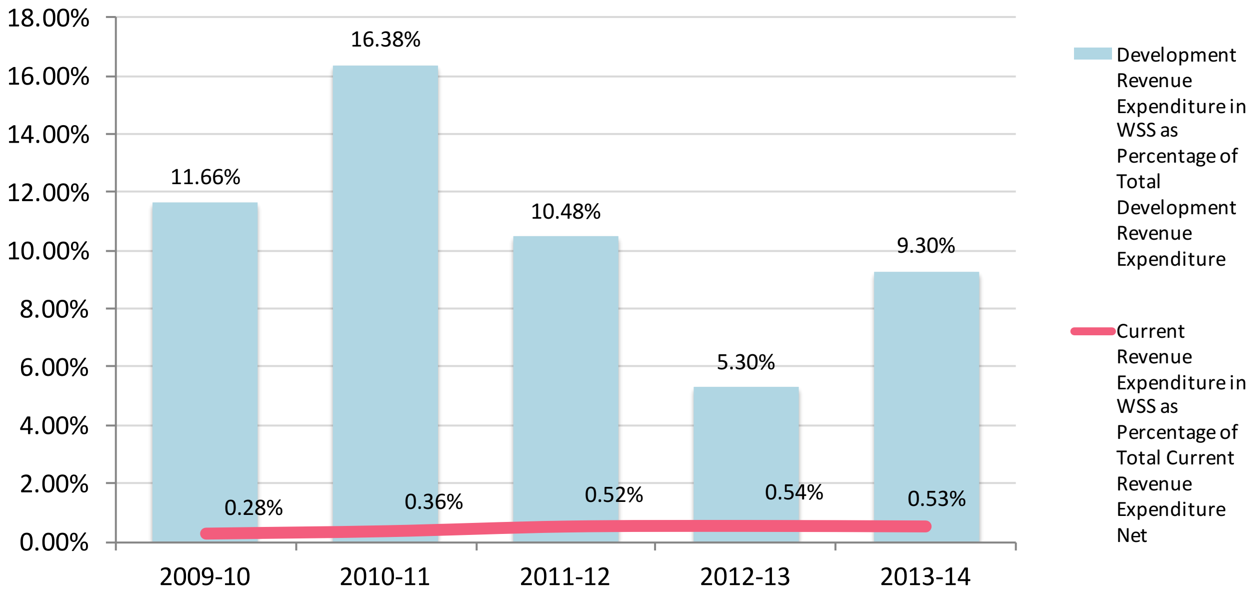


(Source: Annual Budget Statements, Government of Punjab – 2009-10, 2010-11, 2011-12, 2012-13, 2013-14; Punjab Medium Term Development Framework 2013-16)

Sectoral Development Expenditure Trends

The overall development revenue expenditure in water supply and sanitation averages around 10% of total development revenue expenditure. There have been increases to over 16% in 2010-11 and reductions to a little over 5% in 2012-13 (**Fig 75**). The sectoral current revenue expenditure averages to about 0.5% of the total current revenue expenditure net.

Figure 75 - Sectoral expenditure as percentage of total revenue expenditure



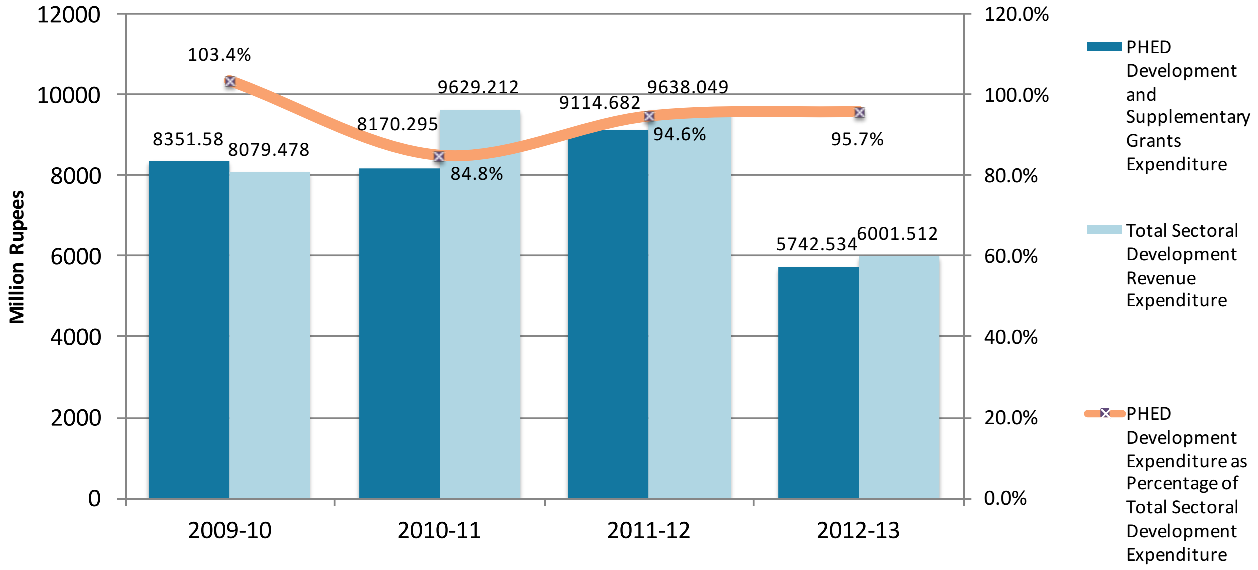
(Source: Annual Budget Statements, Government of Punjab – 2009-10, 2010-11, 2011-12, 2012-13, 2013-14)

Fig 76 illustrates the annual PHED development expenditure (development plus supplementary grants) trends from 2009 to 2013 and shows that about 95% of development expenditure in water supply and sanitation is utilised in the districts.

Figs 77 to 80 indicate the annual status of revised allocation, release and utilisation of development expenditure by the respective districts. The yearly trends show that 95% or more of the allocations are released and that there is almost 100% utilisation.

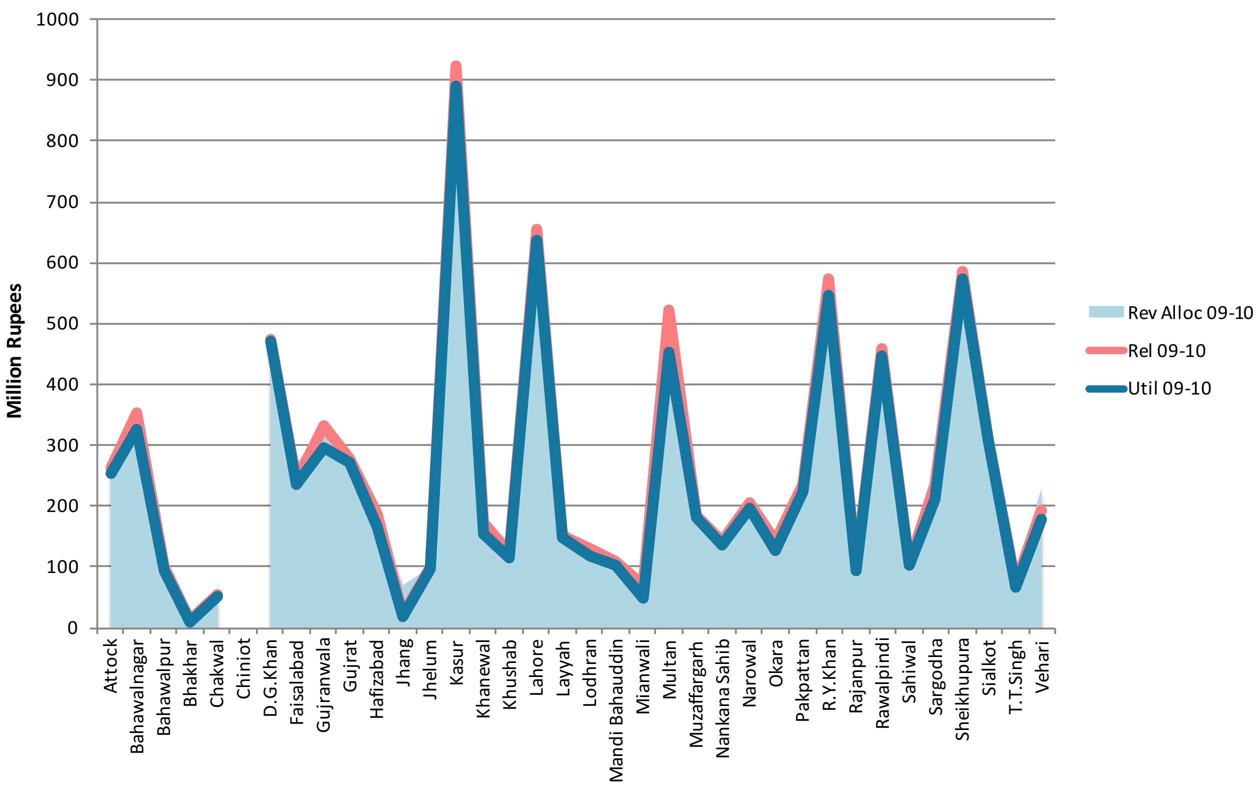
Fig 81 shows the trends in release of development expenditure with most sectoral development investment focused in Gujranwala, Kasur and Sheikhupura, with fluctuations in Mianwali, Multan, Rahim Yar Khan and Rawalpindi.

Figure 76 - PHED development expenditure trends



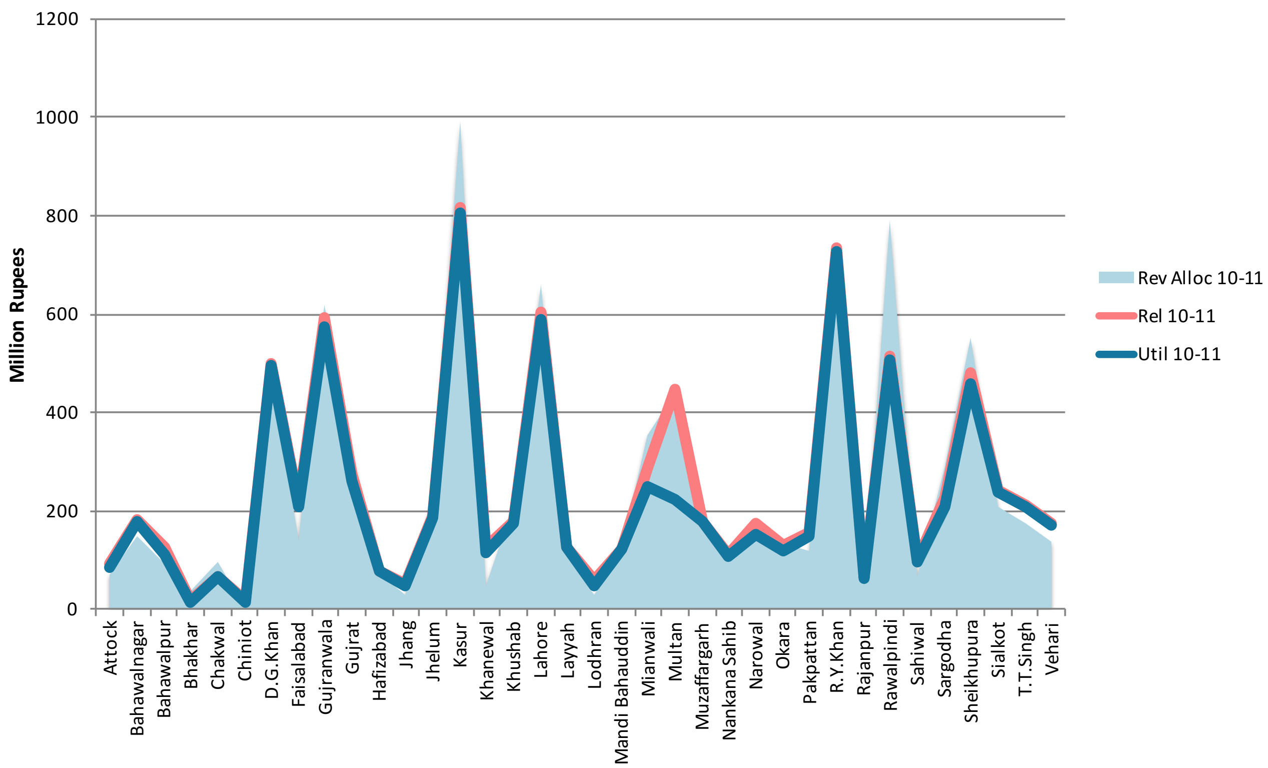
(Source: HUD&PHED 2014)

Figure 77 - Sectoral development allocation, release and utilisation by districts 2009-10



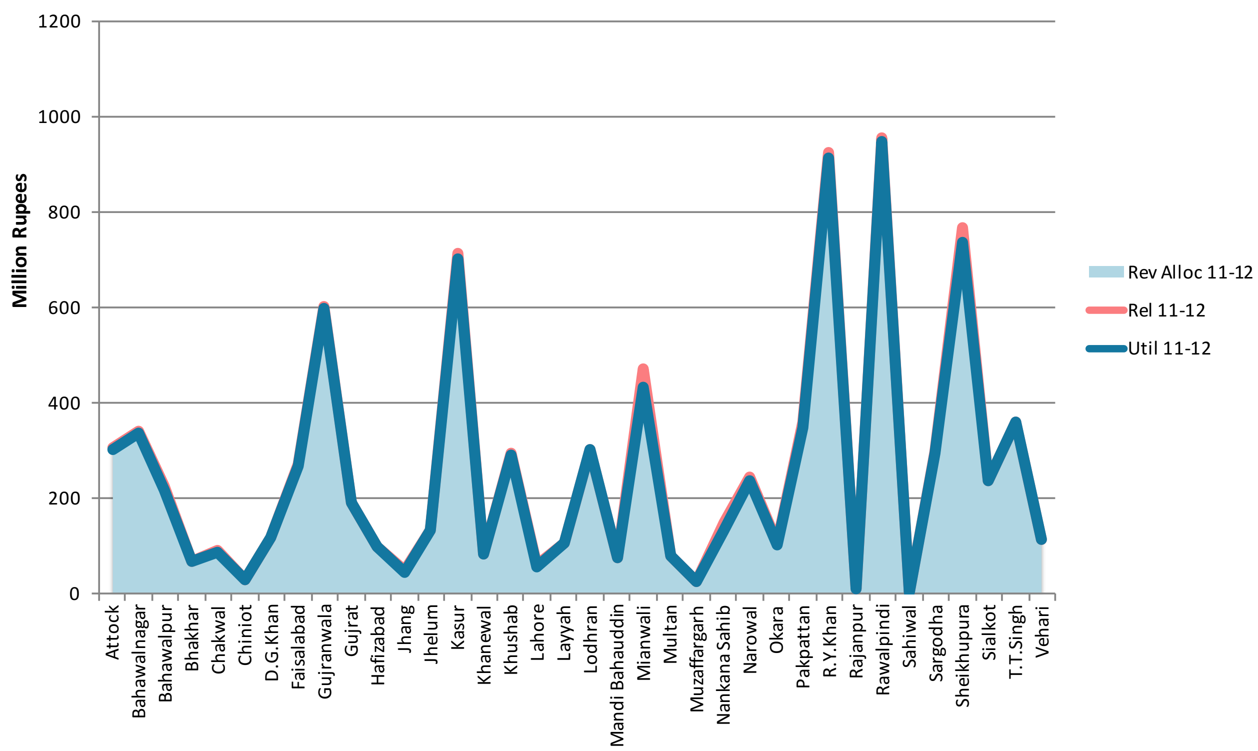
(Source: HUD&PHED 2014)

Figure 78 - Sectoral development allocation, release and utilisation by districts 2010-11



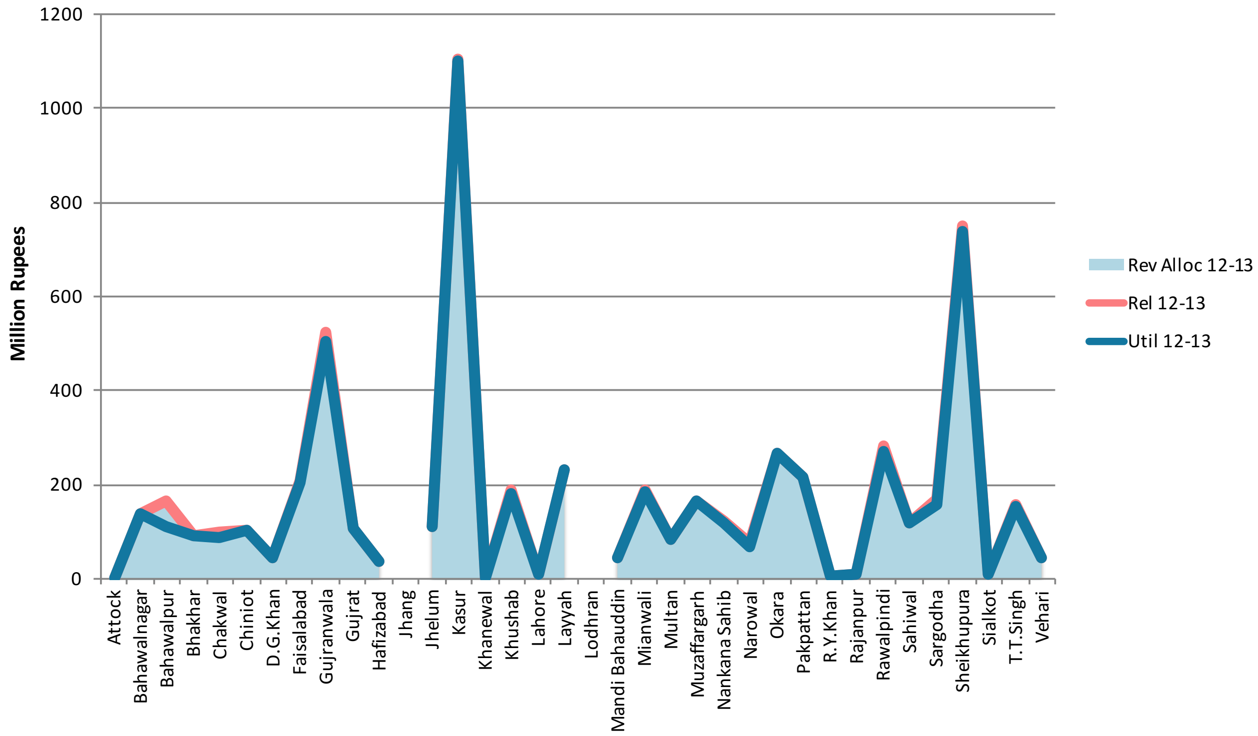
(Source: HUD&PHED 2014)

Figure 79 - Sectoral development allocation, release and utilisation by districts 2011-12



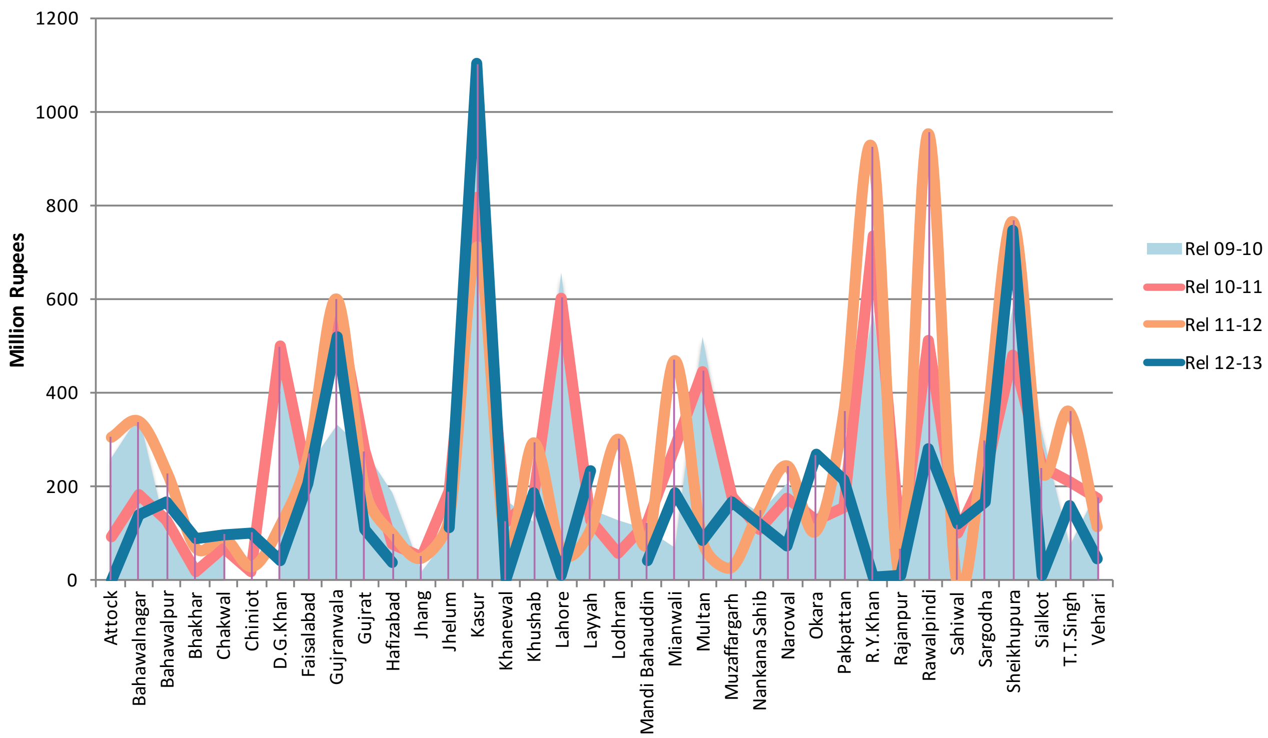
(Source: HUD&PHED 2014)

Figure 80 - Sectoral development allocation, release and utilisation by districts 2012-13



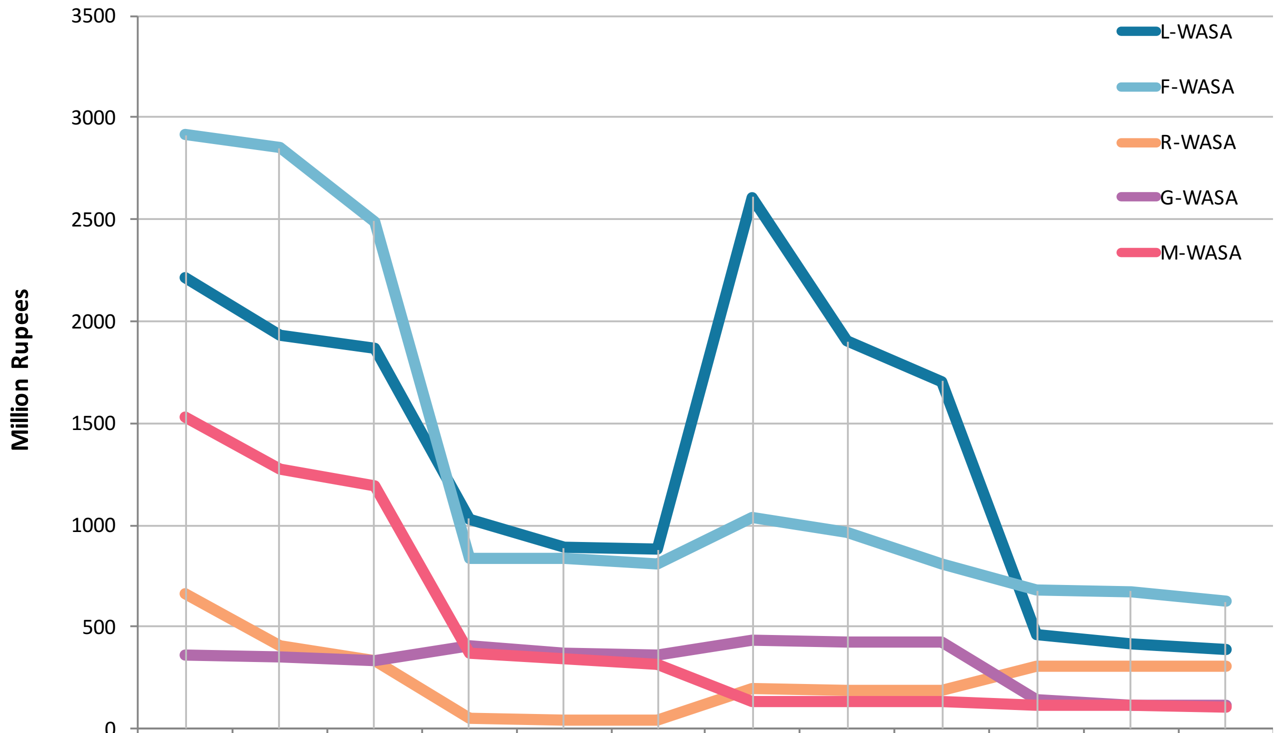
(Source: HUD&PHED 2014)

Figure 81 - Sectoral development expenditure release 2009-2013 by districts



(Source: HUD&PHED 2014)

Figure 82 - Development expenditure revised allocation, release and utilisation by WASAs



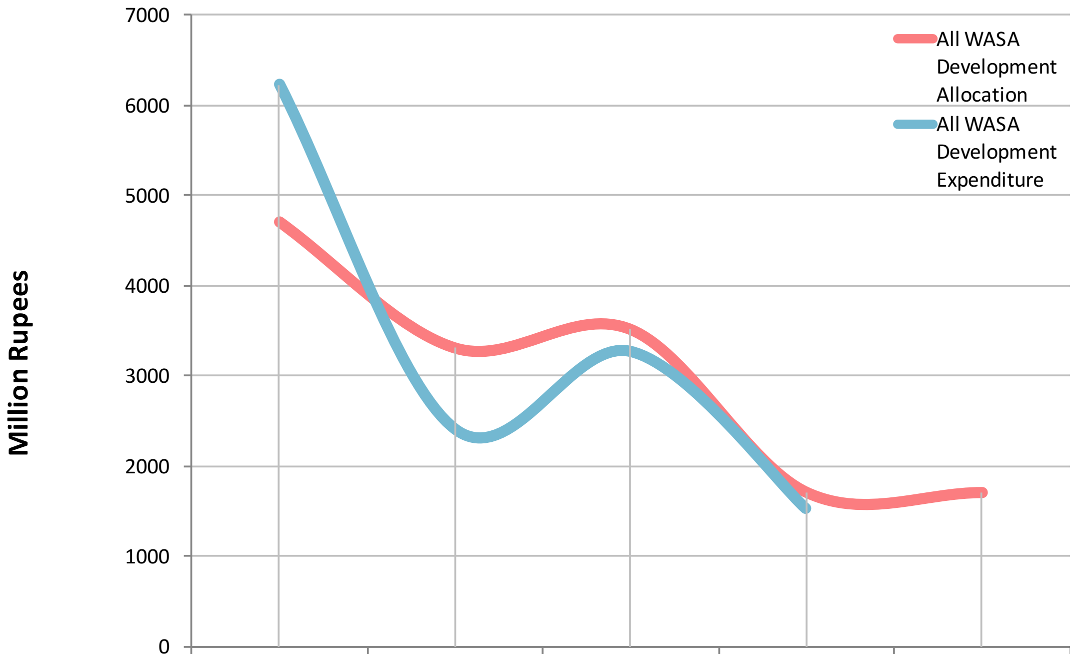
	Rev Alloc 09-10	Release 09-10	Utilization 09-10	Rev Alloc 10-11	Release 10-11	Utilization 10-11	Rev Alloc 11-12	Release 11-12	Utilization 11-12	Rev Alloc 12-13	Release 12-13	Utilization 12-13
L-WASA	2212	1932	1867	1031	890	880	2609	1901	1708	465	415	390
F-WASA	2916	2851	2493	839	837	810	1039	969	810	681	675	625
R-WASA	665	405	335	48	47	47	195	193	192	307	307	307
G-WASA	364	353	338	405	369	361	432	427	427	148	115	114
M-WASA	1535	1274	1193	372	341	320	138	138	138	114	114	104

(Source: HUD&PHED 2014)

Development expenditure in WASAs has shown a downward trend from 2009-10 to 2012-13, with one upward spike for Lahore WASA in 2011-12 (**Fig 82**).

Fig 83 illustrates overall downward trend of WASA development expenditures. It also shows that for 2011-12 and 2012-13 there was 90% or more utilisation of the allocation.

Figure 83 - WASA Development Allocation and Expenditure trends



	2009-10	2010-11	2011-12	2012-13	2013-14
All WASA Development Allocation	4718	3312	3518	1703	1701
All WASA Development Expenditure	6226	2418	3275	1540	

(Source: HUD&PHED 2014 and Punjab Medium Term Development Frameworks 2009-12, 2010-13, 2011-14, 2012-15, 2013-16)

Sectoral Development Expenditure and Selected Indicators

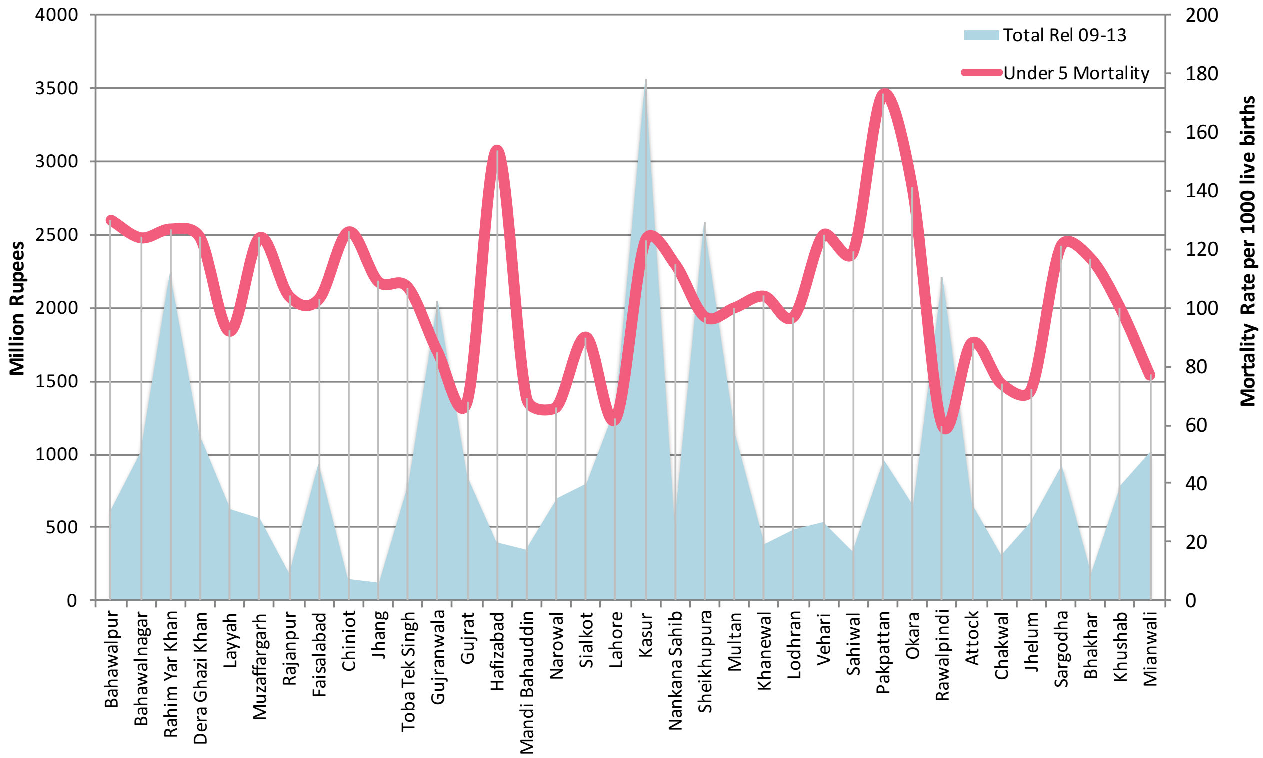
The total development expenditure released to the districts between 2009-13 is compared with the status of Under 5 Mortality, open defecation, use of the hand pump tap and diarrhoea in children under 5 years in the last two weeks. The Punjab MICS 2011 is used as the reference.

Figs 84 – 87 show the following highlights:

- **Child mortality (Under 5 Mortality rate) rates** were generally highest in those districts that had low or least levels of development investment in water supply and sanitation. Rahim Yar Khan, Kasur and Sheikhupura were outliers as they still had high child mortality rates despite comparatively more investment in the sector. While recognising that there are other factors that impact on child mortality, the findings suggest that districts with high child mortality rates are a useful indicator to prioritise resources and interventions
- **Open defecation rates** were consistently high in those districts with low or least level of development investment in the sector, with the exception of Rahim Yar Khan and Kasur that had high open defecation rates despite comparatively high investment.
- The **use of hand pump tap** was consistently high in those districts with low or least level of development investment in the sector, with the exception of Rahim Yar Khan and Kasur that had high hand pump tap rates despite comparatively high investment.

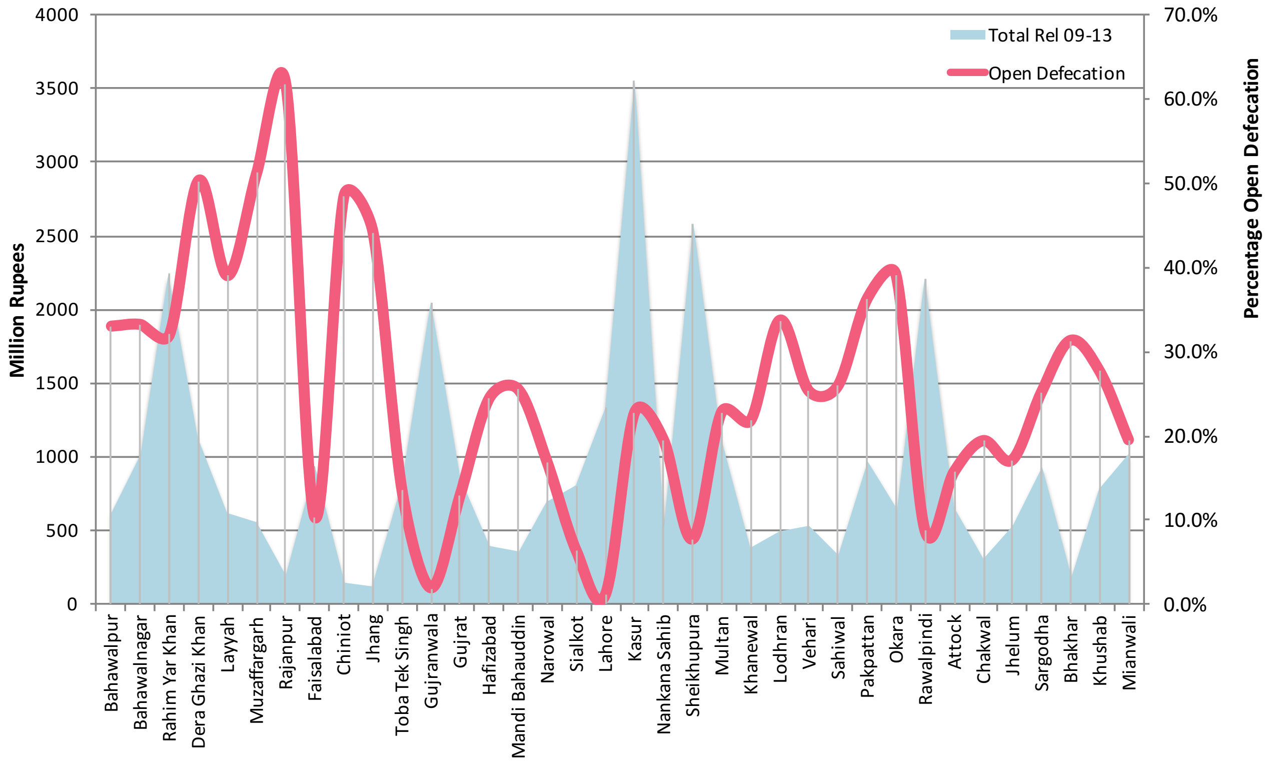
- **Diarrhoea rates** were consistently high in those districts with low or least level of development investment in the sector, with the exception of Lahore, Kasur and Sheikhupura that had high diarrhoea rates despite comparatively high investment.

Figure 84 - Sectoral development expenditure and child mortality



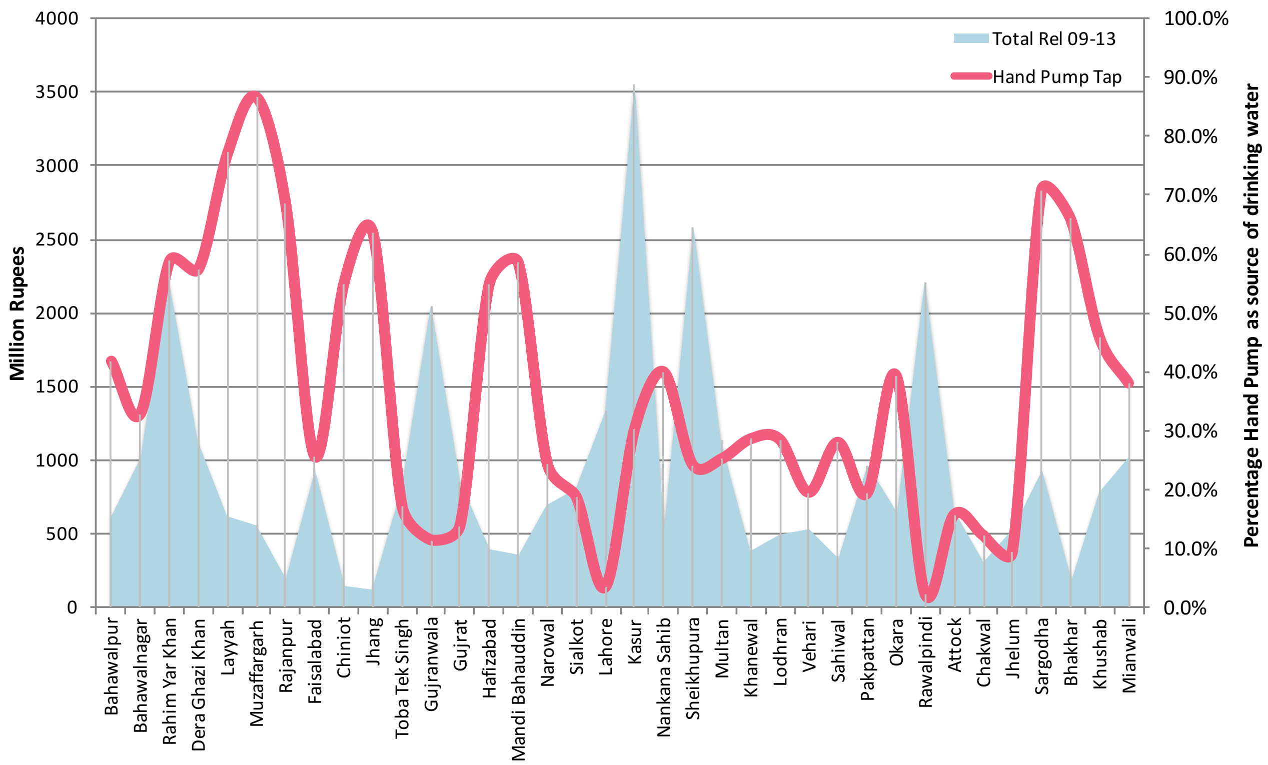
(Source: HUD&PHED 2014 and Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP)

Figure 85 - Sectoral development expenditure and open defecation



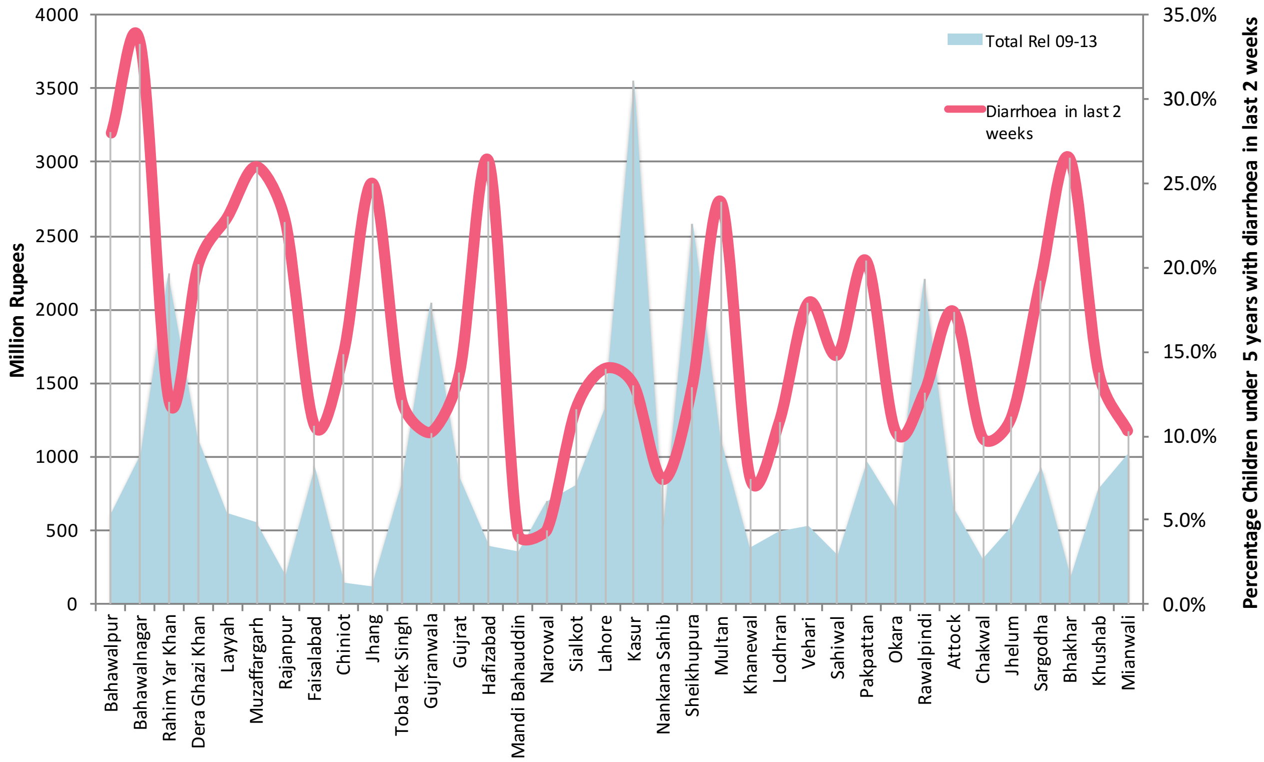
(Source: HUD&PHED 2014 and Multiple Indicator Cluster Survey (MICS) 2011 Punjab)

Figure 86 - Sectoral development expenditure and hand pump tap



(Source: HUD&PHED 2014 and Multiple Indicator Cluster Survey (MICS) 2011 Punjab)

Figure 87 - Sectoral development expenditure and diarrhoea in last 2 weeks



(Source: HUD&PHED 2014 and Multiple Indicator Cluster Survey (MICS) 2011 Punjab)

These findings suggest that while sectoral investment has been steadily increasing especially in industrial cities or more populated areas, it has not always been made in the areas that are also most in need. It also raises the issue that planning for investment in water supply and sanitation should also be determined on equity, health and development factors other than just economic or population factors. Furthermore, the situation in the outlying districts like Rahim Yar Khan, Kasur, Sheikhupura etc. warrant further study to determine the apparently lower social impact of sectoral investment.

Estimating Cost for Sectoral Investment

The Punjab Medium Term Development Framework (MTDF) 2013-16[162] describes the use of MDG targets to establish investment needs for water supply and sanitation in both urban and rural areas. The MDG targets used in the MTDF 2013-16 are as follows:

- Urban water supply – piped water supply coverage 80%
- Rural water supply – piped water coverage 65%
- Urban sewerage and drainage – coverage 82%
- Rural sewerage and drainage – coverage 70%

For the purposes of estimating sectoral investment:

- Urban and rural population estimates are derived from the Punjab Development Statistics 2013[163] estimates
- Status of piped water, hand pump and motor pump is obtained from Punjab MICS 2011[164]
- Status of sewerage system is derived from PSLM 2011-12[165]
- Unit rates for water supply schemes and filtration are obtained from PHED
- Latrine construction is presumed to be the responsibility of the citizens, and therefore sanitation costs refer to sewerage and drainage

Tables 24-26 illustrate the population coverage gaps for both 100% coverage and according to MDG targets in MTDF. **Table 25** provides estimates if filtration is to be used as an option.

Table 24 presents two options – firstly, if 100% coverage is required and secondly if 80% urban and 65% rural coverage with piped water is required. In the latter option, the resource requirement is PKR 217.108 billion for 2014-2024.

Table 25 also presents two options in case filtration plants are required to cover hand and motor pump. The total costs for 80% urban and 65% rural coverage with filtration for hand and motor pump is PKR 140.842 billion for 2014-2024.

Table 26 illustrates various scenarios for sanitation (sewerage and drainage). The total costs for 82% urban and 70% rural coverage with underground drains is PKR 205.893 billion for 2014-2024. If 70% coverage of those with no sewerage system is contemplated, the total costs are PKR 53.394 billion for 2014-2024.

If we consider 80% urban and 65% rural coverage with piped water (PKR 217.108 billion) (**Table 24**), and 82% urban and 70% rural coverage with underground drains (PKR 205.893 billion) (**Table 26**), the total costs are PKR 423.001 billion for 2014-2024 indicating roughly 50% for water supply and 50% for sanitation (sewerage and drainage). This comes to about PKR 42.3001 billion per year.

[162] Medium Term Development Framework 2013-16 and Annual Development Programme 2013-14. Government of Punjab

[163] Punjab Development Statistics 2013. Bureau of Statistics, Government of the Punjab

[164] Multiple Indicator Cluster Survey (MICS) 2011 Punjab. Bureau of Statistics, P&DD, Government of Punjab, UNICEF, UNDP

[165] Pakistan Social and Living Standards Measurement Survey 2011-12. Pakistan Bureau of Statistics, Government of Pakistan

The Government of Punjab is already investing about PKR 12 billion annually in development expenditure in water supply, sanitation and sectoral component in cities improvement. This means that an additional PKR 30 billion per year in development funding has to be allocated to the sector.

The overall funding that would be available would be determined by the resource envelope and expenditure ceilings for sectoral spend.

Table 24 - Estimated costs for water supply

Urban Water Supply	Urban Population	Piped water coverage	Fraction	Population served	Population gap to meet 100% coverage	Population gap to meet MDG target of 80%	Unit Rate of Urban Water Supply Scheme	Total Cost Billion Rupees
100% coverage	31,312,000	38.7%	0.387	12,117,744	19,194,256		6500	124.763
80% coverage	31,312,000	38.7%	0.387	12,117,744		15,355,405	6500	99.810
Rural Water Supply	**Rural Population**	**Piped water coverage**	**Fraction**	**Population served**	**Population gap to meet 100% coverage**	**Population gap to meet MDG target of 65%**	**Unit Rate of Rural Water Supply Scheme**	**Total Cost Billion Rupees**
100% coverage	66,911,000	10.1%	0.101	6,758,011	60,152,989		3000	180.459
65% coverage	66,911,000	10.1%	0.101	6,758,011		39,099,443	3000	117.298
Total costs for 100% urban and rural coverage with piped water								**305.222**
Total costs for 80% urban and 65% rural coverage with piped water								**217.108**

Table 25 - Estimated costs for filtration in urban and rural areas

Urban Water Supply	Urban Population	Pump water coverage	Fraction	Population served with hand and motor pumps	100% coverage of hand and motor pump users with filtration	80% coverage of hand and motor pump users with filtration	Unit Rate of Filtration	Total Cost Billion Rupees
Hand pump	31,312,000	8.5%	0.085	2,661,520				
Motor pump	31,312,000	39.5%	0.395	12,368,240				
Filtration need for 100% hand pump and motor pump				15,029,760	15,029,760		4000	60.119
Filtration need for 80% hand pump and motor pump				15,029,760		12,023,808	4000	48.095
Rural Water Supply	**Rural Population**	**Pump water coverage**	**Fraction**	**Population served with hand and motor pumps**	**100% coverage of hand and motor pump users with filtration**	**65% coverage of hand and motor pump users with filtration**	**Unit Rate of Filtration**	**Total cost Billion Rupees**
Hand pump	66,911,000	44.1%	0.441	29,507,751				
Motor pump	66,911,000	41.2%	0.412	27,567,332				
Filtration need for 100% hand pump and motor pump				57,075,083	57,075,083		2500	142.688
Filtration need for 65% hand pump and motor pump				57,075,083		37,098,804	2500	92.747
Total costs for 100% urban and rural coverage with filtration for hand and motor pump								**202.807**
Total costs for 80% urban and 65% rural coverage with filtration for hand and motor pump								**140.842**

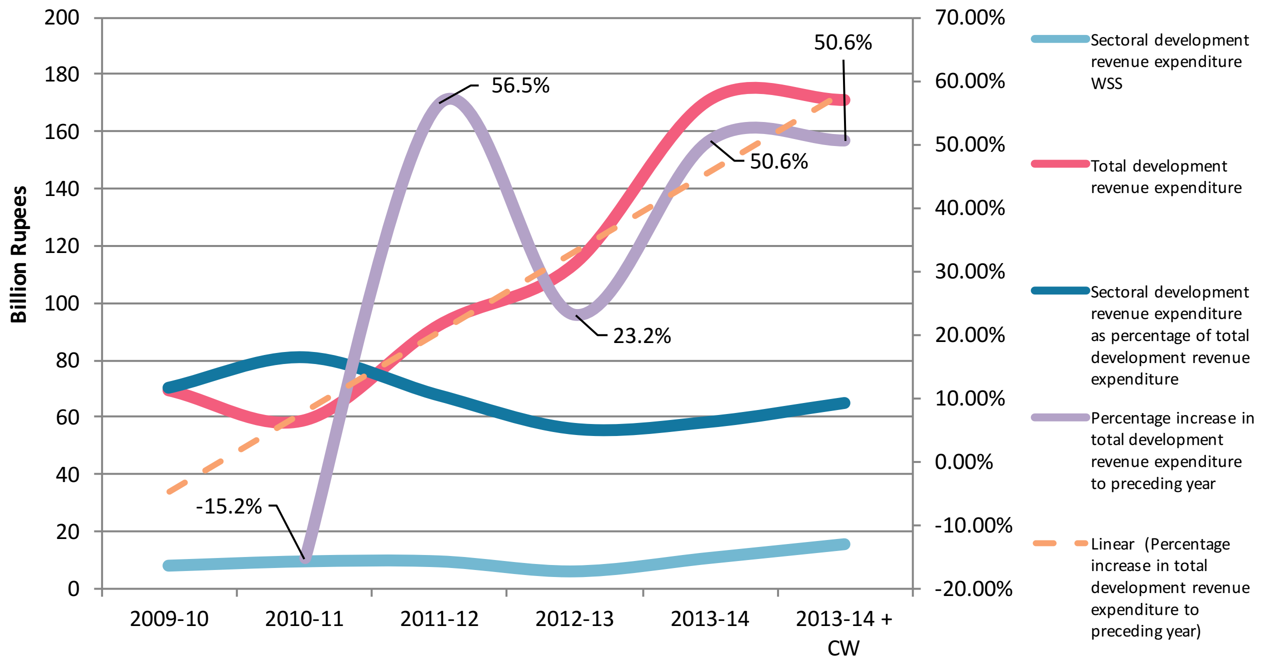
Table 26 - Estimated costs for sewerage and drainage

Urban Sewerage and Drainage	Urban Population	Underground drain coverage	Fraction	Population served	Population gap to meet 100% coverage	Population gap to meet MDG target of 82%	Unit Rate of Urban Sewerage and Drainage Scheme plus wastewater treatment	Total Cost Billion Rupees
100% coverage	31,312,000	53%	0.53	16,595,360	14,716,640		6000	88.300
82% coverage	31,312,000	53%	0.53	16,595,360		12,067,645	6000	72.406
Rural Sewerage and Drainage	**Rural Population**	**Underground drain coverage**	**Fraction**	**Population served**	**Population gap to meet 100% coverage**	**Population gap to meet MDG target of 70%**	**Unit Rate of Rural Sewerage and Drainage Scheme plus wastewater treatment**	**Total Cost Billion Rupees**
100% coverage	66,911,000	5%	0.05	3,345,550	63,565,450		3000	190.696
70% coverage	66,911,000	5%	0.05	3,345,550		44,495,815	3000	133.487
100% coverage of those with no system		38%	0.38	25,426,180	25,426,180		3000	76.279
70% coverage of those with no system		38%	0.38	25,426,180		17,798,326	3000	53.395
Total costs for 100% urban and rural coverage with underground drains								**278.996**
Total costs for 82% urban and 70% rural coverage with underground drains								**205.893**
Total costs for 100% coverage of those with no system								**76.279**
Total costs for 70% coverage of those with no system								**53.395**

Development Revenue Expenditure Trends

Fig 88 illustrates the development revenue expenditure trends and shows that while total development revenue expenditure has increased at an average of 28.79% year on year from 2010-11 to 2013-14 and an average of 43.44% from 2011-12 to 2013-14, the proportion of sectoral development revenue expenditure has averaged between 5% to 10% suggesting that there has not been a proportional increment in sectoral investment.

Figure 88 - Development Revenue Expenditure Trends - total and sectoral



(Source: Annual Budget Statements 2009-10, 2010-11, 2011-12, 2012-13, 2013-14; and Punjab Medium Term Development Frameworks 2009-12, 2010-13, 2011-14, 2012-15, 2013-16)
CW – Clean water special package by Government of Punjab for 2013-14

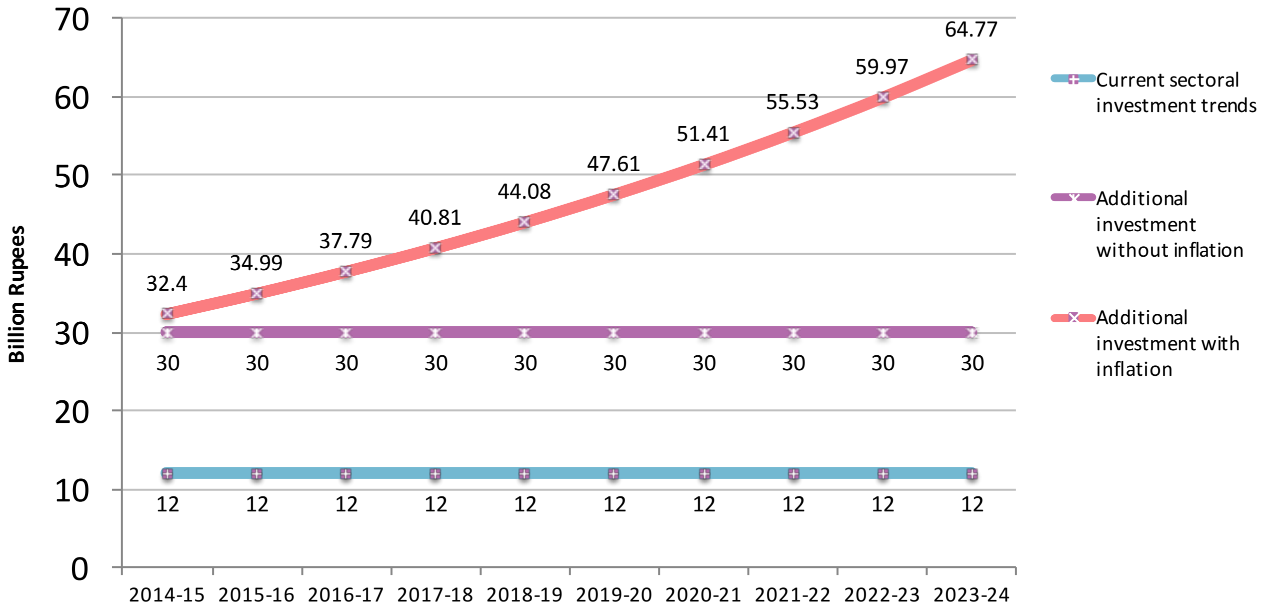
Fig 89 presents existing sectoral development expenditure trends and new sectoral investment requirements. Two scenarios are presented – firstly, without inflation factor, and secondly, with inflation factor.

Inflation has been estimated to be in single digit and is likely to continue into 2015[166]. The current average rate of inflation is about 8%.

For the period 2014-2024,

- Total sectoral investment at current trends (PKR 12 billion per year, which includes about PKR 10 billion for WSS and about PKR 2 billion under urban development) will be PKR 120 billion
- Total additional sectoral investment required (PKR 42 billion – PKR 12 billion = PKR 30 billion per year) without inflation is PKR 300 billion
- Total additional sectoral investment required (at PKR 30 billion per year with 8% inflation factored in per year) is PKR 469 billion

Figure 89 - Sectoral investment scenario with and without inflation



166 Pakistan Economic Survey 2012-13. Ministry of Finance, Government of Pakistan

Fast Track Approach

As per the earlier calculation presented in the strategy to achieve the gaps in the next ten years, PKR 42 Billion were proposed annually, which is about PKR 420 billion for 10 years without inflation. The section below presents the costing if a fast track approach for four years is to be adopted. However, when planning for fast track approaches, it is pertinent to point out that institutional and operational capacities may not have been adequately developed and strengthened to support a shorter delivery time. While taking cognisance of this caveat, three fast track options are presented below.

First Option - 80% Urban and 65% Rural

As per tables 24 and 26, the total estimates for water and sanitation are PKR 423 billion. This includes PKR 217.108 billion for piped water supply (80% urban and 65% rural) and PKR 205.893 billion for sewerage and drainage (82% of urban and 70% rural). The government has a commitment of about PKR 68 billion (17 billion per year as per 2014-2015) with a gap of PKR 355 billion.

Thus, PKR 105.75 billion are required annually to achieve these targets in the next four years, considering the current commitment of PKR 17 billion from the existing budget and an additional PKR 88.75 billion that would be required annually.

For the period 2014-2018,

- Total sectoral investment at current trends (PKR 17 billion per year, which includes about PKR 15 billion for WSS and about PKR 2 billion under urban development) will be PKR 68 billion
- Total additional sectoral investment required (PKR 105.75 billion – PKR 17 billion = PKR 88.75 billion per year), which without inflation comes to PKR 355 billion
- Total additional sectoral investment required (at PKR 88.75 billion per year with 8% inflation factored in per year) is PKR 399.92 billion

Year 1:	88.75 billion
Year 2:	95.85 billion
Year 3:	103.52 billion
Year 4:	111.80 billion
Total:	399.92 billion

Second Option - 100% coverage

As per tables 24 and 26, total estimates for water and sanitation are PKR 584.217 billion. This includes PKR 305.222 billion for piped water supply (100% coverage rural as well as urban) and PKR 278.996 billion for sewerage and drainage (100% coverage rural as well as urban). The government has a commitment of about PKR 68 billion (17 billion per year as per 2014-2015) with a gap of PKR 516 billion.

Thus, PKR 146 billion is required annually to achieve these targets in the next four years, considering the current commitment of PKRs 17 billion from the existing budget and an additional PKR 129 billion that would be required annually.

For the period 2014-2018,

- Total sectoral investment at current trends (PKR 17 billion per year, which includes about PKR 15 billion for WSS and about PKR 2 billion under urban development) will be PKR 68 billion
- Total additional sectoral investment required (PKR 146 billion – PKR 17 billion = PKR 129 billion per year), which without inflation comes to PKR 516 billion
- Total additional sectoral investment required (at PKR 129 billion per year with 8% inflation factored in per year) is PKR 581.29 billion

Year 1:	129.00
Year 2:	139.32
Year 3:	150.47
Year 4:	162.50
Total:	581.29

Open Defecation in Punjab

As per MICS 2011, about 22.9% population of Punjab defecates in the fields. As per Punjab Development Statistics 2013, the population of Punjab is 98.223 million. Based on this, about 22.5 million population of Punjab defecates in the fields.

In 2014-2015, the government has allocated PKR 400 million for ending open defecation. The PHED & HUD and Local Government departments have estimated an average per capita cost of PKR 75 for ending open defecation (this includes cost of capacity building, social mobilisation and monitoring and evaluation). Overall, PKR 1.687 billion will be required to achieve Open Defecation Free status for 22.5 million population. An estimated PKR 421.9 million is required for each year. With 8% inflation, a sum of PKR 1901.2 million will be required in four years.

Year 1:	421.9 million
Year 2:	455.7 million
Year 3:	492.1 million
Year 4:	531.5 million
Total:	1901.2 million

Other Sectoral Investment Considerations

While the previous section has presented new development costs, there is still considerable sectoral development that needs to take place in terms of rehabilitation, maintenance, and upgrading of existing systems.

Water Supply

Under the ongoing programme, 68 water supply schemes (37 Urban and 31 Rural) are being executed at a total cost of PKR 8.593 billion. These would need to be factored in overall sectoral investment planning[167].

Many tube wells are shallow tube wells that need to be replaced to depths beyond 500 feet. In addition, there is need for rehabilitation of older/malfunctioning tube wells and their control gear.

Presently, many tube wells lack any system of monitoring water flows and therefore need installation of bulk flow meters and pressure gauges at tube well. Also, water treatment modalities are lacking and there is need to provide chlorinators.

In order to cater for periods of water shortage, there is need for additional storage capacity in the form of large capacity elevated reservoirs, which also implies need for chlorination and sufficient tube well capacity. An alternate power source is required, which may be in the form of standby generators or solar powered generators (a successful pilot has been carried out in Gujrat using a solar powered generator).

With increasing demand and power shortages, provision of large diameter mains and phased replacement of old and leaky distribution mains and connections is required.

Present tariff setting is low together with low billing and collection efficiency. Household metering would need to be introduced, which may initially need to be phased in selected zones e.g. high income to ensure that a certain proportion of O&M costs are met through revenue generated and that the poor areas are not deprived of service. The household metering will also have an initial capital investment cost.

In urban areas with ample precipitation, rainwater harvesting initiatives would need to be taken, initially to meet part of non-domestic municipal water use like washing streets, watering plants and gardens, general cleaning services etc.

The issue of groundwater recharge is of particular importance as per capita availability of water declines. The role of storm water holding areas, where space is available, would need to be considered.

Water quality has been noted as a vital component of provision of a clean and safe drinking water supply. This will require periodic water quality assessments, and therefore functioning and efficient water testing laboratories.

[167] (Source: Punjab Medium Term Development Framework 2013-16 and Annual Development Plan 2013-14)

Sewerage and Drainage

Under the ongoing programme, 74 sanitation schemes (31 Urban and 43 Rural) are being executed at a cost of PKR 10.1847 billion. These would need to be factored in overall sectoral investment planning[168].

Sub-sector investments in this area are of critical importance both from health and environmental perspectives.

One of the challenges is how to attenuate storm water flows to sewers and to separate sewerage and storm water streams. In urban areas, this would require remodelling of drain flows, to attenuate as much as possible if not separate completely storm water flows to sewers.

Existing sewage flow capacity may be impeded due to choked and silted sewers as a result of inadequate O&M. Periodic sewer de-silting and sludge removal, and safe sludge disposal would need to be done in collaboration with solid waste management ensuring health and safety of sanitary workers.

There is a general deficiency of equipment for sewer maintenance. Based on city-wise and town-wise gap analysis, sucker/jetting machines, sucker machines, jetting machines would need to be provided and maintained.

One of the challenges facing existing drains and sewers is defective or non-functional pumping stations. Consideration would need to be given to rehabilitation of pumping stations.

Evidence shows that 53% of rural and 38% of urban areas in Punjab have open drains. This is an unimproved method of sanitation. Therefore, a phased replacement of drains by sewers would need to be instituted but first ensuring that O&M is made available.

As metropolitan and municipal service areas expand, and even in existing areas with overly surcharged sewerage systems, construction of new collector sewers and branch sewers would be required.

A consistent deficiency that has been noted is the lack of adequate wastewater treatment. While widespread wastewater treatment plants (WWTPs) may not be possible in all mega and intermediate cities and towns by 2024, a phased plan to establish WWTPs initially in the mega cities and intermediate cities would need to be accelerated as part of a cities improvement programme. At the same time, where opportunities and feasibility exists, WWTPs may be need to piloted at TMA level. A high level technical consultation may be required at provincial level to provide guidance on type of WWTP to adopt (e.g. waste stabilisation ponds, constructed wetlands, aerated lagoons and trickling filter, biological reactors etc.) in various urban and rural settings.

The issue of untreated industrial wastewater and its implications for contamination of surface and groundwater, and the health risks posed by it need urgent attention. While it may not be possible to have systems in place for full coverage of wastewater treatment from industries, a certain percentage of industrial wastewater would need to be treated and coverage enhanced in a phased

[168] (Source: Punjab Medium Term Development Framework 2013-16 and Annual Development Plan 2013-14)

manner over time. In the short to intermediate term, options like Common Effluent Treatment Plant (CETP) may need to be considered for a cluster of industries.

Periodic wastewater quality assessment is required to monitor environmental quality standards, which carries its own cost.

Solid Waste Management

The Chief Minister's Special Initiative on Solid Waste Management in Punjab is likely to bring about a paradigm change in SWM in the province. Situation analyses from over 60 TMAs have shown that there is a consistent lack of infrastructure, equipment capacity and technical/management capacity.

For upgradation of SWM services, capital costs would need to be incurred for household collection containers, commercial/institutional containers, community pushcarts, waste collection trucks (5 m^3 and 10 m^3), arm roll trucks (5 m^3 and 10 m^3), arm roll containers (5 m^3 and 10 m^3), and development of waste equipment storage areas.

Collection and transfer of solid waste would need to be linked with construction of sanitary landfill sites, initially for large and intermediate cities, and interim but effective measures adopted for smaller towns and villages.

A solid waste management plan[169] proposed for Sialkot city has indicated that the capital and infrastructure development costs for a solid waste management plan (including construction of a sanitary landfill site) is likely to cost about PKR 1.7 billion per million population.

Privatisation

In view of the successful application of a private enterprise model in Lahore for solid waste management and setting up of the Punjab Municipal Development Fund Company, consideration may need to be given to establishment of water and sanitation companies in intermediate cities and larger towns for integrated water supply, sewerage and drainage, and solid waste management.

There is also merit in considering 'term' contract to cover maintenance and repair of tube wells and improve billing and collection efficiency.

However, while privatisation is a good option and deserves scaling up in selected urban areas of Punjab, the municipal services should not be absolved of their roles and responsibilities as enshrined in the Punjab Local Government Act 2013.

Government municipal services (water supply, sewerage and drainage, solid waste) must be continuously developed and upgraded and therefore require investment, its technical and

[169] Sialkot Solid Waste Management Strategy and Action Plan 2010. Punjab Cities Improvement Investment Programme. Urban Unit, Government of Punjab

management capacities strengthened, and appropriate and feasible zoning of service areas defined for municipal and privatised services.

Climate Change Adaptation and Mitigation

Data from the Intergovernmental Panel on Climate Change[170] suggests that in South Asia, regional countries need to invest at least 0.2% of their GDP on building their adaptive capacity. It is vital that water and sanitation programmes incorporate mitigation and adaptation measures to climate change.

Currently, public sector investment in water and sanitation in Pakistan is about 0.18% of GDP[171], and the overall sectoral investment (government investment, revenue, investment by national and international partners) is about 0.26% of the GDP[172]. In Punjab, the investment in water and sanitation is about 0.12% of provincial GDP.

This suggests that strengthening the mitigation and adaptive capacities of the sector to climate change alone will require a doubling of current investments.

Technical Capacity

The investment planning scenarios presented earlier do not take into account technical capacity building, training and continuing professional development needs in the sector. There is need for establishing new training institutes and initiating graduate, postgraduate and continuing professional development capacity building programmes for the sector

School Education Department and Missing Facilities

The School Education Department has allocated PKR 8.00 billion for provision of missing facilities in schools during 2014-15. Out of this allocation, 20% funds shall be used for the provision of toilets and usable drinking water in schools. This funding needs to be sustained in future years.

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[170] The cost to developing countries of adapting to climate change. World Bank 2010

[171] PRSP Progress Report Fiscal Year 2011-12. PRSP Secretariat, Finance Division, Government of Pakistan

[172] Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) Pakistan Country Report 2013

Strategy

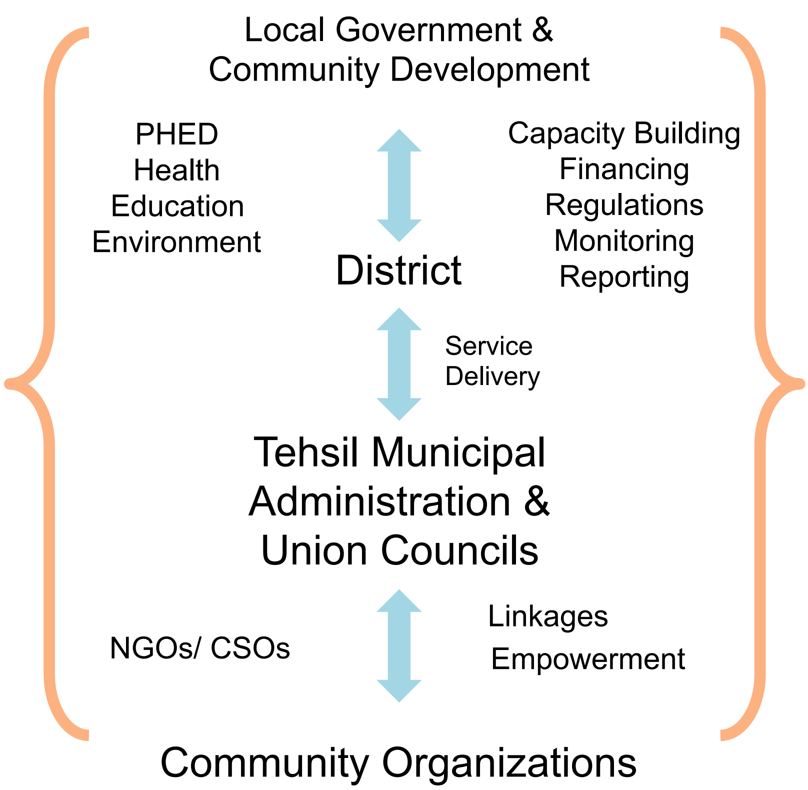
Sector Financing			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Increased Own Source Revenue (OSR) in sub-sectors by TMAs	Incentivise by providing matching grants to TMAs related to sub-sector OSR At least 30% of TMAs increase their baseline sub-sector OSR by 100% or more	At least 60% of TMAs increase their baseline sub-sector OSR by 200% or more	At least 75% of TMAs increase their baseline sub-sector OSR by 300% or more
Increased regulated private sector participation in sub-sectors	Incentivise private sector with subsidies to provide water supply, filtration plants, O&M services, rehabilitation of dysfunctional schemes, solid waste management, wastewater treatment in selected areas and city and town zones Determine type of contract arrangement and ensure regulatory mechanism in place	At least 30% or more of coverage of municipal services in mega cities provided by private sector At least 30% or more of coverage of municipal services in intermediate cities provided by private sector At least 25% or more of coverage of municipal services in TMAs provided by private sector	At least 60% or more of coverage of municipal services in mega cities provided by private sector At least 60% or more of coverage of municipal services in intermediate cities provided by private sector At least 50% or more of coverage of municipal services in TMAs provided by private sector
Increased development expenditure allocation to sub-sectors	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 80% of sector development allocation requirement and release achieved	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 90% of sector development allocation requirement and release achieved	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 100% of sector development allocation requirement and release achieved
Punjab Town Improvement Programme	Town Improvement Programme for 105 towns developed that incorporates integrated water supply, sewerage and drainage, wastewater treatment and solid waste management, and climate change adaptation and mitigation	Town Improvement Programme launched in 20% of TMAs	Town Improvement Programme launched in 40% of TMAs
Fast track approach for declaring priority districts ODF	At least 30% of 11,904 villages in priority districts declared ODF	At least 60% of 11,904 villages in priority districts declared ODF	At least 90% of 11,904 villages in priority districts declared ODF

SECTOR COORDINATION

Institutional Arrangements

The Constitution of Pakistan designates local government, drinking water supply, sanitation, solid waste, rural /urban development as provincial subjects. Since promulgation of the Local Government Ordinance 2001, municipal services including water supply, sanitation and solid waste management are the responsibility of TMAs (**Fig 90**). However, the new Punjab Local Government Act 2013 envisages the restoration of the former mayoral system for the metropolitan cities, and chairman led district councils. The rural-urban divide has once again been instituted. In rural areas, the union councils and zila (district) councils will be responsible for services; while in urban areas and the metropolis, metropolitan, municipal corporation, municipal and town committees will be restored. Presently, TMAs are functional under a transition period until the new local bodies election take place, as these elections are pending since October 2009. Urban water and sanitation authorities in six cities of Punjab are entrusted to deliver municipal services under supervision of the local governments.

Figure 90 - Institutional set-up



The responsibility of planning, funding, regulating, monitoring and service delivery for water and sanitation at district and sub-district levels rests with Local Government and Community Development Department in association with Public Health Engineering Department of Punjab.

The sector is overseen by a number of departments, including Local Government, Rural Development section in Planning and Development Department, Works and Services, Health, Education for WASH in schools and Public Health Engineering Departments (PHED). The Local Government through TMAs works with PHED for seeking technical support in infrastructure development especially in relation to complex schemes. The local community organisations are responsible for operation and maintenance of water supply schemes under PHED, and similar emphasis is being given to sanitation interventions through Local Government. Very recently, detailed guidelines for developing effective community based organisations have been developed by both governmental departments that provide the basis for developing effective linkages and voices of the communities.

Pakistan Approaches to Total Sanitation (PATS) is being rolled out in Punjab with an active social mobilisation strategy by building a cadre of human resources who inspire and empower the communities to construct technically sound and viable latrines which are connected to a secure disposal system and achieve total sanitation status, adopt sustainable hygiene practices and continuously use improved sanitation facilities. Presently, Local Government and PHED have worked for developing a framework of PATS that promotes synergies and develops linkages among key actors including national and international partners. It is noted that many initiatives/pilot taken by the civil society partner organisations for scaling up of PATS and WASH programmes are not well embedded with Government, PHED and TMAs programmes and initiatives. Resultantly, these pilot initiatives are not scaled up, as there are gaps in the understanding of the stakeholders about government operational mechanisms.

It is also recognised that government priorities are often driven by the political agenda derived from political party manifestos, and advocacy of the international and national partners based on research and evidence. A number of research institutes and universities in Punjab have conducted research on water, sanitation, wastewater and solid waste management for the province but evidence generated from these studies has not been widely disseminated or used in the planning and execution of WASH programmes. There is a strong need for identifying a water and sanitation research agenda that feeds into the development of new programmes and initiatives of the government of Punjab.

Different provincial departments responsible for WASH are in need of developing an integrated approach to envision and design common implementation plans that are owned by multiple departments and supported by all major support organisations. Currently, issue specific coordination arrangements through different committees exist in the province where stakeholders share their perspectives and initiatives, but there is no single coordinating focal point that holds the different sub-sector strands together. Resultantly, there is a compelling need for a specific provincial mechanism that takes the responsibility of coordination with WASH stakeholders and for setting and delivering the agenda of WASH in collaboration with other stakeholders.

Stakeholder Perspectives

In order to obtain stakeholder perspectives regarding WASH and its implication for sector planning, a sample of various types of stakeholders was interviewed and their responses were then synthesised to draw out commonalities.

Each stakeholder was asked the same set of questions. The questions covered in the consultation process included the following:

1. Please can you provide an overview of your organisation's work in Punjab Province including the coverage and access to water and sanitation separately?
2. What are key sources or areas of financing/funding that is extended by your organisation? Level of funding may be explored?
3. How do you perceive the 'fit' of your interventions with Punjab Government strategies for water and sanitation sector? Any challenges as well as opportunities?
4. Please can your share key strengths and weaknesses of WASH in Punjab along with opportunities and constraints?
5. What steps do you suggest to the Government of Punjab to address inequities especially rural and urban divide as well as poverty? This should be elaborated for sanitation, hygiene and water separately?
6. How do you think the challenge of coordination and collaboration for WASH sector in the province should be addressed?
7. What are key priorities of your organisation in the province for the next five to ten years?
8. Any other feedback or comments?

The key themes and conclusions that emerged from the analysis are presented below.

1. Holistic approach towards WASH

WASH is comprised of important components of clean drinking water, sanitation and health sector activities. Within the sanitation sector, sewerage, drainage and solid waste collection systems are important segments. All these activities are interlinked and affect positively or negatively, the overall environment and human health. The WASH sector, therefore, is dependent on each other's activities and is inextricably integrated as a cycle of activities. Facilitation in implementing any single activity may create a vacuum in the required holistic approach towards WASH. During consultations, it has been noted that there is a pressing need to ensure a holistic approach towards development of WASH with coordination of all government and non-government implementing partners.

2. The Roles and Responsibilities of Facilitators and Beneficiaries

As per the conventional approach, a district, tehsil or UC level local government is responsible for provision of the WASH sector facilities to the masses living in rural and urban areas. With the advancement in sustainable development approaches, the beneficiaries could ideally be made responsible for ownership of some of these activities with the view to ensure their O&M and hence their sustainability. This multi-prong approach can enhance developmental tempo by trickling down the ownership at the grassroots level entrusting the people to take charge of these facilities. The sponsoring government can then focus on enhancing WASH coverage or undertaking new developments for it.

3. Coordination among Stakeholders

During the consultation process, vertical and horizontal coordination among specific stakeholders was found missing. They were not aware about the areas of work and nature of WASH activities of different organisations active in the sector/sub-sectors. It was also apparent that overlapping sometimes occurred in terms of the activities and beneficiaries. To ensure productive use of resources, the future planning process in WASH should focus on addressing this vacuum.

4. Adoption of Uniform Approach

The uniform approach in WASH sector activities was yet another missing link. For example, a package of hygiene activities needs to be designed for school children with clear emphasis on hand washing, proper use of toilets, and awareness about preventive measures against common water and sanitation related diseases. This standardised package should be implemented in all schools to enhance health protection and promotion.

5. Area/ Activities Coverage

A number of organisations are not covering specific geographical areas or all activities of the WASH sector. Moreover, the working of some organisations is just confined to only piloting. The partial coverage or pilot activities, if not replicated at scale, may not address the real objective of wider coverage of WASH. A number of organisations are now adopting this approach of scaling up, which after proper planning, should be streamlined. Various organisations could be assigned specific area(s) or activities in the WASH sector across all areas.

6. Sustainability

During the consultation process, it was noted that physical implementation was the predominant activity in WASH, whereas the responsibilities of O&M, despite being a vital factor for sustainability, was found very weak and did not receive the attention it deserved. In the future WASH sector plan, it should be made mandatory that all WASH activities should include in their design a built-in mechanism of O&M responsibilities, preferably to be entrusted to the beneficiaries at tertiary level.

7. Awareness about WASH

It has been generally observed that awareness of the communities about WASH was a weaker aspect of the sector. The starting point of this sector should, therefore, include awareness, mobilisation, and sensitisation campaigns followed by physical implementation.

8. Replication at scale

Organisations have developed pilot or prototype activities in WASH sector successfully but without any plan of taking these prototype activities to scale. Eventually, trained human and financial resources are required for this purpose, which in most cases were not adequately arranged. In order to benefit from these prototype R&D, the availability of partners and resources should be made part and parcel of the plan otherwise it may result in a futile exercise.

9. Long term Planning Process

Most of the organisations were doing their planning on yearly basis without making comprehensive long term periodic planning. It could be due to uncertainty of resources. Nevertheless, working on short-term planning basis may jeopardise proper and sustainable use of available resources. A long-term planning process is essential to extend coverage to the designated areas or communities.

10. Resource constraints

Generally, financial resources are a major constraint towards effective planning and implementation of WASH sector activities in the province. To work under resource constrained circumstances, sector planning has to be done in "phases" focusing on a holistic approach of development in specific areas. Furthermore, there are significant poverty related implications for WASH in targeted communities, as directly or indirectly, it affects the productivity of human beings and their incomes.

11. Capacity Building

There is a general insufficiency in capacity building of the staff in the WASH sector. Moreover, under the integrated approach in development, the beneficiaries should also have the capacity to perform O&M of the WASH sector. Capacity building is a continuous process that extends to professionals, managers, administrators and even beneficiary communities, and therefore should be made part of the overall plan in the province.

12. Rural versus Urban Areas

For the WASH sector, the priority areas are urban centres. Rural areas receive lesser emphasis. These inequities need to be addressed in future planning processes. The poor, however, do benefit from the WASH interventions as the nature of activities of this sector is designed to provide benefits to the poor besides middle and higher income groups.

13. Funding Source

UNICEF has been a major source of funding to a number of NGOs directly and indirectly. The other source was UN HABITAT. However, in the consultation with the LG&CDD, it was noted that the government sector has been promoting public-private partnerships, but that it needs better planning and quick decisions to implement activities of this sector.

14. Role of Public Health Engineering & Health Departments

In the hygiene sector, the role of PHED and health department is very important. These two departments are working in isolation. Therefore, efforts need to be made to incorporate the role of these two departments in the WASH sector with clear mandate and activities.

Strategy

Sector Coordination			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved governance mechanism for coordination	Constitute a Punjab Steering Committee on WASH under the Punjab Water Commission Set up sub-sector Task Forces under the Steering Committee Ensure multi-stakeholder representation as appropriate NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene	Six monthly meetings of Steering Committee and sub-sector task forces Monitor progress of sector development plan and report to Chief Minister NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene	Six monthly meetings of Steering Committee and sub-sector task forces Monitor progress of sector development plan and report to Chief Minister NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene
Improved operational performance and information and knowledge management	Establish a Project Management Unit (PMU) for the sector plan to support the Punjab Water Commission PMU devises M&E framework PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter	PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter	PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter
Special Panel on Research	A Special Panel on Research constituted under the Punjab Water Commission to review existing evidence and	Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste	Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste

	recommend wastewater treatment options for different urban, peri-urban and rural settings Identify gaps where more research is needed Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste Research in Punjab' Report to the Punjab Water Commission and recommend practical applications of the research in the context of the sector development plan	Research in Punjab' Report to the Punjab Water Commission and recommend practical applications of the research in the context of the sector development plan	Research in Punjab' Report to the Punjab Water Commission and recommend practical applications of the research in the context of the sector development plan

SECTOR MONITORING AND EVALUATION

Monitoring and reporting activities in the sector and sub-sector take place at various levels but are fragmented.

At the federal level, the Poverty Reduction Strategy Paper (PRSP) progress report involves an annual review process led by the Ministry of Finance. Coverage is tracked through national household surveys and sector investments obtained through provincial submissions. Financial budget and expenditure data is fed into financial management systems at TMA, district and provincial levels using specific entry codes. The data available against these codes are then grouped for reporting and summarised in the PRSP Progress Reports. Data on water and sanitation coverage are usually obtained from PSLM surveys.

At the provincial level several mechanisms exist for providing overviews. For instance, the provincial PRSP Report, Medium Term Development Framework (MTDF), Medium Term Budgetary Framework (MTBF) and Annual Development Plans (ADP). Generally, the ADP provides the basis for planning, but current arrangements do not support a comprehensive assessment or access to capital expenditure on sanitation and hygiene. In absence of a template for a Sector/sub-sector Performance Report, it is difficult to consolidate the input and output data to have an overall picture of the sector i.e. investments, operational costs, output/outcome data, etc. While each project/scheme does in theory have a project cycle, based on a series of documents from PC-I to PC-V, the end of project evaluation stage (PC-V) is undertaken infrequently, bypassing yet another institutional monitoring mechanism.

Furthermore, there are challenges of coordination for monitoring and reporting due to complexities in the roles and responsibilities of different stakeholders in the government, cantonment boards and defence housing authorities, non-government and private sectors.

Presently, there are four reports/sources that provide information about access to water and improved sanitation. These are as follows:

Pakistan Poverty Reduction Strategy Paper Progress Report (PRSP)

The Ministry of Finance publishes periodic PRSP progress reports and budgetary expenditure reports that include sectoral pro-poor expenditure as part of Pakistan's obligations to achieve the MDGs. These reports obtain data from the provincial finance departments and collate them to present a country and provincial progress report. Water and sanitation coverage statistics is usually obtained from the recent Pakistan Bureau of Statistics publications like PSLM. These reports provide useful information about trends in sectoral spending and projected planned expenditure.

Pakistan Social and Living Standards Measurement Survey (PSLM)

The PSLM is conducted annually by the Pakistan Bureau of Statistics. It provides disaggregated data by province and district, urban and rural, and by quintiles. While essential statistics are covered every year, additional data is obtained every 3-4 years together with a Household Integrated and Economic Survey (HIES) that is conducted with the same periodicity. Additionally, PSLM also collects data on sewerage systems and solid waste collection. However, it does not provide any significant information on hygiene. In addition, PSLM also has statistics on health (e.g. diarrhoea), education, housing etc. The type of WASH related indicators collected in PSLM are shown in **Table 27**.

Multiple Indicator Cluster Survey (MICS) Punjab

The MICS is a province specific survey that is usually conducted every 5-6 years and it has a bias towards child, nutritional and reproductive health. It is conducted by the Bureau of Statistics Punjab in close collaboration with UNICEF. In Punjab, the two recent MICS were done in 2003, 2007-08 and 2011. MICS provides useful and more comprehensive data on sources of water and type of toilet. In addition, it is also rich in hygiene indicators. It disaggregates data by district, education profile and by quintiles. It does not collect any data on sewerage systems or solid waste. The type of WASH related indicators collected in MICS are shown in **Table 27**.

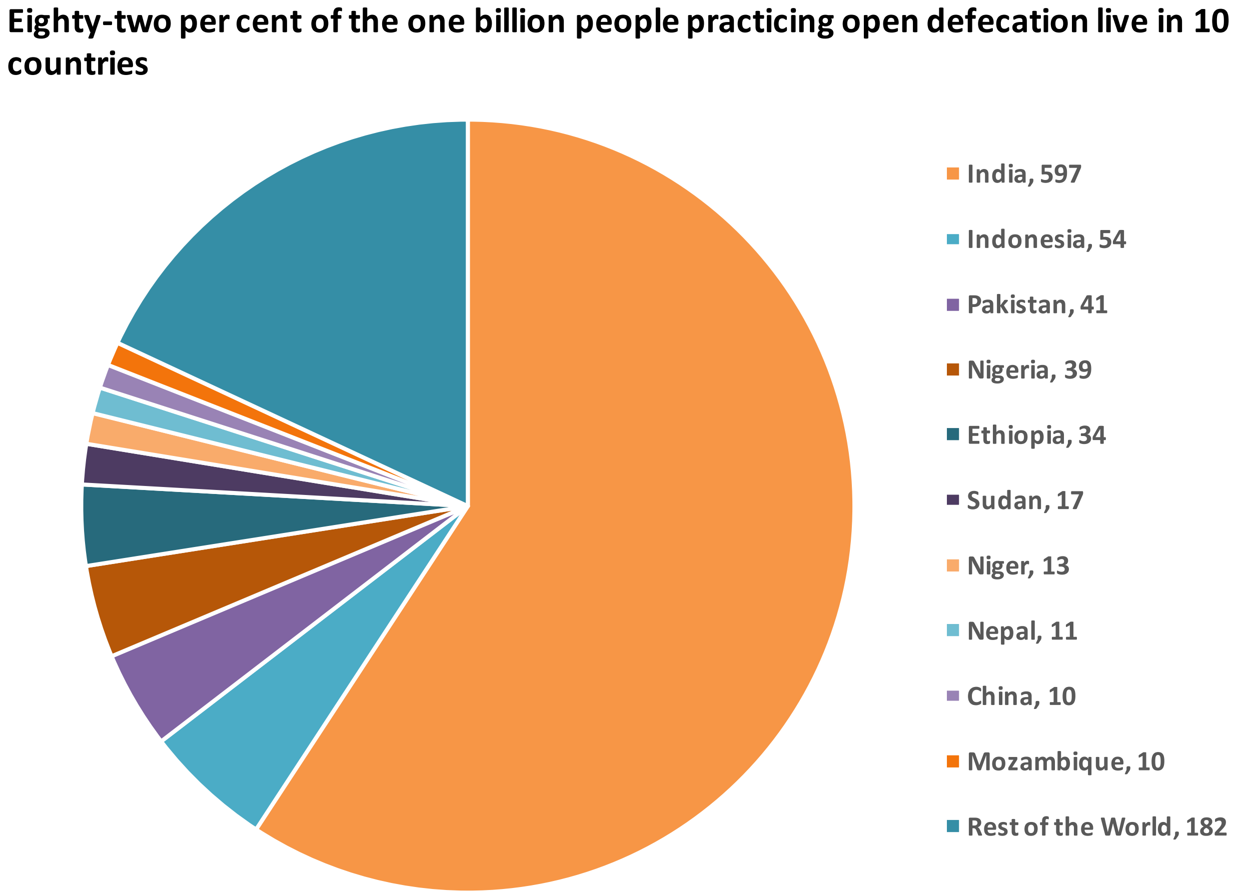
Pakistan Demographic and Health Survey (PDHS)

The PDHS is also a periodic survey conducted every 7-8 years and its main focus is on health and population. It is supported by USAID with contributions from UN agencies like UNICEF, UNFPA, WHO and UNAIDS. It is conducted by the National Institute of Population Studies in collaboration with international partners. It has close similarity to MICS. It does not collect any data on sewerage systems or solid waste. The type of WASH related indicators collected in PDHS are shown in **Table 27**.

Joint Monitoring Programme (JMP) of WHO and UNICEF

The JMP is an official UN mechanism to monitor the progress and achievement of the Millennium Development Goals on water and sanitation. It is conducted every two years and involves review of existing survey data usually about 2-3 years old. The surveys commonly referred to are PSLM and PDHS. JMP utilises regression analysis using population estimates obtained from United Nations Population Division (UNPD). This mechanism provides country trends and an overall picture in water and sanitation for urban and rural. It does not differentiate sub-nationally.

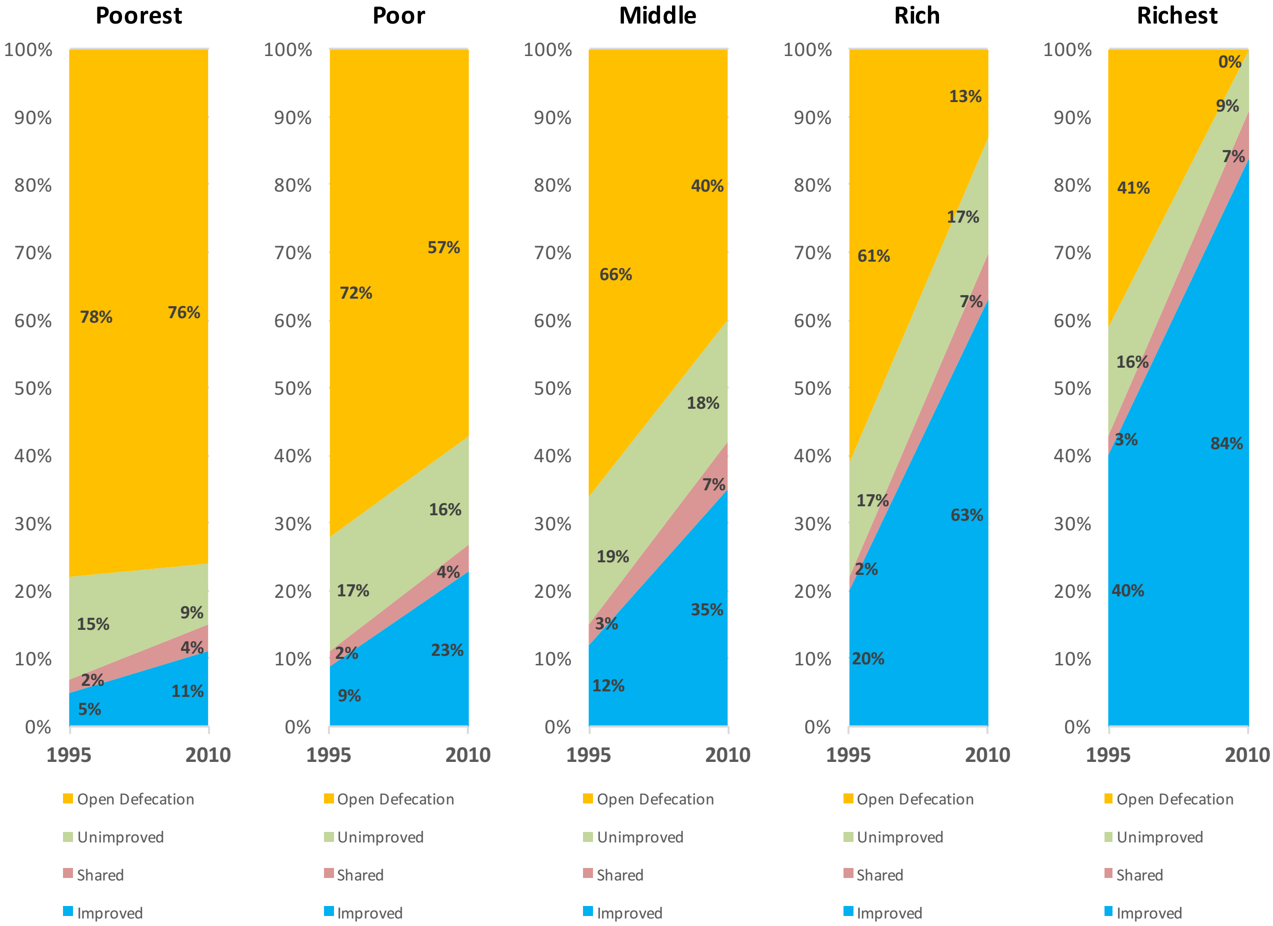
Figure 91 - Top 10 countries with the highest numbers of people (in millions) practicing open defecation



(Source: Adapted from JMP Report 2014)

Fig 91 shows that Pakistan has the third highest number of people practicing open defecation in the world. Evidence shows that most of these reside in Punjab. This is further evident from **Fig 92**, which shows that 76% of the poorest quintile still lacks access to improved sanitation.

Figure 92 - Disparities in rural improved sanitation coverage



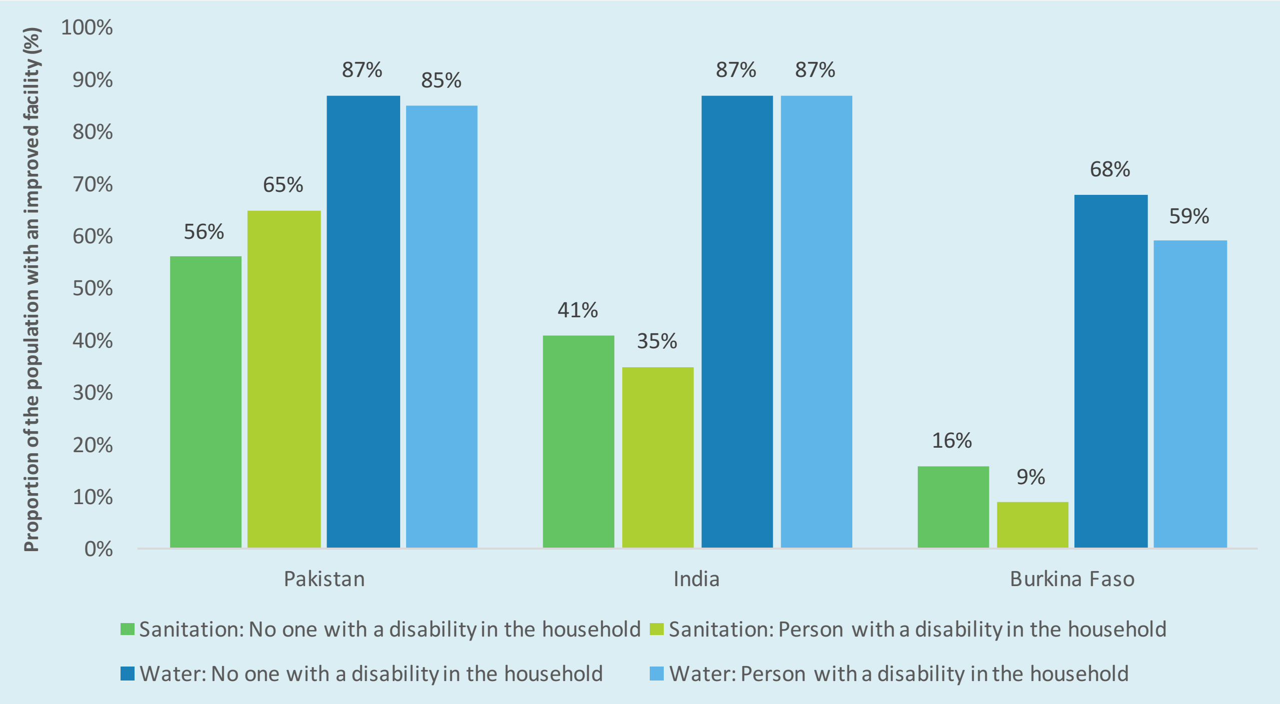
(Source: Adapted from JMP Report 2014)

Disability

Fig 93 presents an interesting perspective of households that have a person with disability in the household. About two-thirds (65%) indicated that the population had access to improved sanitation, while over four-fifths (85%) said that the population had access to improved drinking water sources.

These trends are important as all countries that have ratified the UN Convention on Rights of Persons with Disabilities, of which Pakistan is one of them, are now obliged to ensure that the rights of persons with disability for access to improved and safe drinking water and improved sanitation are implemented in social sector and development initiatives. It also requires development of disability sensitive indicators for water and sanitation services.

Figure 93 - Access to improved drinking water sources and sanitation facilities – disability perspectives



(Source: Adapted from JMP Report 2014)

Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS)

The GLAAS report is a biennial reporting mechanism implemented by WHO and supported by the World Bank. Every two years, a Sanitation and Water For All (SWA) High Level Meeting (HLM) is held in which countries present their progress and outline their commitments. The biennial meetings are jointly hosted by the World Bank and UNICEF at the World Bank/IMF spring meetings. The GLAAS report provides country level data on government investment in WASH; budgeting and expenditure in WASH; WASH coverage of schools and health facilities; the existence of policies and strategies for WASH; the effectiveness of planning, monitoring and evaluation mechanisms; participation and equity, sustainability of water and sanitation initiatives; human resources capacity for WASH; and hygiene promotion especially in schools and primary health care.

Completion of a GLAAS questionnaire is coordinated and facilitated by the Climate Change Division and receives inputs from all provinces. The last report was published in 2014.

Pakistan Water Operators Network

As part of a collaborative project with Water and Sanitation Programme (World Bank), the Pakistan Water Operators Network (P-WON) was formed and consists of all the WASAs in Pakistan. A standard reporting template has been developed that WASAs have to report on every quarter (**Table 28**). P-WON monitoring reports provide information on service coverage, consumption and production, non-revenue water, metering practices, network performance, cost and staffing, quality of service, billing and collection, and financial performance. These reports are available online. Some WASAs are particularly efficient and their quarterly reports are up to date, while some may lag behind in the quarterly reporting.

Tehsil Municipal Administration and Performance Management System (PMS)

As part of the Punjab Municipal Services Improvement Project implemented by the Punjab Municipal Development Fund, capacities of 105 TMAs have been developed in using the PMS. This is a user friendly and practical planning and monitoring mechanism that covers the three sub-sectors – water supply, sewerage and solid waste. The information is readily accessible on the website of each TMA as alluded to earlier. It depends on how motivated the TMO is to keep their respective TMA municipal services information up to date. The types of sub-sector indicators collected in PMS are shown in **Table 29**. While monitoring indicators for water supply and solid waste are adequate, the indicators for sewerage and sanitation need more improvement.

School Education Department Project Management Implementation Unit (PMIU)

The PMIU collects quarterly information regarding missing facilities (electricity, usable drinking water, usable latrine, school cleanliness, boundary wall etc.) in all government schools of Punjab. These are published in periodic progress reports of School Education department. They provide an invaluable update on the status of school WASH.

Annual State of Education Report (ASER)

The ASER report is published annually and is a survey of a representative sample of primary, middle and high schools in the government and private sectors. Apart from enrolment and school participation data, it also provides information on the status of school drinking water and sanitation facilities.

Pakistan Council of Research in Water Resources (PCRWR)

PCRWR monitor groundwater quality as part of the national water quality monitoring programme (NWQMP). It has surveyed 24 major cities and 23 surface water bodies in Pakistan. Its reports for Punjab have been alluded to earlier in the chapter on water quality. In Punjab, it has set up water quality laboratories in Lahore, Bahawalpur, Faisalabad, Gujranwala, Sargodha, Sialkot, Sahiwal, Multan, Mianwali and Dera Ghazi Khan.

PCRWR monitors the quality of bottled/mineral water regularly and publishes a quarterly report. The reports show that on average, 25%-30% brands are overall unsafe, 20% are chemically unsafe, 10% are microbiologically unsafe, 60% brands are consistent, 30%-80% brands disappear from the market, and 35%-40% new brands appear.

Public Health Engineering Water Testing Laboratories

PHED has set up 31 water testing laboratories at district headquarter level in Punjab. It is expected that these will provide monthly water quality monitoring data.

Directorate General Monitoring and Evaluation

There is a whole directorate for monitoring and evaluation called Directorate General Monitoring and Evaluation (DGME). The DGME may have offices at divisional level, but does not have enough presence at district level. However, it is mandated to conduct evaluations of projects that are completed as indicated in the PC-1. It is the responsibility of executing departments to complete the PC-IV and PC-V and ensure that evaluations are done.

Surveys and Evaluations by State and Non State Actors

Project surveys, research and evaluations are also undertaken by other councils (e.g. Pakistan Council for Scientific and Industrial Research), government departments (e.g. Land Reclamation Department, Agriculture, Fisheries etc.), university departments, bilateral and multi-lateral donors, UN agencies, national and international non-governmental organisations.

Collation, Synthesis and Dissemination

Despite the mass of information available from disparate sources, monitoring reports, evaluation studies, surveys, research studies etc., there is no mechanism to collate and synthesise this information and disseminate to policy, management and operational level stakeholders.

The development of a Management Information System (MIS) for Drinking Water and Sanitation has been started a few years back and is still in the piloting stage in Punjab and Azad Jammu and Kashmir. The new MIS shall be based on GPS data creating decision-making and analytical scenarios for the government to develop effective sanitation programmes.

Under public sector development programme financed by Government of Pakistan, the Climate Change Division has started development of a national MIS for WASH from July 2013 and this is likely to be completed over a period of three years.

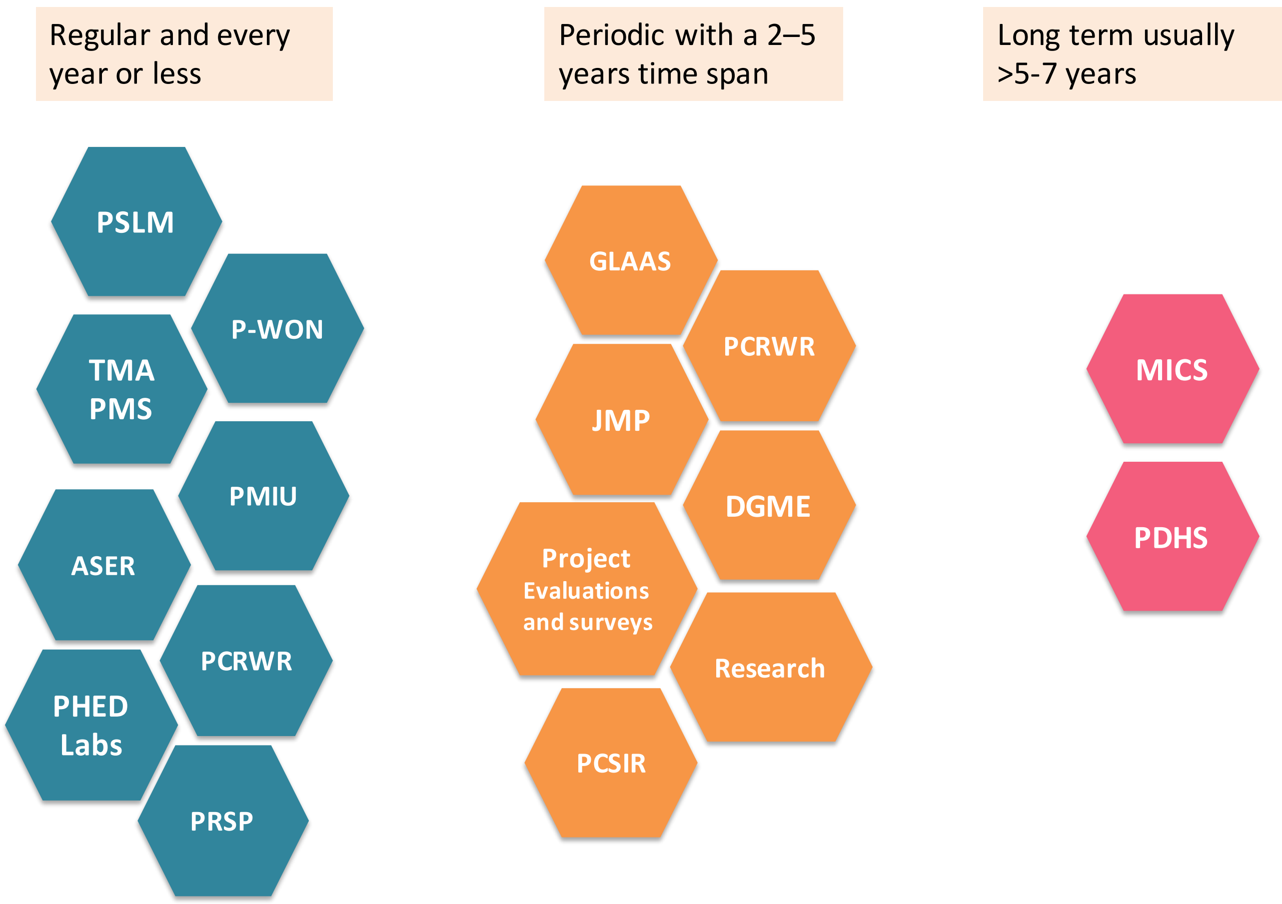
Furthermore, there are efforts from various actors to set up different monitoring systems and reporting formats. While these may be useful for project specific interventions, they do not bear any semblance to existing institutional monitoring and reporting systems, with the result that monitoring and evaluation information flows remain fragmented, uptake by executing agencies and institutional partners is low, and the sector and sub-sectors remain under-reported. Synergies between government initiatives in the subsectors of water supply, sewerage and solid waste management and those of national and international non-governmental organisations are sometimes hard to achieve.

For monitoring of drinking water and sanitation indicators to be institutionalised, it is essential that monitoring of the sector is contextualised within the broader monitoring framework of the province and that key stakeholders like the Bureau of Statistics, DGME, planning, reforms and those involved with management information systems to facilitate information management for drinking water and sanitation.

Monitoring and Reporting Information Systems

The monitoring and reporting systems appear to cluster into three groups (**Fig 94**). The first group is where there are regular annual or more frequent reports. The second group includes those that have a periodicity of between 2-5 years, provide some mid-term trends, are isolated activities and may not be performance related. The third group provides a long term perspective and is useful to see broader societal impact of social sector investments and behaviour change.

Figure 94 - Existing monitoring and reporting systems

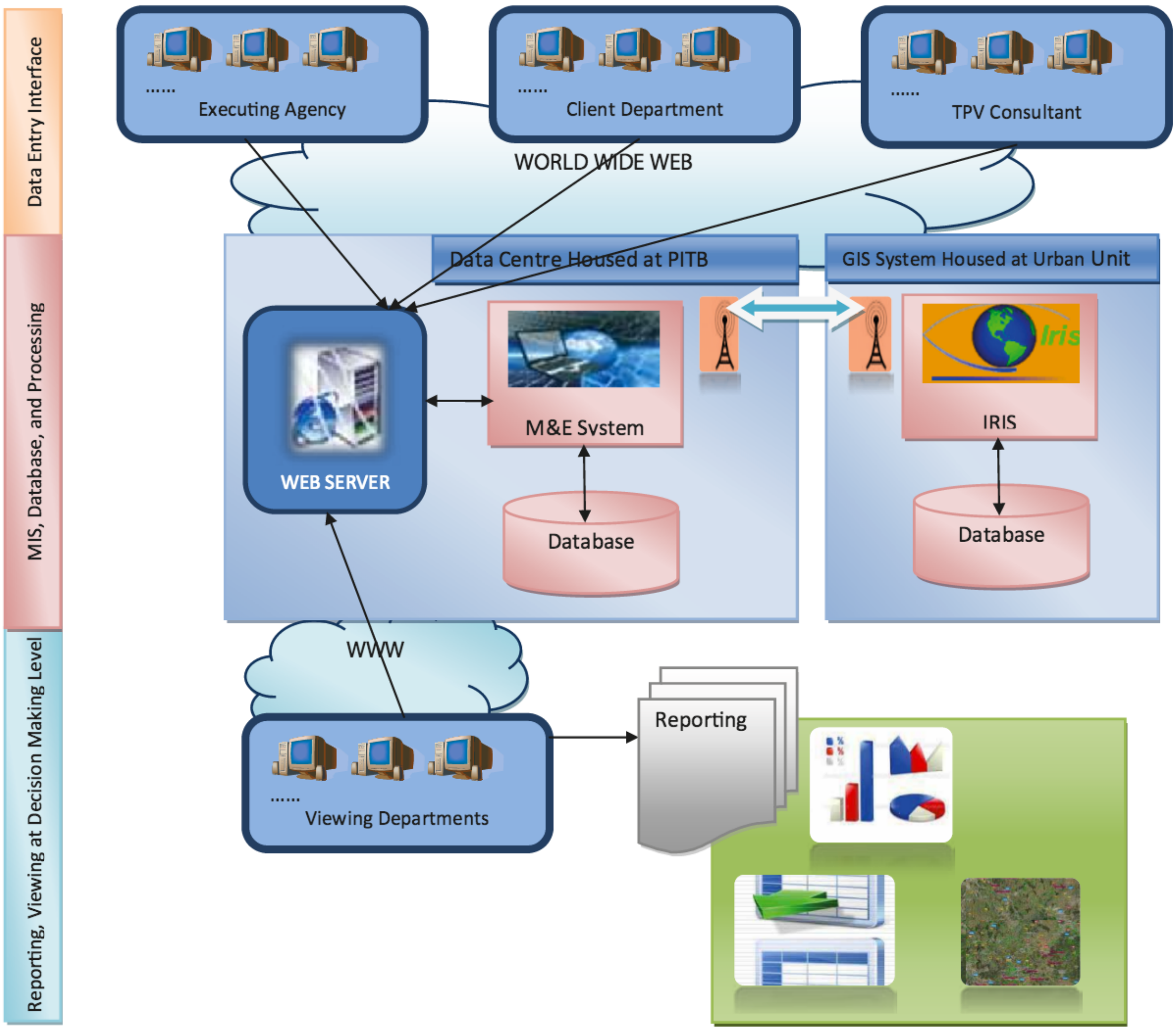


However, it is interesting to note that several institutional monitoring and reporting systems already exist, but the potential to distil information for policy, planning and execution has not been adequately harnessed.

Urban Unit and Web-based Monitoring and Evaluation

The Urban Unit is playing a key role in improving governance, planning and reporting systems in various sectors in Punjab. It has helped to develop base maps and municipal services maps for TMAs, has supported the development of a web-based Citizen Liaison Cell at Faisalabad WASA, is the main driver for the Punjab Cities Governance Improvement Project, has developed and is piloting the use of GIS based smart M&E monitoring, and has now proposed a web-based application for M&E of development projects.

Figure 95 - Proposed M&E for development projects



(Source: M&E system for development projects in Punjab. Urban Unit)

Fig 95 illustrates the concept in which a data centre would be housed by Punjab Information Technology Board (PITB) and would be linked with the GIS system database at Urban Unit. Executing agencies can input the data through distant terminals and viewing departments can generate planning, decision making, monitoring and performance reports.

Strategy

Sector Monitoring and Evaluation			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Enhanced management performance of water and sanitation operators and TMAs	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter
Consolidated Dashboard of sub-sector performance	Collaboration with Urban Unit and Punjab Information Technology Board to develop web-based information management system that links WASA performance system, TMA performance system, District Water Quality monitoring and other periodic monitoring data (financial allocation, release and utilisation; wastewater quality; industrial wastewater contamination etc.) Dashboard housed and operated by PMU, which generates a quarterly District Scorecard and provides updates on its website	PMU generates a quarterly District Scorecard, a city scorecard, TMA scorecard and provides updates on its website	PMU generates a quarterly District Scorecard, a city scorecard, TMA scorecard and provides updates on its website
Production of an annual sector status report	PMU produces an annual "State of Water, Sanitation and Solid Waste in Punjab' Report PMU produces biennial provincial data for JMP and GLAAS reports	PMU produces an annual "State of Water, Sanitation and Solid Waste in Punjab' Report PMU produces biennial provincial data for JMP and GLAAS reports	PMU produces an annual "State of Water, Sanitation and Solid Waste in Punjab' Report PMU produces biennial provincial data for JMP and GLAAS reports

Periodic sector review	Strategic review of sector plan at end of short term	Strategic review of sector plan at end of medium term	Strategic review of sector plan at end of long term

Performance Measurement Framework

The key performance indicators for the Punjab WASH sector strategy are presented below and are aligned with and adapted from the Punjab Economic Growth Strategy 2018. More detailed indicators are found under respective sectoral plans e.g. health[173], urban development[174].

Result Statements	Performance Indicators	Targets for 2018	Collection Methods	Collection Frequency
Outcome Results				
Access to improved water sources and sanitation	Proportion of Population with Access to Improved Water Sources (%)	93% Rural 100% Urban	MICS	4 years
	Proportion of Population with Access to Improved Sanitation (%)	90% Rural 100% Urban	MICS	4 years
Reduced Child Mortality	Proportion of Children Under 5 Who Suffered from Diarrhoea in the Last 30 Days (%)	<10%	MICS PSLM	4 years Annual
Outputs				
1. Village water ponds causing contamination eliminated	Number of villages where ponds are eliminated	500	LGCD	Monthly
2. Solid waste management in villages	Number of villages with solid waste management system	6	LGCD	Monthly
3. Implementation of sanitation schemes	Number of sanitation schemes implemented	95 42 Rural 53 Urban	HUD-PHED LGCD	Monthly
4. Implementation of water supply schemes	Number of water supply schemes implemented	78 37 Rural 41 Urban	HUD-PHED LGCD	Monthly
	Rehabilitation of Dysfunctional schemes	172	HUD-PHED LGCD	Monthly
5. Implementation of ODF in villages	Number of villages ODF certified	3360	PHED LGCD	Monthly
6. Water filtration Plants established	Number of filtration plants installed and operational	1479	HUD-PHED	Monthly
	Number of beneficiaries getting clean drinking water		HUD-PHED	Quarterly

173 Punjab Health Sector Plan 2014-18. Building a Healthier Punjab, Government of Punjab

174 Urban Development Sector Plan 2014-2018, Government of Punjab

Result Statements	Performance Indicators	Targets for 2018	Collection Methods	Collection Frequency
7. District Water quality testing labs	Number of water quality testing laboratories in operation	36	HUD-PHED	Quarterly
	Number of water samples examined		HUD-PHED	Monthly
8. Water resources effectively managed	Number of cities with schemes for rain water harvesting initiated	19	HUD-PHED LGCD	Annually
9. Environment friendly disposal of sewage water	Number of pilot decentralised sewage water treatment system constructed	1 big city 1 intermediate city 1 small city	HUD-PHED LGCD	Annually
10. Improved sectoral governance	Number of cities with Master Plans for sanitation, water supply and drainage up to 2035	4 big cities 4 intermediate cities	HUD-PHED LGCD	Annually
	Consumer water meters installed for accurate billing for small and medium cities (water supplies) and big cities (through service connection fee/ government support)	10 small and intermediate cities 5 big cities	HUD-PHED LGCD	Annually
	Number of cities where bulk meters installed at major distribution system, tubewells, distribution stations and overhead reservoirs to measure quantity pumped of water	30 small and intermediate cities 5 big cities	HUD-PHED LGCD	Annually
	Number of cities with Master plans for solid waste management	20 cities	HUD LGCD	Annually
11. Enhanced solid waste collection	Percentage of garbage/waste collected against the estimated amount of garbage produced	70% 20 cities	LGCD	Monthly
	Number of cities where secondary collection points established for small and medium cities	20 cities	LGCD	Monthly
12. Improved waste disposal system	Percentage of waste finally disposed	70% 20 cities	LGCD	Monthly
	Number of cities where hospital hazardous waste shall be managed and disposed of	40	LGCD DoH DoE	Monthly
	Percentage of waste disposed at land fill sites against the total waste collected for cities	75% 20 cities	LGCD	Monthly

Table 27 - Comparative WASH indicators in PSLM, PDHS and MICS

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
DRINKING WATER		**DRINKING WATER**		**DRINKING WATER**	
Water delivery system	Urban, rural and overall Tap Water Hand Pump Motor Pump Dug Well Others	Improved source of drinking water	Piped into dwelling/yard/plot Public tap/standpipe Tube well or borehole/hand pump Protected well Protected spring/rain water Bottled water Filtration plant	Main source of drinking water - improved	Piped into dwelling Piped into compound, yard or plot Pipe d to neighbour Public tap / standpipe Tube well Hand pump (tap) Motorised pump (donkey / turbine) Protected well Protected spring Bottled water (mineral)
		Unimproved source of drinking water	Unprotected well Unprotected spring Tanker truck/cart with drum Surface water Other source	Main source of drinking water - unimproved	Unprotected well Unprotected spring Tanker-truck Cart with small tank / drum Surface water (Toba, river, stream, dam, lake, pond, canal) Bottled water (mineral) Other/ Missing
Main source of drinking water by income group	1^{st}, 2^{nd}, 3^{rd}, 4^{th} and 5^{th} quintiles Source of drinking water Province, urban, rural and overall	Water treatment prior to drinking	Boiled Bleach/chlorine added Strained through cloth Ceramic, sand, or other filter Solar disinfection Other No treatment Percentage using an appropriate treatment method	Water treatment method used in the household	Boil Add bleach/chlorine Strain through a cloth Use water filter Solar disinfection Let it stand and settle Other None Percentage of household members in households using unimproved drinking water sources and using an appropriate water treatment method using an appropriate treatment method

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
DRINKING WATER		**DRINKING WATER**		**DRINKING WATER**	
Percentage households paying for water by region and water source	Households getting water from source Households paying for water Average amount paid per month Urban, rural and overall Source of water – tap water, hand pump, motorised pump, dug well, river/canal/stream, other				
Percentage of households paying for piped water by region and quintile	Urban, rural and overall 1st, 2nd, 3rd, 4th and 5th quintiles				
Who installed the water delivery system by province	Water delivery system – piped water, hand pump, motor pump, open well, closed well Local government Non-government Household itself Don't know Total				
Distance to water source by province	Water source – tap water, hand pump, motorised pump, dug well, river/canal/stream, other Inside the house, 0-0.5 km, 0.5-1 km, 1-2 km, 2-5 km, Over 5 km	Time to obtain drinking water (round trip)	Water on premises Less than 30 minutes 30 minutes or longer Don't know/missing	Time to source of drinking water	Users of improved or unimproved drinking water sources Water on premises < 30 minutes 30 + minutes Missing/Don't know
				Percentage of households without drinking water on premises Person usually collecting water	Adult woman (age 15+ years) Adults man (age 15+ years) Female child (under 15 years) Male child (under 15 years) Don't know or missing

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
SANITATION		**SANITATION**		**SANITATION**	
Type of toilet	Urban, rural and overall Flush Non-Flush No Toilet	Improved, not shared facility	Flush/pour flush to piped sewer system Flush/pour flush to septic tank Flush/pour flush to pit latrine Ventilated improved pit (VIP) latrine Pit latrine with slab	Improved sanitation facility	Flush to piped sewer system Flush to septic tank Flush to pit latrine Flush to unknown place/not sure/don't know where Ventilated improved pit (VIP) latrine Pit latrine with slab Composting toilet
Type of toilet used by the household by province	Flush, non-flush and no toilet Province, urban, rural and overall	Non-improved facility	Flush/pour flush not to sewer/septic tank/pit latrine Pit latrine without slab/open pit Bucket Hanging toilet/hanging latrine No facility/bush/field Other Missing	Unimproved sanitation facility	Flush to somewhere else Pit latrine without slab/open pit Bucket Other Missing Open defecation (no facility, bush, field)
Type of toilet used by the household by quintile	Flush, non-flush and no toilet Urban, rural and overall 1st, 2nd, 3rd, 4th and 5th quintiles	Shared facility	Flush/pour flush to piped sewer system Flush/pour flush to septic tank Flush/pour flush to pit latrine Ventilated improved pit (VIP) latrine Pit latrine with slab	Users of improved or unimproved sanitation facilities	Not shared Public facility Shared by 5 households or less Shared by more than 5 households Missing/don't know Open defecation (no facility, bush, field)
Type of sanitation system used by province	Underground drains Covered drains Open drains No system Urban, rural and overall				
Type of sanitation system used by quintiles	Underground drains Covered drains Open drains No system Urban, rural and overall 1st, 2nd, 3rd, 4th and 5th quintiles				

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
HYGIENE					
		Hand washing	Percentage of households where place for washing hands was observed Soap and water Water and cleansing agent other than soap only Water only Soap but no water Cleansing agent other than soap only No water, soap, or other cleansing agent	Hand washing	Water and soap are available Water in available, soap is not available Water is not available, soap is available Water and soap are not available Missing
				Place of disposal of child's faeces (children aged 0-2 years)	Child used toilet/latrine Put/rinsed into toilet or latrine Put/rinsed into drain or ditch Thrown into garbage (solid waste) Buried Left in the open Other, don't know or missing Percentage of children whose stools were disposed of safely

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
SOLID WASTE		**SOLID WASTE**		**SOLID WASTE**	
Garbage collection systems from the household by province	Province, urban, rural and overall Municipality Privately No system				

PSLM	Indicators	PDHS	Indicators	MICS	Indicators
HEALTH		**HEALTH**		**HEALTH**	
Diarrhoea in children under 5 years in the past 30 days	Children under five (5) suffering from diarrhoea in past 30 days – by region and province Diarrhoea cases: duration of episode Diarrhoea cases: severity of illness Diarrhoea cases in past 30 days - by province and quintiles Treatment of diarrhoea in children under 5 years– by region and province	Diarrhoea in children under 5 years in the two weeks preceding the survey	All diarrhoea Diarrhoea with blood Also related with source of drinking water and type of toilet facility (improved, not improved etc.)	Percentage of children age 0-59 months with diarrhoea in the last two weeks, and treatment with oral rehydration solutions and recommended homemade fluids	Had diarrhoea in last two weeks Children with diarrhoea who received: ORS (Fluid from ORS packet or pre-packaged ORS fluid) Any recommended homemade fluid (Boil water, Sugar, Salt etc.,) ORS or any recommended homemade fluid

Table 28 - WASA monitoring indicators quarterly collection

Monitoring area	Indicators
Service Coverage	Water Coverage % Sewerage Coverage %
Consumption and Production	Water Production L/capita/day Water Consumption L/capita/day
Non Revenue Water	Non Revenue Water % Unaccounted For Water %
Metering Practices	Metering Level % Metered Water Sold %
Network Performance	Pipe Breaks-Burst/km Sewer System Blockages/km Pipe Leakages/^{km} Replacement of Manhole Covers % Cleaning/Desiltation of Manholes % Cleaning/Desiltation of Sewers % Storm Water Drain Used as Sullage Carrier % Sewer Collapse/Crown Failure %
Cost and Staffing	Unit Operating Cost – Water Consumption Rs/m^3 water consumed Unit Operating Cost – Water Production Rs/m^3 water produced W&WW Staff Per 1000 W&WW Connections Water Staff Per 1000 Water Connections Waste Water Staff Per 1000 Waste Water Connection Salary Cost as % of Total Operating Cost Electricity Cost as % of Total Operating Cost Maintenance Cost as % of Total Operating Cost Contracted Out Cost as % of Total Operating Cost

Monitoring area	Indicators
Quality of Service	Continuity of Service per day Chemical Unfit Source(s) % Biologically Unfit Source(s) % Chemically Unfit at Taps % Biologically Unfit at Taps % Water Quality – % of Required Residual Chlorine Test Water Quality – Samples Passing On Residual Chlorine % Complaints About W&WW Services % of total connections Waste Water Treatment – Primary Level % Waste Water Treatment – Secondary Level %
Billing and Collection	Average Revenue Water and Waste Water Rs/m^3 water sold Collection Period days Billing Efficiency % Collection Efficiency (Physical) % Collection Efficiency (Financial) %
Financial Performance	Operational Cost Coverage (ratio) Working Ratio Debt Servicing %

Table 29 - TMA municipal services indicators periodic collection

Water Supply (six monthly)	Sewerage (annual)	Solid Waste (daily and monthly)	Slaughterhouse (annual)
Source of water supply Water Taste Ground water table depth in feet Number of Tube wells Number of Tube Wells with bad status Overhead reservoir Ground storage tanks Coverage % Consumer connections Served Households Water Tariff residential Water Tariff commercial	Coverage % Disposal station Open drains	City coverage % House to House primary collection Number of collection points Dumping Average Solid Waste collection % Average Solid Waste collection Tons/day	Number of slaughterhouses Disposal of Slaughterhouse solid waste
		Walled waste dumps Metaled tray Wheel barrows Hand carts Tractors Steel containers open Covered containers Tractor trolleys Tractor with blade Tractor with bucket loader Mechanised loader Dumper trucks Arm roll truck Mechanical Sweeper Container carrier Water tanker Rickshaws Litter bins	

Water Supply	Sewerage	Solid Waste	Slaughterhouse
Tehsil Officer TO (I&S) Assistant Tehsil Officer ATO (I&S) Supervisor Sub-Engineer Operators Head tube well operator Plumbers Lady Water Checker Valve man Baildar Chowkidar		Chief Sanitary Officer Supervisory Officers Sanitation Inspector Sanitary Inspectors Supervisors Sanitary Workers Vehicle drivers Water carriers Sanitary Mate Spray man Auto mechanics Auto electricians Helpers	Veterinary doctor

CONSOLIDATED SECTOR DEVELOPMENT STRATEGY

Legislations, Regulations, Policies and Strategies			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Finalisation of drafted policies and strategies and their implementation	Approval of Draft Sanitation Policy and Strategy, Punjab Drinking Water Strategy, Draft Behaviour Change Communication Strategy and their implementation Develop and implement bye-laws of solid waste management at town and metropolitan level		
A legal framework that governs municipal water	Enactment and promulgation of the Punjab Municipal Water Act	City and Town master plans developed and incorporate zone-wise development of water supply, sewerage and drainage, and solid waste management	Industrial wastewater management regulations put into effect in industrial zones and curbs to stop pollution enforced
Punjab Water Commission that acts as a regulatory body	Establishment of the Punjab Water Commission	Tariff structure revised Minimum service delivery standards established for municipal services (water, sanitation, solid waste management) Ensure that each local government has a master plan on water, sanitation and solid waste management for its area of jurisdiction	Review water, sanitation hygiene and solid waste policies and strategies and update them accordingly
Municipal services duty bearers have necessary managerial and leadership skills for an integrated water supply, sewerage and drainage, and solid waste management programme	Capacity building programme of city, town and union council officials on application of regulations, policies and strategies in planning, development and delivery of municipal services	Capacity building programme of city, town and union council officials on planning for and implementing integrated water supply, sewerage and drainage, and solid waste management	Municipal services training and capacity building programme provides at least 75% or more coverage to TMA officials

Water Resources			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Sectoral capacity for climate change adaptation and mitigation developed	Sub-sector climate change adaptation and mitigation strategies developed	Piloting of climate change adaptation and mitigation in selected towns	Climate change mitigation capacities developed in phased manner in towns located in zones vulnerable to climatic events
Municipal services duty bearers fully conversant with climate change and its mitigation strategies	Need assessment of sub-sector human resources for climate change adaptation and mitigation	Capacity building programme of city, town and union council officials in pilot areas on climate change mitigation strategies	Capacity building programme of city, town and union council officials on climate change mitigation strategies extended to other areas
Mega and intermediate cities with ample precipitation have rainwater harvesting systems in place	Rainwater harvesting pilot projects evaluated and plan to extend to other feasible cities developed	In participating cities, rainwater harvesting provides at least 10% of water used for non-domestic municipal services and horticulture	In participating cities, rainwater harvesting provides at least 30% of water used for non-domestic municipal services and horticulture
Increase use of surface water for municipal services	Joint programme with Irrigation department to map potential areas for surface water use	Build water storage reservoirs and water treatment plants with distribution supply in viable areas	Incorporate surface water use in town planning and municipal services in selected areas
Artificial recharging of groundwater enhanced	Storm water management plan developed for cities and town with ample precipitation	Storm water holding areas developed in 25% of selected sites	Storm water holding areas developed in 50% of selected sites

Water Supply

Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All rural areas, cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 100% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Dysfunctional tube wells/schemes adequately rehabilitated and maintained	A phased plan for rehabilitation of dysfunctional tube wells/schemes developed according to district and TMA and implemented in a phased manner	At least 50% of dysfunctional tube wells/schemes rehabilitated and operational, and O&M system functioning	At least 100% of dysfunctional tube wells/schemes rehabilitated and operational, and O&M system functioning
Shallow tube wells replaced by deep tube wells	Mapping of shallow tube wells by districts and TMAs	Phased replacement plan for at least 10%	Phased replacement plan for at least 20%
Rehabilitation and replacement of old infrastructure	Each city and town has mapped out old infrastructure and leaky mains that need rehabilitation or replacement	At least 10% of old infrastructure in cities and 20% in towns replaced or rehabilitated as part of city or town development	At least 20% of old infrastructure in cities and 40% in towns replaced or rehabilitated as part of city or town development
Existing functional tube wells/schemes continue to perform optimally	Each district and TMA has a scheduled tube well/scheme maintenance plan	Tube wells/schemes perform at 80% or better functionality	Tube wells/schemes perform at 95% or better functionality
Energy efficient water supply schemes	Map areas that have persistent power shortage Introduce solar energy supported water supply schemes At least 20% of water supply schemes converted to solar energy All new water supply schemes are solar energy compliant where feasible	At least 40% of water supply schemes converted to solar energy	At least 60% of water supply schemes converted to solar energy
100% piped water coverage in cities and towns	Extend distribution networks and supply lines to provide 60% coverage in cities and towns	Extend distribution networks and supply lines to provide 70% coverage in cities and towns	Extend distribution networks and supply lines to provide 100% coverage in cities and towns
65% piped water coverage in rural areas	Extend distribution networks and supply lines to provide 20% coverage in rural areas (depending on baseline)	Extend distribution networks and supply lines to provide 40% coverage in rural areas	Extend distribution networks and supply lines to provide 65% coverage in rural areas

Enhanced coverage of filtration plants in zones with high hand/motor pump use	High prevalence hand/motor pump use areas mapped in all TMAS Filtration plants installed in 25% of areas with high hand/motor pump use	Filtration plants installed in 45% of areas with high hand/motor pump use	Filtration plants installed in 65% of areas with high hand/motor pump use
Water flows monitored at tube wells	Bulk flow meters and pressure gauges installed at 20% of tube wells	Bulk flow meters and pressure gauges installed at 40% of tube wells	Bulk flow meters and pressure gauges installed at 60% of tube wells
Additional water storage capacity developed	Storage capacity needs of cities and towns determined	At least 25% TMAs build extra overhead storage capacity	At least 50% TMAs build extra overhead storage capacity

Water Quality			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Monthly water quality testing at water source	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 25% of tube wells	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 50% of tube wells	PHED water testing laboratories conduct monthly water quality tests of TMA water supplies and filtration plants, and quarterly testing of at least 75% of tube wells
Periodic water quality testing of distribution network	At least 30% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell	At least 60% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell	At least 90% coverage of distribution system every quarter Water quality testing linked with health alerts from disease surveillance cell
Periodic monitoring of water quality zones	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported Upgrade PHED laboratories to test for heavy metals	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported	PHED, PCRWR and Irrigation department conduct joint mapping of sweet, brackish and salt water zones and arsenic zones every two years Remedial measures monitored and reported
All ground and overhead reservoirs supplied with chlorination treatment	Status of ground and overhead reservoirs in cities and towns determined Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 30% of reservoirs (or tube wells where storage capacity does not exist)	Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 60% of reservoirs (or tube wells where storage capacity does not exist)	Scheduled quarterly cleaning and maintenance of all reservoirs Installation of chlorinators in 90% of reservoirs (or tube wells where storage capacity does not exist)

Sanitation (Sewerage and Drainage)			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 25% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Optimal sewage flow capacity maintained	Sewage flows determined for all cities and towns, and de-silting and cleaning of 30% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities	De-silting and cleaning of 60% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities	De-silting and cleaning of 90% drains and sewers with safe sludge disposal per quarter in TMAs and zones in cities
Optimal status of sewer maintenance equipment (sucking machine, jetting machine, sucking/jetting machine)	Status of equipment availability and functionality determined for each TMA and city zone At least 30% of TMAs and city zones equipped with sewer maintenance equipment	At least 60% of TMAs and city zones equipped with sewer maintenance equipment	At least 90% of TMAs and city zones equipped with sewer maintenance equipment
Adequate and functional collector and branch sewers	Status of collector and branch sewers in each city determined Phased replacement or laying of new lines instituted	Phased replacement of 25% non-functional collector and branch sewers or laying of new lines instituted	Phased replacement of 50% non-functional collector and branch sewers or laying of new lines instituted
Optimal functionality of pumping stations	Status of pumping stations in each city and TMA determined Phased rehabilitation plan instituted for at least 30% dysfunctional pumping stations	Phased rehabilitation plan instituted for at least 60% dysfunctional pumping stations	Phased rehabilitation plan instituted for at least 90% dysfunctional pumping stations
82% sewerage coverage in cities and towns	Extend sewerage system lines to provide 60% coverage in cities and towns	Extend sewerage system lines to provide 70% coverage in cities and towns	Extend sewerage system lines to provide 82% coverage in cities and towns
70% sewerage coverage in rural areas	Extend sewerage system lines to provide 10% coverage in rural areas	Extend sewerage system lines to provide 40% coverage in rural areas	Extend sewerage system lines to provide 70% coverage in rural areas
Replacement of open drains by sewers	Replace 10% open drains with sewers and install wastewater treatment with maintenance plan	Replace 25% open drains with sewers and install wastewater treatment with maintenance plan	Replace 50% open drains with sewers and install wastewater treatment with maintenance plan

Promote safe sanitation practices in high open defecation zones	Develop provincial and district level road maps on PATS/ODF for 11,904 villages in 21 priority districts Government allocates funds through its regular programme for soft component and facilitates 30% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery	Government allocates funds through its regular programme for soft component and facilitates 60% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery	Government allocates funds through its regular programme for soft component and facilitates 90% villages to obtain the status of ODF Incentivising the ODF villages by laying of water supply scheme, sewerage system, waste water treatment, provision of hand pumps etc Execution of schemes on component / cost sharing basis i.e. Community invests in internal component, while Government invests for external component Collaborate with NGOs for WASH services delivery

Wastewater Management

Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Elimination of stagnant ponds and prevention of pounding	Mapping of ponds in each TMA and categorise by size and level of risk Prioritise cleaning of large and high risk ponds At least 50% of mapped ponds eliminated and preventive measures instituted	At least 100% of mapped ponds eliminated and preventive measures instituted	Prevention measures in place to prevent recurrence of pounding
Water supply and sanitation schemes linked with wastewater treatment	At least 25% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes	At least 50% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes	At least 75% of new schemes have in-built wastewater treatment facility Incorporate wastewater treatment options (like oxidation ponds, wetlands, sewerage treatment units, community septic tanks) in rural sanitation schemes
Wastewater treatment plants for cities	Each mega city has at least one wastewater treatment plant functional	Each intermediate city has at least one wastewater treatment plant functional	Each large town (especially those that are discharging into surface water) has at least one wastewater treatment plant functional and wastewater recycled for reuse in agriculture and horticulture
Monitor contamination levels of industrial effluent	PHED, Land Reclamation department, PCSIR and Punjab Environment Protection Agency map major industrial wastewater flows in relevant districts and conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced	Hazard and risk GIS mapping of contaminated rivers and water bodies done Conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced	Conduct periodic wastewater testing and public reporting of industrial effluent quality Environment protection regulations enforced
Increased proportion of treated industrial wastewater	Set up Combined Effluent Treatment Plant (CETP) for cluster of industries where feasible focusing on Faisalabad, Lahore, Sialkot, Gujranwala, Sheikhupura and Rahim Yar Khan as priority districts	At least 3% - 5% of industrial wastewater treated Incentivise industries who set up wastewater treatment with a tax rebate	At least 6% - 10% of industrial wastewater treated Incentivise industries who set up wastewater treatment with a tax rebate

	Identify industries with high volume of untreated effluent and prioritise for enforcement of regulations Incentivise industries who set up WWT with a tax rebate		

Solid Waste Management			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
All cities and towns have surveys, strategies and action plans for integrated water supply, sewerage and drainage, and solid waste management	All cities have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 25% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management	At least 50% of towns and rural areas have completed surveys, GIS mapping and strategies, and start implementing action plans for integrated water supply, sewerage and drainage, and solid waste management
Solid waste collection and disposal	At least 70% of solid waste generated is collected and disposed of per day At least 30% TMAs providing door to door collection service Village based solid waste management piloted in selected villages	At least 80% of solid waste generated is collected and disposed of per day At least 40% TMAs providing door to door collection service Village based solid waste management scaled up to 10% villages in Punjab	At least 90% of solid waste generated is collected and disposed of per day At least 50% TMAs providing door to door collection service Village based solid waste management scaled up to 30% villages in Punjab
Effective solid waste management	Establish water and sanitation companies in large and intermediate cities whose mandate includes solid waste management and specify service zones Develop a minimum standards list of hardware and equipment for solid waste management and upgrade in 30% of TMAs Establish an Enforcement Wing to ensure effective solid waste management	Upgrade the hardware and equipment for solid waste management in 60% of TMAs	Upgrade the hardware and equipment for solid waste management in 90% of TMAs
Efficient Solid waste disposal and recycling	At least 30% TMAs establish transfer stations to reduce disposal time Recycle at least 10% of solid waste by systematic separation Regional sanitary landfill options identified for 2-3 TMAs where feasible	At least 60% TMAs establish transfer stations to reduce disposal time Recycle at least 15% of solid waste by systematic separation At least 20% of TMAs served by sanitary landfill sites	At least 90% TMAs establish transfer stations to reduce disposal time Recycle at least 20% of solid waste by systematic separation At least 40% of TMAs served by sanitary landfill sites
Waste to Energy	Formalise contracts with companies for waste to energy options	At least each mega city has a WTE option in place	At least each intermediate city has a WTE in place

Safe hospital high risk waste disposal	TMAS and Department of Health orient each hospital waste management committee oriented on Environmental and Medical Waste Management Guidelines, municipal solid waste and high risk waste and their separate disposal Each mega city and intermediate city has a centralised and functional high risk hospital waste disposal facility At least 50% of hospital high risk waste disposed of safely	Each TMA has a centralised and functional high risk hospital waste disposal facility At least 60% of hospital high risk waste disposed of safely	At least 90% of hospital high risk waste disposed of safely
Safe and hygienic Slaughterhouses	Update status of slaughterhouses in each TMA and prioritise those for rehabilitation, solid waste and wastewater management Develop slaughterhouse safety and hygiene practice guidelines and orient 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 30% of municipal services dispose of slaughterhouse solid waste safely	Provide refresher training on slaughterhouse safety and hygiene practice guidelines to 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 60% of municipal services dispose of slaughterhouse solid waste safely	Provide refresher training on slaughterhouse safety and hygiene practice guidelines to 100% slaughterhouse staff in TMAs in safe handling and disposal of carcass, entrails, hides, and wastewater At least 90% of municipal services dispose of slaughterhouse solid waste safely
Efficient and effective management of Industrial Solid Waste	Determine the current status of industrial solid waste production and disposal	Develop strategies and actions for efficient and effective management of industrial solid waste	

Health and Hygiene			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
WASH integrated in health promotion in primary health care	WASH health education module added to curriculum of Lady Health Workers with supporting training material Master trainers, district trainers and facility trainers oriented in key WASH messages and LHWs provided training on WASH health promotion and hygiene At least 100% of LHWs trained in WASH health promotion and hygiene	At least 60% of LHWs receive refresher training in WASH health promotion and hygiene	At least 100% of LHWs receive refresher training in WASH health promotion and hygiene
WASH integrated in health campaigns and health weeks	WASH component of health promotion and hygiene integrated in mother and child health weeks At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events	At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events	At least two WASH health promotion and hygiene campaigns run every year in each district with regional, local, cultural festivals and events
Effective disease surveillance cell	Dissemination of health alerts linked with TMAs using mobile technology At least 50% TMAs have a technology system to receive health alerts	At least 100% TMAs have a technology system to receive health alerts	
Fully functional water and sanitation services in health facilities	TMAs collaborate with district health administration to ensure all health facilities have functional water and sanitation services, soap and hand sanitizers At least 50% of first level health facilities have usable water and sanitation services	At least 100% of first level health facilities have usable water and sanitation services, soap and hand sanitizers	
School health promotes WASH	WASH integrated into school health programme run by School Health Nutrition Supervisors	At least 50% of schools receive WASH health promotion and hygiene	At least 75% of schools receive WASH health promotion and hygiene

	At least 25% of schools receive WASH health promotion and hygiene		

Education			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
WASH integrated in teacher training programme	Collaborate with Curriculum Wing and incorporate WASH hygiene promotion in teacher training programme WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 25% schools receive training in WASH hygiene	WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 50% schools receive training in WASH hygiene	WASH hygiene promotion cascaded through Directorate of Staff Development, District Training and Support Centres and Cluster Training and Support Centres At least 2 teachers per school of 75% schools receive training in WASH hygiene
WASH integrated in schools curriculum	Collaborate with Textbook Board for inclusion of topics on water, sanitation and hygiene in curriculum for classes 1 to 12		
All schools have usable drinking water and usable latrines	Collaborate with PMIU PESRP on status of missing facilities in schools More than 80% of schools have usable drinking water and usable latrines	More than 90% of schools have usable drinking water and usable latrines At least 50% public schools have 1 latrine for 25 girls and 1 latrine for 50 boys	100% of schools have usable drinking water and usable latrines At least 50% public schools have safe drinking water At least 90% public schools have 1 latrine for 25 girls and 1 latrine for 50 boys
Chief Minister's Water Ambassadors Programme	In collaboration with School Education department and school health programme, launch a Chief Ministers Water Ambassadors Programme for primary and middle school children. Children leaders trained to act ambassadors for water conservation and family hygiene At least 30% of schools have Water Ambassadors	At least 60% of schools have Water Ambassadors	At least 90% of schools have Water Ambassadors
Menstrual hygiene management integrated in health and hygiene for girls	WASH hygiene promotion module incorporates menstrual hygiene management for girls	At least 50% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion	At least 75% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion

	At least 25% of girls middle and high schools impart menstrual hygiene management education in WASH hygiene promotion		

Sector Efficiency			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved and efficient use of Water Production	Public education campaign launched about water conservation In areas with production of more than 200 L/capita/day, reduce water production to 136 L/capita/day (30 gallons/capita/day) In areas with production of 100-200 L/capita/day, maintain at 136 L/capita/day (30 gallons/capita/day) Revise 50 gallons per capita per day formula and reduce to 30 gallons per capita per day and use for all new schemes	Public education campaign maintained about water conservation Maintain water production at 136 L/capita/day or less (30 gallons/capita/day)	Public education campaign maintained about water conservation Maintain water production at 136 L/capita/day or less (30 gallons/capita/day)
Improved water conservation through improved water consumption practices	In areas with consumption of more than 200 L/capita/day, reduce water consumption to 114 L/capita/day (25 gallons/capita/day) In areas with consumption of 100-200 L/capita/day, maintain at 114 L/capita/day (25 gallons/capita/day)	Reduce and maintain water consumption at 114 L/capita/day or less (25 gallons/capita/day)	Reduce and maintain water consumption at 114 L/capita/day or less (25 gallons/capita/day)
Reduced systems leakages of Non Revenue Water and Unaccounted for Water	Reduce to 20% or less Outsource at least 25% of revenue collection	Reduce to 20% or less	Reduce to 20% or less
Increased household water metering	Introduce water metering in phases All new connections to be metered At least 100% of high income areas have metering in place All commercial and business premises have water metering	At least 10% of medium income areas have metering in place	At least 20% of medium income areas have metering in place

Water flows monitored at tube wells	Bulk flow meters and pressure gauges installed at 20% of tube wells	Bulk flow meters and pressure gauges installed at 40% of tube wells	Bulk flow meters and pressure gauges installed at 60% of tube wells
Cost and Staffing efficiency	Water staff rate reduced to 2-3 per 1000 connection Wastewater staff rate reduced to 2-3 per 1000 connections	Water staff rate maintained at 2-3 per 1000 connection Wastewater staff rate maintained at 2-3 per 1000 connections	Water staff rate maintained at 2-3 per 1000 connection Wastewater staff rate maintained at 2-3 per 1000 connections
Efficient Billing and Collection	Collection period reduced to less than 30 days Billing efficiency increased to 50% Financial collection efficiency increased to 50% Outsource billing and collection	Collection period reduced to less than 15 days Billing efficiency increased to 75% Financial collection efficiency increased to 75%	Collection period maintained at less than 15 days Billing efficiency increased to 90% and above Financial collection efficiency increased to 90% and above
Enhanced and sustainable Financial Performance	Operating cost coverage ratio of 0.5 achieved Working ratio reduced to 2.0 or less	Operating cost coverage ratio of 0.75 achieved Working ratio reduced to 1.5 or less	Operating cost coverage ratio of 1.0 or more achieved Working ratio reduced to less than 1.0
Enhanced and sustainable financial performance by TMAs	At least 30% of TMAs have a working ratio of 4.0 or less	At least 60% of TMAs have a working ratio of 3.0 or less	At least 90% of TMAs have a working ratio of 2.0 or less
A functional Biometric tracking system in all cities and TMAs	All mega cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 50% of intermediate cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 30% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles	At least 50% of intermediate cities have an installed and functional biometric tracking system for staff, equipment/vehicles At least 60% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles	At least 90% of TMAs have an installed and functional biometric tracking system for staff, equipment/vehicles

Sector Capacity			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved human resource development and management	Each sub-sector covering cities and TMAs conducts a human resource development assessment, need for professional staff placements and develops an action plan	At least 30% of human resource development actions implemented in cities and TMAs	At least 60% of human resource development actions implemented in cities and TMAs
Establish a Punjab Municipal Services Institute	A municipal services institute established for professional and technical training of TMA staff Core curricula and faculty development plan formulated Professional and continuing education programmes launched	At least 30% of TMA professional staff undergo continuing professional development in defined technical areas At least 30% of professional staff placements in TMA subsectors achieved At least 30% of TMAs prepare their budgets according to TMA development plans	At least 60% of TMA professional staff undergo continuing professional development in defined technical areas At least 60% of professional staff placements in TMA subsectors achieved At least 60% of TMAs prepare their budgets according to TMA development plans
Local Government Academy upgraded	Infrastructure and capacity development plan developed for Local Government Academy at Lala Musa Administration training curricula reviewed and updated Core package of administration and soft skills training developed Upgradation plan initiated	At least 30% of TMA staff trained in core package of administration and soft skills	At least 60% of TMA staff trained in core package of administration and soft skills
Improved performance of WASAs	Complete process of capacity and performance assessment of all WASAs	All WASAs implement at least 75% of all critical capacity and performance improvement measures	All WASAs implement at least 75% of all essential capacity and performance improvement measures
Establish a Water and Sanitation Academy for WASA staff	Water and Sanitation Academy established Core curricula and faculty development plan formulated Professional and continuing education programmes launched	At least 30% of WASA professional staff undergo continuing professional development in defined technical areas At least 30% of professional staff placements in WASAs achieved	At least 60% of WASA professional staff undergo continuing professional development in defined technical areas At least 60% of professional staff placements in WASAs achieved

CBOs capacities strengthened	Strengthen CBO through their capacity building and registration under the Government Act	Strengthen CBO through their capacity building and registration under the Government Act	Strengthen CBO through their capacity building and registration under the Government Act

Sector Financing			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Increased Own Source Revenue (OSR) in sub-sectors by TMAs	Incentivise by providing matching grants to TMAs related to sub-sector OSR At least 30% of TMAs increase their baseline sub-sector OSR by 100% or more	At least 60% of TMAs increase their baseline sub-sector OSR by 200% or more	At least 75% of TMAs increase their baseline sub-sector OSR by 300% or more
Increased regulated private sector participation in sub-sectors	Incentivise private sector with subsidies to provide water supply, filtration plants, O&M services, rehabilitation of dysfunctional schemes, solid waste management, wastewater treatment in selected areas and city and town zones Determine type of contract arrangement and ensure regulatory mechanism in place	At least 30% or more of coverage of municipal services in mega cities provided by private sector At least 30% or more of coverage of municipal services in intermediate cities provided by private sector At least 25% or more of coverage of municipal services in TMAs provided by private sector	At least 60% or more of coverage of municipal services in mega cities provided by private sector At least 60% or more of coverage of municipal services in intermediate cities provided by private sector At least 50% or more of coverage of municipal services in TMAs provided by private sector
Increased development expenditure allocation to sub-sectors	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 80% of sector development allocation requirement and release achieved	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 90% of sector development allocation requirement and release achieved	Proportionate increase in sub-sector development expenditure allocation and release with increase in overall development expenditure allocation At least 100% of sector development allocation requirement and release achieved
Punjab Town Improvement Programme	Town Improvement Programme for 105 towns developed that incorporates integrated water supply, sewerage and drainage, wastewater treatment and solid waste management, and climate change adaptation and mitigation	Town Improvement Programme launched in 20% of TMAs	Town Improvement Programme launched in 40% of TMAs
Fast track approach for declaring priority districts ODF	At least 30% of 11,904 villages in priority districts declared ODF	At least 60% of 11,904 villages in priority districts declared ODF	At least 90% of 11,904 villages in priority districts declared ODF

Sector Coordination			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Improved governance mechanism for coordination	Constitute a Punjab Steering Committee on WASH under the Punjab Water Commission Set up sub-sector Task Forces under the Steering Committee Ensure multi-stakeholder representation as appropriate NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene	Six monthly meetings of Steering Committee and sub-sector task forces Monitor progress of sector development plan and report to Chief Minister NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene	Six monthly meetings of Steering Committee and sub-sector task forces Monitor progress of sector development plan and report to Chief Minister NGOs initiatives in sub-sectors linked and synergised with master plans of cities, municipalities, towns, district councils so as to strengthen existing systems, assist government efforts to reduce open defecation and improve WASH hygiene
Improved operational performance and information and knowledge management	Establish a Project Management Unit (PMU) for the sector plan to support the Punjab Water Commission PMU devises M&E framework PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter	PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter	PMU monitors district scorecard for WASH PMU collates key sector related information from various departments PMU provides updates to Punjab Steering Committee and presents progress on operational performance according to M&E framework to Chief Minister every quarter
Special Panel on Research	A Special Panel on Research constituted under the Punjab Water Commission to review existing evidence and recommend wastewater treatment options for	Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste Research in Punjab' Report to the Punjab Water	Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste Research in Punjab' Report to the Punjab Water

	different urban, peri-urban and rural settings Identify gaps where more research is needed Collate and synthesise research in the sub-sectors and present a biennial 'State of Water, Sanitation, Hygiene and Solid Waste Research in Punjab' Report to the Punjab Water Commission and recommend practical applications of the research in the context of the sector development plan	Commission and recommend practical applications of the research in the context of the sector development plan	Commission and recommend practical applications of the research in the context of the sector development plan

Sector Monitoring and Evaluation			
Strategic Goal	Short Term 1 - 3 years	Medium Term 4 - 6 years	Long Term 7 - 10 years
Enhanced management performance of water and sanitation operators and TMAs	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter	Each WASA ensures quarterly updating of WASA performance indicators of previous quarter and updated on website Each TMA ensures quarterly updating of sub-sector indicators of previous quarter and updated on TMA website Each TMA ensures utilisation of computerised Financial Management System, Performance Management System, Client Tracking System and updated on TMA website every quarter
Consolidated Dashboard of sub-sector performance	Collaboration with Urban Unit and Punjab Information Technology Board to develop web-based information management system that links WASA performance system, TMA performance system, District Water Quality monitoring and other periodic monitoring data (financial allocation, release and utilisation; wastewater quality; industrial wastewater contamination etc.) Dashboard housed and operated by PMU, which generates a quarterly District Scorecard and provides updates on its website	PMU generates a quarterly District Scorecard, a city scorecard, TMA scorecard and provides updates on its website	PMU generates a quarterly District Scorecard, a city scorecard, TMA scorecard and provides updates on its website
Production of an annual sector status report	PMU produces an annual “State of Water, Sanitation and Solid Waste in Punjab’ Report PMU produces biennial provincial data for JMP and GLAAS reports	PMU produces an annual “State of Water, Sanitation and Solid Waste in Punjab’ Report PMU produces biennial provincial data for JMP and GLAAS reports	PMU produces an annual “State of Water, Sanitation and Solid Waste in Punjab’ Report PMU produces biennial provincial data for JMP and GLAAS reports

Periodic sector review	Strategic review of sector plan at end of short term	Strategic review of sector plan at end of medium term	Strategic review of sector plan at end of long term

ACRONYMS

ADB	Asian Development Bank
ADP	Annual Development Plan
AEPAM	Academy of Educational Planning and Management
BCC	Behaviour Change and Communication
BCM	Billion Cubic Metre
BHU	Basic Health Unit
BOD	Biological Oxygen Demand
CBOs	Community Based Organisations
Cd	Cadmium
CDGF	City District Government Faisalabad
CDGL	City District Government Lahore
CETP	Common Effluent Treatment Plant
CFMS	Computerised Financial Management System
CMW	Community Midwife
COD	Chemical Oxygen Demand
CPD	Continuing Professional Development
CTS	Complaint Tracking System
CTSC	Cluster Training and Support Centre
Cu	Copper
Cusec	Cubic feet per second
CW	Constructed Wetland
DALYs	Disability Adjusted Life Years
DEWS	Disease Early Warning System
DGME	Directorate General Monitoring and Evaluation
DHIS	District Health Information System
DoE	Department of Environment
DoH	Department of Health
DSD	Directorate of Staff Development
DTE	District Teacher Educator
DTSC	District Training and Support Centre
EMWMP	Environmental and Medical Waste Management Plan
EPI	Expanded Programme for Immunisation
FANSA	Fresh Water Action Network South Asia
GDP	Gross Domestic Product
GIS	Geographical Imaging System
GLAAS	Global Analysis and Assessment of Sanitation and Drinking Water
HCWM	Health Care Waste Management
HIES	Household Integrated Economic Survey

HUD&PHED	Housing Urban Development and Public Health Engineering
ICMP	Infection Control Management Project
IMNCH	Integrated Mother Newborn and Child Health
IMR	Infant Mortality Rate
IPCC	Intergovernmental Panel on Climate Change
IRSP	Integrated Rural Support Programme
IWASRI	International Waterlogging and Salinity Research Institute
JMP	Joint Monitoring Programme
LG&CDD	Local Government and Community Development Department
LHW	Lady Health Worker
LWMC	Lahore Waste Management Company
M&E	Monitoring and Evaluation
MAF	Million Acre Feet
MGD	Million Gallons per Day
MHM	Menstrual Hygiene Management
MICS	Multiple Indicator Cluster Survey
MIS	Management Information Systems
MSW	Municipal Solid Waste
MTDF	Medium Term Development Framework
NCHD	National Commission for Human Development
NEMIS	National Education Management Information System
Ni	Nickel
NRW	Non-Revenue Water
O&M	Operation and Maintenance
ODF	Open Defecation Free
ORS	Oral Rehydration Solution
OSR	Own Source Revenue
OHR	Overhead Reservoir
P-WON	Pakistan Water Operators Network
P&D	Planning and Development
PATS	Pakistan Approach to Total Sanitation
Pb	Lead
PCWSSP	Punjab Community Water Supply and Sanitation Project
PDHS	Pakistan Demographic and Health Survey
PESRP	Punjab Education Sector Reforms Programme
PHC	Primary Health Care
PKR	Pakistani Rupees
PMDFC	Punjab Municipal Development Fund Company
PMIU	Programme Management Implementation Unit
PMS	Performance Management System

PMSIP	Punjab Municipal Services Improvement Project
ppb	Part per billion
PRWSSP	Punjab Rural Water Supply and Sanitation Project
PSLM	Pakistan Social and Living Standards Measurement Survey
PSPC	Punjab Saaf Pani Company
PSPU	Policy and Strategic Planning Unit
PST	Primary School Teacher
RDF	Refuse Derived Fuel
RHC	Rural Health Centre
RO	Reverse Osmosis
Rs	Pakistani Rupees
SACOSAN	South Asia Conference on Sanitation
SHSP	School Health Services Programme
SLTS	School Led Total Sanitation
SWM	Solid Waste Management
TB DOTS	Tuberculosis Directly Observed Treatment Short-course
TDS	Total Dissolved Solids
TE	Teacher Educator
TMA	Tehsil/Town Municipal Administration
TO (I&S)	Tehsil Officer (Infrastructure and Services)
TPV	Third Party Validation
TT	Teacher Trainer
U5MR	Under 5 Mortality Rate
UC	Union Council
UF	Ultra Filtration
UNICEF	United Nations Children Emergency Fund
USD	United States Dollar
VAM	Vulnerability Analysis and Mapping
W&WW	Water and Wastewater
WASA	Water and Sanitation Agency
WASH	Water Sanitation and Hygiene
WFP	World Food Programme
WHO	World Health Organization
WSP	Water Sanitation Programme
WSS	Water Supply and Sanitation
WTE	Waste to Energy
WWTPs	Wastewater Treatment Plants
Zn	Zinc

(1 United States Dollar is equivalent to about 100 Pakistani Rupees)

OPERATIONAL DEFINITIONS

Agency **-** means an Agency established under any of the laws for the time being enforced and includes any government department and any other local or international organisation

Agricultural Solid Waste - Solid waste that is generated by the rearing of animals, and producing and harvesting of crops or trees.

Aquifer **-** means a layer of water-bearing strata located underground that conveys water in sufficient quantity to supply pumping wells or natural springs

Arsenic Contamination - is the natural contamination of drinking water caused by application of insecticides, wood preservatives, mining activities and petroleum refining. The water quality guidelines mentioned by the NDWQS state that the level of arsenic contamination for safe drinking water should not exceed 0.05 mg/L (50 ppb).

Authority **-** means an Authority established under any law and includes any government, local or international authority

Bacterial contamination - is usually measured by the faecal coliform levels in the water. Faecal coliform is an indicator organism; it is easily measured and can signal the presence of other harmful bacteria in water.

Basic Sanitation **-** means provision of sewerage services to the inhabitants of any area using the lowest-cost technology ensuring hygienic excreta and sludge disposal and a clean healthy living environment

Basic Water Supply - means the supply of prescribed quantity and quality of water to households, including informal households, to support life and personal hygiene

Bulk Water Entitlement - means the volumetric authorisation given by the Commission to a bulk water supplier for a specific period of time as provided in the permit granting the entitlement

Bulk Water Supplier - means any person, who having procured a bulk water entitlement, treats it as per prescribed standards and then supplies it to service provider in an area or service providers in more than one area for retail distribution; and includes a supplier of wastewater treatment services

CBO - refers to Community Based Organisation; Organise and motivate community of the village(s) of WSS Scheme for ascertaining need for the scheme, Providing support to Public Health Engineering for planning, designing, estimation, execution and operation of the scheme and operate & maintain rural water supply schemes.

Chemical contamination - is measured by a test specific to a particular chemical. Chemicals contaminations can naturally occur or can be caused by anthropogenic activities entering from either point sources (such as a specific leak from a pipe or a dumping site) or from non-point sources (such as oil or other gasoline products from large-scale runoff from a highway or parking lot), and are considered to be very harmful.

Community Led Total Sanitation - is an “innovative methodology for mobilising communities to completely eliminate open defecation. Communities are facilitated to conduct their own appraisal and analysis of open defecation and take their own action to become open defecation free.”

Component Sharing - Approach by which responsibility for development of sanitation infrastructure is bifurcated between community and government. The community pays for and constructs internal infrastructure (household latrines, lane and small collector sewers) while the government agency constructs external infrastructure (primary and trunk sewerage, disposal stations and treatment plants). The division of components is explained below.

a. Internal Development comprises of

- Inside the house-sanitary latrines,
- In the lane-underground sewerage line, and
- Small, secondary or collector sewers.

(Community is responsible for internal development)

b. External Development that constitutes

- Large secondary or collector sewerage,
- Trunk sewer/nullah development,
- Disposal station, and
- Treatment plant.

(Government is responsible for external development)

Conservancy - means the collection, treatment, removal and disposal of refuse

Consumer - means any end user who receives water supply or sanitation services from a service provider

District Council - means a body corporate having perpetual succession and a common seal, with power to acquire and hold property and enter into any contract and may use and be used in its name

Drain - includes a sewer, a house drain, a drain of any other description, a tunnel, a culvert, a ditch, a channel or any other device for carrying sullage or rain water

Drinking Water - means water used for municipal purposes including drinking, cooking, hygiene and other domestic uses

Effluent - means wastewater discharged from point sources which enters into a body of water or upon land, or wastewater arising as a by-product of any water use

Environmental Remediation Use - means use of water for environmental remediation purposes

Groundwater - means subsurface water that occurs beneath a water table in soils and rocks, or in ecological formations

Groundwater Vulnerability - is defined as the tendency and likelihood for general contaminants to reach the water table after introduction at the ground surface

Hospital waste management - It means the management of waste produced by hospitals (during diagnosis, treatment or immunisation of human beings or animals or in research) using such techniques that will help to check the spread of diseases

HUD&PHED - refers to the Housing, Urban Development Department & Public Health Engineering Department

Improved sanitation facilities - Facilities that ensure hygienic separation of human excreta from the human contact. They include pour-flush latrines/ toilets, linked to piped sewerage system septic tank, pit latrines, ventilated improved pit latrine, pit latrine with slab, composting toilets

Improved source of drinking water – refers to piped into dwelling; piped into compound, yard or plot; piped to neighbour; public tap or standpipe; tube well; hand pump with tap; motorised pump; protected well; protected spring; bottled mineral water

Industrial (Residual) Solid Waste - Solid waste generated by industrial processes and manufacturing

Intermediary Towns - Those towns which are not metropolis but bigger in respect to area and population. These towns have more than one hundred thousand population

LG&CDD - refers to the Local Government and Community Development Department and its attached and affiliated entities

Local Government - means a local government established under the Punjab Local Government Act, 2013, and includes a Union Council, a Municipal Committee, a Municipal Corporation, the Metropolitan Corporation, a District Council, a District Education Authority and a District Health Authority

Mauza or Deh - is a demarcated territorial unit for which a separate revenue record including a cadastral map is maintained by the provincial revenue departments. One Mauza / Deh may contain one or more population settlements or may have no settlement (Bechiragh)

Metropolitan Corporation - means the Metropolitan Corporation Lahore

Municipal Committee - means a Municipal Committee constituted under the PLGA 2013

Municipal Corporation - means a Municipal Corporation constituted under the PLGA 2013

Municipal Purpose - means use of water in an area for drinking, domestic and recreational use, horticultural, industrial or commercial use and includes such other purposes as may be prescribed but excludes water used solely for the purposes of irrigation

Municipal services - include intra-city network of water supply, sanitation, conservancy, removal and disposal of sullage, refuse, garbage, sewer or storm water, solid or liquid waste, drainage, public toilets, express ways bridges, flyovers, public roads, streets, foot paths, traffic signals, pavements and lighting thereof, public parks, gardens, graveyards, arboriculture, landscaping, billboards, hoardings, firefighting, land use control, zoning, master planning, classification declassification or reclassification of commercial or residential areas, markets, housing, urban or rural infrastructure, environment and construction, maintenance or development of these services and enforcement of any law relating to municipal services

Municipal Water - means the total water required for municipal purposes in an area

National Drinking Water Quality Standards - means the standards approved the Pakistan Environmental Protection Council in March 2010

National Environmental Quality Standards - means the standards issued by the Pakistan Environmental Protection Agency established under the Pakistan Environmental Protection act, 1997

Open defecation - Defecation in fields, forests, bushes, bodies of water or other open spaces, or disposal of human faeces with solid waste

Operational Cost Coverage – This is the ratio of total annual operational revenue divided by total annual operating costs

Public sector - refers to all ministries, departments, entities, bodies and local governments at the provincial, federal and local levels

Refuse - includes rubbish, offal, night-soil, carcasses of animals, deposits of sewerage, waste and any other offensive matter

Rural area - means the area of a District Council

Safe Drinking Water - refers to the water complying with national/provincial drinking water quality standards

Sanitation - is defined as hygienic means of preventing human contact with the hazards of wastes. Wastes include human and animal faeces, solid wastes, domestic wastewater (sewage, sullage, and grey water), industrial wastes, and agricultural wastes, hygienic means of prevention by using engineering solutions (e.g. sewerage and wastewater treatment), simple technologies (e.g. latrines, septic tanks), or even by personal hygiene practices (e.g. simple hand washing with soap)

Service Providers - refer to local government institutions (District Government / Tehsil Municipal Administrations / Town Committees, etc.) WASA, CBOs responsible for the management, treatment and distribution of municipal water or collection, transport, treatment and disposal of wastewater

Sewage & wastewater treatment - Chemical, biological, and mechanical procedures applied to an industrial or municipal discharge or to any other sources of contaminated water to remove, reduce, or neutralise contaminants before discharging it into a water body

Sewerage - means a system of collection of wastewater from an area including its houses, institutions, industry and public places; the pumping, treatment and disposal of such wastewater, effluent, sludge, and other end products

Shared sanitation facilities - Sanitation facilities of an otherwise acceptable type shared between two or more households. Shared facilities include public toilets

Small Towns - Small towns are those having a population of less than hundred thousand, comprising of two to three union councils devoid of any municipal council

Solid Waste - means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges

Sources of Drinking Water – these include the following:

- Tap water is a delivery system where the water is delivered through a network of pipes and the water is treated before it is supplied. In urban areas generally, water comes in to house through pipes and is stored in tanks, built in the house. Then the water for the use of household is lifted to small tanks built at the top of the house
- Hand Pump is a pump operated manually to draw water from a bored hole. Sometimes hand pump and motor are operated at the same hole
- Dug well is of two types - opened and closed well. Closed well is a dug well with a covering and opened well is a dug well without covering

Surface Water - means water, which lies above the surface of the ground, is open to the atmosphere and is subject to surface runoff

TMA - refers to Town / Tehsil Municipal Administration

Total Sanitation - Combination of four interventions that include; hygiene, foul water disposal/drainage, excreta disposal and solid waste management (sustaining ODF status and ensuring its sustainability)

Unimproved Sanitation facilities - Facilities that do not ensure hygienic separation of human excreta from human contact. Unimproved facilities include pit latrines without a slab or platform, hanging latrines and bucket latrines

Urban area - means an area within the jurisdiction of the Metropolitan Corporation, a Municipal Corporation, or a Municipal Committee and includes any other area, which the Government may, by notification, declare to be an urban area for purposes of the PLGA 2013

User of Water - means any natural or artificial person or persons, whether Government owned or controlled or not, who or which uses water for any municipal purpose

Village - means an integrated and contiguous human habitation commonly identified by a name and includes a dhok, chak, gaown, basti, killi or any other comparable habitation. There may be one or more Villages / Basties / Killies in a Mauza

Water and Sewerage Services Provider - means Any Government or private body established under any law and operating as services providers

Water Body - means both natural and man-made bodies of fresh, brackish, and saline waters, and includes, but is not limited to, aquifers, groundwater, springs, creeks, streams, rivers, ponds, lagoons, water reservoirs and lakes but does not include bodies constructed, developed and used purposely as water treatment facilities, or water storage for recycling and re-use which are integral to process industry or manufacturing

Water Coverage - refers to the proportion of the population that has access to safe drinking water.

Water Pollution - means any alteration of the physical, chemical, biological, or radiological properties of a water body resulting in the impairment of its purity or quality

Water Quality - means the quality of water, which conforms to the national drinking water quality standards. It also means water the quality whereof is appropriate as per standards issued by a regulating authority for the purpose for which it is supplied or used

Water safety planning approach - is a plan to ensure the safety of drinking water through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer

Water Service - means in general water supply and sewerage services, unless otherwise specified

Water Supply Services - means the appropriation, conveyance, treatment and distribution of municipal water, or water (through withdrawal and abstraction of ground or surface water or harvesting of rainwater) intended to be converted to municipal water

Well - means a well sunk for the search or abstraction of water by a person or persons for carrying out scientific investigations, exploration, development or management work for the survey and assessment of water resources or for providing water and includes open well, dug well, bore-well, dug-cum-bore-well, tube well and collector well

Working Ratio – This is the ratio of total operating expenses divided by total operating revenues

Annex 1 – Bottleneck analysis Punjab

Determinants	Bottlenecks Identified	Actions	Priority
Social Norms	OD is generally acceptable in rural Punjab – relatively more acceptable for children and older people	Mass awareness campaign on health hazards and associated protection risks of OD – focus more on parents, children and older people	High
Legislation/ Policy	The Provincial Sanitation Policy is yet to approved	▪ Advocate/lobby for approval of Provincial Sanitation Policy ▪ Hold policy dissemination session at least at district/tehsil levels, and develop district/tehsil Sanitation Plans – while engaging relevant stakeholders	High
Budget/ Expenditure	Joint budgeting for water and sanitation with evident leaning towards water	▪ Lobbying for adequate financial allocations for rural sanitation, ▪ Inclusion of funds for softer components (community mobilisation)	High+
Management/ Coordination	▪ Limited coordination between relevant departments for rural sanitation ▪ Limited awareness of the potential contributions/roles of health, education and civil society actors. ▪ Limited technical capacities of staff at local level ▪ Political interferences in award of schemes	▪ Lobbying to form multi-stakeholder coordination forums at provincial and district levels for coordinated planning and resource sharing (leverage existing linkages between LG&RD and PHED) ▪ Encourage engagement of relevant public and civil society stakeholders in areas of comparative advantage e.g. CSOs in community mobilisation.	High
Availability of essential commodities / inputs	Limited penetration of sanitation products in rural markets in Punjab, localisation (in terms of technologies), availability of low costs solutions and skilled manpower	Develop and support innovative models of public private partnerships (entrepreneurship) for deeper market penetration, localisation, low-cost and diversified solutions and creation of skilled manpower for services.	Medium

Determinants	Bottlenecks Identified	Actions	Priority
Access to adequately staffed services, facilities and information	Technical capacity gaps at sub-district levels, limited awareness of mandate and services and lack of support for information dissemination	Focus on staff development in varied management and technical skills – priorities the field level staff, that is to deal with communities	High+
Financial Access	Poverty and inaccessibility to low cost sanitation products and trained work force (results in cost escalations), hence impedes greater demand	Improve market penetration (for products and services for easier accessibility), encourage competition for low costs models (for technological innovation) and public-private partnerships to offer subsidies, financing and other options.	Medium
Social and Cultural Practices and Beliefs	▪ Strong reservations and resistance to change for improved sanitation as is considered an urban evil. ▪ Greater acceptability for older people and children to defecate in open compared to women and girls.	▪ Integrate religious elements as to cleanliness in the planned mass awareness campaign design. ▪ Engage local institutions/change leaders such as schools, Masjid, teachers, students, religious leaders – to contribute actively in public awareness	High +
Continuity of Use	Limited focus on community mobilisation in public domain resulting in poor buy in from communities and indifferent attitude/resistance to take charge of O&M responsibility	▪ Increased staff capacities and resources for softer components during design and implementation phase of WASH interventions ▪ Evolve community lead O&M to ensure greater ownership and sustainability.	High
Quality	▪ Drive to increase accessibility often leads to compromise on quality considerations ▪ Quality standards for rural sanitation are either non-existent or where available are not complied with	▪ Advocate and prioritise coverage expansion, while laying considerable focus on quality services provision. ▪ Introduce and implement exhaustive sanitation related standards in NEQS as extension of the policy	Medium

(Source: PATS-Government stakeholders bottleneck analysis - Punjab. UNICEF 2013)

Annex 2 – Equity in Water and Sanitation

There is a general awareness that poor sanitation is generally associated with poverty and some measures of economic status directly include sanitation access as an asset or proxy for wealth. The MDG target on water and sanitation does not directly prioritise improvements for the poor. Often sector investments are primarily used for infrastructure, such as drinking water supply and urban wastewater treatment that is not likely to disproportionately benefit the poor.

Equity involves recognising that people are different, and for the realisation of their rights, different approaches and support are required. This may include special measures and processes to address the needs of people who are discriminated and disadvantaged. Moreover, Inclusion is about improving access to services while supporting people who are marginalised and excluded. It is desirable to understand the critical factors creating disparities at different levels i.e. local, provincial and national.

In order to develop an equity-focused programme, an equity based mapping of Punjab for water and sanitation was conducted by using PLSM 2010-2011 datasets for identification of areas most in need of interventions[175].

Methodology / Approach

Wealth Quintiles

Disparities in Drinking Water Supply and Sanitation Services have been assessed on the basis of wealth index/wealth quintile, and coverage/access to water and sanitation services. The datasets of Pakistan Social Living Measurement (PSLM) Survey 2020-2011 have been used for the construction of wealth quintiles, by using principal component analysis (PCA) approach, based on the ownerships of assets possessed by the households interviewed. Overall 12 assets were included. The lowest quintile is the Poorest (1st quintile) followed by Poor (2nd quintile), Middle (3rd quintile), Rich (4th quintile) and the Richest (5th quintile). The calculations for rural, urban and overall coverage have also been done.

[175] Analysis of Inequities in Basic Water Supply and Sanitation in Pakistan, 2014. UNICEF

Further, as per JMP criteria, the access to improved drinking water sources and improved sanitation are divided into various categories.

The criteria of inclusion for improved and unimproved sources for drinking water are:

1.	Tap (in home, courtyard)	Improved Source
2.	Tap (outside the home)	Improved Source
3.	Hand pump	Improved Source
4.	Water motor	Improved Source
5.	Covered well	Improved Source
6.	Open well	Un-Improved Source
7.	River, stream, pond etc.	Un-Improved Source
8.	Tanker truck, water	Un-Improved Source
9.	Mineral Water fetcher	Un-Improved Source
10.	Others	Un-Improved Source

The criteria of inclusion for improved and unimproved sanitation are:

1.	Flush system (linked to sewerage)	Improved Facility
2.	Flush (linked to Septic tank)	Improved Facility
3.	Flush (connected with open drain)	Un-improved Facility
4.	Privy seat	Un-Improved Facility
5.	Digged ditch	Un-Improved Facility
6.	Facility not available	Un-Improved Facility
7.	Others	Un-Improved Facility

After constructing wealth quintiles, the spread of categories of improved water and improved sanitation for each quintile was determined to identify the disparities of water and sanitation respectively. The results were calculated for each district covered in PSLM into three areas i.e. overall, urban and rural.

Exposure Index

Exposure scores were constructed based on the disparities prevailing in the population in accessing the basic sanitation related facilities and extent to which the population is exposed to the threats underlying in the poor sanitation conditions prevailing across the areas.

Susceptibility Index

The susceptibility index was developed by accounting for diarrhoeal risk factor for children under five i.e. likelihood of receiving appropriate treatment for diarrhoea. The index was constructed for each child basis. Oral rehydration Solution (ORS) administration in the effected children is believed to be an effective remedy for preventing deaths due to diarrhoea in children less than 5 years of age. Similarly, polio vaccination is considered effective in preventing polio among children.

Sanitation Risk Index

By combining the Exposure index and Susceptibility index, an overall Sanitation Risk index has been determined with a postulation that children who have no exposure and have no risk. The Sanitation Index only covers ORS administration whereas Sanitation Index 2 is derived by adding the value of polio.

The districts haven been categorised in the tables below, and new investments in Punjab can be planned for the districts having high sanitation risk index as well as low coverage in the poorest quintiles.

Table 30 - District level quintiles for access to improved water - Punjab (PSLM 2010-11)

	Urban					Rural					Overall				
Region	Poorest	Poor	Middle	Rich	Richest	Poorest	Poor	Middle	Rich	Richest	Poorest	Poor	Middle	Rich	Richest
Pakistan	93	94	94	93	92	75	80	86	89	93	78	85	90	93	93
Punjab	94	92	93	91	88	91	95	95	95	96	92	95	94	94	93
Islamabad	94	81	79	93	92	85	86	83	96	96	90	83	80	94	94
Attock	73	77	100	94	100	72	63	68	79	86	72	64	73	83	92
Rawalpindi	80	91	91	97	92	58	58	64	63	80	62	71	78	85	88
Jhelum	100	90	89	94	82	93	91	90	95	93	94	91	90	95	89
Chakwal	100	79	100	97	100	80	86	82	95	95	81	86	83	95	97
Sargodha	100	90	86	91	88	99	97	97	99	100	99	96	95	96	95
Bhakkar	.	92	94	100	98	100	100	100	100	100	100	100	99	100	99
Khushab	100	100	100	100	100	93	97	93	94	100	94	98	94	96	100
Mianwali	83	94	94	97	97	78	92	88	94	94	78	93	89	94	95
Faisalabad	71	66	67	58	46	98	96	92	92	92	94	85	81	72	61
Jhang	94	100	100	100	98	95	99	100	100	100	95	99	100	100	99
TT Singh	100	96	100	100	99	94	94	99	99	99	95	94	99	99	99
Chiniot	100	100	97	100	99	100	100	100	100	100	100	100	99	100	99
Gujranwala	100	100	98	99	98	100	99	100	100	100	100	100	99	100	99
Gujrat	95	97	97	96	96	98	100	99	100	100	98	99	99	99	98
Sialkot	95	95	90	94	91	100	99	100	100	98	99	98	98	98	95
Hafizabad	95	96	96	95	98	97	100	100	100	100	97	99	99	98	99
Mandi Bahauddin	100	78	88	96	94	100	99	100	100	100	100	98	98	99	99
Narowal	100	100	92	93	92	99	99	100	99	100	99	99	99	98	98
Lahore	99	99	99	97	99	100	98	97	95	93	99	99	99	97	98
Kasur	95	100	100	94	94	98	99	99	99	100	98	99	100	98	98
Sheikupura	100	96	96	100	98	96	99	100	100	100	97	98	99	100	99

Table 30 continued

	Urban					Rural					Overall				
Region	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**
Nankana Sahib	94	92	100	93	92	99	100	100	96	100	98	98	100	95	98
Vehari	92	100	100	91	83	96	97	99	100	100	96	97	100	98	92
Multan	87	95	98	100	98	97	97	97	98	96	96	96	97	99	98
Khanewal	100	100	100	100	100	94	99	96	100	100	95	99	97	100	100
Lodhran	86	97	100	100	100	86	89	91	87	97	86	90	92	88	98
DG Khan	100	100	85	86	92	27	50	69	96	99	27	51	69	94	96
Rajanpur	100	100	100	100	100	78	79	83	95	91	78	79	84	96	93
Layyah	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Muzaffargarh	100	100	100	100	100	95	97	99	100	100	95	98	99	100	100
Bahawalpur	97	89	89	91	79	100	98	98	98	100	100	97	96	95	87
Bahawalnagar	95	96	100	100	99	99	93	96	97	96	99	93	97	98	97
Rahim Yar Khan	100	83	88	79	64	99	98	99	99	97	99	96	97	92	82
Sahiwal	100	100	100	98	100	98	98	100	100	100	99	99	100	99	100
Pakpattan	100	100	100	100	100	93	97	98	94	97	93	97	98	95	98
Okara	100	100	100	100	99	100	99	100	100	100	100	99	100	100	100

Table 31 - District level quintiles for access to improved sanitation - Punjab (PSLM 2010-11)

	Urban					Rural					Overall				
Region	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**
Pakistan	60	76	84	87	85	8	19	38	53	68	13	33	56	73	80
Punjab	68	83	87	91	91	11	30	47	64	76	18	45	62	79	84
Islamabad	88	89	97	100	99	83	86	77	95	98	86	88	92	99	99
Attock	41	44	73	84	87	48	66	52	65	78	48	64	55	70	82
Rawalpindi	68	86	91	94	95	46	67	78	89	86	51	74	85	92	92
Jhelum	77	86	100	92	92	24	61	75	91	91	33	66	80	91	91
Chakwal	85	95	86	88	93	44	65	81	74	83	46	67	82	77	85
Sargodha	71	82	87	96	96	14	35	57	70	79	17	43	64	80	86
Bhakkar	.	92	44	73	71	18	32	26	40	55	18	35	28	47	61
Khushab	42	71	82	75	80	28	54	73	84	66	30	58	74	81	72
Mianwali	57	88	94	86	91	19	42	61	74	90	23	51	67	76	90
Faisalabad	93	99	99	98	95	42	79	90	96	96	49	87	94	97	96
Jhang	49	52	52	63	75	4	11	28	35	65	7	15	33	42	70
TT Singh	61	78	87	87	97	30	54	65	71	61	33	58	69	76	71
Chiniot	58	91	69	97	94	10	26	36	69	83	15	38	42	81	89
Gujranwala	90	90	92	90	95	70	85	91	97	96	76	87	92	92	95
Gujrat	89	95	89	95	95	49	79	86	92	94	55	83	87	93	94
Sialkot	88	84	88	90	81	63	94	94	96	100	67	92	93	94	92
Hafizabad	68	82	82	79	88	26	56	74	78	73	33	61	76	78	79
Mandi Bahauddin	66	89	100	99	100	14	43	56	81	82	17	45	64	86	86
Narowal	0	26	35	53	55	15	36	57	67	62	14	35	55	64	60
Lahore	90	94	97	95	97	45	62	75	82	80	75	88	94	94	95
Kasur	26	30	22	33	35	7	5	22	11	25	10	11	22	17	29
Sheikupura	26	69	58	82	80	20	37	36	53	56	21	46	44	65	71

Table 31 continued

	Urban					Rural					Overall				
Region	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**	**Poorest**	**Poor**	**Middle**	**Rich**	**Richest**
Nankana Sahib	43	55	35	32	52	19	30	41	35	56	22	35	40	35	55
Vehari	16	72	74	63	76	7	24	29	41	46	8	26	35	46	60
Multan	48	65	59	77	88	10	26	38	47	55	14	34	46	61	79
Khanewal	14	44	68	62	76	10	17	36	43	37	10	20	41	49	51
Lodhran	29	53	53	45	79	24	29	33	31	59	24	32	35	33	64
DG Khan	.	40	42	65	80	1	7	16	32	50	1	7	17	37	63
Rajanpur	50	80	87	84	88	0	6	5	26	54	0	8	11	41	64
Layyah	26	47	59	72	63	2	17	40	58	69	3	18	43	61	67
Muzaffargarh	0	38	42	72	70	6	7	14	32	35	5	8	17	38	49
Bahawalpur	24	49	55	74	85	8	25	37	66	87	9	29	42	69	86
Bahawalnagar	48	62	69	76	73	12	28	48	74	85	15	31	52	74	80
Rahim Yar Khan	44	79	86	90	95	13	25	45	72	83	14	31	53	78	88
Sahiwal	29	71	84	83	97	17	28	34	50	47	17	32	41	57	63
Pakpattan	53	47	64	54	74	5	19	25	43	65	6	21	30	45	69
Okara	56	59	69	73	90	10	29	35	44	57	12	30	37	49	70

Table 32 - Summary table of improved water, improved sanitation and sanitation index - Punjab (PSLM 2010-11)

Area	Improved Water - %			Improved Sanitation - %			Exposure Index	Susceptibility Index		Sanitation Index	Sanitation Index 2
	Urban	Rural	Overall	Urban	Rural	Overall		ORS only	ORS & Polio	ORS only	ORS & Polio
Pakistan	93	85	88	78	37	51	2.40	0.70	1.48	3.10	3.88
Punjab	92	95	94	84	45	58	2.43	0.61	1.37	3.04	3.80
Islamabad	88	90	89	95	88	93	0.90	0.59	1.34	1.49	2.25
Attock	94	73	77	76	60	64	1.30	0.75	1.65	2.06	2.96
Rawalpindi	92	63	77	90	68	79	1.52	0.77	1.56	2.29	3.09
Jhelum	90	92	92	90	66	72	1.29	0.67	1.57	1.96	2.86
Chakwal	97	87	88	90	68	71	0.99	0.77	1.58	1.76	2.58
Sargodha	89	98	96	92	47	58	2.35	0.62	1.28	2.96	3.63
Bhakkar	97	100	100	69	33	38	1.70	0.46	1.26	2.15	2.95
Khushab	100	95	96	74	59	63	1.46	0.61	1.34	2.07	2.81
Mianwali	95	89	90	87	55	61	1.67	0.73	1.57	2.39	3.23
Faisalabad	58	95	78	97	74	84	2.06	0.63	1.41	2.69	3.47
Jhang	99	99	99	64	24	33	2.57	0.55	1.30	3.11	3.87
TT Singh	99	97	97	85	55	62	2.25	0.52	1.14	2.76	3.38
Chiniot	99	100	100	89	39	53	2.27	0.52	1.33	2.78	3.60
Gujranwala	99	100	99	92	85	89	1.48	0.70	1.47	2.18	2.95
Gujrat	97	99	99	94	79	83	1.46	0.75	1.65	2.21	3.11
Sialkot	92	99	98	86	88	87	1.50	0.33	1.09	1.82	2.59
Hafizabad	96	99	98	81	59	65	1.87	0.67	1.47	2.54	3.34
Mandi Bahauddin	93	100	99	96	53	60	2.13	0.64	1.40	2.76	3.53

Note: The higher the Sanitation Index, the worse the situation

Table 32 continued

Area	Improved Water - %			Improved Sanitation - %			Exposure Index	Susceptibility Index		Sanitation Index	Sanitation Index 2
	Urban	Rural	Overall	Urban	Rural	Overall		ORS only	ORS & Polio	ORS only	ORS & Polio
Narowal	94	99	99	43	46	46	2.85	0.42	1.22	3.28	4.08
Lahore	99	98	99	95	61	89	3.07	0.71	1.45	3.78	4.53
Kasur	96	99	98	30	13	18	4.31	0.70	1.36	5.01	5.67
Sheikupura	98	99	98	69	38	49	3.02	0.58	1.39	3.60	4.41
Nankana Sahib	94	99	98	43	35	37	2.92	0.52	1.25	3.45	4.18
Vehari	89	98	97	68	27	35	3.31	0.66	1.50	3.97	4.81
Multan	98	97	97	75	30	47	4.16	0.70	1.49	4.86	5.65
Khanewal	100	98	98	65	27	34	3.34	0.59	1.29	3.94	4.64
Lodhran	98	90	91	61	34	38	2.99	0.71	1.47	3.70	4.46
DG Khan	91	65	68	75	19	25	2.22	0.83	1.71	3.05	3.93
Rajanpur	100	84	86	85	16	24	1.89	0.89	1.78	2.78	3.67
Layyah	100	100	100	61	34	39	1.90	0.61	1.32	2.51	3.22
Muzaffargarh	100	98	98	63	17	24	3.16	0.63	1.41	3.80	4.57
Bahawalpur	86	99	95	71	37	47	1.55	0.45	1.19	2.00	2.75
Bahawalnagar	99	96	97	70	46	50	1.87	0.37	1.10	2.24	2.97
Rahim Yar Khan	76	98	93	89	42	53	2.19	0.42	1.10	2.61	3.29
Sahiwal	99	99	99	85	34	42	3.29	0.67	1.47	3.96	4.75
Pakpattan	100	95	96	66	28	34	3.34	0.51	1.24	3.85	4.58
Okara	100	100	100	80	33	40	3.11	0.67	1.34	3.78	4.45

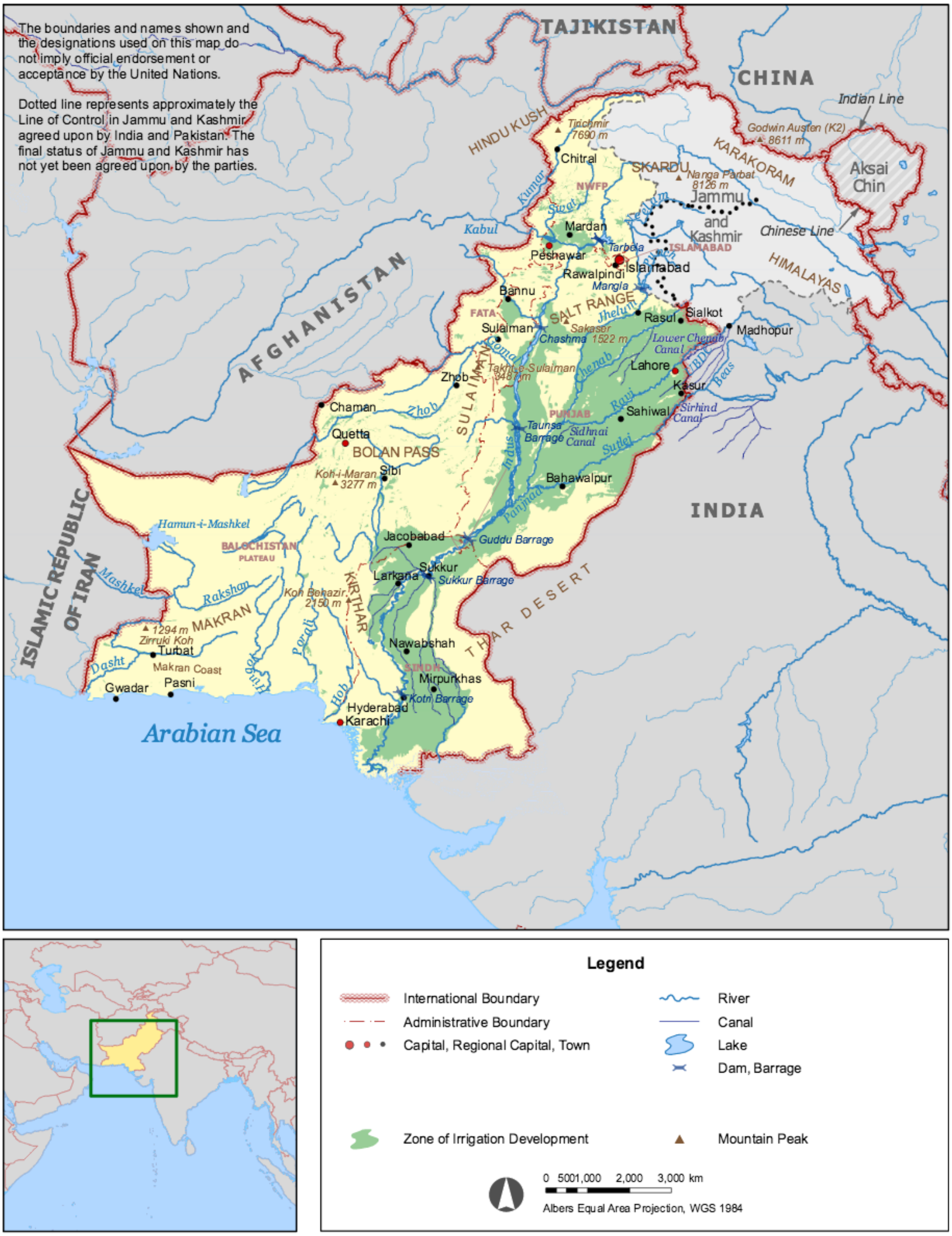
Note: The higher the Sanitation Index, the worse the situation

Annex 3 – Status of Industrial Wastewater in selected cities in Punjab

District	Number of Industries	Main types of industry / Municipality	Average effluent discharge (Cusec)	Municipal Discharge (Cusec) – untreated sewage	Quality of industrial effluent	
					Number of Industries with Unfit Effluent	Number of Industries with Fit Effluent
Faisalabad	299	Bakery Products, Board Factory, Calico, Chemical, Cold Store, Corporation, Daal Factory, Danium, Dyeing, Energy Unit, Fibre Mill, Floor, Flour Mill, Gattah, Ghee Mill, Hosiery, Maize, Paper Mill, Petroleum, Poultry, Power, Power Loom, Rice Mill, Soap Factory, Spinning, Sugar Mill, Textile, Welfare Trust	453.47	145	296	3
Hafizabad	1	Chemical	0.5	15	1	
Gujranwala	94	Board Mills, Ceramics, Dyeing, Engineering, Flour Mill, Gattah Factory, Ghee, Glass, Leather, Marble, Municipality, Paper Mills, Pharmaceuticals, Pipe, Pottery, Printing, Rice Mill, Sewerage, Soap, Steel, Tannery, Textile, Woollen	105.7	63	94	
Sialkot	58	Flour Mill, Glove, Rubber Industry, Tannery	56.66	3	58	
Lahore	271	Battery, Bexmics, Board, Carpets, Casing, Clean Mill, Clothing, Cooking Oil, Cotton, Dairy, Dyeing, Electronics, Engineering, Food, Garments, Gattah Factory, Ghee Mills, Hatchery, Hosiery, Hospital, Ice Factory, Knitting, Leather, Marble, Oil Industry, Paint, Paper Mill, Pesticide, Pharmaceutical, Pipe, Plastic, Poly Pack, Polymer, Poultry Feed, Power Generator, Protein, Pulp and Paper, Rubber, Sewage, Shoe Factory, Soda Water, Spinning, Sports Industry, Synthetic, Tanneries, Tea, Tent, Textile	281.6	59.08	271	
Kasur	22	Board, Chemical, Dairy, Fabrics, Fertilizer, Sewage, Spinning, Sports, Technical, Textile	17.96	40	22	
Sheikhupura	220	Belt, Burn Gas, Cables Factory, Chemical, Cold Store, Concrete, Cotton, Engineering, Fabrics, Feed, Fertilizer, Flour Mills, Gattah Factory, Ghee, Glass, Glove, Glue, Hatchery, Jute, Leather, Mechanical, Milk Factory, Milk Pack, Municipality, Oil, Oil Depot, Paper Mill, Pipe Industry, Plastic, Polyester, Power Unit, Protein Farms, Resin, Rice, Rubber Industry, School, Sewage, Sewerage Water, Shoe, Silicate, Soap, Spinning, Steel Mills, Sugar Mills, Tanneries, Textile, Tyre, Welding Electrode, Wire Works	313.45	90.5	218	2

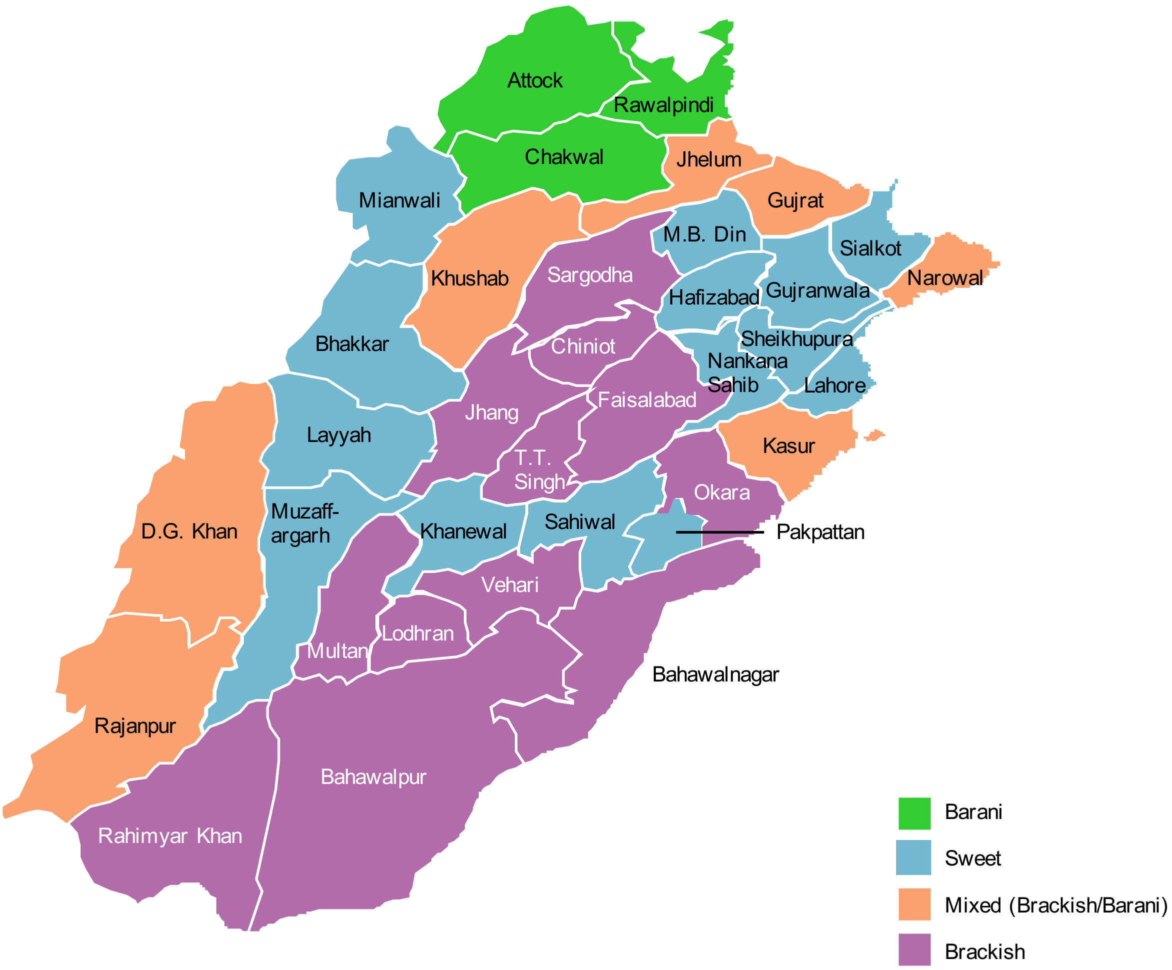
District	Number of Industries	Main types of industry / Municipality	Average effluent discharge (Cusec)	Municipal Discharge (Cusec) – untreated sewage	Quality of industrial effluent	
					Number of Industries with Unfit Effluent	Number of Industries with Fit Effluent
Mandi Bahauddin	3	Food Colour, Sewerage, Sugar Mill	7.05	25	3	
Gujrat	3	Flour Mill, Leather, Municipality, Textile Mill	2	40	3	
Sargodha	18	Chipboard, Flour Mill, Ghee Mill, Juice Factory, Milk Factory, Paper Mill, Pulse Factory, Rice Mill, Sewerage, Sugar Mill, Thread Mill	21.4	74.5	18	
Khushab	13	Flour Mills, Ghee Mills, Jute Mills, Khal Mills, Spinning Mill, Sugar Mills	6.7		13	
Jhang	20	Chipboard Factory, Flour Mills, Gattah Factory, Ghee Mills, Ice Factory, Paper Mill, Sewerage, Spinning, Sugar, Textile Mills	16.95	6	20	
Khanewal	6	Generating Electric Power, Milk Plant Coolers, Sewage Water Disposal, Spinning, Sugar Mill	50.2	2.4	3	3
Multan	9	Chemical, Fertilizer, Ghee, Pesticides, Sewage, Tanneries	11.35	201.8	7	2
Lodhran	1	Ghee Mills	0.5		1	
Bahawalpur	1	Sewage, Sugar Mills	1.25	24	1	
Rahim Yar Khan	4	Beverage, Ghee, Sugar, Urea	10		4	
Dear Ghazi Khan	0	Sewage		60		
Muzaffargarh	6	Oil Industries, Power Generation Unit, Sewage, Sugar Mills	26.5	18.5	1	5
Sahiwal	20	Dairy, Soap, Sugar Mill, Paper, Spinning, Sweets Factory, Tanneries, Textile, Vegetable Ghee	7		17	3
Toba Tek Singh	4	Spinning, Sugar Mills	4.5		4	
Okara	12	Flour Mills, Fruit Farms, Oil Mill, Paper Mills, Sugar Mills, Weaving Mills	21		11	1
Total	**1085**		**1415.74**	**867.78**	**1066**	**19**

Annex 4 – Zones of Irrigation Development



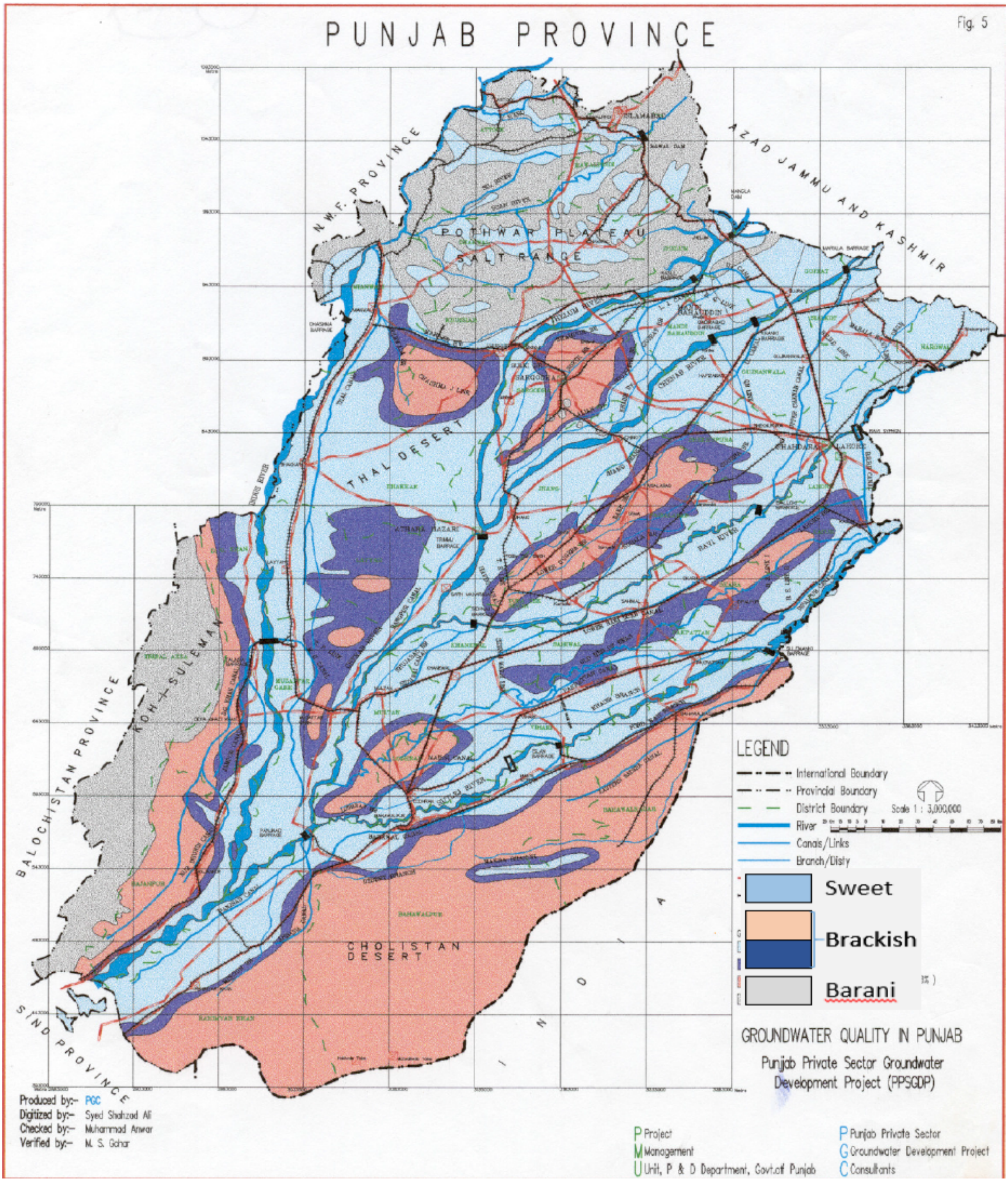
(Source: FAO, AQUASTAT 2011)

Annex 5 – Map of Punjab Depicting Districts in Sweet, Brackish, and Barani Zones



(Source: Adapted from Cheema, Maliha. The Impact on Health and the Willingness to Pay for Piped Water in Punjab, Pakistan [PhD Thesis], North Carolina State University 2013)

Annex 6 – Punjab Water Availability Zones



(Source: Punjab Water and Sanitation Rural Agenda 2014)