

## CHAPTER III

# Community Participation in Rainwater Harvesting – A Case Study of Delhi

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### Introduction

In urban settings like Delhi, the availability of open spaces is restricted, and not all built-up areas are conducive to rainwater harvesting due to space crunch, design limitations, accessibility issues, and safety concerns. However, the city has many government structures, private offices, educational institutions, and residential societies. In these settings, installing rooftop rainwater harvesting systems stands out as a versatile and scalable approach that will play an important role in guaranteeing water sustainability and resilience while having a substantial impact. Adopting rainwater harvesting allows urban areas to become more water-conscious, environmentally responsible, and better equipped to fulfill their water requirements by harnessing rainwater at its source.

The following built-up areas where rainwater harvesting can be implemented effectively:

1. **Rooftops:** As mentioned earlier, rooftops are one of the most common and suitable areas for rainwater harvesting in urban environments. Rainwater can be easily collected from residential, commercial, and industrial buildings with proper gutter and downspout systems.
2. **Balconies and Terraces:** In multi-story buildings, balconies and terraces can be equipped with rainwater collection systems to harness runoff water from these areas.
3. **Parking Structures:** Covered parking structures or carports can be modified to incorporate rainwater harvesting systems, capturing rainwater from the roof and directing it to storage tanks.

4. Courtyards and Atriums: In some buildings, inner courtyards or atriums can be designed to collect rainwater, providing a visually appealing and functional water harvesting feature.
5. Canopies and Awning Structures: Shops, restaurants, and public spaces often have canopies and awnings. These structures can be modified to collect and channel rainwater to storage tanks.
6. Permeable Pavements: As previously mentioned, permeable pavements in walkways or pedestrian zones can allow rainwater to seep through and be collected for reuse.
7. Sports Fields and Playgrounds: Artificial turf or natural grass sports fields and playgrounds can be designed with drainage systems that collect and store rainwater for irrigation purposes.
8. Public Plaza and Square: Public gathering spaces can be designed to incorporate rainwater harvesting features, making them environmentally friendly and sustainable.
9. Bus Stops and Shelters: Bus stops and shelters with rooftops can be retrofitted with rainwater harvesting systems, contributing to water conservation efforts.
10. Industrial Facilities: Factories and manufacturing plants may have built-up areas with large rooftops and paved surfaces, making them potential candidates for rainwater harvesting.
11. Educational Institutions: Schools and universities often have various built-up areas like lecture halls, gymnasiums, and administrative buildings that can be considered for rainwater harvesting.
12. Apartment Complexes: Shared spaces in residential apartment complexes, such as clubhouse areas, can be used for rainwater harvesting.

When selecting built-up areas for rainwater harvesting, it's important to evaluate the structural integrity and sustainability feasibility of existing infrastructure. Involving the community, civil society, and obtaining financial and technical support from government agencies will ensure a successful and safe project implementation. Moreover, adhering to local

regulations and building codes is essential to meet guidelines and restrictions related to rainwater harvesting systems.

### **3.1 Scope of Community Participation in Rain Water Harvesting in Delhi**

Delhi holds immense rainwater harvesting potential, which can be extrapolated from an illustrative calculation applied to a single building to the entire city. Considering the city's vast area of 1,486 sq. km., the rainwater harvesting potential of Delhi stands at a staggering 907 billion liters annually. This substantial amount is equivalent to fulfilling the water requirements for the entire city for approximately 270 days. According to the Delhi Master Plan 2021, there are approximately 1.7 million buildings within the city, making rainwater harvesting is more promising and vital approach to address water scarcity and ensure sustainable water management. These include residential, commercial, industrial, and government buildings. There are large numbers of buildings that can have immense potential for rainwater harvesting. In addition to that the number of buildings in Delhi is constantly increasing due to rapid urbanization and population growth. The government of Delhi has taken an important policy decision to mandate the installation of rainwater harvesting systems on all new buildings where the rooftop runoff is 10,000 litres or more per day. This decision ensures that these buildings must actively participate in the storage of rainwater.

In this context, the active involvement of the community can significantly augment the effectiveness of rainwater harvesting. Since the community typically owns a majority of the buildings, their contribution becomes essential in gathering and storing rainwater on a communal scale. Communities can come together to plan and implement rainwater harvesting systems, such as building rainwater harvesting pits, installing rooftop rainwater harvesting systems, and creating green spaces. Effort should be made to involve the public in the planning and implementation process.

The first step in promoting community participation in rainwater harvesting is to create awareness among the RWAs, common citizens and different institutions about the importance and benefits of rainwater

harvesting. Awareness campaigns can be organized at the local and community level, including residential societies, schools, colleges and government agencies. To encourage community participation government can also provide incentives to individuals and communities who adopt rainwater harvesting practices. This could include subsidies, tax breaks, or other financial incentives to encourage people to adopt rainwater harvesting systems. As we have seen that the Government of Delhi is also trying to connect people through one of its major rain water harvesting scheme. It can be expected that with active participation from individuals and communities, rainwater harvesting can become a successful solution to the water crisis in Delhi.

Rainwater harvesting in cities has several benefits, including:

1. **Groundwater Recharge:** Data of Delhi Jal Board shows that during August 2009 to August 2019, nearly 60 percent of monitoring wells show fall in water level of August 2019, comparing decadal mean of August water level of 2009-18, whereas rest 40 percent monitoring wells show rise in water level. So by capturing rainwater, it can be used to recharge the groundwater table, which can be beneficial for areas facing water scarcity.
2. **Water Conservation:** Rainwater harvesting reduces the dependence on freshwater sources for non-potable purposes like irrigation, flushing, and cleaning. It can also supplement the main water supply during water shortages. Rainwater can be collected from rooftops of buildings and stored in tanks or underground reservoirs. This water can be used for non-potable purposes such as flushing toilets, washing clothes, and watering plants.
3. **Reduced Flooding:** Urban areas often experience flooding due to the rapid runoff of rainwater. Many water bodies in Delhi have been encroached upon, which has led to a reduction in their storage capacity. Diverting and storing rainwater into these water bodies can reduce the volume of storm water runoff, which can help to mitigate flooding and the damage it causes.
4. **Cost-Effective:** Rainwater harvesting can reduce the demand for treated water from public utilities, which can save money on water

bills. Rainwater harvesting systems have low maintenance and installation costs as they require minimal upkeep. Rainwater harvesting can reduce the amount of water required from the main water supply, resulting in lower water bills. This is especially beneficial to the community living in areas where water scarcity is an issue, and water is expensive. As we have seen that the government in Delhi is providing monetary benefits and subsidy in water bill to people through one of its major programs.

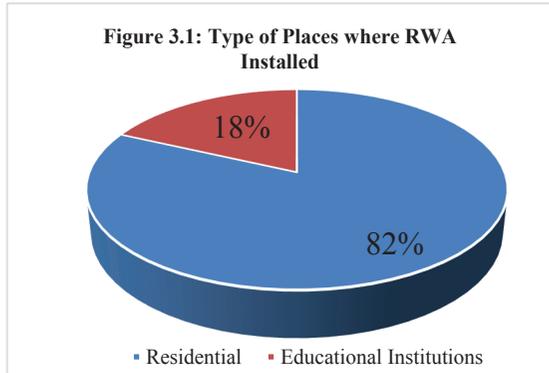
5. **Environmental Benefits:** Rainwater harvesting can help to reduce the impact of urbanization on the environment by reducing the amount of water runoff, decreasing soil erosion and reducing the demand for energy to transport water from distant sources.
6. **Improved Water Quality:** Rainwater is usually free from contaminants and is suitable for several non-potable purposes. By using rainwater, the demand for treated water is reduced, and the burden on the municipal water treatment plants is

In view of the above, conducting a case study to evaluate the community's engagement in rainwater harvesting across various housing societies, organizations, and institutions can serve as a model for others to follow. The primary objective of this study is to assess the level of community participation and the government's efforts in implementing and maintaining 11 rainwater harvesting systems in Delhi.

### **3.2 Site Description of RWH Systems at Societies and Organizations**

While studying the community's engagement in adopting rainwater harvesting systems at societies and organizations in Delhi, our research team conducted interviews with different stakeholders, including residents, management committees, and members of Residents' Welfare Associations (RWAs). The primary objective was to assess the effectiveness and accomplishments of the Delhi Jal Board scheme in facilitating this process.

For this study, the research team randomly selected 11 distinct sites located in various regions across Delhi, as outlined in Figure 3.1. All these chosen locations are exclusively from the North, West and North West districts of Delhi. Out of the selected sites, 8 are residential societies, 2 are schools, and 1 falls into a different institutional category. The rationale behind this deliberate selection was to comprehensively explore and comprehend the extent of community engagement among diverse segments of society. By examining various types of organizations, the research sought to gain valuable insights into the patterns of participation among different sections of the community.



Source: IIPA Field Survey, 2023

### 3.3 Attributes of studied RWH Installed Systems

Table 3.1 describes about the attributes of the installed Rainwater Harvesting (RWH) systems in the studied locations. Some common attributes includes, the geographic location, plot area, roof area under RWH, storage capacity and number of people residing in the premise were analyzed and documented during the research. Each of the 11 societies and organizations has enough plot area to have functional RWH in their premises. As per the DJB guidelines

In estimating the harvestable rainwater in these societies, the mean annual rainfall figure is typically employed, though it's important to note that the actual amount may not be guaranteed. However, with a 95% likelihood, it can be expected. The calculation of rainwater that can be collected from a specific rooftop area can be determined using the Rational formula, which is as follows:

$$Q = C \times I \times A$$

Where, Q is amount of discharge from the roof (in m<sup>3</sup>) A is Area of the rooftop (in m<sup>2</sup>) I is depth of annual rainfall received on the roof (in m) c = runoff coefficient (no units)

**Table – 3.1: Main Attributes of Rain Water Harvesting System Installed**

Sl.No	Name of the RWAs/Organizations	Plot Area (M <sup>2</sup> )	Roof Area Under RWH (M <sup>2</sup> )	Capacity (M <sup>3</sup> )	No of flats/people in premise	Potential amount of water being harvested (in Litre)
1	Printers Society, Rohini	6070	2500	45	180 flats	11,45,625
2	The Arya Apartments, Rohini, Sector 15	9000	6000	90	200 flats	27,49,500
3	The Hans Society, Rohini-15	8093	3500	60	225 flats	16,03,875
4	Lucky Homes, Rohini 13	5260	1800	40	150 flats	8,24,850
5	DAV School, Pachim Vihar	5000	1000	25	2800 St/Teach	45,8250
6	MRG School, Rohini-3	4500	1000	28	2500 St/Teach	45,8250
7	Vasundhra Apartment, Dwarka	6070	3000	50	200 flats	13,74,750
8	Vijay Apartments, Model Town	4046	2800	42	125 flats	12,83,100
9	Sundaram Enclave, Dwarka	8094	5500	65	240 flats	25,20,375
10	Model Town Apartments, Model Town	5000	3500	70	110 flats	16,03,875
11	Vasudha Apartment, Sector 9, Rohini	4500	2500	25	100 flats	89,09,838

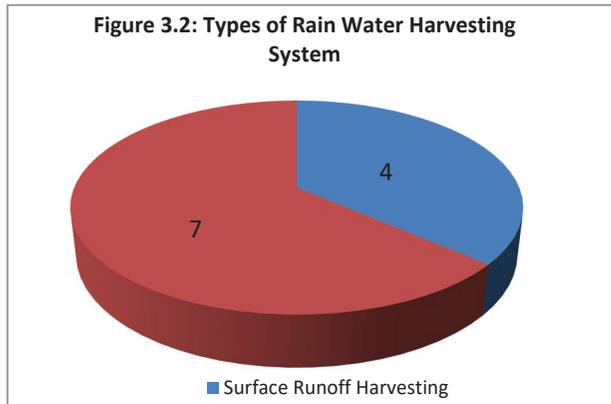
Source: IIPA Field Survey, 2023

Delhi receives an average annual rainfall of approximately 611 mm. The runoff coefficient for concrete roofs typically ranges from 0.7 to 0.8, and the rooftop areas of each society/organization are provided in Fig. 2.1. Utilizing this data, we can calculate the potential amount of rainwater that can be harvested in these societies and organizations. The data from each

Rainwater Harvesting (RWH) system indicates that they have significant water storage capacity, which can be utilized for various purposes. Take Arya Society as an example, where the potential amount of harvestable rainwater is approximately 27.49 lakh litres. This quantity proves to be adequate for fulfilling various water-related needs, except for drinking purposes.

### 3.3.1 Types of installed rainwater harvesting systems

The quantity of water harvested through rainwater harvesting is influenced by the nature of the catchment area used to collect the rainwater. For instance, when rain falls on a concrete terrace, approximately 70%



Source: IIPA Field Survey, 2023

of it becomes runoff, while merely 10% of the rainfall on a wooded or grassy area flows away, with the majority being retained on the surface and naturally infiltrating into the ground. According to figure 3.2, two distinct methods are employed by the surveyed societies and organizations. Among the 11 locations surveyed, 4 of them (The Hans Society of Rohini-15, Lucky Homes of Rohini, Sundaram Enclave of Dwarka, Vasudha Apartment of Sector 9 Rohini utilize runoff harvesting on their premises, while the remaining 7 locations opt for rainwater harvesting from their rooftop areas.

### 3.3.2 Storage of rainwater

**Table 3.2: Types of Rain Water Collection System**

Sl. No.	Options/Methods	No. of Societies/ Organisations
1	Recharge pit /Trench	11
2	Recharging of Abandoned Borewell	0
3	Soakaway	0
4	Recharge trough	0
5	Raising of storm water drains	0

Source: IIPA Field Survey, 2023

From a technical perspective, distinct water storage systems can be employed for different rainwater harvesting method. During the study, all the societies and organizations which are studied emphasized the primary purpose of rainwater harvesting is to groundwater recharging (Table 3.2). As a result, each of them constructed rainwater recharge pit tanks within their premises, and rainwater was channeled to these tanks through connected pipes and channels. The collective objective was to replenish the groundwater levels and promote sustainable water management practices.

#### **1.1.1 Proportion of Roof Area used for Rainwater Collection**

The quantity and quality of water stored in a water harvesting system are directly influenced by the size of the catchment area and the catchment surface of the society/organization. To optimize rainwater storage, it is crucial to employ the entire roof area for rainwater harvesting. The study revealed that in 9 out of 11 societies utilize their entire rooftop for water harvesting. However, the two educational institutions selected in the survey, namely DAV School, Pachim Vihar, and MRG School, Rohini-3, reported using only two-thirds of their rooftop area for rainwater harvesting.

**Table 3.3: Roof Area used for rainwater collection**

Sl. No.	Roof Area Cover	No. of RWA
1	Whole Area	9
2	Two third area	2
3	Half Area	0
4	Quarter Area	0
5	Total	11

Source: IIPA Field Survey, 2023

### **3.3.4 Purpose of Rainwater Harvesting (RWH) installation**

When surveying members of various societies and institutions were asked about the purpose of setting up Rainwater Harvesting (RWH), a range of answers were provided to the research team. However, the central objective of Rainwater Harvesting (RWH) installation in all 11 locations was to adopt sustainable water management practices and address water scarcity within their premises. Nine societies/institutions reported that they had previously experienced water crises, leading them to install RWH systems to reduce their reliance on conventional water supplied by the Delhi Government. As a result, this has helped them become less dependent on external water sources. Furthermore, seven societies/institutions acknowledged that one of their motivations for implementing RWH was to mitigate the flow of stormwater, thereby preventing flooding in nearby areas. By capturing and managing rainwater, they contributed to flood prevention measures in the region. In addition to water scarcity and flood prevention, two societies/institutions disclosed that they opted for RWH installations to avoid penalties imposed by the Delhi Government.

**Table 3.4: Purpose of Rain Water Harvesting**

<b>S. No.</b>	<b>Purpose of installation of RWH</b>	<b>No. of Society/ Institution</b>
1	Ground water recharge	11
2	To overcome Water scarcity	9
3	Reducing the flow of storm water to prevent urban flooding	7
4	Mandatory direction from Government of Delhi	2

Source: IIPA Field Survey, 2023

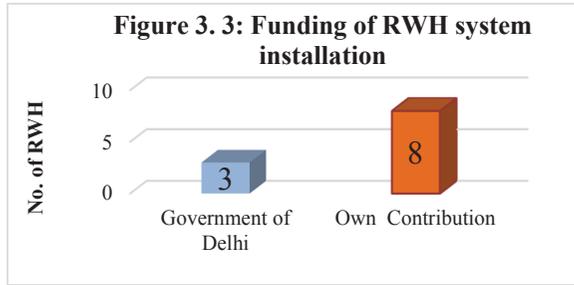
### **3.4 Government support to RWH system installation**

RWH system installation in societies/intuitions involves initial setup costs, which might be challenging for some RWAs/Institutions to bear on their own. Financial support or subsidies from the government can incentivize and enable RWAs to implement RWH projects without putting excessive financial strain on their members. Apart from that these private entities may do not have technical expertise and the experience for designing, installing, and maintaining RWH systems. So government support ensures that the RWH projects are implemented efficiently and effectively, maximizing their water-harvesting potential. Government involvement also ensures proper monitoring and evaluation of RWH projects. This helps assess the effectiveness of implemented systems, identify areas for improvement, and measure the impact on water conservation and water table recharge.

#### **3.4.1 Funding of RWH system installation**

In 2012, the government of Delhi made it obligatory for properties with a plot area exceeding 100 sq.m. to have rainwater harvesting (RWH) systems installed. They also promised to provide the cost for construction and maintenance and provide a subsidy on the Water Bill. Many private societies and institutions took the initiative to install RWH systems on

their premises and applied for the aforementioned benefits from the Delhi Government. However, out of the 11 surveyed places, only three societies, namely Printers

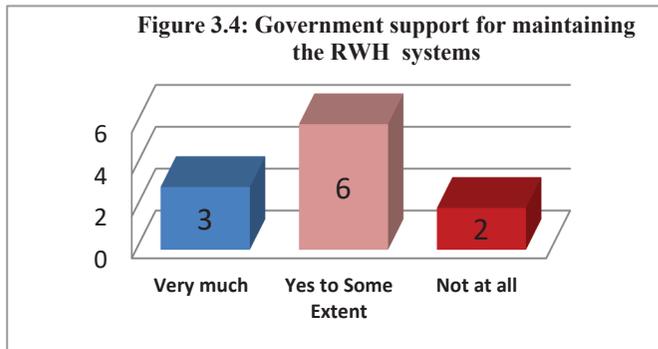


Source: IIPA Field Survey, 2023

Society of Rohini, The Arya, CGHS of Dwarka, and Lucky Homes of Rohini Sector 13, have reported receiving financial support for their RWH system installations. On the other hand, the following societies, namely The Hans Society - Rohini-15, DAV School - Pachim Vihar, MRG School - Rohini-3, Fancy Apartment - Vasundhra Enclave, Vijay Apartments - Model Town, Sundaram Enclave - Dwarka, Marwaha Associates - Model Town, Vasudha Apartment - Sector 9, Rohini, have stated that they independently funded the installation of their RWH systems. These societies had indeed applied for financial assistance from the government, but they have not received the promised amount to date.

### 3.4.2 Government support in maintenance of RWH system

According to the guidelines, the Delhi Jal Board (DJB) is responsible for providing technical expertise and guidance to Resident



Source: IIPA Field Survey, 2023

Welfare Associations (RWAs) to obtain functionality certificates for their Rainwater Harvesting (RWH) systems. These certificates are necessary for RWAs to avail rebates on their water bills. The support from DJB ensures that RWH projects are implemented efficiently and effectively, optimizing their water-harvesting capabilities. In response to accessing

government support for maintaining their rainwater harvesting systems, the survey revealed that only three societies/organizations reported receiving full support from the government for maintaining their RWH systems. This support likely includes technical assistance and financial aid, ensuring proper upkeep and functionality of the RWH installations.

Six societies/organizations stated that they received government support to some extent in maintaining their RWH systems. This support might involve partial technical guidance or limited financial assistance. Two organizations disclosed that they did not receive any technical or financial support from the government for the maintenance of their RWH systems. This lack of support could potentially pose challenges in ensuring the optimal functioning of their RWH installations. Overall, the survey reflects the varying degrees of government assistance received by RWAs and organizations in maintaining their RWH systems.

### **3.4.3 Level of communication between the government and the societies/RWAs**

Transparent communication between the government and societies/institutions about the available grants, subsidies, or financial incentives enables eligible entities to access the necessary funding are crucial for successful Rainwater Harvesting (RWH) and water conservation efforts. It empowers communities with knowledge, resources, and support, fostering a collaborative and sustainable approach towards addressing water challenges in the region. However, if we look at the table 3.5, the current situation appears to be less than promising. There seems to be a lack of communication between the Government and societies/institutions. Only 3 societies/organizations have confirmed that there is regular communication between them and the government. On the other hand, 8 out of 11 societies/organizations reported that their communication with the government is either non-existent or very rare, which is a great challenge to the success of water conservation efforts in Delhi.

**Table 3.5: Communication between the Government and Societies/Institutions**

S. No.	Level of Communication	No. of Societies/Orgs
1	Always	2
2	Often	1
3	Rarely	6
4	Never	2

Source: IIPA Field Survey, 2023

#### **3.4.4 Adequacy of financial support to the Societies/Organisations for RWH System**

RWH system installation involves initial setup costs, including equipment, materials, and labour. Adequate financial support helps societies/organizations cover these expenses, making it feasible for them to implement RWH projects. It motivates them to adopt RWH systems, leading to broader implementation and increased overall water conservation. Insufficient or delayed funding may lead to compromises in the quality of the RWH system. Adequate financial support allows for the use of high-quality materials and reliable technologies, leading to more efficient and long-lasting systems. Under the Rainwater Harvesting (RWH) guidelines, the Delhi government offers a 50 percent financial assistance, capped at a maximum of Rs 50,000, along with a 10 percent rebate on water bills. As per Table 3.6, all the surveyed Societies/Institutions have shown their dissatisfaction with regards to the amount of financial support or subsidies to societies/organisations. Although this much financial assistance is sufficient, it is necessary that it is fully implemented. It seems that the institutions are more worried about not getting the financial aid as promised and subsidy on the water bill.

**Table 3.6: Adequacy of financial support or subsidies to Societies/Organisations**

S. No.	Opinion regarding sufficiency of financial assistance or subsidies	No. of Studied RWH
1	No	11*
2	Yes	0
3	Total	11

Source: IIPA Field Survey, 2023

### **3.5 Status of RWH systems in Societies/Institutions**

A well-maintained RWH system ensures efficient rainwater collection and storage by maximizing the amount of water harvested. The operational RWH is a vital asset in assuring Delhi's water security and a more resilient future for both societies/organizations and the surrounding environs. Accordingly, guaranteeing the appropriate operation and maintenance of RWH systems is also in the interest of societies and organizations adhering to Delhi Government requirements and reaping financial benefits.

#### **3.5.1 Functionality of RWH systems in Societies/Institutions**

An operational RWH systems help recharge the groundwater table by allowing rainwater to percolate into the soil. This replenishes underground aquifers, which are essential for maintaining a sustainable water balance. As seen in the table 3.7, except for the Printers Society of Rohini, all other Societies/Organisations' RWH systems are operational which is very encouraging.

**Table 3.7: The rain water harvesting system of your housing society functional**

S.No.	Status	No. of Societies/ Institutions	Name of the Society/Organisation
1	Functional	10	1. The Arya - CGHS, Dwarka 2. The Hans Society - Rohini-15 3. Lucky Homes, - Rohini 13 4. DAV School - Pachim Vihar

			5. MRG School - Rohini-3 6. Fancy Apartment - Vasundhra Enclave 7. Vijay Apartments - Model Town 8. Sundaram Enclave – Dwarka 9. Marwaha Associates - Model Town 10. Vasudha Apartment - Sector 9, Rohini
2	Functional to Some Extent	1	11. Printers Society, Rohini
3	Non Functional	-	-
Total		11	

Source: IIPA Field Survey, 2023

### 3.5.2 Use of Harvested Water

It is well known that rainwater captured by Rainwater Harvesting (RWH) is not fit for potable use because it has not been processed to satisfy drinking water standards. However, the gathered water can be used for a variety of non-potable uses. Furthermore, frequent maintenance of the RWH system is required to ensure the quality of the gathered water and the system's longevity. According to the findings of this study, all assessed RWH systems are predominantly used for recharging subsurface aquifers, hence promoting groundwater replenishment (Table 3.8). Additionally, 8 societies/organizations utilize the conserved water for cleaning purposes, 2 societies/organizations employ it for domestic tasks, and 1 society/organization employs it for gardening purposes.

**Table 3.8: Uses of Harvested Rainwater**

S. No.	Uses of RWH	No. of Studied RWH
1	Ground water Recharge	11
2	Recharge + Cleaning + Gardening	8
3	Recharge + Domestic	2
4	Recharge +	1

Source: Source: IIPA Field Survey, 2023

### 3.5.3 Maintenance of RWH system

The intricacy of the RWH system influences its maintenance requirements, and regular filter cleaning and maintenance are required to prevent clogging and provide optimal water flow. If the RWH system incorporates storage tanks, they must be cleaned on a regular basis to eliminate silt and debris. Tank maintenance ensures that the stored water is pure and free of contaminants. Various societies/organizations have various perspectives in this setting. Nobody in the study has claimed that maintaining a RWH system is simple (Table 3.9). Seven societies claimed that managing the RWH system is challenging, while four societies stated that maintaining the RWH standard is tough.

**Table 3.9: Complexity of RWH System Maintenance**

S. No.	Managing RWH	No. of Studied RWH
1	Easy to manage	-
2	Somewhat Easy to Manage	7
3	Complicated	4
Total		11

Source: IIPA Field Survey, 2023

### 3.5.4 Measures Taken To Avoid Water Pollution

As said earlier, the maintenance of a Rainwater Harvesting (RWH) system can vary in complexity depending on the type of system, its design, and the environmental conditions. However, RWH systems with storage tank require different types of maintenance and demand more attention and effort to avoid water pollution. Table 3.10 talks about the 9 such measures, which are necessary to avoid contamination of water going to the storage tank. For example, 10 societies/organizations have said that they clean their roofs and maintain the examined RWH systems on a regular basis. It can be seen in the table 3.10 that only 7 societies/organizations have installed gutter guards and filters to prevent clogging and maximize water flow. Cleaning gutters and roofs is crucial to preventing the accumulation of leaves, dirt, and other debris that might taint collected rainwater. 5 have first flush mechanisms to prevent

contaminated rainfall from entering the system for the first few minutes. Only three societies/organizations conduct periodic water quality monitoring, which is critical to ensuring that rainwater collected remains safe for its intended non-potable purposes. Two societies/organizations have admitted to installing a leaf diverter or rain head and cleaning their filter material on a regular basis. Only one has stated that they provide chemical roof treatments on regular basis. Nobody is using a sediment trap or installing a mesh or fine filter system. When members of RWAs/Institutions were asked about the cause of such delays in RWH maintenance, the most common response was a lack of funding.

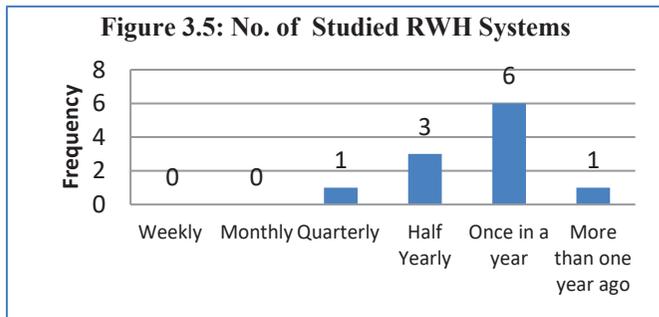
**Table 3.10: Measures Taken To Avoid Water Pollution**

S. No.	Measures Taken	No. of Studied RWH Systems
1	Regular roof and gutter maintenance	10
2	Installation of gutter guards and filters	7
3	Installed First flush devices	5
4	Conduct water quality testing	3
5	Installation of a leaf diverter or rain head	2
6	Cleaning of Filter Media	2
7	Chemical treatments on roofs	1
8	Using a sediment trap	0
9	Installed a mesh or fine filter system	0

Source: IIPA Field Survey, 2023

### 3.5.5 Frequency of Cleaning of RWH Water Storage Tanks

RWH systems with storage tanks must be cleaned on a regular basis to remove silt and debris, ensuring that the stored



water remains pure and uncontaminated. During the discussions, more

than half of the societies/organizations reported cleaning the RWH system once a year. Furthermore, three societies/organizations said they clean their RWH systems every six months, while one said they cleaned their water storage area within the last year.

### 3.5.6 Major difficulties with the RWH system's upkeep

Setting up and maintaining a Rainwater Harvesting (RWH) system in established societies and institutions involves various obstacles for both citizens and government officials. The challenges encountered during the implementation and maintenance of such systems is consistent across the societies/institutions analyzed for this study. Some of the prominent obstacles identified by members of these researched societies/institutions are as follows:

As shown in the table 3.11, numerous challenges have surfaced regarding the maintenance of Rainwater Harvesting (RWH) systems, with the government's pressure being a significant factor. Ensuring the optimal functioning of these systems is crucial, but societies are struggling to secure funds for appropriate equipment and hire qualified personnel to conduct regular upkeep. As a consequence, system efficiency is compromised, and potential failures loom.

According to 9 respondents, the government's support is lacking, making compliance with DJB regulations, obtaining no objection certificates, and accessing water bill subsidies time-consuming and demanding.

**Table 3.11: Maintenance issues of Rain Water Harvesting System**

S. No.	Major issues	No. of Studied RWH Systems
1	Difficult to maintain the system	11
2	Govt. does not seems very supportive	9
3	Not enough awareness among residents of its benefits	8
4	Not enough professional to design	4
5	Any Other Issue/Space	5

Source: IIPA Field Survey, 2023

Moreover, 8 representatives have emphasized on the lack of awareness and understanding among citizens about the benefits and operation of RWH systems. Many residents fail to recognize the significance of RWH and lack the know-how to operate and maintain the system effectively. Additionally, limited space poses a challenge, restricting the system's capacity and effectiveness in certain cases, particularly in shared societies where ownership, management, and responsibilities become contentious issues for RWAs.

### 3.5.7 Maintenance of the RWH System

Rainwater Harvesting (RWH) System maintenance is a huge concern for any community since it necessitates technical competence, citizen participation, and money. Most members of society do not know how to utilize or maintain the system effectively. They also have difficulty in getting individuals with technical expertise for their RWH systems. Conversely, rainwater harvesting (RWH) systems need regular upkeep to ensure their effective operation. As reported by two representatives from the society, their RWH system is in excellent condition. Four representatives indicated that their RWH system is functioning well, while five mentioned it is operating at an average level.

**Table 3.12: Present condition of RWH**

S. No.	Status	No. of Studied RWH Systems
1	Very Good	2
2	Good	4
3	Average	5
4	Poor	0
5	Very Poor	0
Total		11

Source: IIPA Field Survey, 2023

### 3.5.8 Penalty over non-functional RWH

As discussed earlier, the Delhi Government can imposed penalties on RWAs and other organizations/Institutions for non-functional RWH systems or improperly maintained RWH systems. The amount of the fine can depend on the severity of the violation and the specific regulations in place. We observed in the table 3.7 that in 10 surveyed locations the RWH system was fully functional and in only one case it was not working at full

scale. Due to this, no fine has been imposed in any society so far, which is a good thing.

**Table 3.13 : Penalty for Non-functional RWH system**

S. No.	Fine Imposed	No. of Studied RWH Systems
1	Yes	0
2	No	11
Total		11

Source: IIPA Field Survey, 2023

### **3.5.9 Satisfaction with the quality of the harvested rainwater for non-potable uses (e.g., gardening, cleaning)**

The satisfaction of communities with the quality of harvested rainwater for non-potable uses is crucial for the effectiveness of Rainwater Harvesting (RWH) systems. The quality of the harvested rainwater depends on its filtration and treatment. Based on the data, six societies/institutions are very satisfied or satisfied to a large extent, while two are satisfied to some extent. Overall, the acceptance of the quality of water harvested through Rainwater Harvesting (RWH) systems is encouraging. However, three societies/institutions have expressed dissatisfaction with the quality of the harvested water.

**Table 3.14 : Satisfaction with the quality of harvested water**

S. No.	Satisfaction level	No. of Studied RWH Systems
1	Very much satisfied	3
2	Satisfied to large extent	3
3	Satisfied to some extent	2
4	Somewhat dissatisfied	3
5	Not at all satisfied	0

Source: IIPA Field Survey, 2023

### **3.5.10 Feasibility of strict rules or guidelines to ensure proper maintenance of rainwater harvesting systems**

Clear regulations for RWH system installation and maintenance in societies/ institutions can promote better compliance and instill confidence in local communities that the government will provide more financial incentives for adopting effective water management practices.

However, before implementing stricter regulations, ensuring public awareness and full engagement of government agencies to support communities and institutions in meeting the new requirements is essential. The above table 3.15 talks about whether government should introduce stricter regulations or guidelines to ensure the proper maintenance of rainwater harvesting systems. Seven RWA said that they strongly agree that the government should introduce stricter regulations, while the rest of the RWA remain somewhat neutral on the introduction of these regulations.

**Table 3.15 : Feasibility of strict rules or guidelines**

S. No.	Satisfaction level	No. of Studied RWH Systems
1	Strongly agree	7
2	Somewhat agree	2
3	Neutral	2
4	Somewhat disagree	0
5	Strongly disagree	0

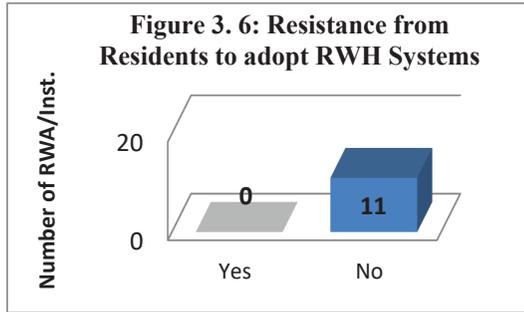
Source: IIPA Field Survey, 2023

### 3.6 Level of Community Participation

Assessing the extent of community participation reveals information about residents' awareness and understanding of RWH. It identifies places where further education and outreach may be required to emphasize the necessity of water conservation and the benefits of RWH. In general, when the community actively engages, it is more probable that they will take ownership of the project and maintain its long-term viability. Rainwater harvesting systems' performance and longevity are determined by how well they are integrated into the daily lives of the community. If the community is actively engaged and enthusiastic about the project, there is a higher likelihood that they will maintain and use the system effectively, thus ensuring its long-term sustainability. Consequently, evaluating the extent of community involvement in rainwater harvesting (RWH) holds significance in this study. Several essential indicators and methodologies has been employed to gauge the effectiveness of RWH systems in conserving water resources.

### 3.6.1 Resistance or Reluctance from Residents to adopt RWH Systems

Installation of RWH system, particularly the roof-top RWH is a new phenomenon and many residents may not be aware of the benefits of RWH or how the system works. Without understanding its advantages, they might be hesitant to adopt new practices. It also involves some initial investment and modifications to existing structures. Some residents might view this as inconvenient and resist the changes. Similarly, residents who are heavily reliant on municipal water supply might not perceive RWH as necessary and might prefer the convenience of relying solely on the public system. Therefore, it was necessary to know whether the members of the Society had resisted before the establishment of RWH in their premises. It is good to find that no society had to face any resistance before the fitting of RWH system



### 3.6.2 Communication between the Government and the Community to make RWH successful

**Table 3.16: Communication between Community and Government**

S. No.	Status	No. of Studied RWH Systems
1	Always	2
2	Often	1
3	Rarely	5
4	Never	2
5	Sometimes	1
Total		11

Source: IIPA Field Survey, 2023

Table 3.16 displays the number of societies/organizations that have received information and recommendations from the government regarding the maintenance of rainwater harvesting systems for community members

The findings reveal that there is a lack of communication and coordination between the government and the community concerning rainwater collection. Specifically, five societies/institutions indicated rare communication with the government. Surprisingly, two societies stated that the government had never contacted them since the establishment of RWH. In contrast, three RWAs expressed that the government consistently communicates with them to ensure the successful implementation of water harvesting initiatives at the local level.

### 3.6.3 Cooperation of the Community Members in the establishment of the RWH system

Community participation is crucial for the successful implementation of RWH systems. Therefore, assessing the level of community participation provides insights into the awareness and understanding of RWH among the residents. Examples of across the world suggest that when the community actively participates, they are more likely to take ownership of the project and ensure its long-term sustainability. Representatives of 7 out societies/institutions said that their fellow residents actively contribute to the maintenance of the RWH system. 3 Societies/Institutions told that only a few residents come forward in the maintenance of RWH system. 1 said that they do not get any cooperation from the residents at all.

**Table 3.17: Level of Community Participation in the Maintenance and Upkeep of the Rainwater Harvesting system**

S. No.	Level of Participation	No. of Studied RWH Systems
1	Yes all society members actively support	7
2	Only few society members actively support	3
3	Only RWA members/Office in charge actively support	1
4	No one bothers about the RWH	0
Total		11

Source: IIPA Field Survey, 2023

### 3.6.4 Savings in Water Bills

The installation of the RWH system within the premises was expected to bring two main financial benefits to the society. Firstly, as per the government's promise, all society members would receive a 10% subsidy on their water bills. Secondly, by utilizing the collected rainwater for various purposes within the society, significant savings could be achieved on the overall water bill. Table 3.18 illustrates the cost savings achieved on water bills after the implementation of rainwater harvesting equipment. Among the 11 surveyed societies/institutions, only 3 have consistently recorded water bill savings, whereas another three of them reported such savings frequently. Four of them experienced occasional cost savings, while the remaining two never observed any such reduction in expenses.

**Table 3.18: Savings in Water Bills**

S. No.	Cost savings in water bills	No. of Studied RWH Systems
1	Always	3
2	Often	3
3	Sometimes	3
4	Never	1
5	Rarely	1
Total		11

Source: IIPA Field Survey, 2023

### 3.6.5 Capacity building of Local Community to maintain RWH system

The Delhi government's RWH initiative prioritizes capacity building among local inhabitants, with a focus on conducting training programs at the community level. When queried about their participation in these training programs, representatives from three societies confirmed attending the training sessions. Conversely, representatives from the other organizations indicated that they had not received any training regarding the upkeep and maintenance of the RWH system.

**Table 3.19: Capacity Building for Community Members**

S. No.	Received any training	No. of Studied RWH Systems
1	Yes	3
2	No	8
Total		11

Source: IIPA Field Survey, 2023

### **3.6.6 Organizing Society/Institution - led awareness campaigns or events for the local community**

By organizing awareness campaigns or events, societies and institutions play a critical role in driving water conservation efforts at the grassroots level. These initiatives create a ripple effect, inspiring more community members to adopt rainwater harvesting and other sustainable water management practices, ultimately contributing to the larger goal of water security and environmental protection. Unfortunately, 8 of the societies/institutions had not organized any awareness campaigns within their premises to inform their residents about the RWH system in their community. It means the work of planning, management and maintenance of the RWH system has been left only to the members of the RWA or managing committee. Only three respondents said that they occasionally conduct public awareness campaigns for water conservation.

**Table 3.20: Awareness Campaign for Community Members**

S. No.	Awareness campaign	No. of Studied RWH Systems
1	Yes on regular interval	0
2	Occasionally	3
3	Never	8
Total		11

Source: IIPA Field Survey, 2023

### 3.6.6 Impact of RWH on Societies/Institutions water security

The primary purpose behind installing Rainwater Harvesting (RWH) systems in Societies/Institutions was to store rainwater and replenish groundwater. Additionally, ensuring water security in these communities was a crucial objective of the scheme. Here are some observations from society members: - None of the respondents reported a significant improvement in water security in their societies due to RWH initiatives (Table 3.21). However, three societies acknowledged that the installation of RWH systems has led to a partial increase in water availability within their premises. On the other hand, other societies or institutions mentioned that they have not observed any noticeable change in water availability since the installation of RWH systems. Some even stated that they do not have information about any such changes. It is essential to note that the actual impact of RWH on water security in Delhi may vary depending on factors such as the scale of implementation, community involvement, maintenance, and the integration of RWH with existing water management practices.

**Table 3.21: Impact of RWH on water security**

S. No.	Observations of Respondents	No. of Studied RWH Systems
1	To Large extent	0
2	Yes to some extent	3
3	Same as before	5
4	No Idea	3
Total		11

Source: IIPA Field Survey, 2023

### 3.6.8 Challenges of societies/institutions in maintaining RWH system

Table 3.22 presents whether the surveyed societies/institutions encountered challenges in maintaining their rainwater harvesting systems. All 11 locations analyzed admitted that they lacked the financial resources to maintain the RWH system. 9 reported issues with the routine maintenance of the RWH system in their society. 7 reported difficulties in coordinating with the government. 3 brought up the issue of insufficient space for rainwater harvesting. Additionally, two locations expressed

uncertainty about the future of their RWH system. This table highlights that the Resident Welfare Associations (RWA)/Institutions are facing four major issues: insufficient financial resources, limited technical knowledge, challenges in regular maintenance, and a lack of coordination and cooperation with the government as well as within the community members.

**Table 3.22: Challenges faced by Society/Institution in Maintaining the RWH system**

S. No.	Challenges	No. of Studied RWH Systems
1	Insufficient financial resources	11
2	Difficulty in regular maintenance	9
3	Limited technical knowledge	8
4	Lack of coordination and cooperation	7
5	Limited space or inadequate roof area	3
6	Uncertainty about the long-term effectiveness	2
7	Unnecessary interventions of local authorities	0

Source: IIPA Field Survey, 2023

### 3.6.9 Impact of RWH system on the Drainage System or Water Logging cases

One of the main purposes of installing RWH systems is to capture, store rainwater and reduce the amount of storm water runoff entering the drainage system. This decrease in runoff can alleviate pressure on the drainage infrastructure during heavy rainfall events. By collecting rainwater on-site, RWH systems can prevent excess water from pooling in low-lying areas, reducing the risk of water logging in the society.

Table 3.23 discusses the impact of Rainwater Harvesting (RWH) on the drainage system or water logging issues in the society after the implementation of the rainwater harvesting system. Seven RWA members said that there is no problem of water logging, while three RWA members expressed concern that yes, the road gets waterlogged and only one said that the areas around the water tank get waterlogged. However, as per the

society members, this problem of water logging is rarely seen when there is a lot of rainfall.

**Table 3.23: Impact of RWH on the Drainage System or Water Logging matters**

S. No.	Cost savings in water bills	No. of Studied RWH Systems
1	Easy drainage of rainwater & no water logging issue	7
2	Yes, the road still gets flooded	3
3	Nearby area of water tank gets flooded	1
Total		11

Source: IIPA Field Survey, 2023

### 3.6.10 Recommending installation of Rainwater Harvesting System to other residential societies

**Table 3.24: Impact of RWH on water security**

S. No.	Observations of Respondents	No. of Studied RWH Systems
1	Very Likely	4
2	Likely	5
3	Unlikely	2
Total		11

Source: IIPA Field Survey, 2023

Installing rainwater harvesting (RWH) system can be extremely helpful for any residential society, particularly in a city like Delhi where water supplies are limited and demand is increasing. There are various reasons why establishing a RWH system is advised, including the fact that it allows water to percolate into the earth, replenishing the groundwater table and contributing to the sustainable use of this essential water resource. The good news is that, with the exception of two cultures,

everyone stated they would recommend rainwater harvesting systems to other societies.

**Table 3.25: Opinion of Societies/Institutions on the effectiveness of RWH system**

Name of the RWAs Society	Scale of 1 to 5				
	1	2	3	4	5
1. Printers Society, Rohini					
2. The Arya, CGHS					
3. The Hans Society, Rohini-15					
4. Lucky Homes					
5. DAV School, Pachim Vihar					
6. MRG School, Rohini-3					
7. Fancy Apartment at Vasundhra Enclave					
8. Vijay Apartments, Model Town					
9. Sunderam Enclave, Dwarka					
10. Marwaha Associates, Model Town					
11. Vasudha Apartment Sector 9 Rohini					
Overall Scaling	0	3	2	3	3

Source: IIPA Field Survey, 2023

### 3.6.11 Effectiveness of rainwater gathering systems in water resource conservation

Measuring the effectiveness of rainwater harvesting (RWH) systems in water resource conservation is essential to understand their impact and optimize their implementation. Table 3.25 assesses the efficacy of RWH systems in various societies/institutions from 1 to 5 scales based on the perspectives of their residents. Three scarcities, MRG School - Rohini-3, Sunderam Enclave - Dwarka and Vasudha Apartment - Sector 9 Rohini are highly satisfied with the outcome of the RWH system in their premises. Respondents of such societies like DAV School - Pachim Vihar, MRG School - Rohini-3 were also quite satisfied with the outcome of Rain Water Harvesting Systems. On the other hand, societies like Arya, CGHS of Dwarka and Vijay Apartments of Model Town, feel that the installation of RWH systems in their premises has not made much difference in terms of water conservations.

## Location of Rainwater Harvesting Systems

