# SITUATIONAL ASSESSMENT FOR FECAL SLUDGE MANAGEMENT IN PAKISTAN



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# ABSTRACT

Even though global sanitation access is improving, safe fecal waste management is becoming a rising challenge. Pakistan is considered the 5th most populous country in the world with an estimated population of 238.18 million. The goal of this study was to evaluate the current need for fecal sludge management (FSM) in Pakistan. It is essential to contact those in charge of looking after sanitation in different cities of Pakistan as well as the local population which is directly affected by it. This study was conducted to get a firsthand view of the sanitation situation in Pakistan. Primary data was collected using a Target Sanitation Survey Form distributed online to the general public. Key Informant Interviews with officials in charge of sanitation in various cities were conducted. Secondary data collection entails gathering information from reports, articles, or other reliable written sources, which was done through a desktop study. Three main cities of Pakistan i.e. Islamabad, Karachi, and Lahore were selected for the sanitation situation assessment. Karachi and Lahore are provincial capitals whereas Islamabad is the capital of Pakistan. In Pakistan, there is a rapid increase in the development and use of onsite sanitation systems since 2000 under the Millennium Development Goals (MDGs). To evaluate the current situational assessment in three major cities of Pakistan, two tools were used, a Shift flow diagram (SFDs) and Modified Service Delivery Assessment (SDA). Shit flow diagrams depict the physical flow of excreta through the city. It analyzes the fate of all wastewater produced. Modified Service Delivery Assessment concerned with reasons for the situation of sanitation. It can be concluded that FSM should be included in the National Sanitation Policy for due attention. The government's budget should be significantly increased and to achieve safe fecal waste management, future sanitation investments must include fecal sludge management strategies. People in these cities should have access to basic sanitation at least, whether onsite or off-site sanitation. Furthermore, to serve the increasing population, the current sewerage network must be extended. Collection efforts must be made to end open defecation. Attention must be given to the construction of new treatment plants to treat wastewater and fecal sludge. Existing treatment plants should be rehabilitated and run at maximum capacity. Media, curriculum, and civil society must all work together to raise awareness about this issue. Community-led Total Sanitation (CLTS) and Public-Private-Partnership (PPP) models must be implemented.

# ACKNOWLEDGEMENTS

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# 1. INTRODUCTION

## 1.1 Global Situation

Global sanitation needs great improvement as one-third of the world's population does not have basic sanitation facilities such as toilets or latrines (WHO, 2019). 15% of the world practices open defecation (Our World in Data, 2019). Moreover, there is a relationship between sanitation and numerous communicable diseases. For instance, lack of sanitation contributes to 10% of the global disease burden, mainly causing diarrheal diseases (WHO, 2019). Unsafe sanitation is responsible for 775,000 deaths each year. The current COVID-19 pandemic has highlighted the need for access to sanitation. The patient's stool contains COVID-19 RNA that can be transferred to others if it is not properly managed (Pharmacology, A., 2020).

Huge economic implications exist for people and countries that fail to address this issue. According to the (World Bank, 2017). 165 million children under age 5 in the world are trapped in poverty as poor sanitation causes childhood stunting and other diseases. According to the same report, children living in places near open defecation are 11% more likely to have stunted growth. These put the children at a disadvantage in a world with scarce resources and a huge population. For every dollar spent in sanitation, there is a return of 5.50 US Dollars in lower health costs (WHO, 2016). Less developed countries are severely affected. As an illustration, loss of man-hours due to diseases and less tourism due to less attractive aesthetics. In the last century, the issue of proper sanitation has impacted many people across the globe.

The stark inequalities between different regions and classes further complicate the issue. The differences exist between the global south and global north and between the rural and urban areas.75% of the rural population lack improved sanitation (World Bank, 2018). The future for sanitation access expansion should be more inclusive of the rural areas and the global south.

## 1.2 Millennium Development Goals

The first response of the global community to the sanitation situation was in the form of Millennium Development Goals (MDGs). It was a set of eight goals agreed upon by almost all countries. This was enforceable from 2000 to 2015. Target 7C of MDG's planned to reduce the number of people without access to sanitation by half. The goal was partially achieved in terms of numbers. 1.9 billion people gained access to "improved" sanitation between 1990 and 2015, equivalent to more than 200,000 people every day (Mara and Evans, 2017). MDG's major success was to bring into discussion the urgency of the provision of sanitation across the world.

## 1.3 Sustainable Development Goals

The second and more comprehensive global effort to tackle the sanitation issue is known as Sustainable Development Goals (SDGs). It succeeded the MDGs, and its time is from 2015 to 2030. These are 17 goals to improve efforts against the threats to the environment. Goal six is related to clean water and Sanitation. The major improvement in the context of our study is the fact that goal 6.2 explicitly mentions Fecal Sludge Management. It aims to provide safe sanitation to the entire world. (SDG Tracker)

## 1.4 Current Situation

**Table 1: Situation in the World** *(Source: WHO, 2019)*

| Facility | Population or Area |
|---|---|
| Consume food irrigated by wastewater | 80 Million |
| Do not have basic sanitation facilities such as toilets or latrine | 2 Billion People |
| Lacked safely managed sanitation services | 4.88 Billion |
| Still defecate openly | 673 Million |
| Diarrheal deaths | 432 000 |

## 1.5 Sanitation Situation in Pakistan

In Pakistan, 79 million people do not have access to a proper toilet, which makes every two out of five people (WaterAid, 2019). Since 2000, Pakistan is among the 16 countries that have reduced open defecation by more than 20% points (WHO, 2019) yet 25 million people still practice open defecation (UNICEF, 2021). The impact of this situation is evident from the situation that 53,000 Pakistani children under five die every year from diarrhea due to poor quality of water and sanitation (UNICEF, 2021).

Under the umbrella of sanitation, various elements are investigated such as hygiene, cleanliness, access to toilets, safe disposal, and handling of human excreta. It is a wall against diseases caused by fecal contamination of food and water. Looking at its importance, Pakistan devised a National Sanitation Policy in 2006, it is a broad framework and caters to the aspects of drinking water, sanitation, and some areas of treatment and reuse. Under the umbrella of Sustainable Development Goals (SDGs) and Pakistan's acceptance of them, only a few years are left to meet the targets of SDG 6 which caters to clean water and Sanitation.

According to a report published by Pakistan Social and Living Standards Measurement (PSLM, 2018-2019), toilets have been divided into three main categories, Flush, Non-Flush, and No Toilet. The category of Flush Toilets (an improved form of a toilet) means it is either connected to a sewerage system, septic tank, pit, open drain, or a composting toilet. Around 80% of households all over Pakistan have Flush toilet facilities (PSLM, 2018-2019), which is an improvement from the year 2013-2014 when 74% of households had this facility.

A disparity exists in toilet facility presence amongst the provinces of Pakistan. In the province of Baluchistan, the percentage of households with no toilet facility is the highest. This percentage is the lowest in the province of Khyber Pakhtunkhwa (PSLM, 2018-2019). Comparing flush type facility, Punjab has the highest percentage of households that have a flush toilet whereas this percentage is again lowest in Baluchistan.
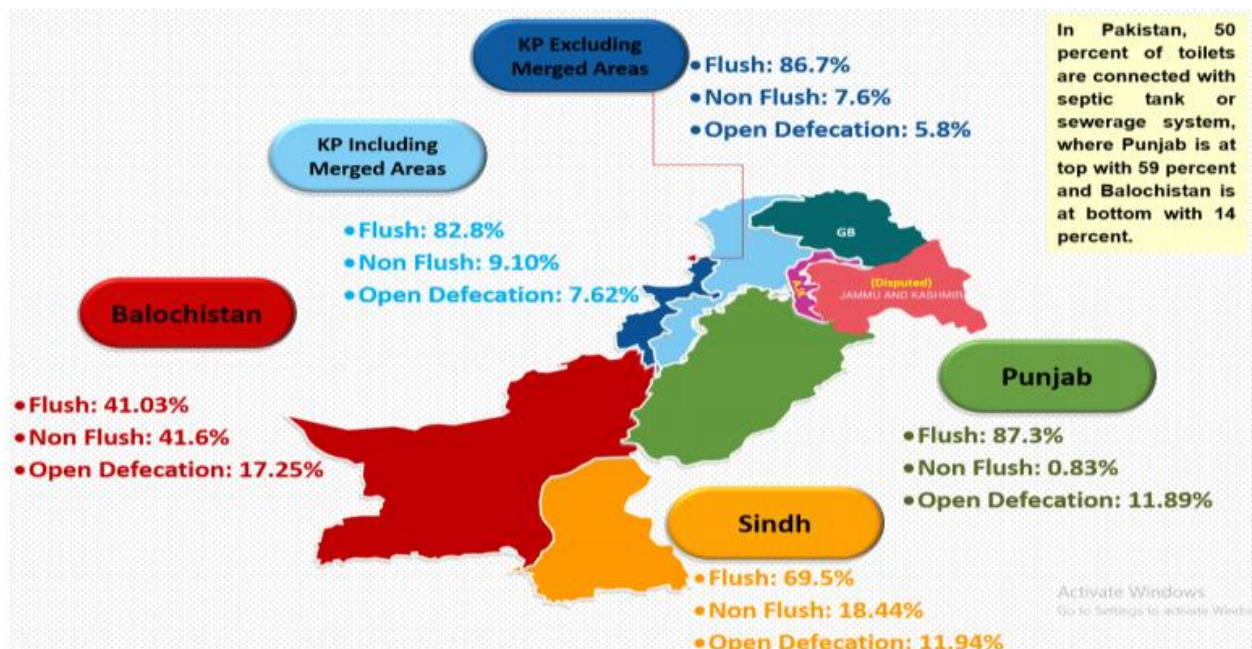


**Figure 1: Sanitation Coverage in Pakistan** (*Source: PSLM Report, 2018-2019)*

In areas where toilet facility is scarce or not present entirely, open defecation is prevalent. The highest levels of open defecation have been observed in Baluchistan, 17.25%, whereas least levels have been observed in Khyber Pakhtunkhwa (KPK), 7.62%.

Sanitation refers to having access to a proper sanitary sewerage system through a house connection, as well as a proper stormwater drainage system and safe wastewater disposal. A sanitation system is not available to 35% of households. (PSLM, 2018-2019). A huge disparity

exists in urban and rural areas. 52 percent of households in rural areas do not have any sanitation system as compared to only 8 percent of households in urban areas.

## 1.6 Onsite Sanitation System in Pakistan

Pakistan is largely reliant on onsite sanitation systems (OSS) to cover up for its missing sewerage infrastructure. The prevalence of high percentages of open defecation is worth noting as Pakistan is considered as the 5th most crowded country in the world with an estimated population of 238.18 million (US Census Bureau). Just like every other country, the sanitation system of Pakistan is something that needs to be prioritized with the increasing population. Currently, non-networked on-site sanitation systems are the predominant form of sanitation systems in the country. In Pakistan, 43 million people living in urban areas have access to sewer networks. While in the rural areas only 7 million people have access to sewer networks. A 180-degree shift can be seen in the use of onsite sanitation systems as 52 million people in the rural areas use a septic tank and only 13 million people in urban areas use septic tanks (JMP, 2017).

Wet sanitation system that requires water for operation and dry sanitation system which do not require water for operation, both systems produce fecal sludge. This fecal sludge production depends on many operational conditions, including water availability for cleaning, dietary habits of the individuals, storage space availability, type of infrastructure built for storage and storage time in the OSS, and type of water entering in the OSS (Blackwater only and/or mixed with greywater.

OSS is considered an inexpensive system for the treatment of blackwater generated at the source. However, it requires a proper management scheme termed Fecal Sludge Management (FSM). The FSM system involves the safe collection, transportation, treatment, and disposal of fecal sludge from the on-site sanitation systems. The sludge that accumulates in the OSS needs to be regularly removed and treated before it is disposed of into the environment. The collection, emptying, and treatment of on-site sanitation is quite expensive, neglected, and undeveloped in Pakistan and it is disposed of into the environment without any treatment. In Pakistan, a major focus has only been on the containment and storage parts of the service chain. Figure 2 shows components of the FSM service chain with highlighted one mentioning the practices currently followed in Pakistan.
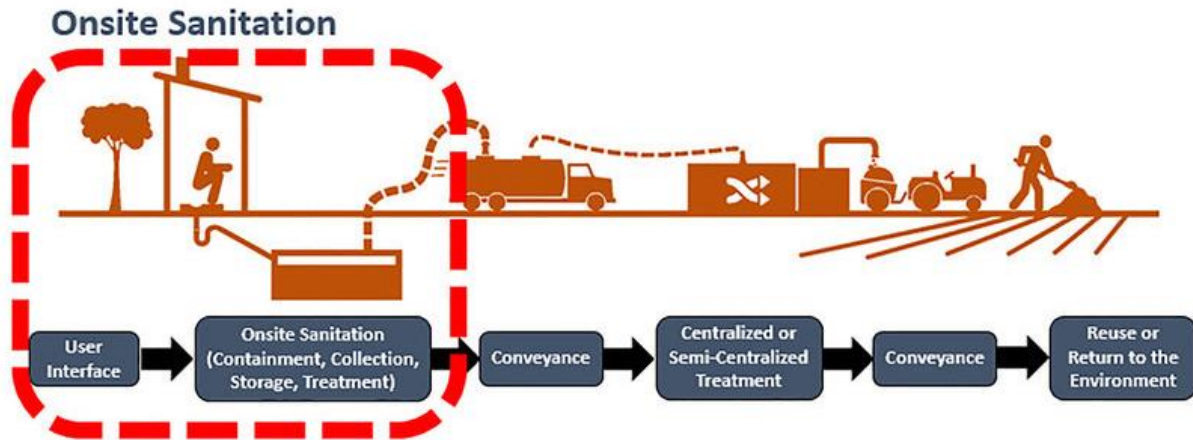
**Figure 2: FSM Service Chain for Safe Management of Excreta with Only Highlighted Components existing in Pakistan** *(Source: waterpathogens.org)*

These older and unhygienic sanitation practices are prevalent across all smaller cities, while some larger cities do have an underground sewerage system but still a significant amount of the population does not have access to a safe FSM service.

## 1.7 Fecal Sludge and Fecal Sludge Management (FSM): Need in Pakistan

FSM in Pakistan should be implemented after careful planning and coordination between the different stakeholders involved, i.e., households, desludging service providers, the city administration, and other concerned institutions.

In Pakistan, the organizations responsible for sewerage management in urban areas are well defined. The institutional framework is present with designated roles however FSM does not get due attention. For example, In the rural areas, Public Heath Department looks after water and sanitation. KWSB is operating in Karachi, CDA looks after Islamabad, and WASA is working in Lahore when it comes to water and sanitation, however, the component of FSM is still missing even though the majority of the population uses OSS. Respective sectors need to take the necessary steps, by amending legislation or by-laws, to ensure that each city/town has an agency that is primarily responsible for FSM.

## 1.8 Policy Framework: Absence of Relevant Scoping

There are certain limitations to the process of promoting FSM in Pakistan. There is a lack of data collection for sanitation in Pakistan. Performance reports are also not available. There is a lack of a mechanism that can report the current situation of sanitation and the urgent need for FSM. There should be a proper mechanism that can explain the situation of all sanitation sectors. This

includes investments, costs, outcomes, outputs, and inequities. The reason for this issue is unplanned financial resources that provide Institutional roles, responsibilities overlap, and services.

# 1.10 OBJECTIVES

The objectives of the final year project are as follows:

### 1.11 To Collect Data from Primary and Secondary Sources

To get a first-hand view of the situation of fecal sludge management in Pakistan, it is imperative to contact those who oversee the situation and the local populace that is directly impacted by it. Primary data is collected from the Target Sanitation Survey Form which was circulated online amongst the public and Key Informant Interviews with officials who overlook the sanitation situation in different cities of Pakistan.

### 1.12 To Assess the Present Situation of Sanitation in Three Major Cities of Pakistan

Data from primary and secondary sources are used to assess the sanitation situation in three major cities of Pakistan. Primary data is validated against secondary data so that collected information is verified at each step.

### 1.13 To Make an Infographic on the Sanitation Situation for Use in Advocacy

Information gathered from primary and secondary data sources is used to make infographics such as Shit Flow Diagrams (SFDs) and Modified Service Delivery Assessment (SDA) to understand the gravity of the sanitation situation in major cities of Pakistan. It gives a pictorial representation that can be used to advocate for the issue. The weak links of the system are also highlighted.

# 2. LITERATURE REVIEW

Sanitation is divided into two main parts. Off-site sanitation is the management of sewage away from its source of production. Similarly, on-site sanitation is the treatment of septage at the point of production (World Bank, 2015). The characteristics of these two types of sewage are entirely different. Fecal Sludge management is the process of collecting the treatment of waste from on-site sanitation systems. These include pit latrines and septic tanks.

## 2.1 Link of Public Health Hazard with Sanitation

Public health is impacted as fecal sludge contaminates through the fecal-oral route. Moreover, there is a relationship between sanitation and numerous communicable diseases. For instance, lack of sanitation contributes to 10% of the global disease burden, mainly causing diarrheal diseases (WHO, 2019). Unsafe sanitation is responsible for 775,000 deaths each year. In a study, it was found that investing in sanitation led to improved perception about hygiene. This in turn resulted in lesser diseases (Cairncross, S.,2018).

In Pakistan, there is a rapid increase in the development and use of onsite sanitation systems (OSS) such as septic tanks and latrines since 2000. The majority of the people gained access to the basic form of sanitation. Fecal sludge control must be a key component of any sanitation strategy for on-site sanitation. Sludge disposal is an essential component of these facilities. However, the need for sludge management is less obvious than that for water supply or toilet facilities, it is often overlooked in sanitation planning. Even when a sanitation plan includes a sludge management aspect, implementation is often disrupted for the same reasons. When dealing with on-site sanitation facilities, sanitation planners and decision-makers must consider the value of fecal sludge control.

## 2.2 Area Wise Distribution of Systems Used for Sanitation in Pakistan

A disparity exists in toilet facility presence amongst the provinces of Pakistan. In the province of Baluchistan, the percentage of households with no toilet facility is the highest. This percentage is the lowest in the province of Khyber Pakhtunkhwa (PSLM, 2018-2019). In areas where toilet facility is scarce or not present entirely, open defecation is prevalent. The highest levels of open defecation have been observed in Baluchistan, 17.25%, whereas least levels have been observed in Khyber Pakhtunkhwa (KPK), 7.62%.

Septic tank is commonly used in peri-urban areas of Pakistan. These areas include the parts of Punjab, Sindh, and KPK. According to the Punjab Sanitation policy, it is mandatory to install a

sewage treatment plant in areas where there is a lack of such systems. Septic tanks connected to flush toilets are becoming dominant for rural houses in KP and Punjab (World Bank, 2018).

### 2.2.1 Areas served with sewerage networks connected to Treatment Plants

The situation of wastewater treatment is poor in Pakistan. Only a few cities have treatment plants and even those are not fully operational. Karachi has 3 treatment plants that were constructed back in the 1960s, yet we see that huge amounts of waste end up in the Arabian sea. The SFD for Karachi shows the waste flow throughout the city. Similarly, there is a treatment plant in the capital city that is also not run at full capacity and only little treatment takes place. There is no wastewater treatment plant in Lahore. Treatment plants also exist in Peshawar. Some treatment is also being done in Hyderabad.

Treatment plants and the infrastructure for off-site sanitation are restricted to some major cities only. Some exceptions are Multi-National Corporations that treat their waste to meet global standards.

### 2.2.2 Peri-urban Areas with Septic Tanks

Septic tank is commonly used in peri-urban areas of Pakistan. These areas include the parts of Punjab, Sindh, and KPK. According to the Punjab Sanitation policy, it is mandatory to install a sewage treatment plant in areas where there is a lack of such systems. Septic tanks connected to flush toilets are becoming dominant for rural houses in KP and Punjab (World Bank, 2018). However, it would be inappropriate, for example, to encourage septic tanks without also offering solutions for routine de-sludging of the facilities and safe sludge disposal. Since the investment costs are paid by consumers rather than public authorities, on-site sanitation systems are also considered less expensive than sewer systems. However, fecal sludge control is a significant cost factor that cannot be neglected and must always be considered when sanitation systems are designed.

### 2.2.3 Rural Areas with Pits

The rural areas of Pakistan use pits that may be lined or unlined. Pits are holes that have been dug in grounds by locals to dump excreta. In unlined pits, the waste directly comes in contact with the soil whereas in lined pits there exists a concrete wall between the waste and soil. According to WHO, if the groundwater level is lower than 30 meters then the pits are considered safely managed sanitation (SuSanA).

### 2.2.4 Areas with Onsite Sanitation

Onsite sanitation is present in the periurban areas of different cities. It is mostly found in the cities of Punjab and Khyber Pakhtunkhwa (KPK).

### 2.2.5 Non-contained Areas

Open defecation is still prevalent. 20 Million people still defecate openly in Pakistan. 0.8 percent of peri-urban Islamabad defecates openly (WaterAid, 2016). However, open defecation is not prevalent in urban areas.

### 2.2.6 Effects of Unplanned Urbanization on Sanitation

There are some areas where collection and treatment are possible where urbanization was planned. For example, Islamabad and Lahore's Master plan. Moreover, cities that have not planned their sanitation systems are becoming a major problem in the country. These areas are the peri-urban areas.

### 2.2.7 Pakistan's Situation and Response

Pakistan is the sixth most populous country in the world with a population size of 208 million (Pakistan Bureau of Statistics).  Pakistan is ranked in the top 10 countries with the greatest number of people living without access to safe water (Junaid, 2016).

Pakistan's data is based on estimates of survey data available for the country, including living and social standards Measurement surveys (Pakistan Bureau of Statistics, 2017). National estimates show that rural and urban population-weighted averages, access to improved water and latrines has risen dramatically across Pakistan in the last 15 years, mostly because of self-provision, while the public sector does not provide piped water or basic sanitation in rural areas (World Bank,2018). Even still Pakistan is the Seventh Worst country with access to sanitation according to Water Aid.

The Pakistan Approach to Total Sanitation (PATS) is a country-specific strategy established by the Pakistani government to increase access to sanitation, especially in rural areas, to eliminate open defecation (Cooper, R., 2018). Community-Led Total Sanitation, school-led total sanitation, component sharing, sanitation marketing, and disaster response are just a few of the models established by PATS. It is managed by the local government, the citizens, and the Non-governmental organizations. (WaterAid, 2016).

While Pakistan's primary goal is to eliminate open defecation by rapidly increasing access to latrines, a lack of commitment to fecal waste management near human settlements has resulted in an "unprecedented accumulation" of untreated feces. This results in increased surface and

shallow groundwater contamination, which further increases channels for fecal waste (World Bank, 2018).

## 2.3 Responsibility for handling Sanitation in Pakistan

Sanitation is a provincial subject after the 18 Amendment in the constitution of Pakistan. Hence, the provincial government is responsible for sanitation in Pakistan. The Punjab Sanitation policy and the "Saaf Suthro Sindh" are the results of provincial efforts toward making policies for the respective provinces. Other than the above mentioned there are some federally administered areas in Pakistan like its capital, Islamabad. The federal government is responsible for these areas. The federal government has launched the National Sanitation Policy. The issues are common in all these policies. There is an implementation gap. Similarly, there is no mention of the FSM service chain in these policies.

## 2.4 The situation of India and Bangladesh

The examples of India and Bangladesh are taken as the socio-economic situation is the nearest to Pakistan. India is rapidly improving its sanitation situation Under the Swatch Bharat Project ('WASH situation under Swachh Bharat Mission' (2016). According to JMP 2017, India provides at least basic sanitation to 60 percent of the population in 2019. India passed the National Policy on Faecal Sludge and Septage Management (FSSM) in February 2017. The policy highlights the commitment of the government to making safe and sustainable sanitation a priority area. In India, five states have already started funding the construction and operation of more than 400 fecal sludge treatment plants (FSTPs); another 11 have passed their state-level FSSM policies, and several others are currently in the process of drafting theirs. (Madhu Krishna, 2019)

Similarly, Bangladesh's government is steadily improving its sanitation under the public-private partnership model. Moreover, it has a comprehensive policy for FSM under the name of Institutional and regulatory framework for fecal sludge management." The provision of basic sanitation is 48 percent. Bangladesh has been declared open defecation-free.

## 2.5 Tools Available for Sanitation

**2.5.1 The Sani Path Tool** (developed by Emory University) is designed to evaluate public health risks from poor sanitation to better plan sanitation investments. The process is systematic yet tailored for each location where it is performed. They developed Results Dashboard to publicly share key findings across previous SaniPath deployments. Exposure to feces in the environment is different for every person, neighborhood, and city. Thus, the SaniPath Tool captures these differences to create customized results and

prioritize sanitation investments (Raj et al., PLOS ONE 2020). The issue with this tool is that it only focuses on the link between sanitation and diseases.

**2.5.2 The Urban Sanitation Status Index**, on the other hand, is used to measure the sanitation status of the lowest administrative unit within a city, through several indicators. It helps prioritize sanitation investments across the city. It analyses the sanitation status which is Consistent with the SFD and perception of Local authorities (World Bank, 2018.). It combines different components like treatment and disposal. Thus, the entire picture is less clear as compared to an SFD.

**2.5.3 The Fecal Waste Diagram**, a tool that can be used in assessing septage management in a city (Peal et al., 2014):. These tools are presently used by the World Bank's Water and Sanitation Program (WSP) to compare septage management in cities across developing countries. Sets of required information were acquired through a specific department in municipal/city offices, i.e., Sanitation Department, Water District, or sanitation reports produced by the municipal/city offices. (World Bank Group-Water and Sanitation Program, 2016)

## 2.6 COMPONENTS OF THE FSM CHAIN

1. **Containment**: Containing is the holding of the waste for a temporary or permanently in a container. In the container, the process of decomposition of waste starts.
2. **Collection**: Collection of waste from the site of containment is carried by different means. It depends on the type of waste and the place from which it is to be collected. (Odey, E. A. *et al.*, 2017)
3. **Transport**: In this process, the waste is transported from the site of production to another site for disposal or the site of treatment. (Odey, E. A. *et al,* 2017)
4. **Treatment**: The waste is treated so that its harmful effects on man and his environment can be mitigated. Moreover, a useful end-product is made to make the chain sustainable.
5. **Disposal or End Use**: The safely managed products are disposed of off to a suitable place. If the product is useful it is utilized for its particular purpose. (Rath, M. *et al.*, 2020)

## 2.7 Primary Data Sources

Data collected from people involved in the process or product under consideration. To collect these two means were used. These were Key informant interviews and Survey forms.

### 2.7.1 Key Informant interview

Key informant interviews are a tool to get information from people who have a know-how of the situation. This helps in getting an overview of the situation. Moreover, it gives the official narrative on the sanitation situation. In some cases, official data provided by such interviews can be of great use.

### 2.7.2 Survey Forms

Survey forms are a well-established means of collecting data. This is also true in the case of a sanitation situation. These forms provide information from a wider audience. This is a useful method to check the validity of data from other sources.

## 2.8 Secondary Data Collection

It involves the collection of data from reports, papers, or any other credible published data. For this desktop study was conducted.

### 2.8.1 Desktop Study

The desktop study is the process in which data relevant to the research is found. Moreover, it helps in assuring that the work being done is new and the process being followed in developing the already present research. (Odirile, P. T. *et al.* (2018))

## 2.9 Infographics

### 2.9.1 Shit flow Diagram

Shit flow diagrams depict the physical flow of excreta through the city. At a single glance, it can tell the detailed management of the city sanitation. For instance, what percentage of the population uses on-site sanitation and how much of the cities.

### 2.9.2 Modified Service Delivery Assessment (SDA)

The SFD gives us the political, economic, and policy environment present to sustain and promote sanitation in a city. This is done against a set of the standard question so that there is uniformity. This allows the enabling environment to be compared to that of the other cities. (Odirile, P. T. *et al.* (2018))

- SFD and SDA both tools that are the latest in practice and are used worldwide for mapping the sanitation situation.
- It gives a holistic picture of the city's sanitation.
- They help identify areas of concern.
- It is a standardized method, and it can be compared with others study areas.
- Presents a complex sanitation situation to decision-makers in an easily comprehensible way
- Participatory planning tool for prioritizing interventions, and for project monitoring and evaluation.
- Easy to implement and interpretation of the results obtained is user-friendly

# 3. METHODOLOGY

## 3.1 Primary Data Collection

### 3.1.1. Target Sanitation Survey Form

A targeted sanitation survey was designed to gather ground data from the public and analyze situational assessment in different cities of Pakistan. The survey form was designed online so that maximum it could reach a wider audience and people from all parts of Pakistan could give their input. The survey form was bilingual so that locals could easily understand the questions and answer to the best of their understanding and knowledge. FSM Toolbox was a guiding tool in the development of the target survey form reference. Questions were about gender, the areas in which people lived, the design of the houses, the material used for construction, where the waste from the toilets ended up, the kind of sanitation technology used in their areas, like a septic tank, and how they emptied them. This was done to understand the sanitation situation on a broad scale in different cities. Moreover, also asked about the source of drinking water and whether it was safe and healthy for them, and consequences of consuming polluted water, the various diseases caused by it and how much did they have to spend on getting cured. People were asked if they are willing to pay some amount annually for emptying and collection of fecal sludge. Lastly, there were questions about the waste generated in their homes daily, and whether they are interested in having a community-based sewerage network and treatment plant constructed in their area.

**Table 2: Summary of Survey Responses**

| Region | Responses |
|---|---|
| Punjab | 130 |
| Islamabad | 32 |
| Sindh | 23 |
| Khyber Pakhtunkhuwa (KPK) | 18 |
| Balochistan | 1 |
| Azad Kashmir | 3 |
| Gilgit Baltistan | 3 |

Three major cities of Pakistan were selected for situational assessment, Karachi, Lahore, and Islamabad. Karachi is the largest city in Pakistan, by population, and the twelfth largest city in the world. It is the capital of the Pakistani Province Sindh. Located on the coast, Karachi has a relatively mild climate. The city's proximity to the sea keeps humidity levels at a near-constant high, and cool sea breezes relieve the heat of the summer months. Lahore is the second-largest city of Pakistan and the capital of the Punjab province with a population of approximately 11.1 million. Lahore has a semi-arid climate; with May the hottest month and October is covered with smog. Islamabad Is the capital city of Pakistan and is administered by the Pakistani federal government as a part of Islamabad Capital Territory Islamabad has a humid subtropical climate with five seasons. Islamabad experiences heavy rainfalls in July because it is located in a hilly area. We select these three cities for situational assessment of fecal sludge management because they are the main cities of Pakistan by analyzing the situation in these cities, we can analyze conditions in other cities of Pakistan, we need to set an example of fecal sludge management in these cities.

### 3.1.2. Key Informant Interviews

Key Informant Interviews (KII) were conducted in three major cities of Pakistan to get an insight from those who are administrating with water and sanitation. KII were conducted to help validate the data collected from secondary sources and vice versa. In Islamabad, KII was conducted with senior officials at the Capital Development Authority (CDA), in Lahore with members of the Water and Sanitation Agency (WASA), and Karachi with members of Karachi Water and Sewerage Board (KWSB).

Questions asked from representatives of these organizations revolved around the current sanitation situation in these cities. The existing sewerage coverage and its coverage were discussed. The shortfalls in the system, lack of planning and infrastructure, and effects were also a part of the interview. The officials from these organizations talked about the importance and necessity of alternatives to sewerage networks, onsite sanitation technologies, and their importance in the ever-increasing population of the cities. Lack of policy, planning, and funds were also covered in the interviews.

## 3.2 Secondary Data Collection

### 3.2.1 Desk Review Study

An extensive desktop study was conducted for data collection and validation of the information from Key Informant Interviews. Policies and major data sources include:

- National and provincial policies related to water and sanitation.
- Published papers with similar methodology in different countries, especially in South Asia.
- Data on population from Pakistan Bureau of Statistics.
- Data from Pakistan Social and Living Standards Measurement (PSLM) Surveys.
- Environmental Management Plans of various projects.
- International reports by Joint Monitoring Program (JMP), UNICEF, and WHO.

## 3.3 Infographics and Situational Assessment

Peal et al. (2014) described two tools that can be used in assessing septage management in a city: The Fecal Waste Diagram and the Service Delivery Assessment (SDA) scorecard. These tools are presently used by the World Bank's Water and Sanitation Program (WSP) to compare septage management in cities across developing countries (Baltazar et.al.,2021)**.** The SDA and SFD Graphic provide an overview of the sanitation situation without recourse to detailed field studies (Peal et al., 2020). These tools have been used in this project to assess the situation in the three cities of Pakistan, namely, Islamabad, Lahore, and Karachi using data sources as mentioned above.

### 3.3.1. Shit Flow Diagrams (SFDs)

A Shit Flow Diagram (SFD) is a tool to instantly understand and convey how excreta flows through a city or town. It shows how excreta produced in a city is or is not contained as it moves from defecation to disposal or end-use. SFDs provides an overview of the fate of excreta. It clearly shows which components of the FSM need attention for the safe disposal of waste. (SuSanA)

SFDs are a useful tool to inform urban sanitation programming, by visualizing the status of urban sanitation services in terms of the fate of excreta. They offer an innovative way to engage city stakeholders from political leaders to sanitation experts and civil society organizations in a coordinated dialogue about excreta management. (SuSanA)

SFDs are made via graphic generator on the SuSanA website. Data is entered depending upon the sanitation services available. The groundwater pollution aspect can also be considered in

areas where sewage directly comes in contact with groundwater. Numerical data is entered based on the percentage population to get an infographic.

The "shit-flow diagram" or SFD approach has had rapid uptake and is now accepted as a tool for focusing political will and technical effort on critical sanitation problems in the city.

### 3.3.2. Modified Service Delivery Assessment (SDA)

The service delivery assessment is a tool used that analyses a cities' sanitation situation and helps in policy-level decision making. The infographic presents a vivid picture of the strong and weak areas of each city. Similarly, this tool can be used to compare the performances between cities. Even more, it is an empirical way of developing a comparison with other countries around the world with similar socio-economic conditions.
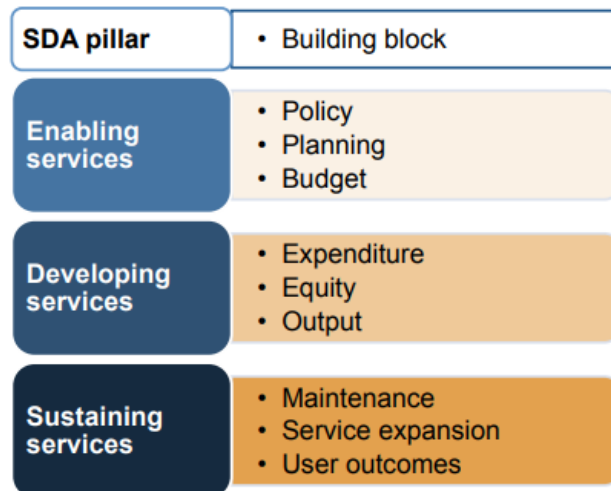


**Figure 3: Components of SDA** (*Source: Peal, A, Evans, BE, Blackett, I et al., 2014)*

It is an analytical framework with three building blocks used to measures the quality of the enabling environment, the level of service development, and the level of commitment to maintain the WASH services sustainability. A composite SDA 'score' is calculated for each building block at each step along the value chain. Therefore, in total, the SDA produces a set of 45 scores. Each score comes after answering a set of questions which we call 'area of evidence,' questions. These scores are averaged to a scale between 1 and 3 to give us a final score for each building block (Peal et al., 2014)

# 4. RESULTS AND DISCUSSION

## 4.1. SURVEY RESULTS

The survey was designed using Google forms and circulated online. Over 200 people (213 in exact) participated in this survey belonging to different areas such as Punjab, Sindh, Khyber Pakhtunkhwa (KPK), Balochistan, Islamabad, Azad Kashmir, and Gilgit Baltistan. The results of the survey regarding the FSM service chain are as follows:

### 4.1.1 CONTAINMENT

**Where does waste from your washroom go?**

70% of people who participated in the survey said that they have a sewerage connection compared to only 16.5% of the people who claim to use onsite sanitation systems. This discrepancy in data has been observed because the form was circulated online and not conducted door to door because of COVID-19. In the online audience, the survey form only reached a specific class of people. Even then, 4.1% of people said that their waste goes out into the open environment while 8.5% of people were not sure about the end point of their waste.

### 4.1.2 STORAGE

**In case you use onsite sanitation technology (such as a septic tank), do you get it emptied?**

In the proportion who claimed to be connected to onsite sanitation system, 59.7% do not get their septic tanks emptied while 40.3% of people get their tanks emptied. For those who do not get it emptied, the reasons may be due to the unavailability of facilities.

**How frequently do you empty it?**

40.3% of whom empty their tanks, about 53.7% of them get it done every year, 14.8% said they get it done once every two years and the same was the percentage of people who said they get it done once every 5 years.16.7% people said that empty the tanks once after more than 5 years.

### 4.1.3 TRANSPORT

**How do you empty the septic tank?**

41.7% of people hire private contractors for emptying and transport fecal sludge. This shows the need for FSM. Unfortunately, the provision of services by the government is not adequate as shown at 21.4%. Lack of services in this domain is a major setback and disadvantage for most people using OSS. 9.5% of people empty their septic tanks themselves and 7.1% get help from informal providers.

### 4.1.4 DISPOSAL

**The last time it was emptied, where were the contents emptied to?**

41% of the people say that the contents of the tanks when emptied end up in water bodies primarily as there is no designated site for safe disposal or treatment of fecal sludge. 12% said that the fecal sludge is emptied into another container, 20.5% people said that the contents were emptied into a machine or tanker.

### 4.1.5 DRINKING WATER

**What is the source of your drinking water?**

The majority of the people, about 43.2%, selected community filter plants followed by groundwater at 29.1%. 20.2% of people said that they rely on companies that provide bottled water.

### 4.1.6 WATER DEPTH

**What is the depth at which you have dug a bore for groundwater extraction?**

The depths at which boring is done for the extraction of groundwater are shown in the pie chart.

**What is the depth at which you have dug a bore for groundwater extraction?**

The horizontal distance between a water bore and a septic tank is a key factor in determining the threat of groundwater pollution. If the distance is less than 33 ft (SuSanA) there is a high risk of groundwater contamination. In the survey, we saw that 60% of people had less than 33 ft distance between the bore and their septic tanks.

### 4.1.7 DISEASE

There is a strong correlation between disease and groundwater contamination. Most of the people had fallen sick due to waterborne diseases especially diarrhea at least twice in their lifetimes.
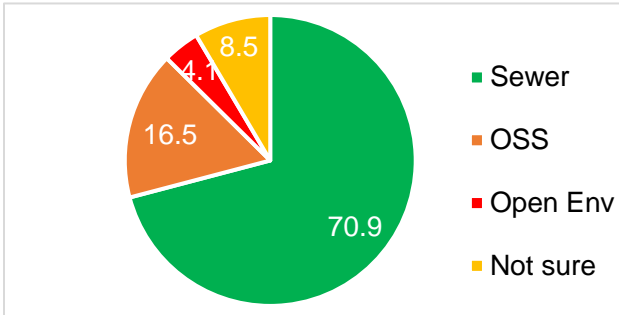
*Figure 4A*

**Where does waste from your washroom go?**
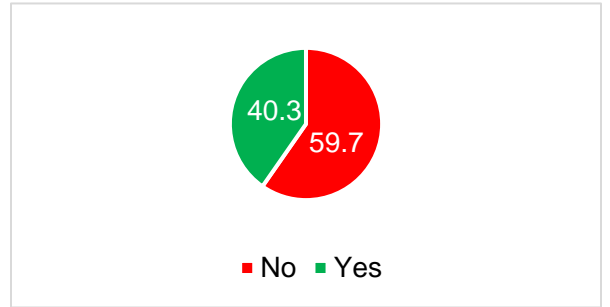


*Figure 4B*

**In case you use onsite sanitation technology (such as a septic tank), do you get it emptied?**
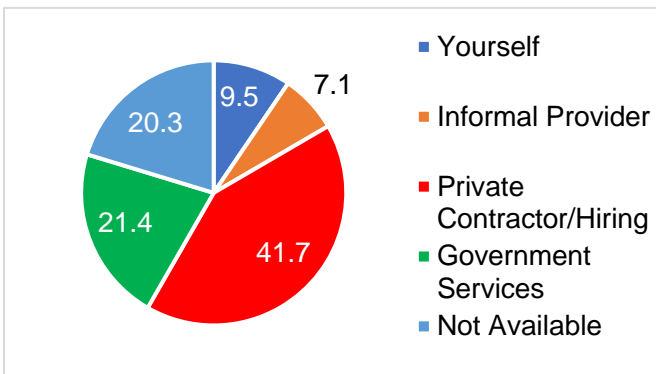


*Figure 4C* **How frequently do you empty it?**
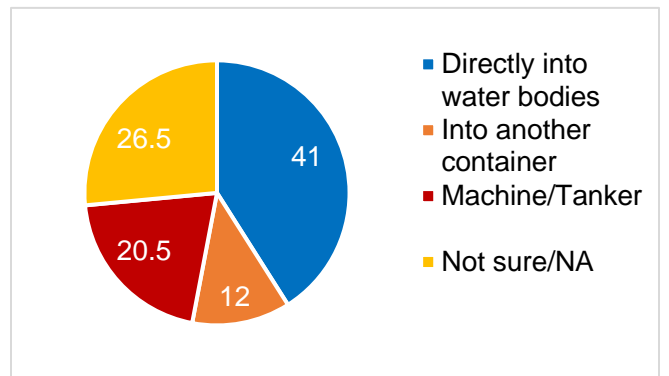


*Figure 4D* **How do you empty the septic tank?**
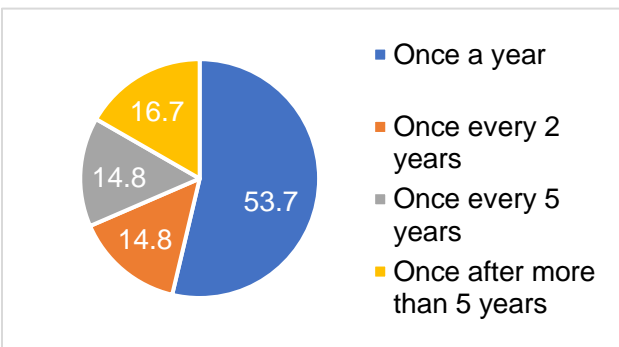


*Figure 4E*

**The last time it was emptied, where were the contents emptied to?**
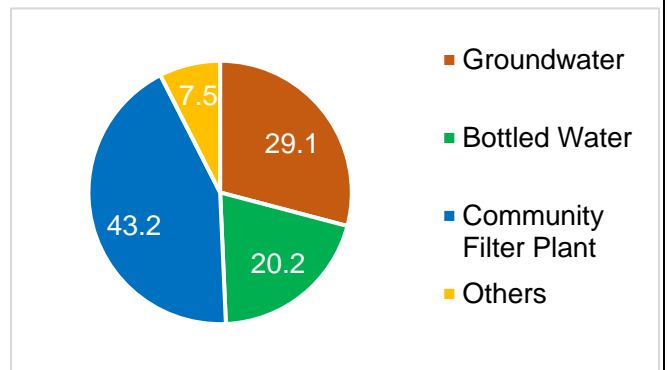


*Figure 4F*

**What is the source of your drinking water?**
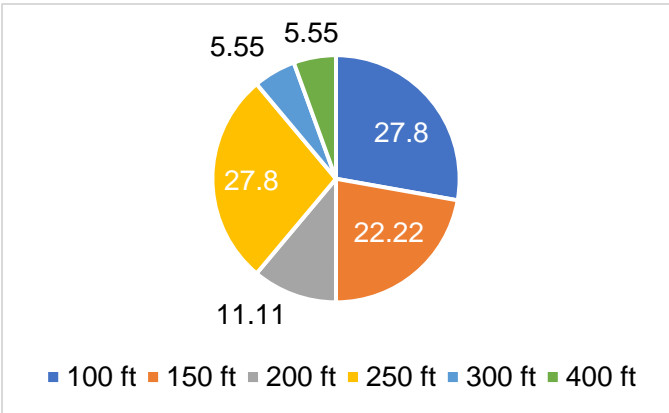
*Figure 4G*

**What is the depth at which you have dug a bore for groundwater extraction?**
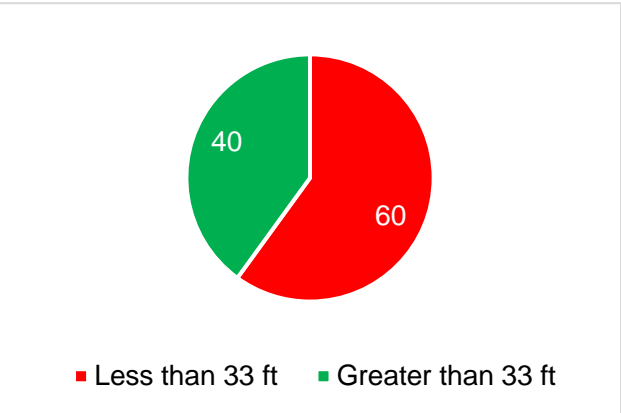


*Figure 4H*

**What is the horizontal distance between the septic tank and bore?**
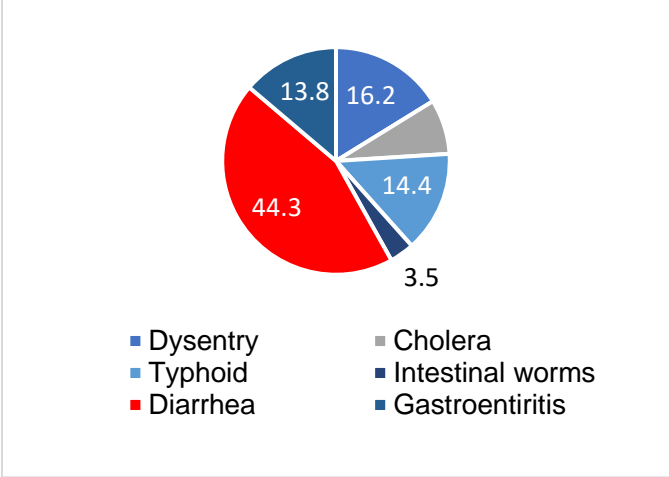


*Figure 4J*

**Have you fallen sick by drinking contaminated water?**

## 4.2. CITY SITUATIONAL ASSESSMENT

## 4.2.1 KARACHI

### 4.2.1.1 STUDY AREA

Karachi, the capital of Sindh, is the largest city of Pakistan by population with more than 16 million people (Pakistan Bureau of Statistics, 2018). This city alone contributes 15% to the national GDP. The Karachi Municipal Council (KMC), which is led by an elected Mayor, is in charge of the city, with the provincial government retaining a strong role and fiscal control. A large number of refugees have settled in informal settlements (Katchi Abadies). Katchi Abadies are home to approximately half of Karachi's population. Katchi Abadies are frequently serviced via illegal connections to the 'Karachi Water and Sewerage Board (KWSB) network. Indus River and Hub Dam on Hub River are the two major sources of surface water for Karachi. Groundwater resources in the Karachi area are limited.

Lyari, Malir, Budnai, and small streams, collectively known as the coastal basin, are the four main drainage systems currently serving Karachi. The Malir River Basin and the Lyari River Basin account for about 80% of the city's surface runoff. These are perennial streams, in streamflow is intermittent, and freshwater inflow depends on rainfall and runoff; both rivers intercept discharges from sewer lines and outfalls and carry sewage to the sea from all parts of the city. The Malir River flows from the east towards the south and center, and the Lyari River stretches from north of the city to the southwest ending in the Arabian Sea.

Thus, the natural drainage system of Karachi city is comprised of mainly the tributaries of the Malir and Lyari Rivers. Figure 5 shows the map of the area involved in this study.
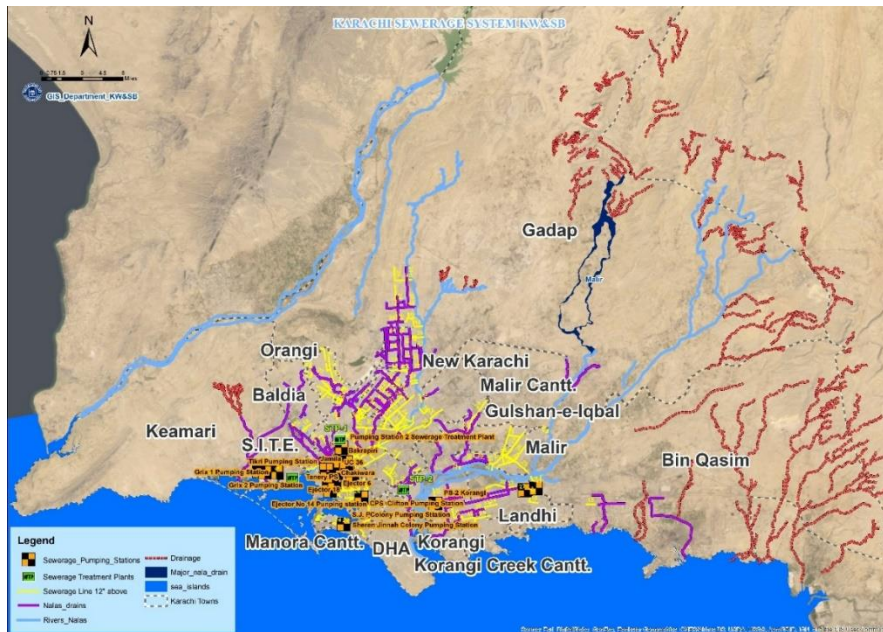
**Figure 5: Map of Karachi** (*Source: KWSB)*

## 4.2.1.2 KEY INFORMANT INTERVIEWS (KII)

In Karachi, Key Informant Interviews (KII) were conducted at two offices of Karachi Water and Sewerage Board (KWSB)

At one office of KWSB, an official explained the water supply and demand situation in the largest city of Pakistan. KWSB meets only 45% of Karachi's actual water demand and 30% population relies on boring. Wastewater generated is around 80% of water demand. Nearly 60% of people in Karachi have access to sewerage connections. Those who do not have access to sewerage use other means such as septic tanks or the wastewater from their homes drains directly into nearby water bodies. There is no service chain to cater to fecal sludge. This is the state of sanitation in a metropolitan city. Even the existing sewerage system has several problems. It was laid down decades ago and is now in dismal condition. Most of the pipes have collapsed on the inside due to continuous subjection to odorous fumes from wastewater. Low sewage flows received at existing sewage treatment plants, resulting from the inadequate provisions of sewer trunk mains and the malfunctioning of pumping facilities, deterioration of water quality in rivers and canals, and clogging of waterways caused by the dumping of massive rubbish are a few of them.

At the other office of KWSB, an official explicitly gave information about Karachi Central District. Wastewater from North Nazimabad, Shadman, and Buffer zone is disposed into Treatment Plant (TP) 1. All North Karachi and New Karachi waste is disposed of in the sewerage system in the Gujjar stream which is then disposed of in the main Lyari river. Paposh Sewerage System is disposed of in the Orangi stream which is then disposed of in the Lyari River. Gulberg waste goes to Pumping Station 3 at Mauripur (In Karachi Went district) through the conduit in the Lyari River.

Table 3 shows the population, both rural and urban, of Karachi in each district (Pakistan Bureau of Statistics (2018)), water demand and supply (KWSB), and wastewater generated (calculated at 80% of water demand). The total wastewater generated (calculated) is around 514 MGD.

Table 4 gives details of the existing treatment plants in Karachi.

**Table 3: Water Demand and Wastewater Generation District wise in Karachi**

| Districts of Karachi | Population (2018) | Urban Population | Rural Population | Water Demand (MGD) | Water Supply by KWSB MGD) | Wastewater generated (MGD) |
|---|---|---|---|---|---|---|
| Karachi Central | 2972639 | 2972639 | | 118.86 | 88 | 95.088 |
| Karachi East | 2909921 | 2909921 | | 116.29 | 61 | 93.032 |
| Karachi South | 1791751 | 1791751 | | 71.67 | 29 | 57.336 |
| Karachi West + Kemari | 3914757 | 3,631,510 | 283,247 | 156.59 | 104 | 125.272 |
| Korangi | 2457019 | 2457019 | | 98.28 | 38 | 78.624 |
| Malir | 2008901 | 1,153,616 | 855,285 | 80.35 | 25 | 64.28 |
| Kemari | Newly created district | | | | | |
| TOTAL | 16054988 | 14916456 | 1138532 | 642.04 | | 513.63 |
| Wastewater generated (KWSB & Desktop Study) | | | | | | 520 |

*(Source: Pakistan Bureau of Statistics (2018), KWSB)*

**Table 4: Existing Treatment Plants in Karachi**

| | TP-1 (SITE) | TP-2 (Mahmoodabad) | TP-3 (Mauripur) |
|---|---|---|---|
| Drainage Area | F.B. Area, Liaquatabad, Nazimabad & North Nazimabad, Part of Orangi Town, Pak Colony, etc. | Old City Areas, Clifton Societies, Mahmoodabad, Part of Azam Basti, Dada Bhai, Sadder, Malir | Old Lyari, Garden East and West, Gulshan-e-Iqbal, PIB Colony, Soldier Bazar, Baldia, Nazimabad, North Karachi |
| Site Area | 120 acres (48.6 ha) | 120 acres (48.6 ha) | 545 acres (221 ha) |
| Year of Construction | 1960/1995 (rehabilitated) | 1960/1996 (rehabilitated) | 1998 |
| Treatment Process | Trickling Filter Process | Trickling Filter Process | Anaerobic + Facultative Pond |
| Capacity (MGD) | 51 | 46 | 54 |
| Present Flow Rate (MGD) | 20 | Closed | 35 |

*(Source: KWSB)*

## 4.2.1.3 INFOGRAPHICS AND SITUATIONAL ASSESSMENT

## *1. SHIT FLOW DIAGRAM (SFD)*

**Table 5** shows that Karachi has a population of 16 million. Out of this, only 60% population has access to sewerage. Out of the remaining 40%, 3% use onsite sanitation technologies and, 1% population practices open defecation.

**Table 5: Sanitation Situation in Karachi**

|  | **Population** | **Percentage** |
|---|---|---|
| Total Population[A] | 16 million | 100 |
| Connected to sewerage via KWSB system[B] | 9.6 million | 60 |
| No sewerage access[C] | 6 million (approx) | 36 |
| Open defecation[D] |  | 1 |
| Onsite Technology[E] | 5 hundred thousand | 3 |

The data sources of the above data can be seen in the annexure.

Seeing the overview of sanitation coverage helps in making the excreta flow diagram. The SFD for Karachi gives a pictorial representation of the waste flow of 16 million people along the FSM service chain.

Table 6 presents the total waste in MGD and its corresponding population that produces this waste.

**Table 6: Excreta Flow in Karachi**

|  | **MGD** | **Population** | **%** |
|---|---|---|---|
| Wastewater Generated[F] | 520 | 16 million | 100 |

| | | | |
|---|---|---|---|
| Sent to Treatment[G] | 151.5 | 4.6 million | 29 |
| Wastewater Treated[G] | 50 | 1.5 million | 10 |
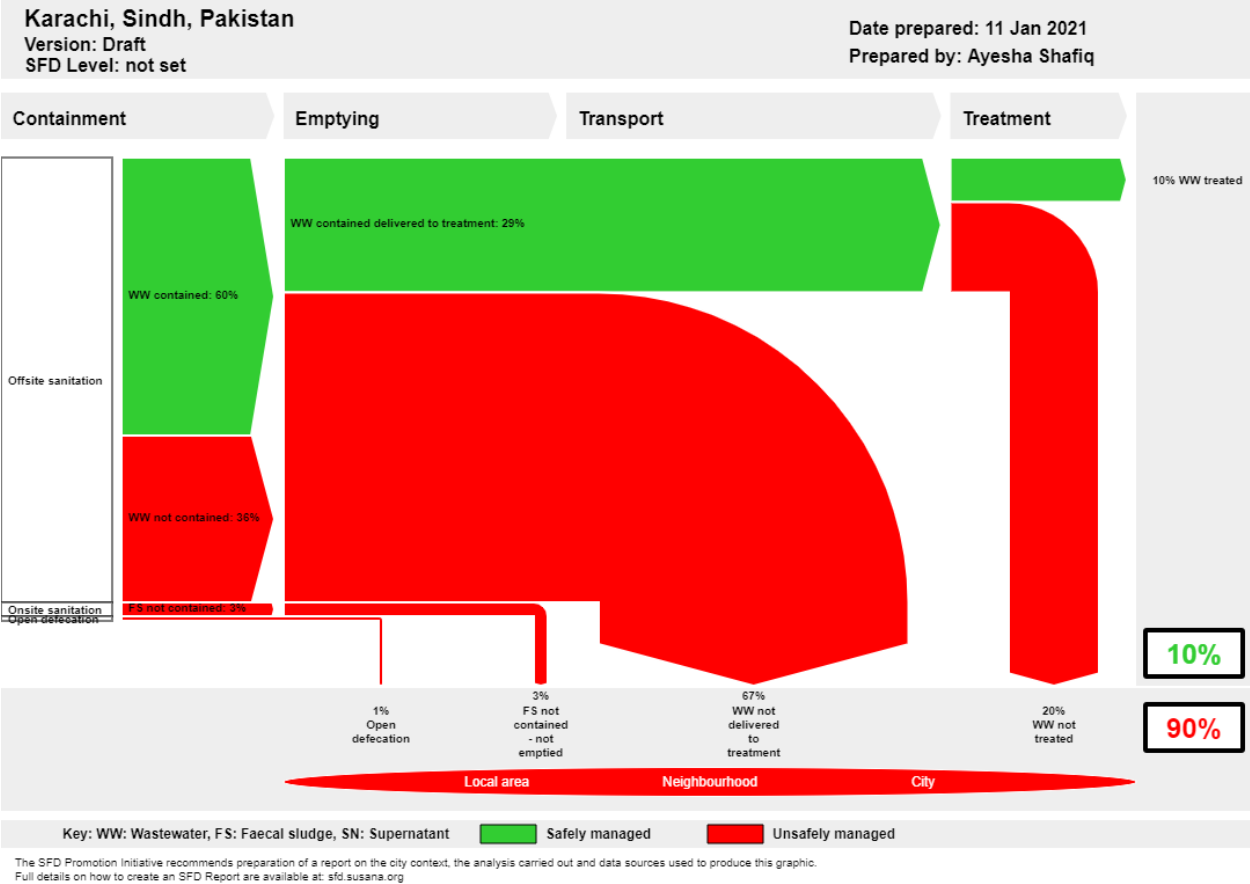


**Figure 6: SFD for Karachi**

An SFD makes it easier to track the flow of waste and to identify the key areas where work needs to be done. In the case of Karachi, 60% population's wastewater is contained as it has access to sewerage, the treatment plants can treat 29% population's wastewater but only 10% population's wastewater gets treated and the remaining reaches the nearby water streams and the major water networks in the city, Lyari and Malir rivers. Karachi has the largest population producing the most waste, yet there is not sufficient capacity to treat the waste. The existing treatment plants were built in the 1960s, almost 6 decades ago. The population has increased significantly in the 6 decades, yet treatment capacity has been nearly stagnant. The sewer lines were also laid down at the same time and little maintenance has been done since due to lack of funds. KWSB only

repairs the severely damaged lines. The wastewater that reaches treatment plants is far less than the total treatment capacity due to damaged sewer lines.

36% of the population has no access to sewerage so the wastewater does not even get contained. Those without access predominantly discharge sewage through the stormwater system, natural drains, or informal sewer pipes directly into the environment, rivers, and ultimately the sea. The portion of the contained wastewater (31%) not delivered to a treatment plant together with this 36% makes a total of 67%. 3% population uses onsite sanitation technology which again does not get contained or disposed of and 1% population practices open defecation. All this waste eventually contaminates groundwater and also pollutes the Arabian sea.

## 2. MODIFIED SERVICE DELIVERY ASSESSMENT (SDA)

The composite SDA scorecard for Karachi is shown in Figure 7. The scores for the policy element of the enabling block indicate that the policy framework is largely in place but does not mention FSM explicitly. The National Sanitation Policy (2006) mentions "safe disposal of excreta by using sanitary latrines, creating an open defecation free environment." Alongside, the Sindh Sanitation Policy (2016) aligns itself with the goals and targets of the SDGs for sanitation, which require sanitation services to be safely managed, have a private improved facility where fecal wastes are safely disposed on-site or transported and treated off-site. The government has taken responsibility to increase the capacity of departments related to sanitation as this is an important component of the implementation of the National Sanitation Policy. At times, NGOs and development partners often coordinate directly with the municipalities and Community Based Organizations (CBOs) and private sector operators play a role in supporting FSM implementation. (Sindh Sanitation Policy, 2016)

| | Containment | Emptying | Transport | Treatment | Disposal |
|---|---|---|---|---|---|
| Policy | 2.5 | 1 | 2.5 | 2 | 1.5 |
| Planning | 1 | 0.5 | 0.5 | 0.5 | 0.5 |
| Budget | 1 | 0 | 1 | 0 | 0 |
| Expenditure | 0.5 | 0 | 0.5 | 0 | 0 |
| Equity | 0.5 | 0 | 0.5 | 0 | 0 |
| Output | 1 | 0 | 0 | 0 | 0 |
| Maintenance | 0 | 0 | 0 | 0 | 0 |
| Expansion | 1 | 0 | 1 | 0.5 | 0.5 |
| User Outcomes | 0.5 | 0 | 0 | 0 | 0 |

**Figure 7: SDA for Karachi**

It is the responsibility of the government to provide funds through public sector development funds. (National Sanitation Policy, 2006). There has been an overall increase in sectoral funding for water and sanitation, overall investment in the sector concerning total pro-poor development spending has reduced. Further, there is diminishing prioritization of investment in the sector compared to other sectors. However, there is also no systematic approach for the monitoring and evaluation of sanitation projects. (Sindh Strategic Sector Plan 2016-2026)

In 2012, the MoCC delegated the implementation of WASH projects to the provincial governments including planning, funding, regulation, and monitoring of services. The Ministry of Planning, Development, and Reforms holds the authority for approving provincial development programs and the Ministry of Finance allocates and transfers funds to the provinces. (WaterAid, 2019)

There is a rapid increase in population yet there is little to no development ensuring that the sanitation services can cater to large masses. Lack of treatment facilities and open dumping of waste into waterbodies is aggravating the problem. Contamination of drinking water sources is creating an added burden on healthcare resources. The structure of the FSM service chain does

not exist, only parts of it exist and even that is not of satisfactory performance. Sanitation services are often not charged for and even if it is, the amount is not sufficient to be in profit. The lack of development is primarily because of a shortage of funds and poor urban planning in Karachi.

**RECOMMENDATIONS FOR THE CITY BASED ON SDA**

Thus, the enabling environment is largely present, but the planning and budget building blocks need improvement. A lot of work needs to be done in the developing and sustaining services altogether to improve the overall sanitation situation in Karachi and to achieve acceptable scores.

# 4.2.2 ISLAMABAD CAPITAL TERRITORY

## 4.2.2.1 STUDY AREA

Pakistan's capital city is Islamabad. It has a population of 2.007 million. The population . is almost equally divided between the rural and urban parts of the city (Pakistan Bureau of Statistics, 2018). The map in Figure 8 indicated the five administrative zones of the city of Islamabad The city has a cosmopolitan culture. The major source of water in the city are Simply and Khanpur dams (CDA).

The Deputy Commissioner is responsible for the administration while the political governance is carried out by the Mayor of Islamabad. For administrative purposes, the city has been divided into 5 zones. Zone I and Zone II are settled urban areas. It is entirely connected to the piped network. Figure 9 indicates the sewerage network of Islamabad. Not all wastewater is treated (Source: KII with CDA). In complete contrast, the city's rural and peri-urban settlements constitute Zones III, Zone IV, and Zone V. These have no access to any severed networks. Different types of fecal sludge containment and transport systems are used. Open defecation is still prevalent. Treatment of fecal sludge is not available (WaterAid (2016).
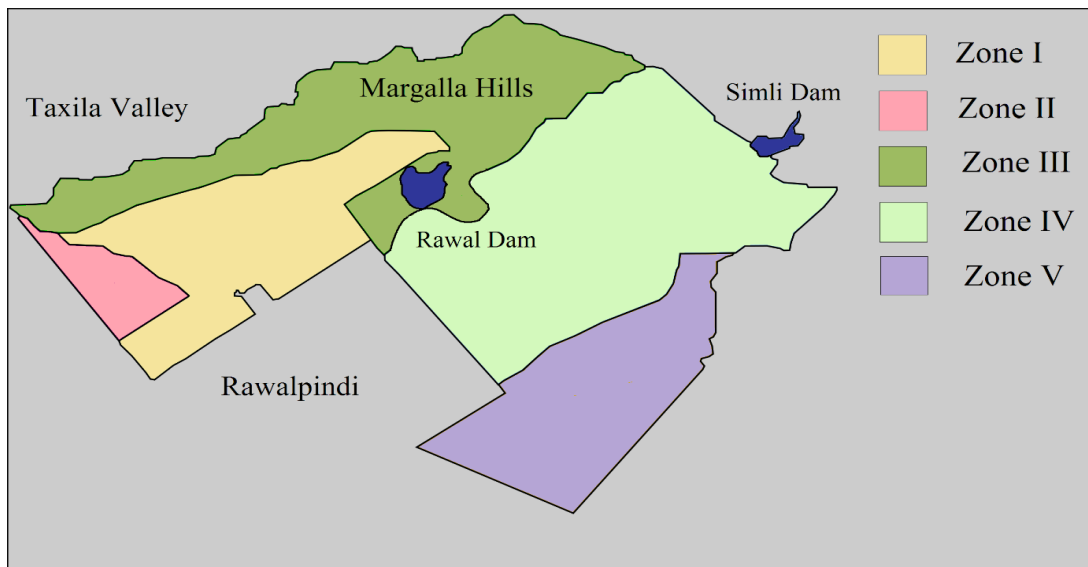


**Figure 8: Administrative Zones of Islamabad** (*Source: Capital Development Authority)*
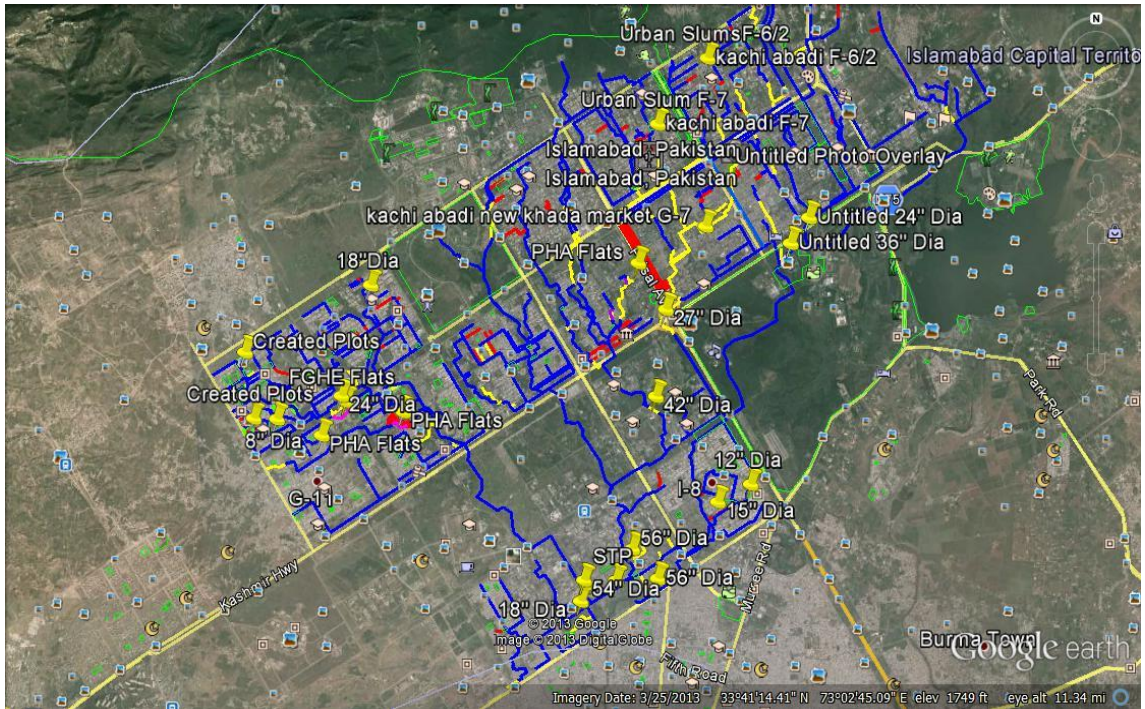
**Figure 9: Main Trunk Sewers of Islamabad** *(Source: Capital Development Authority's Offical Website)*

## 4.2.2.2 KEY INFORMANT INTERVIEWS (KII)

There is no formal institution dealing with fecal sludge management in the city. The "Capital Development Authority (C.D.A)" is responsible for the overall situation in the city. A senior official representative of the capital development authority was contacted. Information about the total wastewater produced per day of the city, the amount of wastewater carried in pipes and the portion of which is contained but not treated was discussed.

The information on the city wastewater management plan and its future extensions were also discussed. An important observation was the lack of information on fecal sludge and its management was noted. This was especially alarming considering it is the only formal wastewater management institution in Islamabad.

To complement the given information, two formal documents of official use were shared. These documents and the key informant interviews provided a lot of credible information.

**Table 7: Treatment Status in Islamabad**

| Number of Treatment plants | 1 |
|---|---|
| Location | I-9 |
| Sewage generated | 30 MGD |
| Treatment capacity | 17 MGD |
| Actual sewage treated | 06 MGD |
| Disposed off untreated | 13 MGD |

*(Source: KII With CDA)*

## 4.2.2.3 INFOGRAPHICS AND SITUATIONAL ASSESSMENT

## *1. SHIT FLOW DIAGRAM (SFD)*

The shit flow diagram for Islamabad paints a picture of contrasting fortunes of the rural and urban population. The urban population is dealt with by CDA. All the water is contained in wastewater systems. For the Urban population in Islamabad, sewage generated is 30 MGD. The Treatment capacity of the I-9 treatment plant is 17 MGD and the Actual sewage treatment is 06 MGD. While the rest is disposed of untreated which stands at 13 MGD. (Source: Key Informant Interview with Officials of Capital Development Authority). Table 9 depicts this.

## Table 8: Sanitation Situation in Islamabad

| Islamabad Capital Territory | Population | % |
|---|---|---|
| Total Population[A] | 2.07 million | 100 |
| Connected to sewerage via CDA System[B] | 1.015 million | 50 |
| Onsite Technology[C] | 0.9985 million | 49.2 |
| Open Defecation[D] | 0.0165 million | 0.8 |

**Table 9: Excreta Flow in Islamabad**

|  | MGD | Population | Percentage |
|---|---|---|---|
| Wastewater Generated[B] | 60 | 2.07 million | 100 |
| Sent to Treatment[B] | 17 | 0.5796 million | 28 |
| Wastewater Treated[B] | 6 | 0.207 million | 10 |
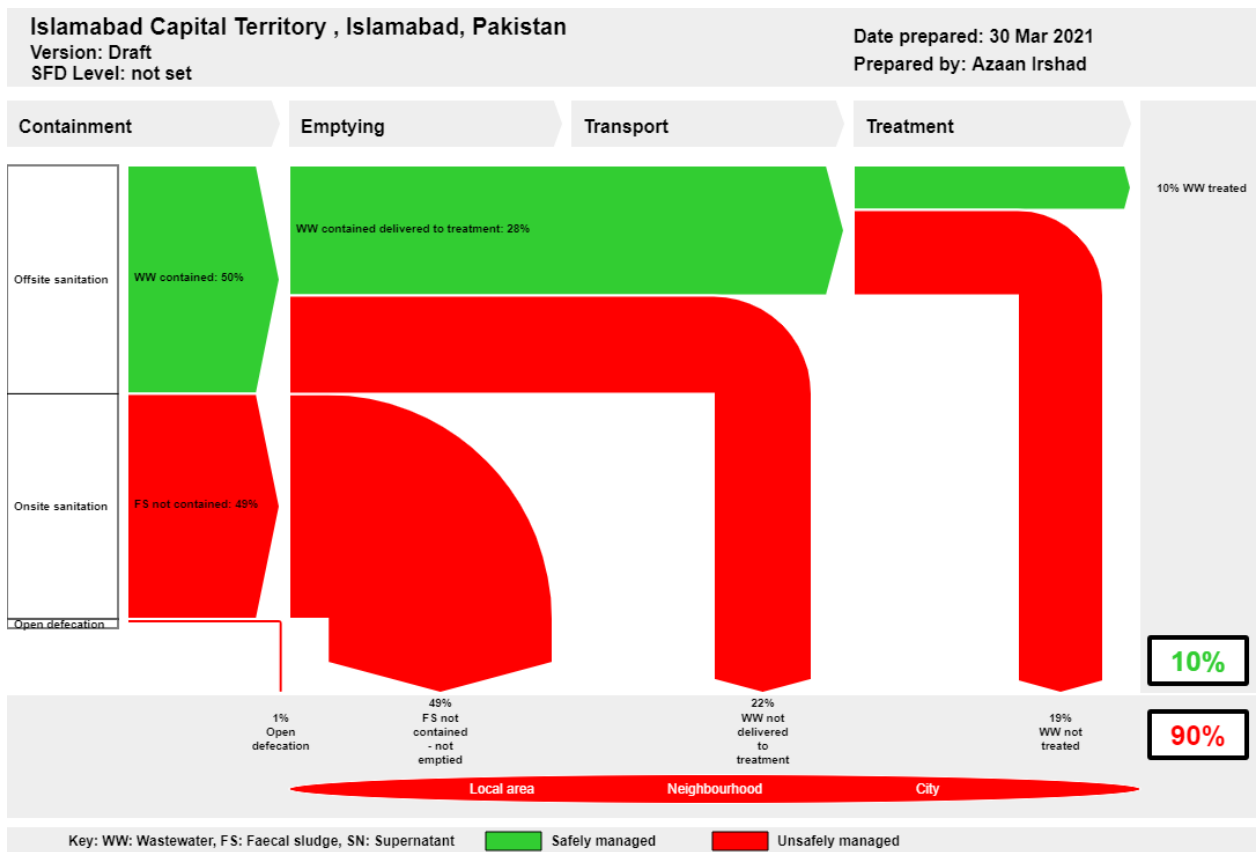


**Figure 10: SFD for Islamabad.**

The population of Islamabad Capital territory is 2.07 Million. Half of the population is connected to a sewer network. 49.2 percent of the total population relies on onsite sanitation while surprisingly around one percent of the capital's population defecates openly.

The city produces a total of 60 MGD wastewater. 17 MGD is sent to treatment. Only 6 MGD is treated out of the total 60 MGD produced.

The SFD gives us a clearer picture for Islamabad, the SFD shows 50 percent wastewater is contained, 28 percent is delivered to treatment while 22 percent is not delivered. 10 percent is treated. 49 percent is not contained, and 1 percent defecates openly.

## *2. MODIFIED SERVICE DELIVERY ASSESSMENT (SDA)*

The National Sanitation Policy is an elaborate document. It contains the goal of eradicating sanitation-related issues by 2025. It effectively diagnoses the issues relating to sanitation. It lays an elaborate framework for the implementation of the plan. The community-led and institution-supported approach has the potential to solve the big problem of the country. Although the policy is not very clear on reuse options. Almost all the fecal sludge-related data was from international organizations like United Nations and so on. The requirement of the budget is 12.3 billion dollars per year while the budget provided stands at 1.1 billion dollars per year (WaterAid, 2020). The National Sanitation does not identify Fecal Sludge Management as a separate domain. The Budget spent on WASH Rupees 1,161–2,060 per capita in Islamabad. According to the SFD, 23 percent is fecal sludge (World Bank, 2018). It is assumed that the same amount of budget is available for FS with containment takes the major portion. Key informant interviews prove the negligible amount of treatment and disposal. Keeping this in mind the following scores mention figure have been allocated. The National Sanitation policy point 6.b gives an important role to the public for participating in sanitation policy. The component sharing model is proposed as a viable option in this regard. The national and local policies are silent on any criteria for budget allocation. by paying a visit to the CDA and EPA websites, it can be concluded that the approach adopted is a project-to-project variable. It has nothing to do with inequality or need.

 The inefficiency of the system can be gauged from the fact that the 2006 National Sanitation Policy planned to reduce sanitation-related issues. This target has not been achieved yet.
In the last 15 years, access to improved water and latrines has increased dramatically across Pakistan, owing largely to self-provision, such as privately bored hand and mechanized pumps and the development of household latrines. (World Bank, 2018). There is little interest of the

government on this side due to no picture projection on fecal sludge, its management, and the issues caused by it. Resultantly, no information is disseminated to the public.

In the capital city of Islamabad, there is no mechanism for sanitation fees. According to a key informant interview, all such efforts have met resistance from the public. Thus, no fee is collected for FSM by a government organization. There are no standards set for fecal sludge management. It is not identified as a separate domain. The reason is that violations can only occur if therein exists a law that forbids it. Moreover, the impact of the open disposal of fecal sludge management is well documented. For instance, (Zahid, J., 2018) highlighted the impacts of poor sanitation on public health. Section 10 of the National Sanitation Policy is completely related to the reward for open defecation free and 100 percent sanitation coverage is mentioned. Thus, the government is promoting WASH through these measures. Similarly, International organizations also invest in the sector. As the measures are inadequate and boost local measures exist so the score will be low.

| | Containment | Emptying | Transport | Treatment | Disposal |
|---|---|---|---|---|---|
| Policy | 2 | 2 | 2 | 2 | 1.5 |
| Planning | 1.5 | 1.5 | 1.5 | 1 | 0.5 |
| Budget | 1 | 1 | 1 | 0.5 | 0.5 |
| Expenditure | 1.5 | 1.5 | 1.5 | 0.5 | 0.5 |
| Equity | 1 | 1 | 1 | 1 | 1 |
| Output | 1 | 1 | 1 | 0.5 | 0.5 |
| Maintenance | 0 | 0 | 0 | 0 | 0 |
| Expansion | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| User Outcomes | 1 | 1 | 1 | 0.5 | 0 |

**Figure 11: SDA for Islamabad Capital territory**

**RECOMMENDATIONS FOR THE CITY BASED ON SDA**

The city does well against other cities in the country. A comparative analysis with other cities with a similar landscape like Bangladesh and India reveals that there is a need for a lot of improvement. The key issue is the low government funding in this regard. Moreover, people generally lack awareness of the sensitivity of the issue. Having said this, the country has shown that it can deliver if it wills. Over the last two decades, the situation has improved enormously. The need of the hour is to double our efforts to cope with this major issue. The Government and the citizens both must fill their responsibilities in this regard. Models like the component sharing model and community-led total sanitation can be viable options in this regard. Moreover, the focus should shift towards the rural parts of the city. In short, the current sanitation situation is not great but more it will be improved to match global standards.

## 4.2.3 LAHORE

### 4.2.3.1 STUDY AREA

Lahore, the capital of Punjab and the second largest city of Pakistan is having a population of more than 11 million people. Lahore is the provincial metropolitan and commercial hub of Punjab and has always stood apart from the rest due to its historical significance. The entire municipal waste from Lahore city is collected through a network of 14 main drains and discharged into the River Ravi without any treatment. This beautiful and culturally rich city's surface and groundwater resources have been under a lot of pressure lately, due to various factors, among which high population growth, increasing urbanization, inefficient irrigation practices, unsustainable water use, and fragmented management are the most prominent. The water demand of the increasing population of Lahore depends entirely on groundwater, but with increasing urbanization and industrialization, the amount of domestic sewage being produced in the city is spiking with each passing day. Lahore disposes of its wastewater directly into River Ravi through different drains without any treatment.

Figure12 shows the map of Lahore including the WASA service area and Non-WASA service area.
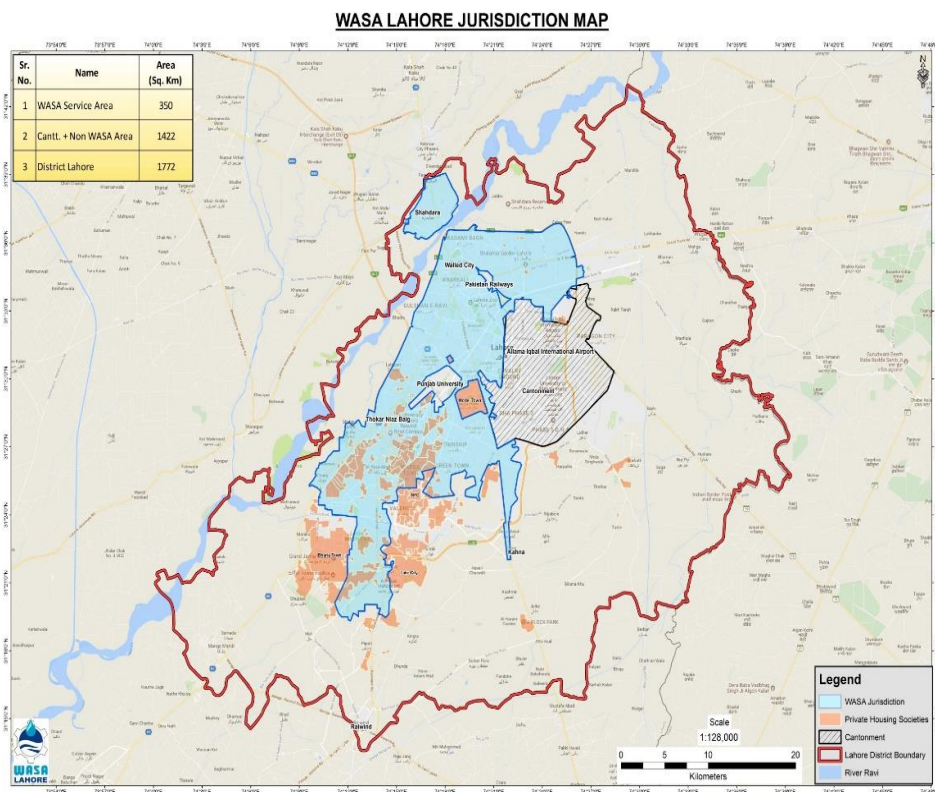


**Figure12: Areas Served by WASA** (*Source: Lahore Water And Sanitation Agency WASA)*

## 4.2.3.2 KEY INFORMANT INTERVIEWS (KII)

In Lahore, a key informant interview was conducted at Water and Sanitation Agency (WASA) head office at Jail Road, Lahore. The visit aimed to collect primary data on sanitation situations and fecal sludge management data (FSM). A key informant interview with the In-charge of the Water and sanitation agency was conducted. There was a thorough discussion about FSM in Lahore and how much water is being treated, and how much is being drained without treatment. An overview was given mentioning that currently there is no wastewater treatment plant in Lahore. There used to be one wastewater treatment plant in Lahore but now it's not functional. The water production and supply situation by WASA in Lahore was also discussed which is about 540 MCM/DAY. Sewerage network maps in all areas under WASA were discussed. Future projects in Lahore for wastewater treatment and how a part of the FSM may be targeted in the upcoming projects.

Another key informant interview was conducted with MD WASA. It was asked about the areas served by WASA in Lahore and learned that 90 % of the total area was served by WASA. They provided a detailed presentation, complete with all the sewerage maps of Lahore, and told that there are leakages in the distribution network and 70% water connections are un-metered resulting in 30-40% wastage. Punjab provisional capital Lahore is also facing the issue of water level lowering down due to excessive pumping compared to recharge. It is estimated that 60-70 percent of Pakistan's population relies on groundwater for their survival, either directly or indirectly. Groundwater is responsible for about 80% of domestic water use and more than half of all drinking water sources. (Mehmood et al, 2013). Overexploitation and depletion of groundwater have resulted in many issues.

## 4.2.3.3 INFOGRAPHICS AND SITUATIONAL ASSESSMENT

### 1. SHIT FLOW DIAGRAM (SFD)

This shit flow diagram (SFD) for Lahore is presenting how excreta physically flows through Lahore. The SFD presents that sewerage networks of Lahore connect to 95% of the total population, from which 85% comes under WASA and 10% comes under Non-WASA area. 2% of the population is practicing open defecation, and the remaining 3% population uses on-site sanitation technology (WASA Lahore) In the past there used to be one biological treatment plant in Lahore but now it is not operational. Currently, there is no wastewater treatment plant in Lahore That is the reason wastewater in Lahore is not getting treated at all (Ghulam Murtaza and Munir H. Zia, 2012) This wastewater has to be disposed of directly into River Ravi, which is why an estimated 540 MGD of untreated domestic sewage is being disposed of into river Ravi. (WASA report). In the key

informant interview, WASA informed of these figures, and they were verified with desk review. Table10 represents that Lahore has a population of 11.1 million. Out of this, 95% population has access to sewerage. Out of the remaining, 3% use, onsite sanitation technologies, and 2 % population practices open defecation.

**Table 10: Sanitation Situation is Lahore**

| Lahore | Population | Percentage |
|---|---|---|
| Population[A] | 11.1 Million | 100 |
| Connected to sewerage[B] | 10.6 Million | 95 |
| Onsite sanitation[C] | 3 hundred thousand | 3 |
| Open defecation[D] | 2 hundred thousand | 2 |

**Table 11: Excreta Flow in Lahore**

| | MGD | Population | Percentage |
|---|---|---|---|
| Wastewater Generated[E] | 540 | 11.1 million | 100 |
| Sent to Treatment[F] | 0 | 0 | 0 |
| Wastewater Treated[F] | 0 | 0 | 0 |
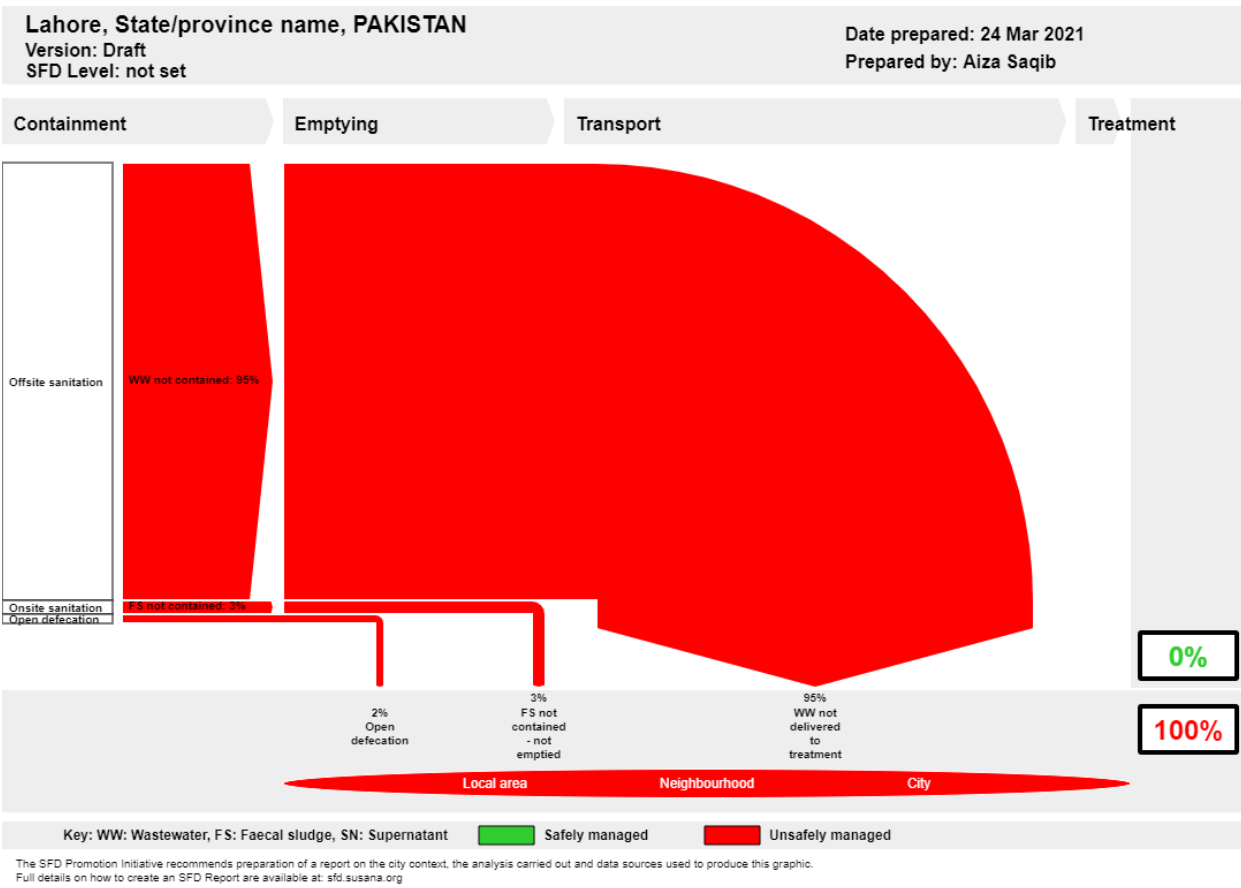
**Figure 13: SFD for Lahore**

## 2. MODIFIED SERVICE DELIVERY ASSESSMENT (SDA)

According to the Punjab Sanitation Policy (2017), the sanitation models like the Component sharing approach, Community-led total sanitation developed by various stakeholders, including NGOs, communities, and private sectors will be identified, recognized, and upscaled by sanitation service delivery departments of government. Furthermore, the government will prioritize the installation of disposals, treatment plants, and trunk sewers at the town and city levels. Sanitary latrines will be used to safely dispose of excreta. Also, the development of sewage and water treatment facilities will be looked upon to utilize it for domestic and industrial use (Punjab WASH Sector Development Plan 2014-2024)

According to Punjab sanitation policy, containment takes up most of the portion followed by emptying and disposal. Transport and treatment take no portion.

97% of the population of Lahore has access to water, but 49% of this water is contaminated, the reason being poor sanitary conditions. Therefore, it is high time to prioritize investment in sanitation. The Government of Punjab already has information about the current sanitation

condition in the urban and rural areas of the province. This data can be used to see which areas are in dire need of a sanitation investment, and a plan will be made to keep the priority areas in consideration. While there's no wastewater treatment in Lahore, only containment is the major contributor, so scores have been given accordingly. The budget of Punjab (2015 -2016) shows that while the expenditure on health is 8.3%, education is 6.8% and social protection is 3.7%, only 1.75% is allocated for water supply and sanitation. The National Sanitation policy has given the citizens an integral role to participate in sanitation policy. Only a meager 0.23% of GDP is spent on water and sanitation. Most of the funds are spent on containment, disposal, and transport while emptying and treatment still have no share.

| | Containment | Emptying | Transport | Treatment | Disposal |
|---|---|---|---|---|---|
| Policy | 1 | 0.3 | 0.1 | 0.1 | 0.3 |
| Planning | 1 | 0 | 0 | 0.1 | 0.6 |
| Budget | 0.5 | 0 | 0 | 0 | 0 |
| Expenditure | 0.1 | 0 | 0 | 0 | 0 |
| Equity | 0.5 | 0 | 0.1 | 0 | 0.3 |
| Output | 0.3 | 0 | 0 | 0 | 0 |
| Maintenance | 0.2 | 0 | 0 | 0 | 0.2 |
| Expansion | 0.8 | 0 | 0 | 0 | 0 |
| User Outcomes | 0.2 | 0 | 0 | 0 | 0 |

**Figure 14: SDA for Lahore**

According to WASA Lahore, some revenue has been reserved for sanitation operations but none for fecal sludge management. The Pakistan Approach for Total Sanitation (PATS) is a holistic approach that works on achieving and sustaining an open defecation-free environment for both urban and rural areas with an emphasis on behavior change. Emphasis is given more toward the provision of toilet facilities and containment of the fecal sludge with no guideline mentioning its emptying, treatment, and safe disposal.

## RECOMMENDATIONS FOR THE CITY BASED ON SDA

Being the country`s second-largest city there is no treatment plant available for wastewater, but there has been an increase in Policy for containment of wastewater, however, there is also no systematic approach for Fecal Sludge Management overall In Lahore. The major issue is the lack of implementing policy and city-wise funding for FSM in province Punjab. Moreover, there is a lack of awareness among people regarding FSM.

# 5. CONCLUSION

Urbanization if planned it has the potential to single-handedly lead a country towards progress. In Pakistan, urbanization has been anything but planned. Karachi's Katchi Abadi is a case in point. This has led to a crisis of sanitation in the cities. Karachi, Islamabad, and Lahore house the major industrial, commercial, and diplomatic institutions of Pakistan. More importantly, Karachi, Lahore, and Islamabad are the 1st, 2nd, and 9th most populous cities. Karachi is the capital of Sindh and is responsible for almost all the cargo handling. Lahore is Punjab's capital, and its cultural value is invaluable. Similarly, Islamabad is the capital of the country and its scenic views attract visitors. In short, it can be said that these three are the most important cities in the country.

The sanitation situation across Islamabad, Lahore, and Karachi varies. On a comparative note, the city of Islamabad fares well against the other two. Analysis suggests that Islamabad's Master Plan and its lower population are the key reasons for it. Similarly, Lahore and Karachi have planned cities, but they have outgrown the original plan by manifolds. Unfortunately, open defecation is still prevalent in all these cities. The piped network's water that is treated accounts for ten percent of Karachi and Islamabad while Lahore has no treatment network. In addition, there are no functional fecal sludge treatment systems in the cities. To conclude, Islamabad, Karachi and Lahore are the order of availability of sanitation facilities.

In the light of the above discussion and analyzing SFDs and SDAs the following recommendations are made. The investment from the government should considerably increase. Offsite or Onsite sanitation should be provided to the citizens of these cities. The order of investment should be Karachi then Lahore and then Islamabad. This will save the country a lot of financial resources in the longer term. Moreover, the lives of citizens will improve and thus the trust in the government. It is imperative to state that investing in these cities will prove to be the best value for money as they have the maximum no of population per square kilometer. In a nutshell, improving the sanitation of the cities will is the need of the hour.

Karachi and Lahore are provincial capitals and rank first in terms of sanitation in their respective provinces even though merely 10% of wastewater gets treated in Karachi and no waste flow gets treated in Lahore. Even in the capital city, 10% of wastewater gets treated and only 50% population has access to sewerage. Open defecation is prevalent in all three cities If such is the situation in cities ranked first, one can only imagine how worse the situation is in other cities all over Pakistan in terms of sewage and fecal sludge.

# 6. RECOMMENDATIONS

The need for FSM all over Pakistan should be highlighted. It should be included in the National Sanitation Policy if Pakistan is to achieve the targets of Sustainable Development Goals. Open defecation must be eradicated, starting from the large cities of Pakistan such as Karachi, Lahore, and Islamabad. The stigma with sanitation work needs to be removed. Awareness regarding this issue must be created through media, curriculum, and civil society. Models of Community-Led Total Sanitation and Public-Private Partnerships must be adopted.

## 6.1 CITY WISE RECOMMENDATIONS

### 6.1.1 Islamabad

- Extend CDA's area of influence from Zone I and Zone II to all V zones of ICT.
- The I-9 treatment plant's maximum capacity should be utilized.
- Capacity building of the staff on fecal sludge maintenance
- Equity in sanitation provision

### 6.1.2 Lahore

- Allocation of more resources to sanitation
- Development of wastewater treatment plants
- Awareness regarding FSM
- Investment in R&D
- Devise a system for the collection of sanitation fees.

### 6.1.3 Karachi

- Provide sanitation coverage to Katchi Abadis
- Rehabilitation of existing sewer networks
- Encouraging private companies to provide FSM service chain facility.
- Expand existing system to cater to growing population needs.

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# ANNEXURE

| Data Sources (SFD – Karachi) | Data Sources (Modified SDA - Karachi) |
|---|---|
| <ul><li>[A]Data on population - 2018 - Pakistan Bureau of statistics</li><li>[B]Data on sewerage connection via KWSB system – Key Informant Interviews (KII)</li><li>[C]Data regarding sewerage connection - Key Informant Interviews (KII), Karachi Water and Sewerage Services Improvement Project (KWSSIP) Environmental Management Framework and (Pakistan Social and Living Standards Measurement Survey, 2015)</li><li>[D]Open Defecation – KII</li><li>[E]Data regarding onsite sanitation - Key Informant Interviews (KII), Karachi Water and Sewerage Services Improvement Project (KWSSIP) Environmental Management Framework and (Pakistan Social and Living Standards Measurement Survey, 2015)</li><li>[F]Generation of Wastewater - Water demand and supply data by KWSB (Generation of wastewater - 70% of demand)</li><li>[G]Data on Treatment - KWSB (Website-data extracted on 10th January 2021)</li></ul> | <ul><li>Key Informant Interviews (KII)</li><li>National Sanitation Policy, 2006</li><li>Sindh Sanitation Policy, 2016</li><li>Pakistan Social and Living Standards Measurement (PSLM) Report 2018-2019</li><li>Highlights based on country reported GLAAS 2016/2017 data</li></ul> |

| Data Sources (SFD – Islamabad) | Data Sources (Modified SDA- Islamabad) |
|---|---|
| and Situational Assessment of Water Sources of Karachi (Report) | |

| Data Sources (SFD – Islamabad) | Data Sources (Modified SDA- Islamabad) |
|---|---|
| [A]Population<br><br>• Pakistan Bureau of Statistics of Statistics 2018<br><br>[B]Sewerage Connection and wastewater generation<br><br>• Capital Development Authority and Metropolitan Corporation of Islamabad<br><br>• WaterAid (2016) 'WASH situation in Pakistan: Know and act'.<br><br>[C]Onsite sanitation and Fecal Sludge Data<br><br>• 'Drinking Water Quality Status and Contamination in Pakistan' Daud, M. K. *et al.* (2017)<br><br>• 'Safe drinking water and sanitary measures: A cross-sectional study in a peri-urban community of Islamabad', Ghazanfar, H. *et al.* (2017)<br><br>• 'Issues and Remedies of Sewage Treatment and Disposal in', Ayub, M. and Lanka, S. (2013). '<br><br>[D]Open Defecation: | • Key Informant Interviews (KII) with Capital development authority<br><br>• National Sanitation Policy, 2006<br><br>• https://washmatters.wateraid.org/blog/financing-water-supply-sanitation-and-hygiene-for-a-clean-green-and-healthy-pakistan<br><br>• "(2018) 'When Water Becomes a Hazard' When Water Becomes a Hazard. doe: 10.1596/30799"<br><br>• Cooper, R. (2018) 'Water, sanitation and hygiene services in Pakistan', Epidemiology, 23(1), pp. 107–115<br><br>• Zahid, J. (2018) 'Impact of Clean Drinking Water and Sanitation on Water Borne Diseases in Pakistan', Sustainable Development Policy Institute, (August), p. 24 |

| Data Sources (SFD – Lahore) | Data Sources (Modified SDA- Lahore) |
|---|---|
| ▪ [A]Data on population - 2018 - Pakistan Bureau of statistics | ▪ Key Informant Interviews National Sanitation Policy, 2006 |
| ▪ [B]Data on sewerage connection via WASA system – Key Informant Interviews | ▪ Punjab Sanitation Policy, 2016 |
| ▪ [C]Data regarding onsite sanitation - Key Informant Interviews | ▪ Pakistan Social and Living Standards Measurement (PSLM) Report 2018-2019 |
| ▪ [D]Open Defecation – Key informant interview | ▪ Highlights based on country reported GLAAS 2016/2017 data |
| ▪ [E]Generation of Wastewater: WASA Punjab gov TORs Report | |
| ▪ [F]Data on Treatment - (JICA, 2010, as cited in Qureshi and Sayed, 2013) | |