ONLINE TRAINING PROGRAMME ON INTEGRATED WASTEWATER MANAGEMENT (IWSM)- A PLANNING APPROACH FOR PRACTITIONERS

TRAINING OF TRAINERS

National Institute of Urban Affairs

SCBP
Sanitation Capacity Building Platform

ecosan SERVICES FOUNDATION

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TITLE

Online Training Programme on Integrated Wastewater Management (IWSM) - A Planning Approach for Practitioners

PUBLISHER

National Institute of Urban Affairs, Delhi

RESEARCH PROJECT

SANITATION CAPACITY BUILDING PLATFORM

CONTENT

This report summarizes the online training program conducted under Sanitation Capacity Building Platform during the COVID 19 pandemic. It elaborates the online training given to technical experts as well as practitioners from local or state government organizations, Nodal training institutes, PMU's or private consulting firms in India, on all aspects of Integrated Wastewater and Septage Management (IWSM) across the service value chain. The report aims to bring together the learnings from this intensive online training program on IWSM, so that organizing agencies can understand the impact of such a training and the feasibility of continuing such an online training program.

GRAPHIC DESIGN

Deep Pahwa, Devender Singh Rawat, Bhavnesh Bhanot, Preeti Shukla

Year of Publishing 2020

CONTACT

National Institute of Urban Affairs
1st and 2nd floor Core 4B,
India Habitat Centre,
Lodhi Road, New Delhi 110003, India
Website: www.niua.org, scbp.niua.org
E-Mail: scbp@niua.org

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Abbreviations

ABR	Anaerobic Baffled Reactor
AF	Anaerobic Filter
BIS	Bureau of Indian Standards
CEPT	Centre for Environmental Planning & Technology
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSP	City Sanitation Plan
CW	Constructed Wetlands
DEWATS	Decentralized Wastewater Treatment Systems
DPR	Detailed Project Report
DTS	Decentralised Treatment System
ESF	Ecosan Services Foundation
FS	Faecal Sludge
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
GoI	Government of India
IHHL	Individual Households Latrine
IIHS	Indian Institute of Human Settlements
IWSM	Integrated Wastewater and Septage Management
MLD	Million Litre per Day
NaWaTech	Natural Water Systems and treatment Technologies
NIUA	National Institute of Urban Affairs
NGT	National Green Tribunal
O&M	Operation & Maintenance
OWSSB	Odisha Water Supply & Sewerage Board
PBMC	Port Blair Municipal Corporation
PCB	Pollution Control Board
PMC	Pune Municipal Corporation
SCBP	Sanitation Capacity Building Program
SeTP	Septage Treatment Plant
SOP	Standard Operating Procedure
STP	Sewage Treatment Plant
SWM	Solid Waste Management
ULB	Urban Local Body
UDDT	Diversion Dehydration Toilet

1. Introduction

India is the second most populous country in the world, with more than 1 billion citizens. In India and around the world, millions are navigating the COVID-19 pandemic with the added challenge of living without access to safe water. Now more than ever access to safe water is critical to the health of families in India. These factors, combined with the current political push to end this crisis, has created unprecedented urgency to implement effective solutions to increase access to safe water and sanitation.

Water and sanitation sector in India need reforms if national and global benchmarks for service delivery are to be met with success. The current plight of the sanitation sector is such that huge gaps in the sanitation service chain are faced by majority of the population of India. This highlights the need for not just institutional remodelling of the sector, but also for a novel approach, innovative ideas and urgent decentralization if the sanitation services are to reach the last common denominator. For sustainable sanitation and water management in India, we need to focus on proper planning of sanitation systems and technologies depending upon the geography, climate and current scenario.

Integrated Wastewater and Septage Management comprises of various aspects of water, wastewater, Faecal sludge & Septage, its understanding, planning, technology selections, execution, stakeholder's involvement and financial aspects for planning and implementation of safe and sustainable sanitation service chain.

The Government of India aims for all cities to have networked sewerage connections, which would send liquid waste to a centralized location for treatment and disposal. However, the centralized wastewater management is not feasible for towns where the population density is low, and the financial management is not up to the mark.

Presently, majority of the urban local bodies (ULBs) do not have this required infrastructure for end to end management of liquid waste and septage management for its complete population. This means the sludge from the containment units must be emptied and moved to a location that will process it further making it safe for reuse or disposal. This ensures that part of the pollution load is reduced, and the health of the onsite containment units is maintained.

Most cities in India lack the capacity to regulate the emptying, conveyance, treatment and dumping of wastewater, faecal sludge and septage. Given these issues of collection, treatment, and disposal, it is exciting that innovators are starting to look to this waste as a resource rather than burden. While there is value of innovation at each level of the sanitation chain, mostly due to the human resource and health potential in infrastructure building and collecting waste, there is an additional value in turning the wastewater and faecal sludge matter into an environmentally beneficial and profitable resource.

This online certificate course was developed to understand all aspects of Integrated Wastewater and Septage Management across the service value chain and further planning and management

Course Objective

To build the capacities of the participants so that they can understand, analyze and apply the learnings in the real-life scenario for technical and financial planning of Integrated Wastewater and Septage Management at a city level with some case studies in India.

A 9-day course with a total duration of 14 hours was designed for online delivery. To engage the participants and ensure that capacity is built to the level of practicing IWSM or conducting similar training, the course was developed using a case methodology and had a mix of presentations, case studies, exercises, information videos and quizzes. The online session contributed to 14 hours of duration whereas the remaining hours were dedicated to the quiz and exercise which the participants had to attempt offline. A separate session was arranged to conduct further discussions with participants to clarify their doubts and queries. A final online quiz was conducted during this session, where in the learning impact assessment was done.

In order to successfully complete the course with certification, the participants had to attend all the sessions, attempt at least six out of the eight session quizzes, complete the exercise and attempt the final online quiz.

2. Agenda

Following is the day wise agenda of the training. A detailed session wise agenda is available in the annexure.

Table 1: Agenda of the Training

Date	Session	Topic	Contents	Duration
Tuesday 15 September, 2020	1a	Sustainable Sanitation and Water Management	Natural and built environment Environmental sanitation EcoSan Concept Waste products Flow of waste products	90 Min.
	1b	Sanitation Systems	Sanitation systems - Wet & Dry systems, Sewered systems, Non sewered systems and Hybrid systems Functional groups - User Interface, Containment, Collection and conveyance, Treatment and Reuse or Disposal Exercise 1 and 2 Video - East Kolkata Wetlands	
Wednesday 16 September, 2020	2a	Sanitation Technologies	User interface - Flush toilet, UDDT, Vacuum Toilet Containment systems - Twin Pit, Septic Tank Collection & Conveyance systems - Gravity sewers, solid free sewers, simplified sewers, vacuum trucks, vacu tugs	90 Min.
	2b	Building sanitation systems	Offsite sanitation system Onsite sanitation system Hybrid sanitation system Exercise 3 Video - Bhandewadi Sewage Treatment Plant	
Thursday 17 September, 2020	3a	Liquid Waste Management	Centralized wastewater management - key components and aspects Decentralized wastewater management - key components and aspects	90 Min.
	3b	Aspects of Decentralized Wastewater Management	Enabling environment Economic aspects Technical aspects Legal aspects Regulatory aspects Social aspects Exercise 4 Video - NaWaTech	

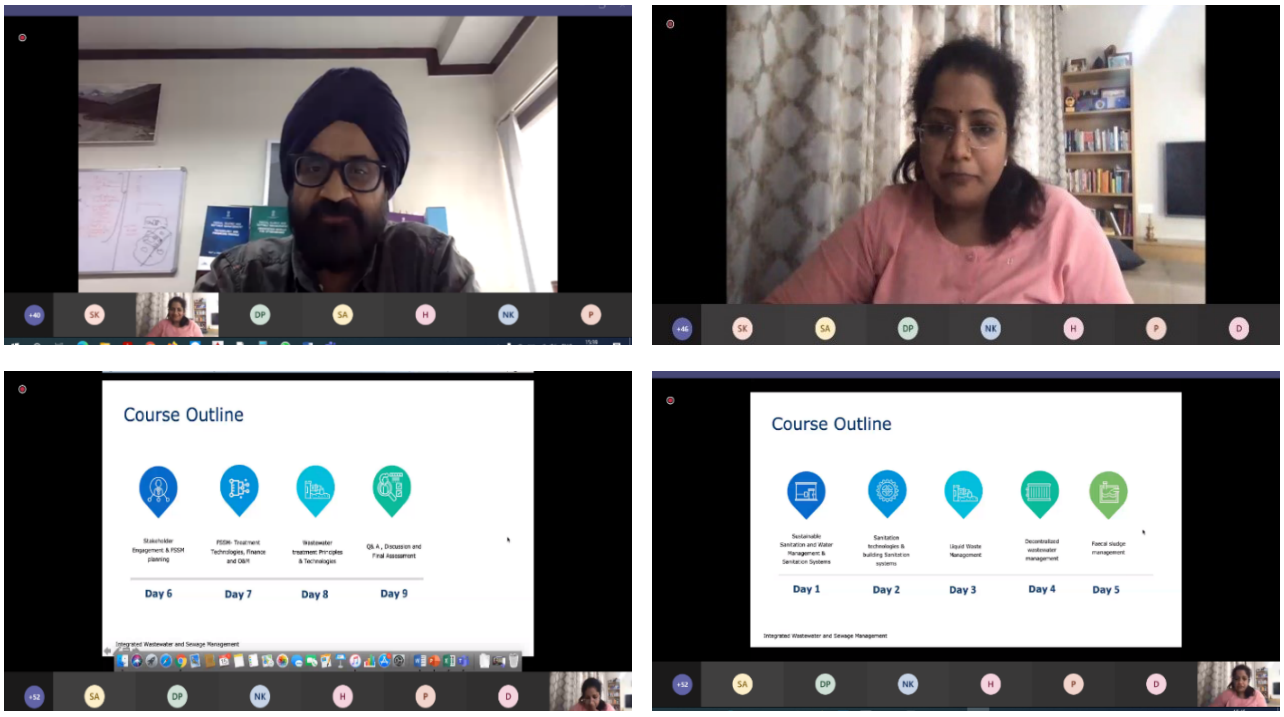
Date	Session	Topic	Contents	Duration
Friday 18 September, 2020	4	Decentralized Wastewater Management	Quantifying black and grey water for following scenarios - Domestic, Commercial, Public Utility Diurnal variation of wastewater generation Handouts on Septic Tank (IS 2470 Part I & II) Handout on Code of Basic Requirements for Water supply, Sanitation and Drainage (IS 1172) Video - Feynan Eco Lodge	90 Min.
Monday 21 September, 2020	5	Understanding Faecal Sludge and Septage Management	Need of FSSM Components of FSSM Planning for FSSM- Quantification of Septage, On demand vs Scheduled desludging Approaches for FSS Treatment - Co Treatment at STP or MSW plant, FSTP, Deep Row Entrenchment Exercise 5 Video - FSSM- Sinnar Maharashtra	90 Min.
Tuesday 22 September, 2020	6a	Stakeholder Management	Identification of stakeholders Characterisation of stakeholders IEC campaign	90 Min.
	6b	FSSM Planning	The participants will be using the information provided in Session 6 to quantify the septage and faecal sludge. They will also be calculating the number of vacuum trucks required for providing collection service for the quantified sludge Exercise 6 Video - FSSM- Bhubaneshwar, Odisha	
Wednesday 23 September, 2020	7a	Faecal Sludge and Septage Treatment	Treatment objectives Treatment stages Treatment units FSTPs in India	90 Min.
	7b	Financial aspects of Faecal Sludge & Septage Management	Financing FSSM Financial transaction in FSSM Financial models	
	7c	Operation and Maintenance cost for FSSM	Calculating the O&M cost for collection - conveyance and treatment of faecal sludge and septage	
Thursday 24 September, 2020	8a	Wastewater Treatment Principles	Objectives of wastewater treatment Treatment processes and stages Component of Sewage Treatment Plant Multi barrier approach Layout of STP	90 Min.
	8b	Wastewater Treatment Technologies	Non-mechanized treatment systems Mechanized treatment systems Selection criteria Video - Sewage Cure, MBBR, SBT	
Friday 25 September, 2020	9	Q&A, discussions, feedback, final assessment		90 Min.

3. Sessions

3.1 Day 1, September 15th, 2020

The online training program commenced with a formal introduction of the Sanitation Capacity Building Platform by Mr. Depinder Kapur, Team Leader, NIUA. He elaborated on the objectives of the platform and the different type of trainings which are conducted through the platform. Ms. Sreevidya Satish, the moderator for the training then introduced Ecosan Services Foundation (ESF). The session began with the introduction to the course, course outline, structure and objectives of the online training program on Integrated Wastewater and Septage Management (IWSM) under Sanitation Capacity Building Platform (SCBP). The Microsoft Teams platform was introduced to the participants. Introduction of the lead trainers and facilitators was carried out, followed by setting the ground rules for all the participants and explaining the mandatory criteria for the successful completion of the course. Ms. Sreevidya also introduced participants to few other platforms namely, Mentimeter, Classmarker and google forms that were used during the training for recording the feedback of the participants, and attempting the exercises and quizzes and how it is important to get the certificate and asked participants to write their expectations and introduction of participants in chat session.

Figure 1: Snapshot of the Introduction session



3.1.1 Session 1a: Sustainable Sanitation and Water Management

Mr. Dhawal Patil, Sr. Resource Person from ESF presented the first session on Introduction to Sustainable Sanitation and Water Management. The session started with Environmental health, its components and services, types of liquid waste products and their flow and basics of ecological sanitation.

The following aspects were discussed during the session:

- Environmental Health
- Environmental Sanitation – Infrastructure, regulations and personal hygiene habits
- Waste Products – Brown water, Black water, Grey water and domestic Wastewater, its characteristics and resource flows.
- Ecological Sanitation – Closing the Loop
- Urban Challenges – Sanitation planning (CSP – Water Supply, Sanitation blocks, liquid and solid waste management and stormwater management.)

Summary – 1. Proper Management of human excreta and wastewater is a way forward to achieve safe environmental sanitation and closing the loop. 2. Urban challenges in sanitation planning constitute of different aspects, however, are mainly driven by lack of professional capacity and management gap.

The following queries were raised during the session:

- In many cities of India, we have toilets connected to septic tanks and the supernatant generated from it is disposed in the public drains along with the grey water. Do we have a specific term for this kind of wastewater/ greywater?

- What are the sources of Faecal coliforms in greywater?

Figure 2: Snapshot of the day one first session

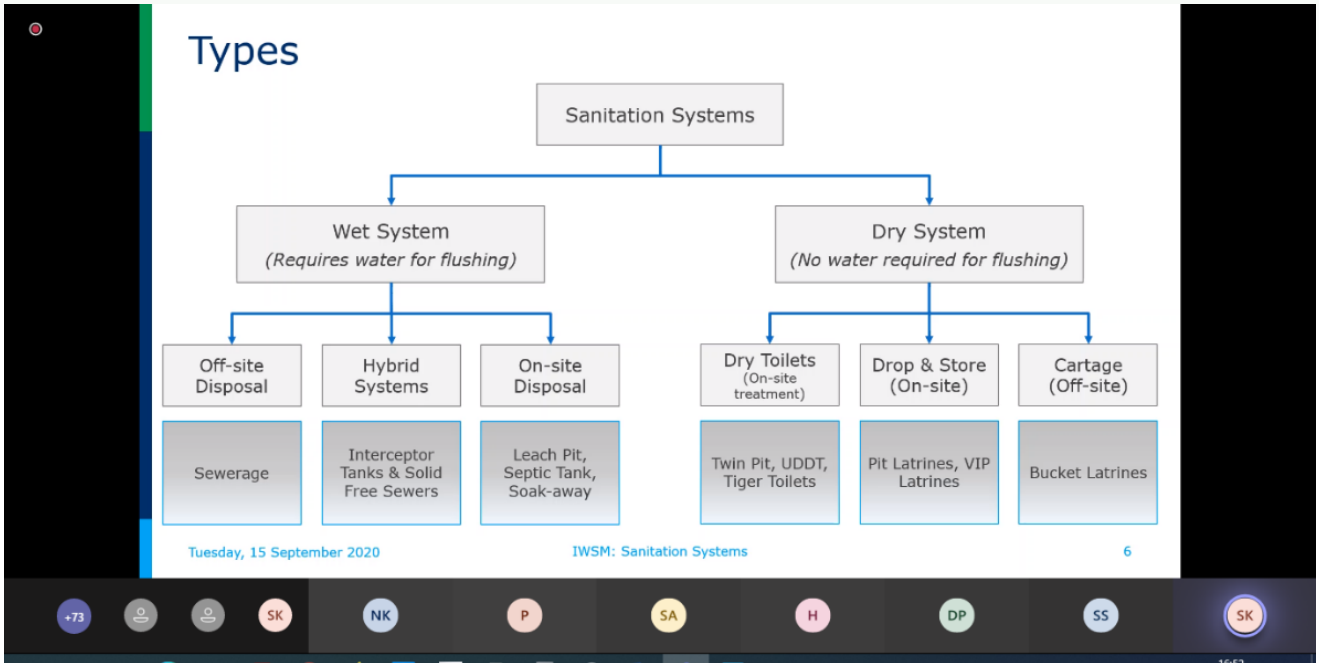
3.1.2 Session 1b: Sanitation Systems

The second session began with the presentation on basics of sanitation systems by Mr. Saurabh Kale.

The following aspects were discussed during the session:

- Definition, objective and types of Sanitation system – Wet and dry systems
- Functional Group – User Interface, Conveyance/containment unit, treatment /disposal
- Operational Factors – Toilet usage, storage, climate, infiltration and exfiltration, equipment used.
- Sampling procedures
- Summary- Sanitation systems are used to protect environmental health. Type of sanitation system used depends upon the affordability and availability of water.

Figure 3: Snapshot of the day one second session



The following queries were raised during the session:

- Pour flush toilet should be considered a wet system or dry system?
- Cost of tiger toilet? Source of tiger worms? Is this technology approved biologically safe?
- Which technology is viable / feasible for the low-income communities who do not have enough space to convert their insanitary toilets to sanitary toilets?
- Which technology is widely used across India? In semi centralised methodologies which one is cost effective?

3.1.3 Exercise: 1 & 2

The lead trainer took all the participants through the ***Part C:*** Design Workbook which was shared with all the participants. The workbook contains four sessions dedicated to four different aspects of sanitation. The trainer briefed about the two cases and asked the participants to go through the section 1 and session 2 – Residential property.

Figure 4: Exercise 1 & 2 from workbook

wards, 28 wards have 100% piped water supply. The total service connections are approximately 18,639. The ULB claims to provide the water supply at the rate of 119 LPCD. The Non-Revenue Water (NRW) is recorded to be significantly high at 55%. One of the reasons for this is number of slums and the population residing in the slums.

1.4 Sanitation

During the census of 2011, following data was captured pertaining to user interface and containment unit.

TABLE 1: CENSUS DATA ON USER INTERFACE AND CONTAINMENT UNIT AS IN 2011

Description	Number
Households practising open defecation	**19%**
Individual Household Toilet (IHHT) coverage	**58%**
Community toilet coverage	**23%**
Number of community toilet blocks	**9**
Number of public toilet blocks	**15**
IHHT connected to septic tank	**43%**

Following is the data captured pertaining to conveyance and treatment.

TABLE 2: CENSUS DATA ON CONVEYANCE AND TREATMENT AS IN 2011

Description	Number
Sewerage connections	**57%**
Area covered by pucca drains	**81%**
Wastewater generated	**12 MLD**
STP design capacity	**15 MLD**
Water flowing through stormwater drains	**10 MLD**

The treated wastewater from the STP is disposed off in to stormwater drains which connect to river.

2 Residential Property

Lake View Residency is a residential project adjacent to prominent lake in the city. The project is located in newly added area under the municipal administrative limits. The details of the project are provided in the Table 3 below.

TABLE 3: DETAILS OF THE LAKE VIEW RESIDENCY PROJECT

Number of buildings	2	no.
Number of floors	5	per building
Apartments	4	per floor
Apartments		no.
Number of persons per apartment[1]	5	no.
Total population		no.

2.1 Water consumption

A piped water supply has been initiated by the municipal body. The piped water supply of 90 LPCD is provided to the project.

Considering the water supply to the project, do you think that the project is eligible to get a sewerage connection? If "NO", then give your rationale?

What is the total wastewater generation assuming that 80% of the water consumed is transformed into wastewater?

[1] It is recommended to assume one extra person per apartment. This takes into account any increase in the number of residents during certain time of the year.

The session ended with Mr. Akshay Agrawal, Program Officer, NIUA briefing the participants on the session quiz. He introduced the Classmarker, the platform used for conducting the online quiz.

3.2 Day 2, September 16th, 2020

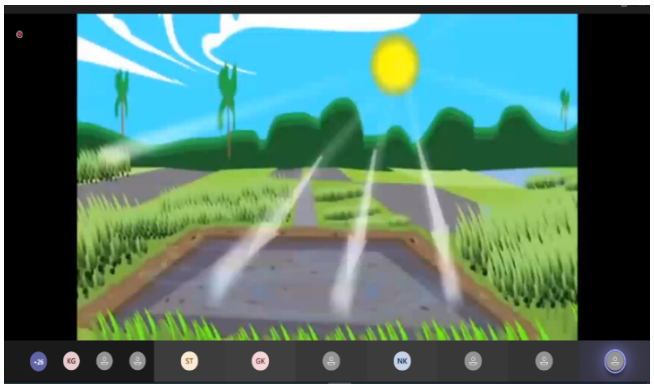
3.2.1 Case Study: East Kolkata Wetland, Kolkata

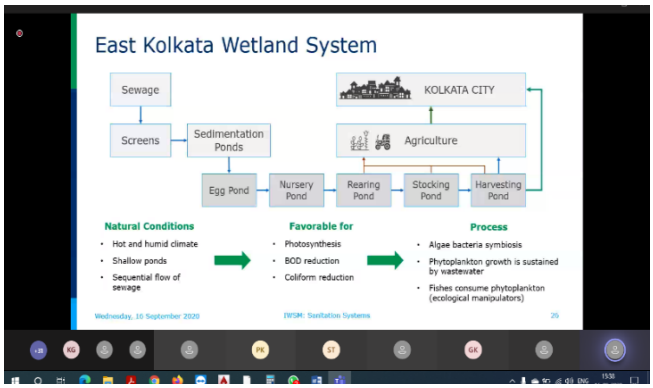
The second day started with a case study video on East Kolkata Wetlands. Mr. Dhawal Patil was the speaker for this case study session. The wetlands to the east of Kolkata are the shock absorbers of all life activities of the city. A unique example of a man made and man managed wetland in which untreated sewage of the city is utilized extensively for fish culture. Treating the waste water from the city by these waste lands saves Kolkata from constructing and maintaining a wastewater treatment plant

The following queries were raised during the session:

- What is O & M mechanism?
- Doesn't adding lime increases pH? How it is neutralized?

Figure 5: Snapshot during case study video of day 2





3.2.2 Session 2a: Sanitation Technologies

Mr. Saurabh Kale, Sr. Resource Person was the lead trainer for this session on Sanitation Systems.
The following aspects were discussed during the session:

- Wet Sanitation Systems, its functional groups.
- Types of user interface – types of toilets in details for better understanding of the participants.
- Containment units with its types in details.
- Collection and transport system with its type and technologies which can be used on ground as per ground condition and area friendly.
- Conveyance system with its types in details like gravity sewers, simplified sewer and solid free sewer.
- Summary – In India, hybrid sanitation system is mostly followed. Solid free sewer is appropriate collection and conveyance system for sullage. Regular emptying of septic is necessary for maintain solid free sewer.

The following queries were discussed during the session:

- Explain the nature of sullage. What is the source composition?
  - Ans- Sullage is defined as domestic wastewater which does not contain blackwater. The septic tank effluent (and not from toilets directly) mixed with grey water is also termed as sullage in literature.
- What would be the cost of vacutug?
  - Ans- Vacutug as the one shown in the picture on the slide is around 4 lakh rupees. They tend to be a little expensive when compared to vacuum truck, however, are indispensable when access to septic tank is not possible for larger vehicles.
- Which sewer system is most prevalent in India?
  - Ans- Gravity sewers are mostly prevalent in India. However, there are cases where simplified sewers have been implemented in slums and unorganized settlements.
- While Planning for a sewerage network for rural or urban area what should be the basic criteria to select the correct sewer system?
  - Ans- Technically population density is critical, however, there are other parameters too.

3.2.3 Case Study: Bhandewadi Sewage Treatment Plant, Nagpur

Mr. Dhawal Patil was the speaker for this case study session. This unique, state-of-the-art, fully automated and one of the largest sewage reuse plants in India is spread over 12.5 acres which takes in 130 MLD of sewage water from Nag river in Nagpur. The treated water is transferred to the MAHAGENCO's 1,980 MW Koradi Thermal Power Station for reuse purpose.

3.2.4 Session 2b: Building Sanitation Systems

Mr. Dhawal Patil, Sr. Resource Person was the lead trainer for this session. Non sewered sanitation system diagram (value chain) with functional group and input product was explained for single pit, twin pit, Ecosan toilet, Biogas toilet. Sewered sanitation system diagram with functional group and input product was explained for septic tank in detail. Septic tanks can also be considered in non sewered sanitation and sewered sanitation system depending upon the area and decision makers. Sewered sanitation system approach was also explained in detail. Backward planning plays an important role in building good city sanitation plans.

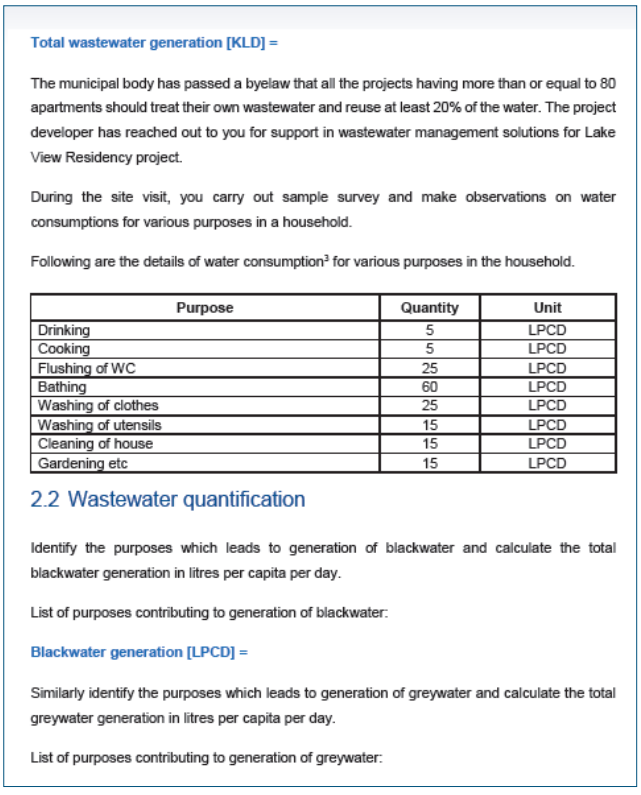
The following queries were discussed during the session:

- Are there any cities who have the Solid free sewers?
  - Ans- Yes, there are few cities where part of them have solid free sewers. Solid free sewers are also found in few villages in Punjab and Gujrat.
- In many cities there are non-sewered sanitation systems - Septic tank waste and all the other effluent goes into storm water drains. Do we have any policy level intervention to implement Solid free sewers?
  - Ans- SBM 2.0 and Jal Shakti Mission talks about managing the liquid waste and grey water. The recent amendments in the ODF++ protocols also mandate managing of the septic tank effluent and greywater. However, there is no policy level intervention directly related to Solid Free Sewers.
- Why is the output of ecosan toilet not considered as humanure but dried faeces?
  - Ans- Since, urine (nutrients) is missing, the digestion process does not happen as efficiently as that compared to Soak pit. hence dried faeces.
- Does adding saw dust, dried leaves etc. added to cover the faeces trigger digestion process?
  - Ans- Organic matter and nutrients are both required for digestion process. Primary objective of adding dehydrating material is to reduce water content and thereby reduce odour emission.

3.2.5 Exercise: 3

Mr. Dhawal Patil explained the exercise to the participants in detail. The exercises 1, 2 & 3 comprised of some data, some quantifications with formulas and the participants were further asked to complete the same.

Figure 6: Exercise 3 from workbook



Total wastewater generation [KLD] =

The municipal body has passed a byelaw that all the projects having more than or equal to 80 apartments should treat their own wastewater and reuse at least 20% of the water. The project developer has reached out to you for support in wastewater management solutions for Lake View Residency project.

During the site visit, you carry out sample survey and make observations on water consumptions for various purposes in a household.

Following are the details of water consumption[3] for various purposes in the household.

Purpose	Quantity	Unit
Drinking	5	LPCD
Cooking	5	LPCD
Flushing of WC	25	LPCD
Bathing	60	LPCD
Washing of clothes	25	LPCD
Washing of utensils	15	LPCD
Cleaning of house	15	LPCD
Gardening etc	15	LPCD

2.2 Wastewater quantification

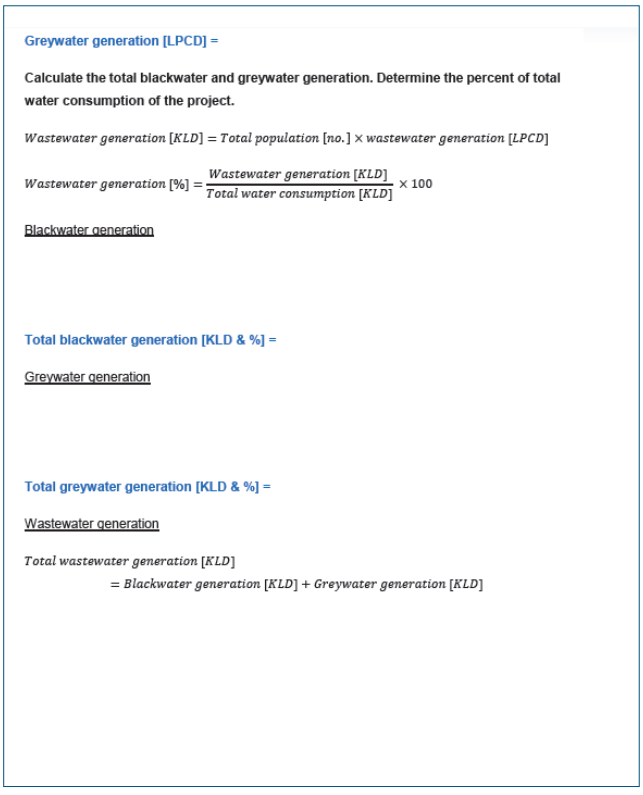
Identify the purposes which leads to generation of blackwater and calculate the total blackwater generation in litres per capita per day.

List of purposes contributing to generation of blackwater:

Blackwater generation [LPCD] =

Similarly identify the purposes which leads to generation of greywater and calculate the total greywater generation in litres per capita per day.

List of purposes contributing to generation of greywater:



Greywater generation [LPCD] =

Calculate the total blackwater and greywater generation. Determine the percent of total water consumption of the project.

$$Wastewater\ generation\ [KLD] = Total\ population\ [no.] \times wastewater\ generation\ [LPCD]$$

$$Wastewater\ generation\ [\%] = \frac{Wastewater\ generation\ [KLD]}{Total\ water\ consumption\ [KLD]} \times 100$$

Blackwater generation

Total blackwater generation [KLD & %] =

Greywater generation

Total greywater generation [KLD & %] =

Wastewater generation

$$Total\ wastewater\ generation\ [KLD] = Blackwater\ generation\ [KLD] + Greywater\ generation\ [KLD]$$

3.3 Day 3, September 17th, 2020

The moderator started day 3 with an introduction to the session of the day. The moderator also explained the technical details to operate the online platform with some ground rules.

3.3.1 Session 3a: Liquid waste management

The objective of the session was to introduce different levels of liquid waste management with respect to changing urban settings, different aspects of centralized and decentralized liquid waste management and planning of liquid waste management. Mr. Saurabh Kale was the lead trainer for this session.

The following aspects were discussed in the session:

- Levels of Wastewater Management
  - Urban, peri-urban, rurban and rural habitats and settings along with their characteristics and probable sanitation systems.

- Centralized Wastewater Management
  - Characteristics, requirements, components of systems, limitations and economic aspects.

- Decentralized Wastewater Management
  - Characteristics, components of systems, features, constraints and economic aspects.

- Other Aspects of Liquid Waste Management
  - Financial sustainability, idle volumes and time, house service connections, recovery of costs and reuse aspects

Summary - Liquid waste management is crucial for maintaining environmental health. Different levels of management fit appropriately in different urban and rural scenarios. Planning of the sanitation systems needs to take into consideration affordability and long-term sustainability of infrastructure. Centralized and decentralized management compliments and provides maximum sanitation coverage.

The following queries were discussed in the session:

- Is the amount of water consumption per capita the governing factor for deciding the type of sewer system?
  - Ans- Water consumption at the consumer end is one of the criteria, however, there are other more critical criteria which determine the feasibility of gravity sewers. For example, even if the water consumption is 135 LPCD however, the population density is low, gravity sewers systems will be uneconomical for operation and maintenance.
- Are there any guidelines available for designing decentralized conveyance and treatment systems other than the CPHEEO?
  - Ans- CPHEEO Manual does not provide much design guidelines for decentralized wastewater treatment. However, there are international publications providing design guidelines.

3.3.2 Session 3b: Aspects of Decentralized Wastewater Management

The objective of this session was to introduce various technical and non-technical of decentralized wastewater management and the importance of enabling environment to scale decentralized wastewater management. Mr. Dhawal Patil was the lead trainer for this session.

The following aspects were discussed during the session:

1. Enabling environment
   - Government support, legal and regulatory framework, institutional arrangements, skills and capacities, financial arrangements and socio-cultural acceptance.

2. Economic aspects
   - Decentralization, treatment quality, treatment cost, investment capital.

3. Technical aspects
   - Decentralization, construction, substrate.

4. Legal aspects
   - DEWAM Application, sectors for DEWATS application - residential application, commercial units and industrial estates, political priorities.

5. Regulatory aspects
   - Regulations and standards, bureaucracy.

6. Social aspects
   - Waste disposal in society, people, partners.

Summary - Lack of appropriate enforcement of the laws and an absence of financial returns, will always lead to wastewater management being the last priority for polluters. Understanding of the variables and good interpretation of the wastewater characteristics is required in order to implement black box approach. Political backing to the legal framework is needed. Regulatory framework to adopt to growing wastewater management assets in India. People's participation is key for success of decentralized wastewater management.

3.3.3 Case Study: NaWaTech

The case study of NaWaTech – Natural Water Treatment Technologies for coping urban water shortages includes information of 3 different sites where natural treatment technologies were implemented in order to make reuse of treated water feasible. The first case was located at College of Engineering, Pune. Here three treatment systems cater to black water, grey water and sewage separately. The second case was located at Indradhanushya Citizenship Centre, Pune. Here the wastewater from the nallah is being treated and reused for landscaping purpose, thereby reducing the freshwater consumption. The third site is located at Ordnance factory residential colony, Nagpur. Here too, the treated water is being reused for short rotation plantation.

3.3.4 Exercise: 4

The participants were introduced to exercise 4 and were requested to attempt the exercises before the next session as the discussion on all the exercises was supposed to take place the next day.

3.4 Day 4, September 18th, 2020

Day 4 began with general information regarding the technical part of the training & participants were requested to follow the WhatsApp group chat for further doubts. Mr. Dhawal Patil shared a video on the group chat about a project on decentralized wastewater management system with biogas production.

3.4.1 Session 4: Decentralized Wastewater Management

Mr. Dhawal Patil was the lead trainer for the design session on decentralised wastewater management as well as for exercise solving.

The following aspects were discussed in the session:
- Water consumption
- Water quantification
- Diurnal Flow
- Need of equalization tank
- Wastewater characterization
- Sanitation requirement

Summary - Methodology for quantification of wastewater needs to be adopted based on the local context. Characterisation of wastewater is important for developing the treatment processes. For developing sustainable sanitation systems, thorough understanding of the processes is required. Nontechnical aspects are as important as the technical aspects while designing the sanitation systems.

The following queries were raised during the session:
- In case of the project not consuming groundwater and simply relying on piped water supply, is decentralized treatment the choice instead of sewerage connection?
  - Ans- Choice of decentralized / centralized wastewater management does not depend on the source of freshwater. It is dependent on the quantity of the water consumed.

- As we have the different breakdown of water consumption, shall we take drinking, cooking and gardening consumption as non-contributing factors for wastewater generation?
  - Ans- Yes. These activities do not contribute to generation of wastewater.

- For drawing diurnal curve, is there any "percentage distribution of hourly-water consumption" or is it purely based on "data collection during hours"?
  - Ans- It is mainly based on the data collected on hourly basis on wastewater generation.

- Is it mandatory to provide mixing or aeration in Equalisation?
  - Ans- It is not mandatory. It mainly depends on the solid content in the wastewater and the succeeding treatment process.

- Which sequence for treatment is more efficient for removal of nitrogen and phosphate? Aerobic followed by Anaerobic or vice versa?
  - Ans- Anaerobic followed by aerobic or Anoxic followed by aerobic is preferred for nutrient removal in wastewater treatment.

3.4.2 Case Study: Feynan Eco Lodge

Mr. Dhawal Patil shared the video with all the participants in WhatsApp group chat and requested participants to raise their doubts. The case study provided insight into a project where in different treatment units have been integrated together to get maximum benefit. The system consists of anaerobic digester followed by ABR, AF and Constructed Wetlands. The black water and kitchen waste is co-digested in the digester which provides output of methane – used in the kitchen for reducing the cost of cooking fuel. The treated water from the constructed wetlands after disinfection is sent for landscaping. The green landscapes not only help to reduce the soil erosion but also regulates the temperature around the property.

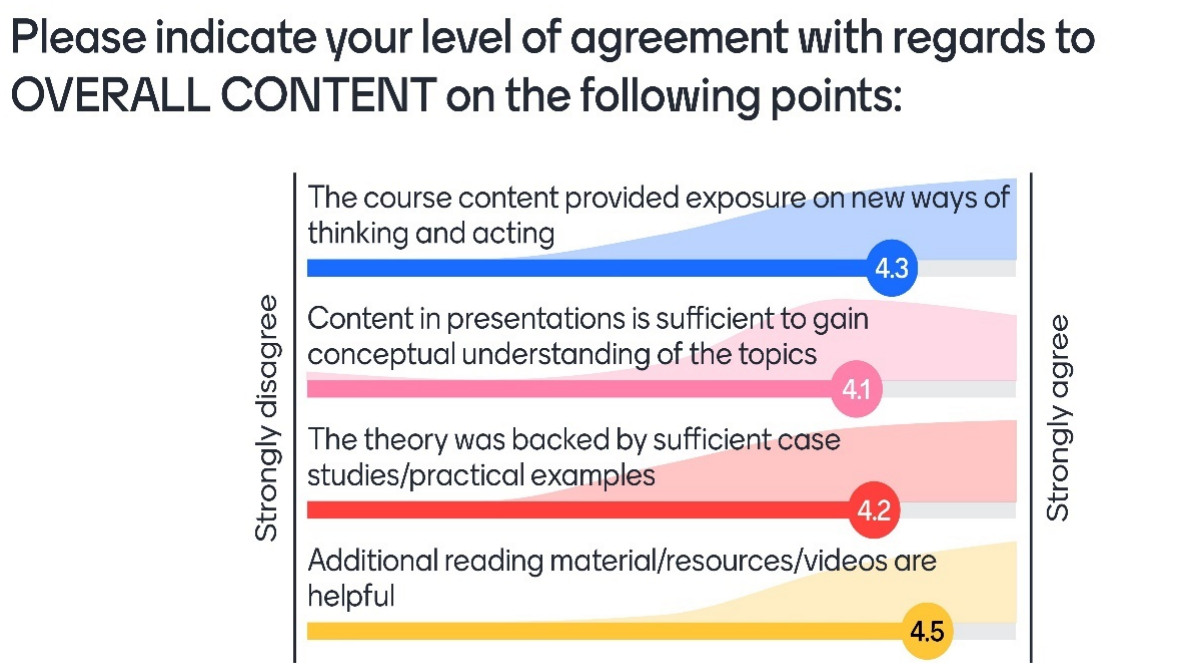
3.4.3 Training Feedback

Day 4 ended with a feedback session, Mr. Akshay Agarwal gave introduction regarding the feedback session and introduced participants to the Mentimeter platform to give their feedback on the sessions.

Overall content feedback

The figure below depicts the overall ratings received from the participants for the level of overall content of the sessions during this training. The ratings are out of 5.

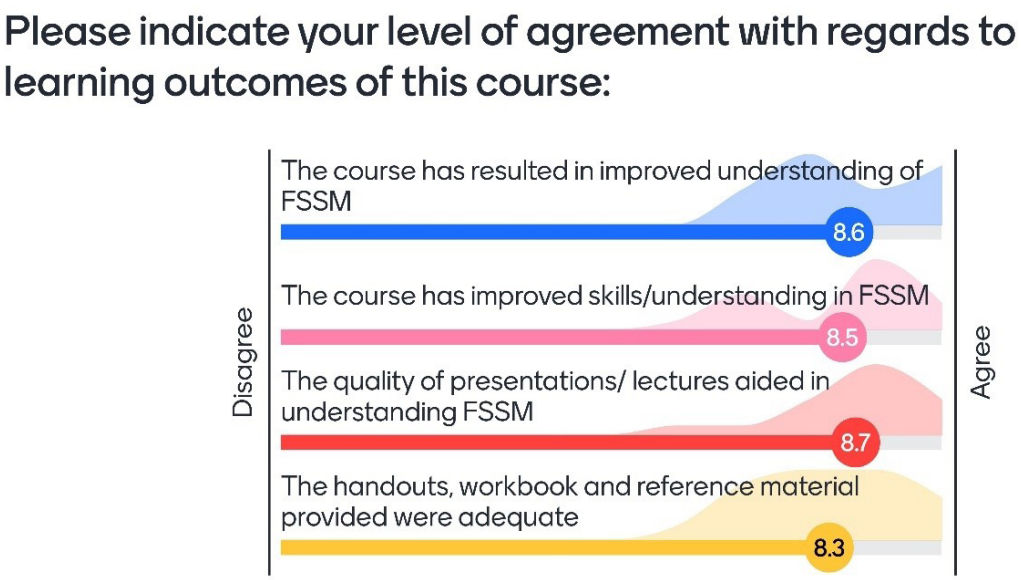
Figure 7: Learning Outcomes of Overall content



Learning outcomes of course feedback

The figure below represents the level of the agreement with regards to learning outcomes of the course. The ratings are in terms of agreement or disagreement of participants. The ratings are out of 10.

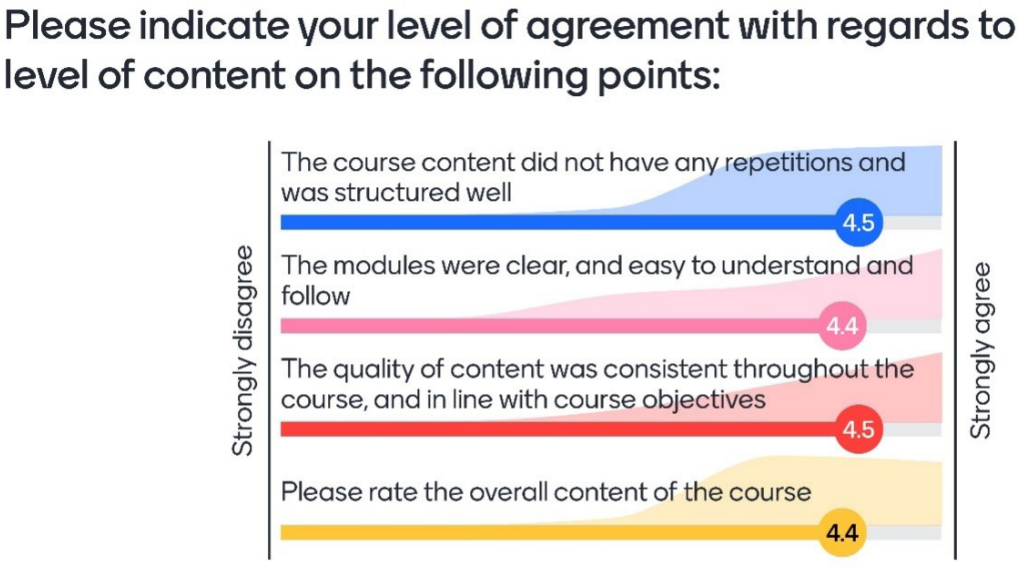
Figure 8: Learning Outcomes of training



Level of content feedback

The figure below represents the level of the content of the course by the participants, The ratings are in terms of agreement and disagreement at the basic, appropriate or complex level. The ratings are out of 5.

Figure 9: Level agreement of content of training



3.5 Day 5, September 21st, 2020

The moderator began the session by giving a brief idea to the participants about the session. The regulations on how to attempt the quizzes & exercises and its importance was reinstated.

3.5.1 Session 5: Understanding Faecal Sludge and Septage Management

Mr. Saurabh Kale was the lead trainer for the session. The main aim of the session was to make participants understand the importance of FSSM as integral part of sanitation system in India, the basics of faecal sludge and septage quantification and type of desludging and the approaches for faecal sludge and septage management.

The following aspects were covered in the session:

- Needs & Challenges in FSSM-
  - Status of Sanitation in Urban India
  - Sanitation Systems around us
  - Need of FSSM
  - Sanitation Services Chain
  - Current Challenges in FSSM

- Planning of FSSM-
  - Quantification of FSS

- Desludging- Demand & Scheduled desludging
  - Approaches of FSSM

Summary- FSSM is required to preserve the environmental health as the dependency on onsite containment units is high in India. Currently, a city faces multiple challenges in operationalizing FSSM ranging from formation of appropriate byelaws and enforcing them to access and managing of funds. Methods and challenges of quantification of faecal sludge and septage vary depending upon the kind of goals. Pros and cons of demand and scheduled desludging were discussed. Approaches for faecal sludge and septage management.

Figure 10: Snapshot of the session on need of FSSM

Dietary habits can change the values or characteristics of sewage or faecal sludge or septage was explained by Mr. Dhawal Patil by giving an example by own experience of a client.

The following queries were raised during the session:

- Why should ULBs shift from demand based to scheduled desludging (3 to 5) when scheduled desludging seen or assessed expensive to ULB or for low income communities?

3.5.2 Case Study: FSSM- Sinnar Maharashtra

Mr. Saurabh Kale shared the video with all the participants in WhatsApp group chat and requested the participants to raise doubts. In Sinnar, majority of toilets are connected to septic tanks. The emptying cycle of containment systems is around 5-7 years leading to high levels of BOD in the effluent flowing into open drains. Earlier, Faecal Sludge and Septage (FSS) from the septic tanks were disposed off at the solid waste management site without any treatment. Improper disposal of septic tank effluents and septage posed direct and indirect socio-economic impacts too. Hence, the city aimed to improve their sanitation situation by moving towards becoming ODF++ as envisioned by the Government of Maharashtra which will take care of its faecal sludge and septage along

the value chain. This includes scheduled emptying of containment systems and installation of Faecal Sludge Treatment plant to manage FSS.

The municipal council has awarded a contract to the private contractor for 3 years to empty FSS on a scheduled basis from households. Whereas, septic tanks of community and public toilets are emptied by Sinnar Municipal Council (SMC). The collected FSS is taken to the 70 KLD treatment facility consisting of a storage/stabilization unit, solid-liquid separation unit, solid treatment and liquid treatment unit. The process involves anaerobic digestion for sludge in the UASB reactor and for wastewater in the Anaerobic Baffled reactor. Post anaerobic digestion of wastewater, advanced treatment of wastewater is done through Post Sand Filtration (PSF) and Activated Carbon Filter (ACF) unit installed after ABR. The sludge settled from the UASB is put for sun drying on the Sludge Drying Beds. Faecal sludge and septage collected from households and community toilets are transferred through vacuum trucks. It is first emptied into collection tank at the FSTP to homogenize the content. The homogenized FSS is then conveyed to clarifier tank for settling process. The settled sludge in the clarifier tank is then pumped to UASB reactor and liquid portion from clarifier goes to Anaerobic Baffled Reactor (ABR) for further treatment UASB reactor produces digested sludge, biogas and liquid effluent, the digested sludge from the bottom of the UASB reactor is taken to the sludge drying beds while the liquid from the top of the reactor flows into the ABR unit. Clarified effluent is further treated through ozonation.

3.5.3 Exercise: 5

Mr. Dhawal Patil asked all the participants to attempt the exercise on FSSM Planning and requested them to raise doubts related to exercise on the WhatsApp group chat for further clarification.

3.6 Day 6, September 22nd, 2020

The moderator began the session by giving a brief idea about the session. The regulations on how to attempt the quizzes & exercises and its importance was reinstated and the participants were asked to watch the case study video shared on WhatsApp group chat.

3.6.1 Session 6a: Stakeholder Management

Mr. Saurabh Kale was the lead trainer for this session. The objective of the session was to understand the process of identification and characterization of stakeholders and to learn about stakeholder's engagement and different tools involved in it.

The following aspects were covered in the session:

- Stakeholder Analysis-
  - Identification of stakeholders
  - Characterisation of stakeholders
  - Influence and interest

- Stakeholders engagement-
  - Participation levels
  - Involvement tools
  - Milestones and cross cutting tasks
  - Distributing and formalising roles and responsibilities.

The trainer also asked participants to do the activity of stakeholder analysis for their own projects which is mentioned in Part B of the module shared with them already.

Summary - Stakeholder analysis is a vital tool for understanding social and institutional context of a project. Identification and characterisation of stakeholders provide early and essential information about who will be affected by and influence the project. Stakeholders engagement play a vital role in sustainability of the project. It develops skills, trust, confidence required within the stakeholders to run the system.

The following queries were raised in the session:

- What are the examples for high influence and low interest?
- Will PCBs be in the same category?
  - Ans- Because they are sceptical of FSM as a reliable to handle waste, they focus on sewered systems. But due to their authority in deciding the discharge norms, their influence is high despite low interest.

3.6.2 Session 6b: FSSM Planning

Mr. Dhawal Patil was the lead trainer for this session. The objective of the exercise session was to understand the logical framework involved planning of faecal sludge and septage management. To understand various on-ground parameters that impact the quantification of faecal sludge and septage at city level.

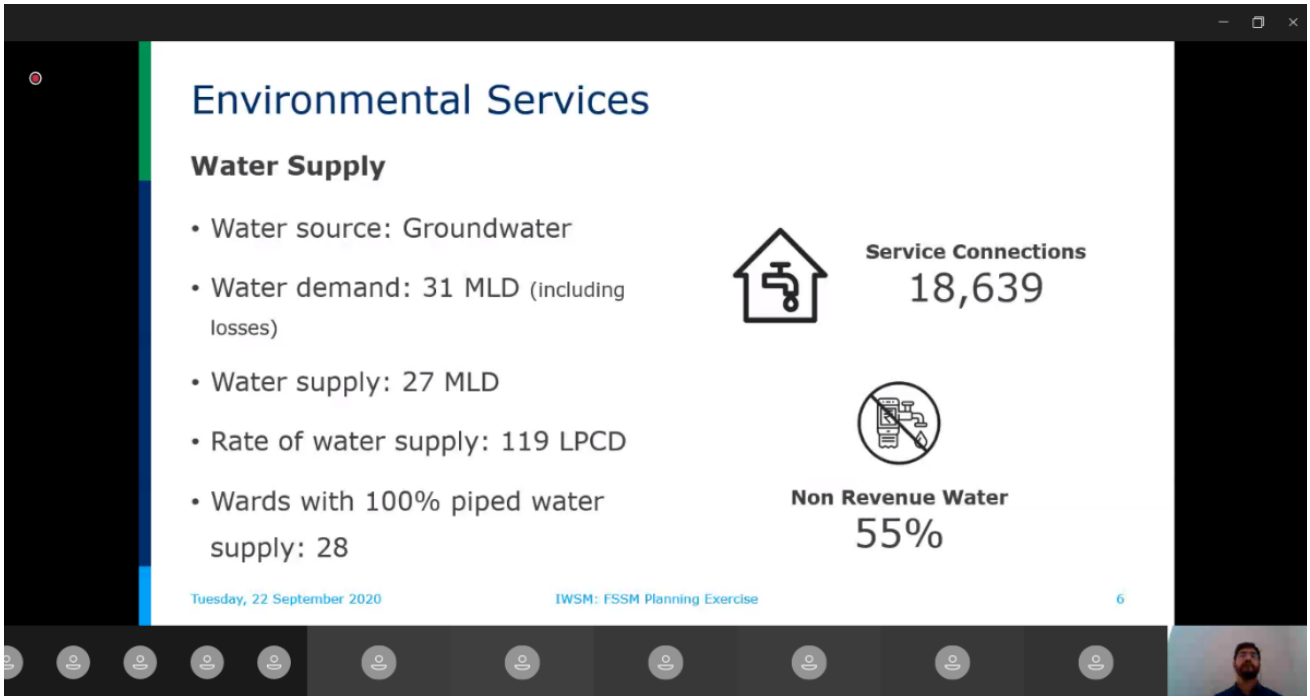
The following aspects were discussed in the session:
City Profile-

- Demography
- Climatic data
- Environmental Services – Water Supply, Sanitation
- Sample Survey
- Foundation
- Steps to solve exercise through formulas – Step I, II, III & IV
- Recommend Management Approach
- Solution of exercise 5

The following queries were raised during the session:

- Deep row entrenchment, soil/ water table contamination? Can we let out any waste water without treatment? Will NGT allow to let out FS waste without treatment?
- Any studies to study on the residues in water/ Soil?
- What would be the precautions the farmer needs to take before using FS as manure? Biomagnification?

Figure 11: Snapshot of the session on FSSM planning



3.6.3 Case Study: FSSM- Bhubaneshwar, Odisha

Mr. Saurabh Kale shared the video with all the participants in WhatsApp group chat and requested the participants to raise any doubts. Odisha is experiencing a fast pace of urbanization (27% decadal urban growth rate) which is accompanied by challenges of providing people of the state with good quality basic amenities such as water and sanitation. As the Government of Odisha has been committed to the cause of ensuring safe, healthy and sanitized towns and cities in the state, it took initiatives four and a half years ago to focus on safe containment, safe transportation, safe disposal and safe treatment of faecal matter. Considering the preponderance of on-site systems in the urban Odisha, the government realized that sewer networks cannot be the only solution for waste water management. Hence, the government has decided to opt for low cost, impactful non-sewer sanitation systems to make cities environmentally clean and safe for the citizens. Constructing Septage Treatment Plants (SeTPs) and Faecal Sludge and Septage Treatment Plants (FSTPs) for safe treatment of waste. Procuring cesspool vehicles of varying sizes specially to negotiate narrow lanes/streets and SeTPs to ensure safe emptying and transportation of the contained faecal waste. Eight AMRUT towns have approval to construct SeTPs i.e. Balasore,

Baripada, Berhampur, Bhubaneswar, Cuttack, Puri, Rourkela & Sambalpur town through AMRUT programme. Out of these, five SeTPs have been completed & commissioned in Bhubaneswar, Puri, Berhampur, Sambalpur and Rourkela. Construction of SeTPs in three towns i.e. Cuttack, Balasore and Baripada is under progress.

Faecal Sludge Management is in the infant stage in the state of Odisha. To fast track the faecal sludge management along with sewage OWSSB has constructed FSTP at Basuaghai, which is centrally located in the non-sewered area of Bhubaneswar. The Sewerage system of the city is under construction and would take some time to be operational. Majority of the population of the city are dependent upon onsite Sanitation. At present the Faecal Sludge is discharged into the environment without any treatment. The plant has an elevated unloading platform for trucks and tankers. Faecal sludge is emptied into a sludge receiving box. After which it goes into an inlet channel Screen bar is placed in the channel. From screens, influent goes to Setting-Thickening tanks. Thickened sludge is taken out of S-T tanks after a period of 10 days and the supernatant goes into ABR chambers. Thickened Sludge is taken to sludge drying beds where they are kept till they are fully dried under direct sunlight. The supernatant is then kept in ABR for 2-3 days for anaerobic treatment. Effluent from ABR is then sent to the horizontal planted/unplanted gravel filter. Water from gravel filters is then taken to polishing pond and finally the treated water is used within the plant premises for landscaping.

3.7 Day 7, September 23rd, 2020

The moderator Ms. Sreevidya Satish began the session by giving a brief idea to the participants about the session. The regulations on how to attempt the quizzes & exercises and its importance was reinstated and the participants were asked to watch a case study of FSSM at Bhubaneshwar and Puri, Odisha. A case study of co-composting approach from a small town Shakhipur Municipality, Bangladesh was shared on WhatsApp group chat.

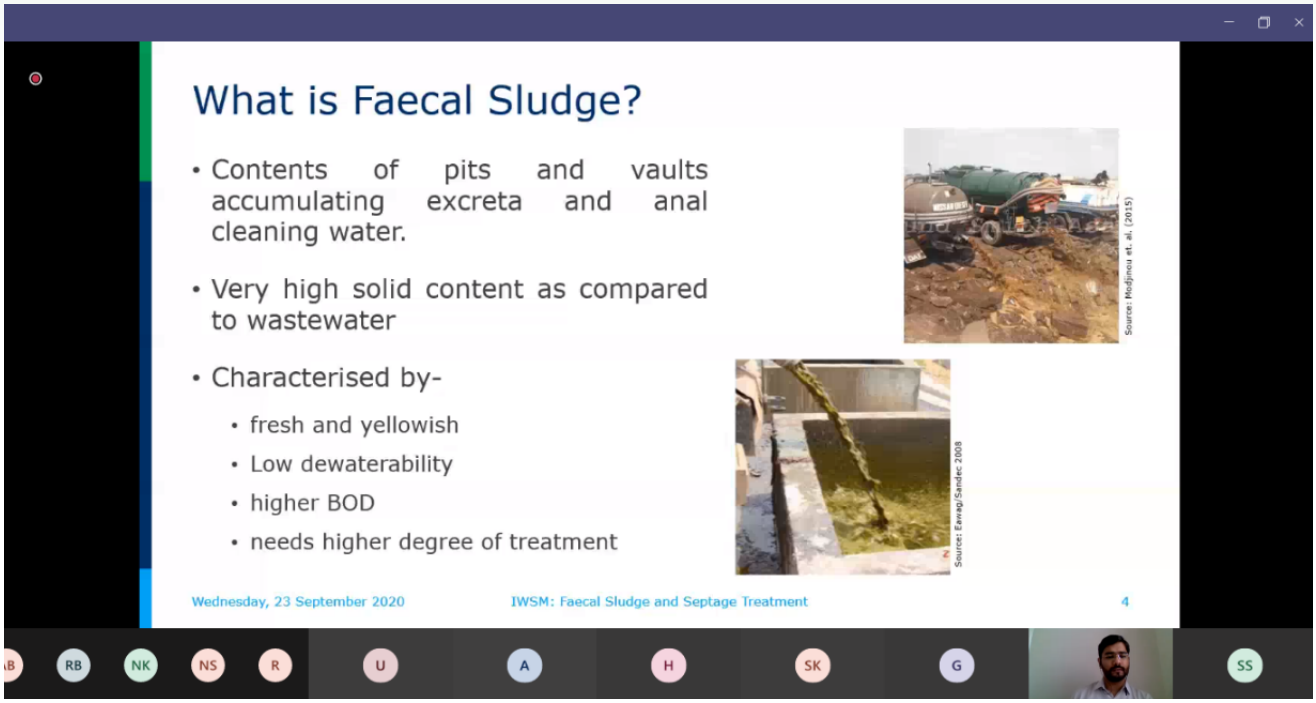
3.7.1 Session 7a: Faecal Sludge and Septage Treatment

Mr. Dhawal Patil was the lead trainer for this session. The main aim of the session was to learn the difference between faecal sludge and septage and its characteristics, objectives and stages of treating faecal sludge and septage and non-mechanized and mechanized treatment units for faecal sludge and septage.

The following aspects were discussed in the session:

- Faecal Sludge and Septage along with its characteristics.
- Treatment objectives-
  - Dewatering
  - Pathogen removal
  - Nutrient recovery
  - Stabilization
- Treatment stages-
  - Solid liquid separation
  - Stabilization
  - Dewatering/Drying
  - Pathogen reduction
  - Potential end products
- Treatment units-
  - Non-mechanised- Settling Thickening Tank, Anaerobic digester, Planted/Unplanted drying beds, Co-composting.
  - Mechanised- Screw press, Belt press, Paddle Dryer, Rotary Dryer, Belt Dryer, Pyrolysis.
  - Selection of treatment mechanisms- treatment performance, local context, O&M requirements and Costs.

Figure 12: Snapshot of the session on Faecal Sludge and Septage Treatment



Summary - Characterization of faecal sludge and septage plays an important role in the selection of treatment objective. FSS treatment facility consist of up to four stages, each having specific treatment objective. FSS treatment facility consists of multiple components to achieve the desired treatment objectives. Defining the right treatment objective is the key to selection of appropriate treatment components for FSS treatment facility.

3.7.2 Informational Video: - Sewage Cure, MBBR, SBT

Mr. Saurabh Kale shared the video in chat box and WhatsApp group chat for more information on various mechanized faecal sludge and septage treatment units. These videos provided further details on the process, area requirement and scale of treatment.

3.7.3 Session 7b: Financial Aspects of FSSM

Mr. Saurabh Kale was the lead trainer for this session. The aim of the session was to discuss the different financial aspects with regard to the infrastructure project such as setting up a FSTP and to understand the different financial models for operating FSSM citywide.

- Financing FSSM:
  - Capital expenditure
  - Operational expenditure
  - Income and revenue
  - Annualized cost
  - Cost analysis of FSTPs in India
  - LCA of FSTPs in India

- Financial flow models:
  - Discrete model
  - Integrated model
  - Sanitation tax model
  - License model
  - Incentivised model

Summary - There are multiple types of costs which need to be considered while setting up an FSTP. Selection of the technologies should be done after looking at LCC of the project. There are multiple transfers which happen when FSSM is operationalized. Selecting appropriate contracting and financial transfer model is the key to sustainability of the FSSM.

3.7.4 Exercise: 6

The lead trainer explained the participants the procedure to complete exercise 1 to 6 of Part B of the exercise and the assumptions that were to be considered for calculations. The exercise was further uploaded on class marker in order to help participants perform better.

At the end of the session, Q&A session was undertaken by the moderator & lead trainers.

The following queries were raised:

- Which is the common technique of pathogen removal used in India?
- How much time does it takes to complete the treatment process- from Solid-liquid separation to final product?

3.8 Day 8, September 24th, 2020

The moderator Ms. Sreevidya Satish began the session with the announcement to attempt the quizzes & exercises and its importance was reinstated and also asked participants to watch the case study video shared on WhatsApp group chat and to fill up the feedback form which is important for the organiser to improve and deliver better content in the future.

3.8.1 Session 8: Wastewater Treatment Principles and Technologies

Mr. Dhawal Patil was a lead trainer for this session. Participants were posting their questions & doubts in the chat box of Microsoft teams while the session was going on and these queries were being answered by other trainers during the session. All the participants were encouraged by the trainers & the moderator to ask any questions they had pertaining to the ongoing sessions. The main objective of this session was to understand in detail the Secondary Treatment Stage of the wastewater treatment and its types and working of each type and to understand the selection criteria for wastewater treatment technologies.

The following aspects were discussed in the session:

- Secondary Treatment
- Non-mechanised treatment systems-
  - DEWATS
  - Waste Stabilisation Pond
  - Advanced Integrated Pond
  - Soil Bio Technology
- Selection criteria
- Mechanised treatment systems-
  - Activated Sludge Process
  - UASB Reactor
  - Sequential Batch Reactor
  - Moving Bed Biofilm Reactor
  - Membrane Bio Reactor

Summary - Secondary treatment stage is the most important stage in wastewater treatment in STP. Various combinations of treatment processes take place in the secondary stage for achieving the reuse or discharge standards. Non-mechanized and mechanized options are possible for wastewater treatment. Capital cost of the project should not be the driving principle for selection of wastewater treatment technology.

The following queries were raised during the session:

- Why is T adopted for inlet in ABR? and what does upper arm of T do for inlet?
- What is the unit of efficiency?
- What is the area required for this advanced integrated pond?
- What's the characters of scum? Why it forms? Characteristics of scum?
- If not L1 then are there any guidelines on standard capex for respective technologies?

3.8.2 Informational Video: - Sewage Cure, MBBR, SBT

Mr. Saurabh Kale shared the video in chat box and WhatsApp group chat for more information on Decentralised Wastewater Treatment System - Non-Mechanized System, Phytorid Technology, SBT, UASB technology, SBR, MBR and MBBR.

3.8.3 Session 7c: O&M cost of FSSM

The trainer explained the objective of O&M and its exercise 6 section 4 of the exercise was to understand various aspects contributing to O&M of desludging services and treatment of faecal sludge and septage.

Mr. Dhawal Patil presented session on exercise on O&M part.

The following aspects were discussed:

- Desludging Services Cost - Fuel cost, Equipment O&M cost, Human resource cost, Protective Equipment Cost, Overheads.
- Treatment Cost - Energy cost, Equipment O&M cost, Human resource cost, Protective Equipment Cost, Overheads.
- Tax & Service Fee - O&M cost of desludging services and treatment plant, Tax collection efficiency, FSSM tariff and Service fee.

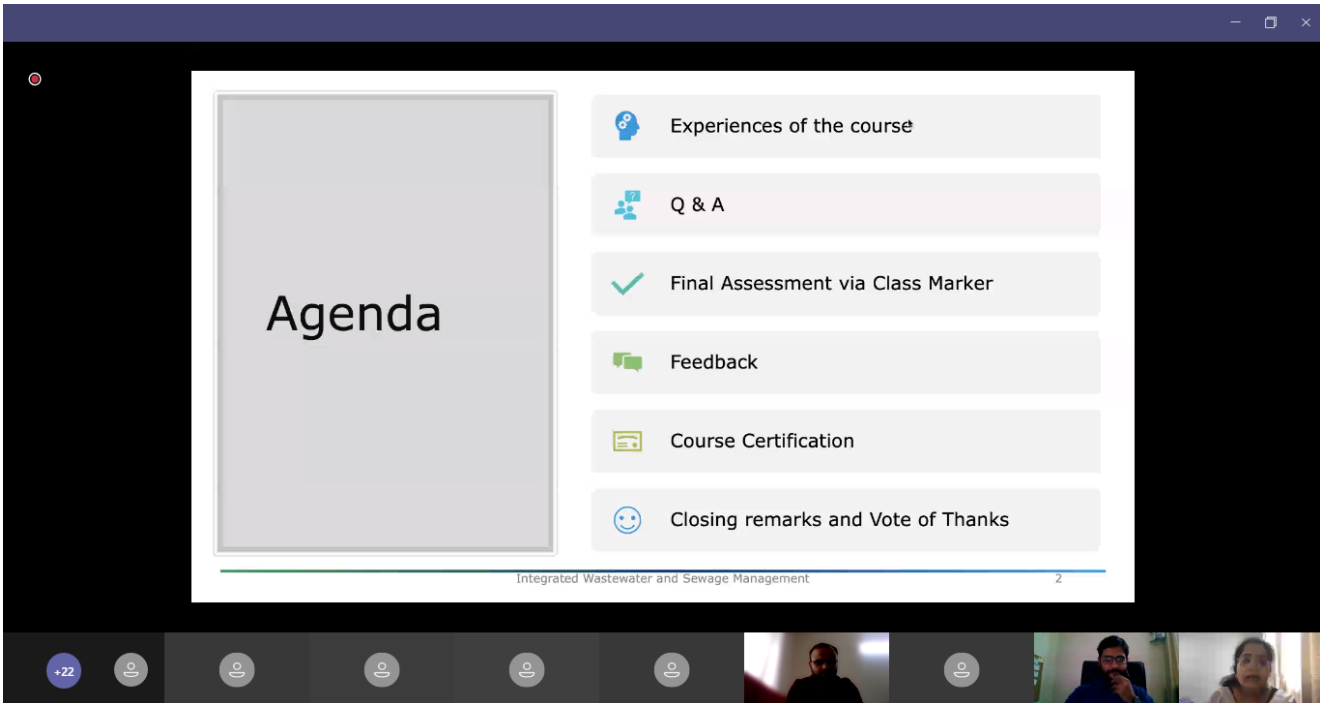
Summary - The cost of desludging is significantly impacted by desludging frequency. Human resource cost contributes significantly to O&M cost of FSSM. Selection technology is quite critical as mechanized treatment requires specialized and costly human resource. Fuel cost is the second highest contributor in O&M cost of desludging services. Treatment plant should be located as close as possible to the city. Cost of safety is negligible; however, it provides larger benefits. Affordability of services determines the demand of desludging by the households.

Instructions pertaining to the final submissions of the exercises on classmarker & how it should be compiled & submitted were given by the moderator. The instructions on quiz sessions were given by moderator to all participants to complete the quiz.

3.9 Day 9, September 25th, 2020

Ms. Sreevidya Satish briefed about the agenda of the day. Amongst the 56 registered participants, 41 attended the training. The expectations from the training which were expressed by the participants on day one were revisited to check which have been achieved through the course. Online quiz and feedback session results were shared during her presentation.

Figure 13: Moderator explaining about quiz, feedback forms & exercise



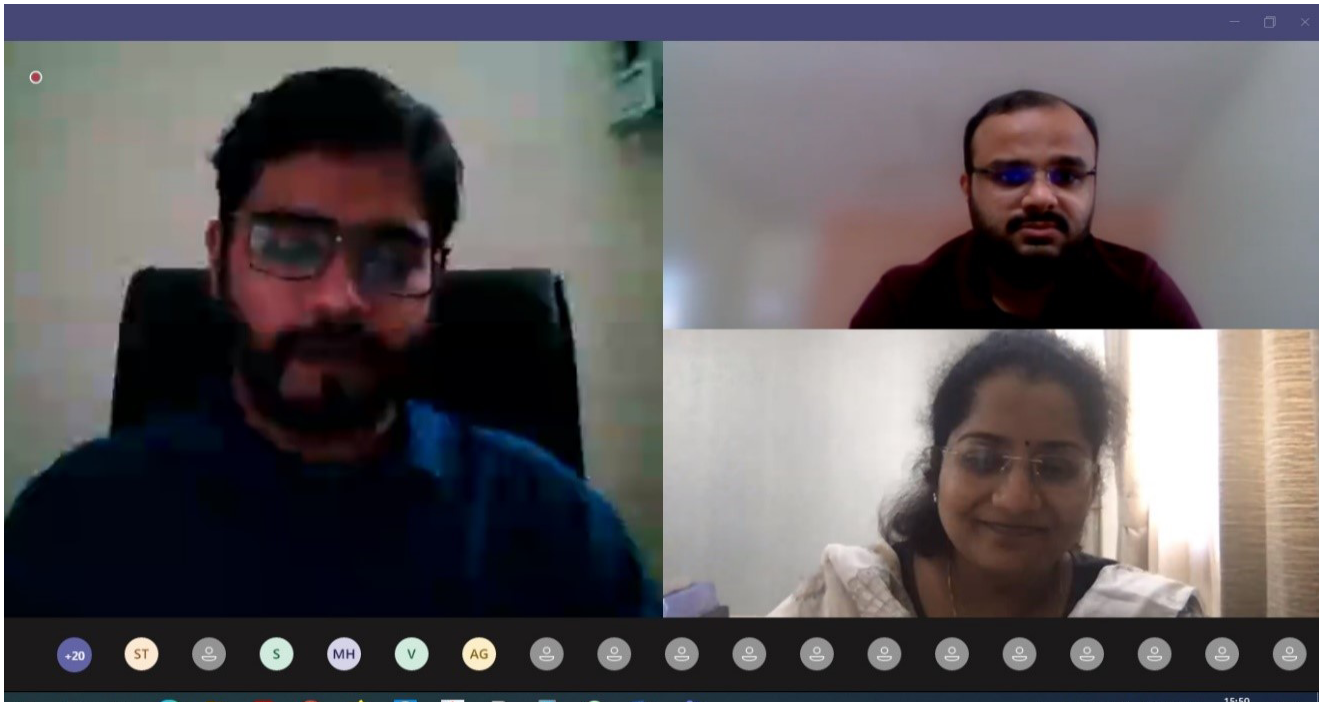
3.9.1 Question and Answers

Moderator Ms. Sreevidya Satish asked participants to post their questions in the chat box or unmute themselves to ask questions in the session.

The following queries were raised during the session:

- If you check the conductivity of FS?
- Electrocoagulation?
- How to draw diurnal curve?
- How does hard sludge from septic tank can be removed at ground level?
- What is your suggestion about SBR as a technology in the current times? I mean handling MBBR with a clarifier is always easier than SBR. As adjustment of MLSS really means controlling of biosolids aka microbiological activity causing treatment issues?
- Does MBBR needs recirculation of sludge? To maintain MLSS?
- Your thoughts on Geo bags, the FS after homogenising and polymerisation and filtration through the bags and then sand and activated charcoal filtration, will the BOD & COD reach the desired levels without any aerobic or anaerobic treatment.

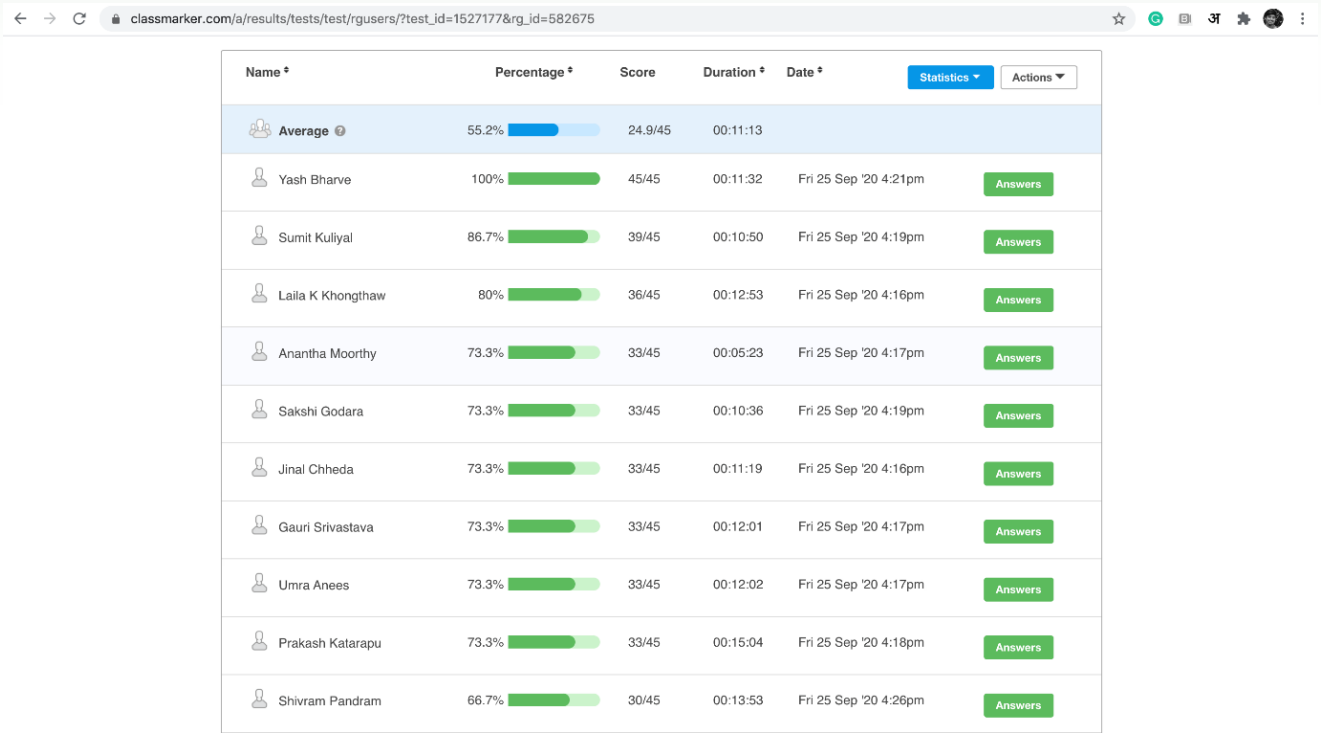
Figure 14: Lead trainer answering question of participants



3.9.2 Online Quiz and feedback session

Mr. Akshay Agarwal briefed participants about the online quiz and how to solve the quiz. Below is the image depicting that the participants attempted the online quiz within given time frame. Ms. Sreevidya Satish also briefed about the feedback session and importance of exercise submission to get the certificate.

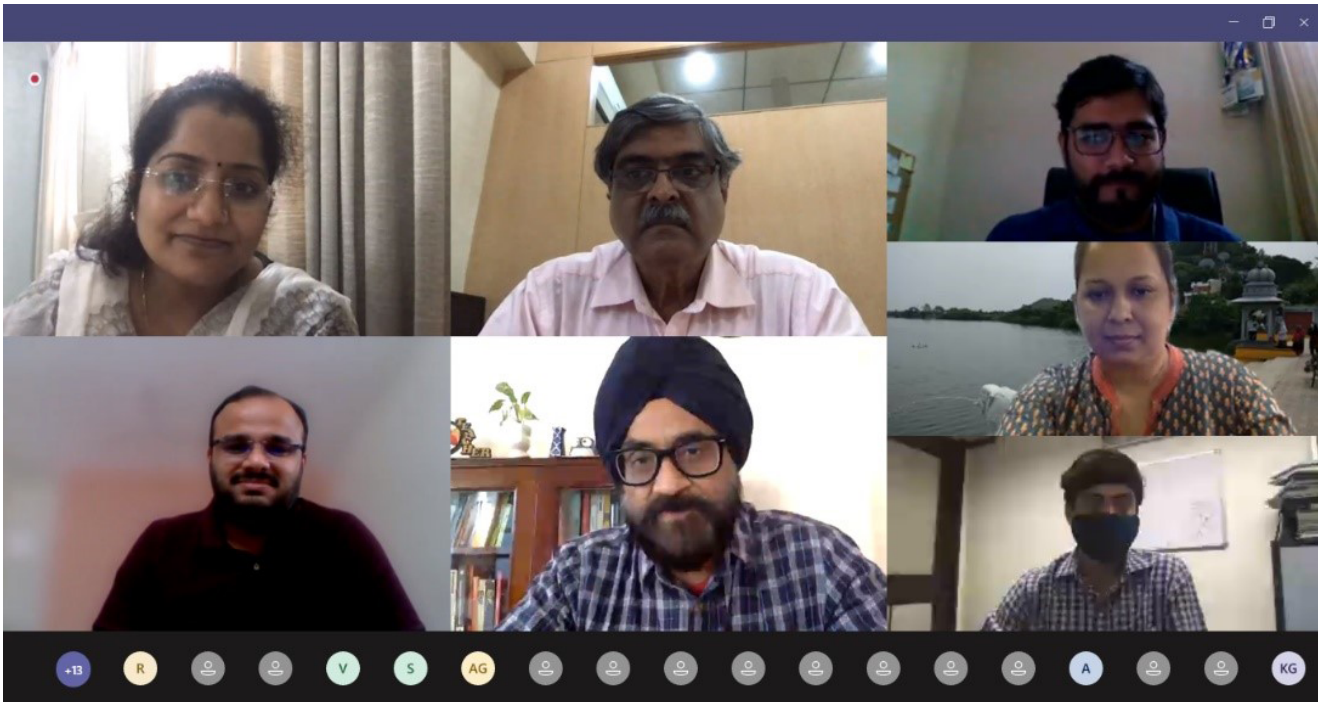
Figure 15: Snapshot of online quiz session



3.9.3 Concluding session

In the concluding session, Ms. Sreevidya Satish expressed her gratitude to all the participants for registering and completing the training. For the concluding session, Mr. Dayanand Panse, Director, Ecosan Services Foundation (ESF) and Mr. Depinder Kapur, Programme Coordinator- SCBP, National Institute of Urban Affairs (NIUA) gave their concluding remarks on the sessions and participants. Entire team of NIUA and ESF expressed their gratitude and shared their experiences of the training along with acknowledging the enthusiastic participants who made the sessions very interactive.

Figure 16: Snapshot of Concluding session with THE organizers



4. Feedback

Providing feedback towards the training sessions and content during the training and after the training program was voluntary. Up to 56% of the participants shared their feedbacks.

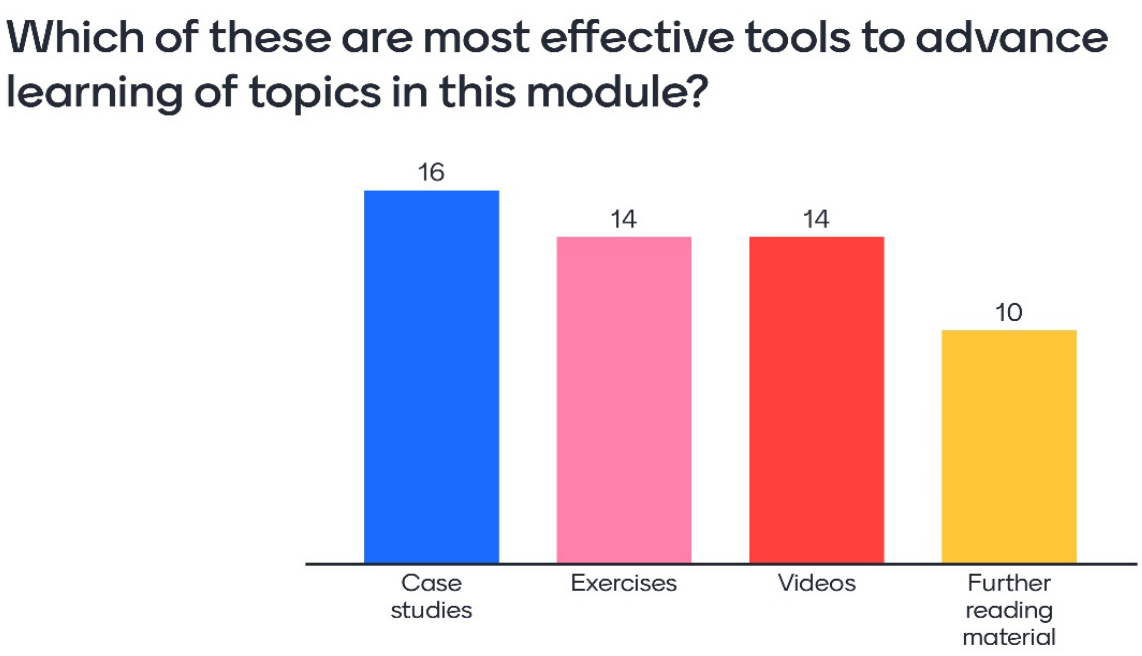
Considering the feedback carried out for contents and level of content and the overall training, following inferences were drawn.

4.1 Online Feedback

4.1.1 Tools of learning of topics in module

The figure below represents the tool which was most effective for better learning of topics in the module.

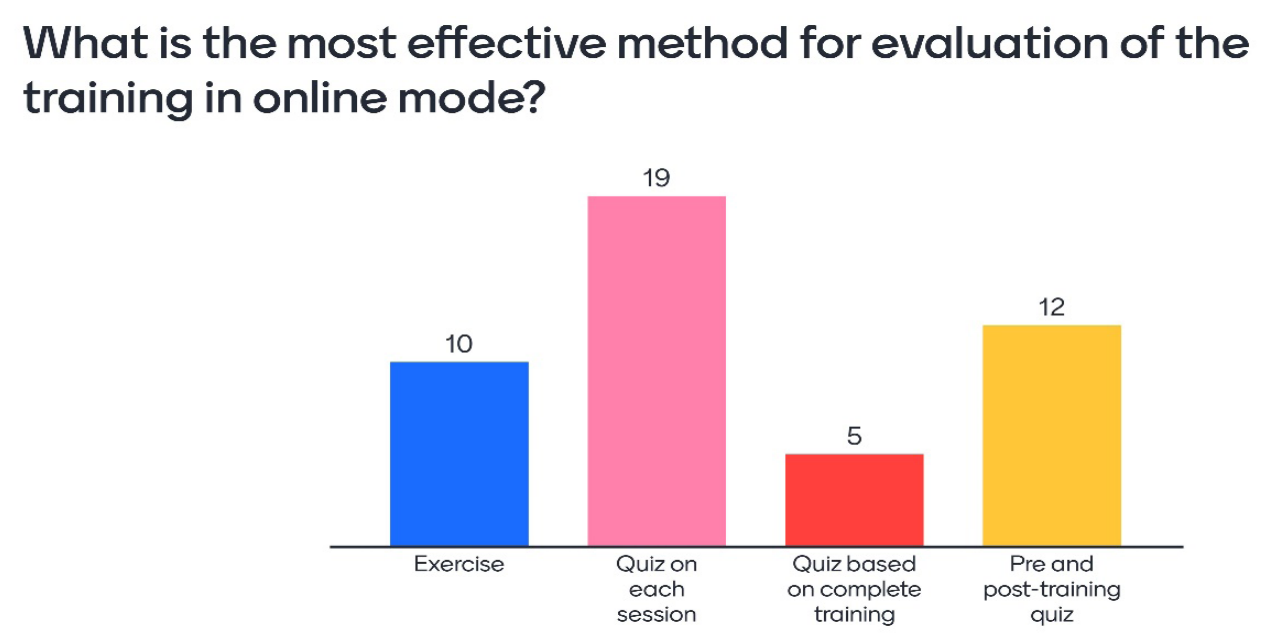
Figure 20: Tools of learning in modules



4.1.2 Method of evaluation of the training in online mode

The figure below represents the most effective method for evaluation of the training in online mode.

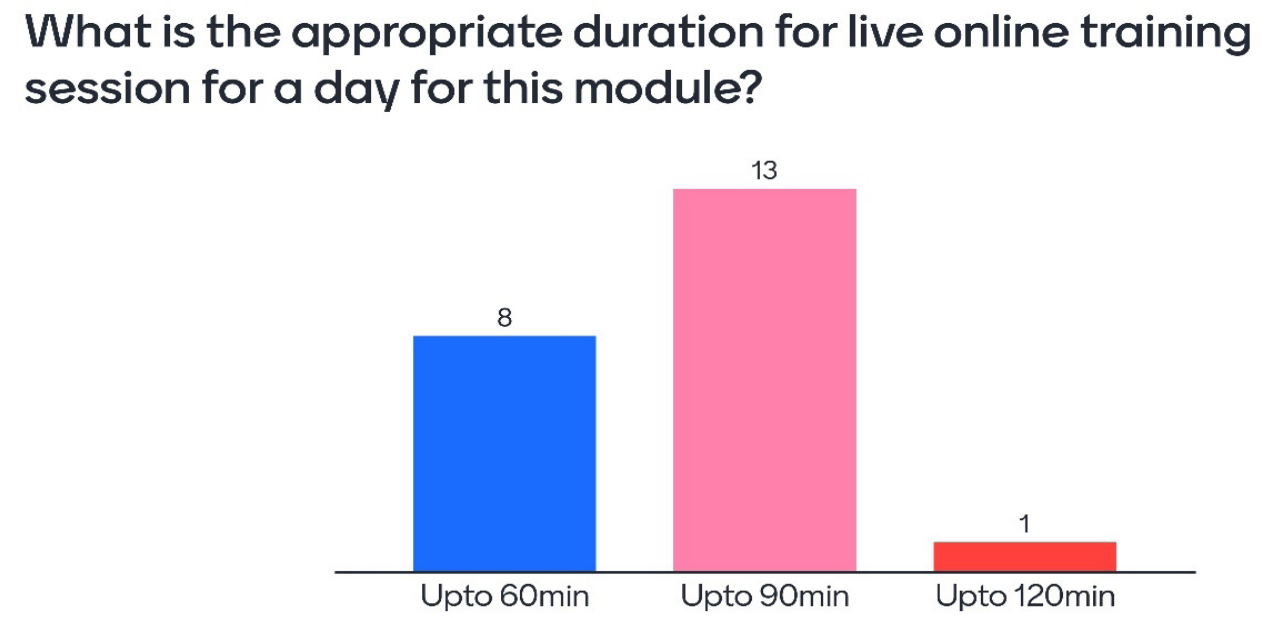
Figure 21: Effective method for evaluation of training



4.1.3 Appropriate duration for live online training session for a day for this module

The figure below represents the appropriate duration for online training session for a day for training.

Figure 22: Appropriate duration for online training session



4.2 Offline Feedback

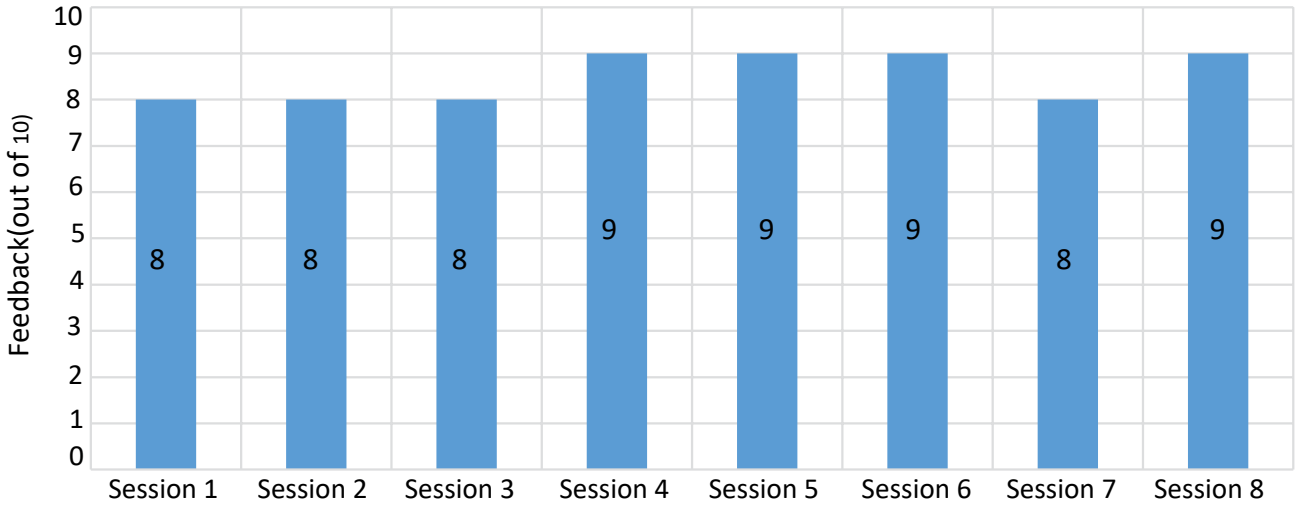
Providing feedback towards each session, exercise, learning outcomes, training tools and management was filled up by all participants after the completion of training. Almost all participants gave their feedback for each part of the training.

4.2.1 Session Content and Delivery feedback

The graph below represents session-wise feedback on content and delivery from participants out of range from 0 -10.

Session 1 - Sustainable Sanitation and Water Management
Session 2 - Sanitation Systems and Technologies
Session 3 - Approaches to Liquid Waste Management
Session 4 - Decentralized Wastewater Management
Session 5 - Wastewater Treatment
Session 6 - Introduction to FSSM
Session 7 - FSSM Planning
Session 8 - Faecal Sludge and Septage Treatment

Figure 23: Session content & delivery feedback



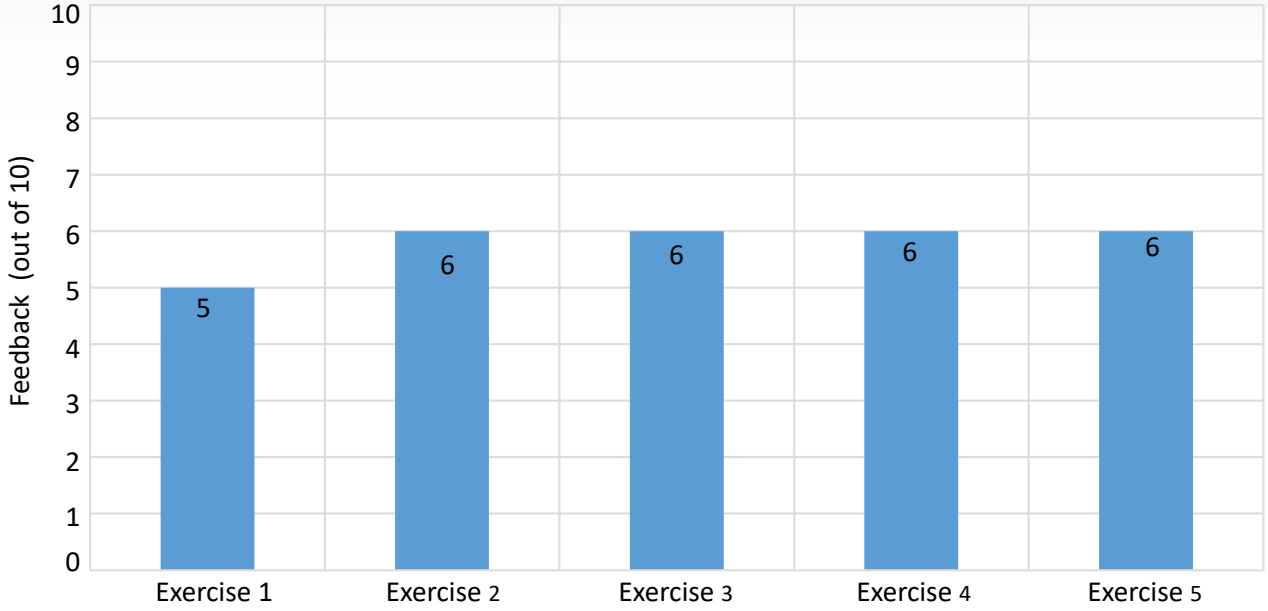
58% of the participants gave greater than 9 rating to the sessions conducted in the training program. Apart from the content of the slide decks, participants also showed an appreciation towards the case studies discussed during the session or the videos that were shared based on the practical implementation of the concepts in India. This helped the participants to find a common ground for potential re-application or for realizing appropriate solutions for their projects.

4.2.2 Complexity of Exercise

The graph below represents exercise feedback on complexity and its understanding from participants out of range from 0 -10.

Exercise 1 - Decentralized Wastewater Management: Residential Property
Exercise 2 - Decentralized Wastewater Management: Slum Sanitation
Exercise 3 - Decentralized Wastewater Management: Public Sanitation
Exercise 4 - FSSM: Planning and Operationalizing
Exercise 5 - FSSM: Calculating tariff and service fee

Figure 24: Complexity of Exercise



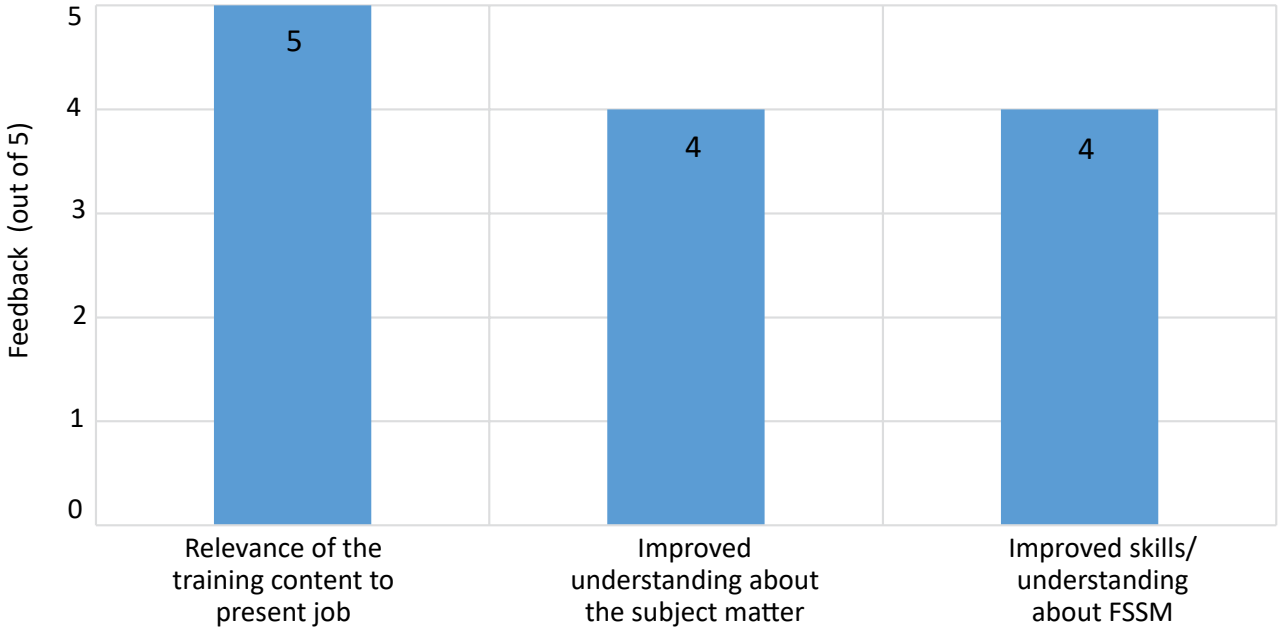
64% of the participants perceived the exercise to be moderately difficult. The perception of participants about the exercise is an important parameter to understand whether the exercise is adequately engaging. It is usually observed that oversimplified exercise is uninteresting and does not provide the understanding of fundamentals to the participants. On the contrary, a highly complex and difficult exercise is perceived as tedious by the participants thereby leading to incomplete attempts. A moderately complex and difficult exercise balances all the essential parameters and objectives of the exercise in an online training format.

4.2.3 Learning Outcomes

The graph below represents feedback on learning outcomes of the training program like relevance of the training content to present job, improved understanding about the subject matter, improved skills/understanding about FSSM from participants out of range from 0 -5.

69%, 56% and 50% of the participants rated 5 in each parameter for learning outcomes. Thus, it can be concluded that the participants have gained substantial knowledge about the wastewater management and faecal sludge and septage management at the city level.

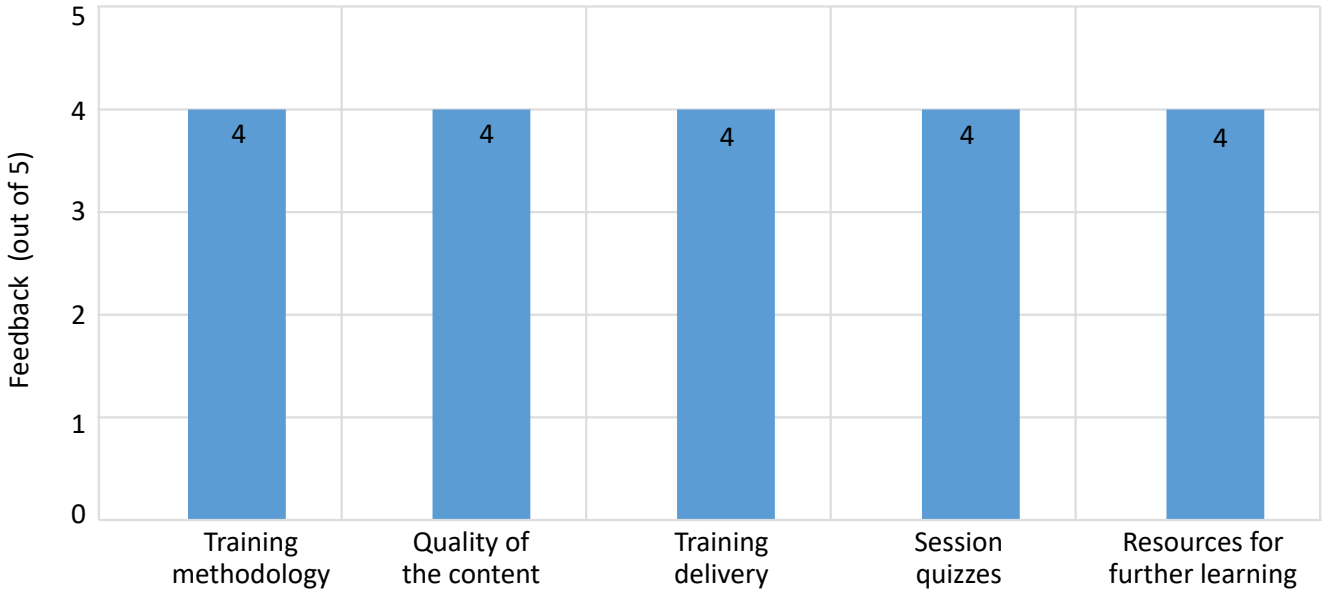
Figure 25: Learning outcomes



4.2.4 Training Tools

The graph below represents feedback on training tools like training methodology, quality of the content, training delivery, session quizzes, resources for further learning from participants out of range from 0 -5.

Figure 26: Training tools

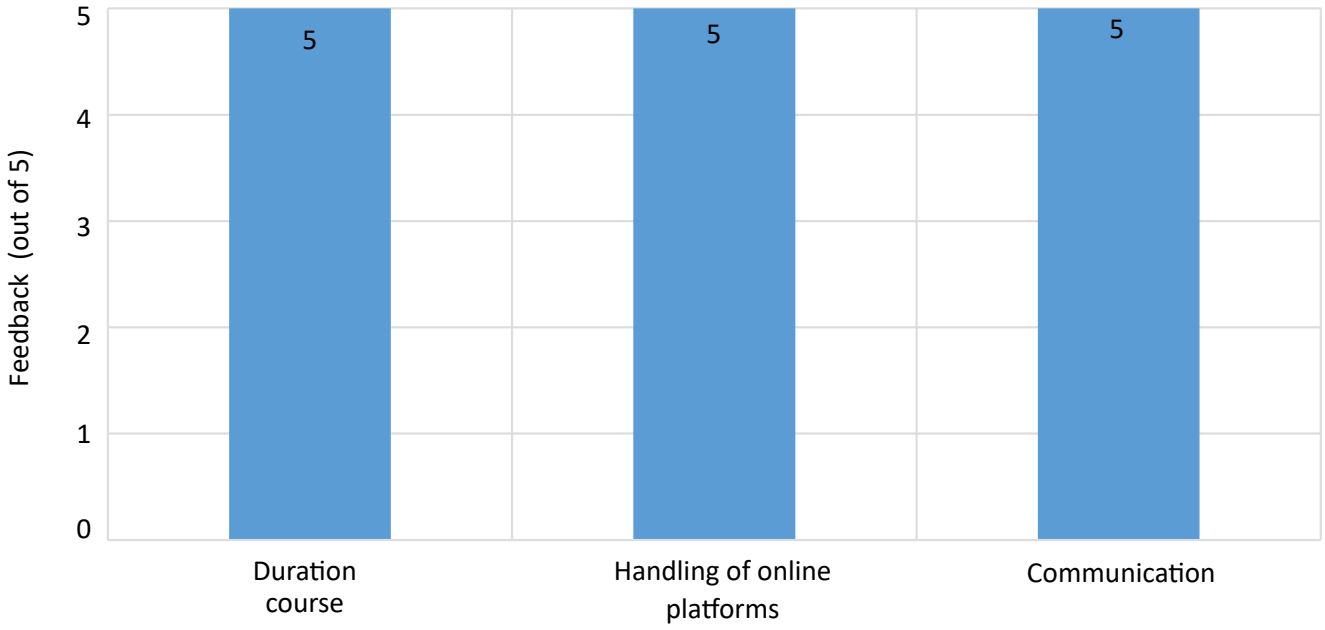


43% and 44% of the participants rated 5 and 4 for the respective parameters for assessing the trainings tools and methodology used in the training program. Combination of different tools for delivering the training program, ensured that the participants were engaged throughout the 9 days, thereby improving their learning experience.

4.2.5 Training Management

The graph below represents feedback on training management, such as duration of course, handling of online platforms, communication from participants out of range from 0 -5.

Figure 27: Training Management



53%, 63% and 56% of the participants provided a rating of 5 in each of the parameters for assessing the training management. For a holistic learning experience, a 9-day training program with each session of 90 min was seen as an appropriate duration.

4.3 Module Revision

The online training was a pilot training conducted on the draft module. Thus, the feedback from the participants from the TMRC organizations will be taken into consideration for revision and finalization of the content of the module. A detailed feedback was provided the by SCBP team.

It was also discussed that for online training, restructuring of the session can be done. Certain sessions will be shortened for the online training. Certain sessions (such as Stakeholder Management) to include case study videos and examples.

The revision of the module will be done based on the feedback provided.

4.4 Participants Testimonials

The training course ended with a feedback and experience sharing of few participants.

Table 2: Testimonials from participants

SR. NO	NAME OF THE PARTICIPANT	ORGANIZATION	Testimonial
1	Mr. Kaushik Ghosh	ATI, West Bengal	The programme has been very nicely and compactly designed with not much pressure on our daily schedule. The faculty - Mr. Dhawal Patil and Mr. Saurabh Kale were excellent, as usual. The overall team who worked behind the scenes as well as the moderator, Sreevidya Satish conducted the session flawlessly. Many thanks to the organisers NIUA & ESF
2	Ms. Jinal Chheda	CEPT, Ahmedabad	It was very well organised. The knowledge which I had before the training was definitely updated and I can tackle the ground realities in a better way. The quiz and the exercise were interesting and engaging enough to keep our curiosity of learning high throughout the training program.
3	Mr. Prakash Katarapu	ASCI, Hyderabad	It was absolutely brilliant. Quality of the content was brilliant.
4	Ms. Tavishi Darbari	SBM, NIUA	The purpose was to understand the treatment technology, but the sessions were very relevant and the case studies helped to understand the on-ground activities. All the trainers did excellent delivery of good and crisp. Gratitude to team ESF and NIUA for a good training.
5	Ms. Krati Gupta	NIUM, Hyderabad	The training was interesting and provided lot of useful information. This course has helped me to grow in the sector of wastewater and septage management.
6	Mr. Anantha Moorthy	CDD Society	Thank you to the resource persons for immense patience and delivering the sessions for 9 consecutive days. I learnt a lot from the sessions and I appreciate the strong command of the technical expertise. The way in which the large audience and multiple questions were handled is highly admired. It was a good experience and thank you for well round coordination of the session successfully.

5. Learning Impact Assessment

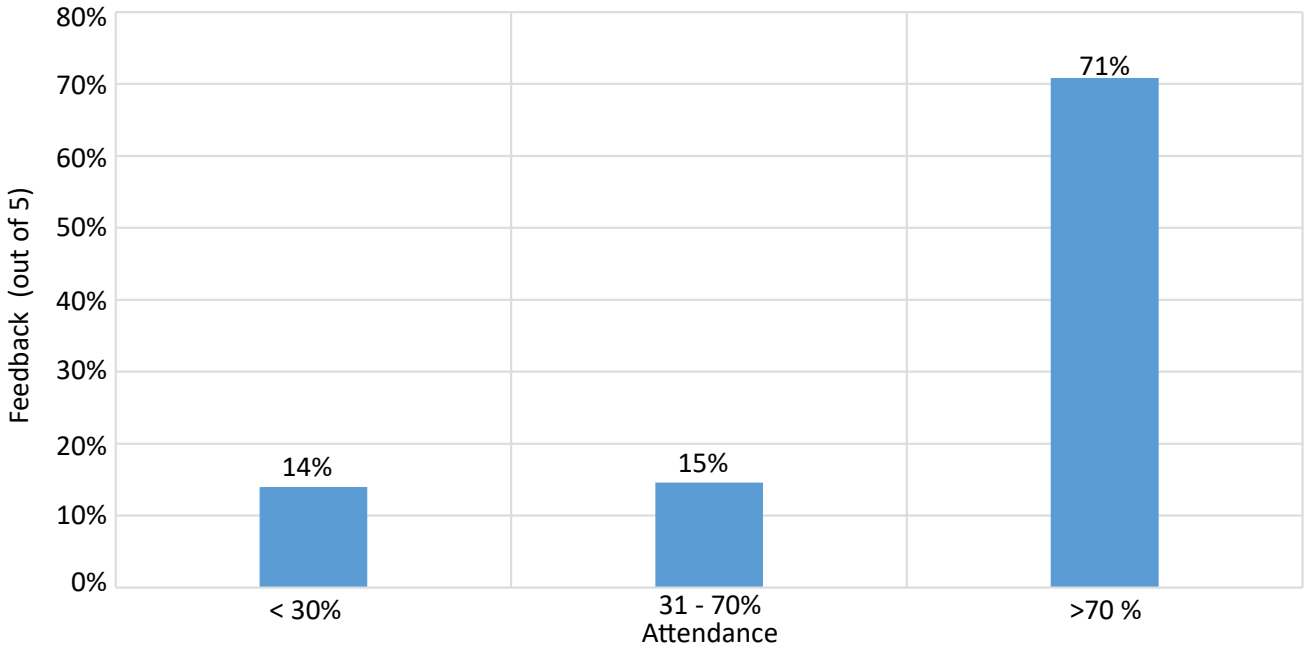
The training program on Integrated Wastewater and Septage Management received a total nomination of 57 people, who were sent the registration forms. Out of the 57 nominated people, 9 did not register for the training program. The remaining 48 participants registered and attended the training program actively.

The successful completion of the course was dependent on:
1. Attending more than 70% of the sessions.
2. Attending more than 70% of the quizzes.
3. Submitting the solution to the exercise.

5.1 Attendance

Out of the 48 participants, 34 participants attended all the sessions. 7 participants dropped out of the training program at the early stages. From the profile of the participants, it can be seen that these participants did have prior knowledge in the topic and/or found the course to be too intensive to attend during the office hours.

Figure 17: Participation in the training program



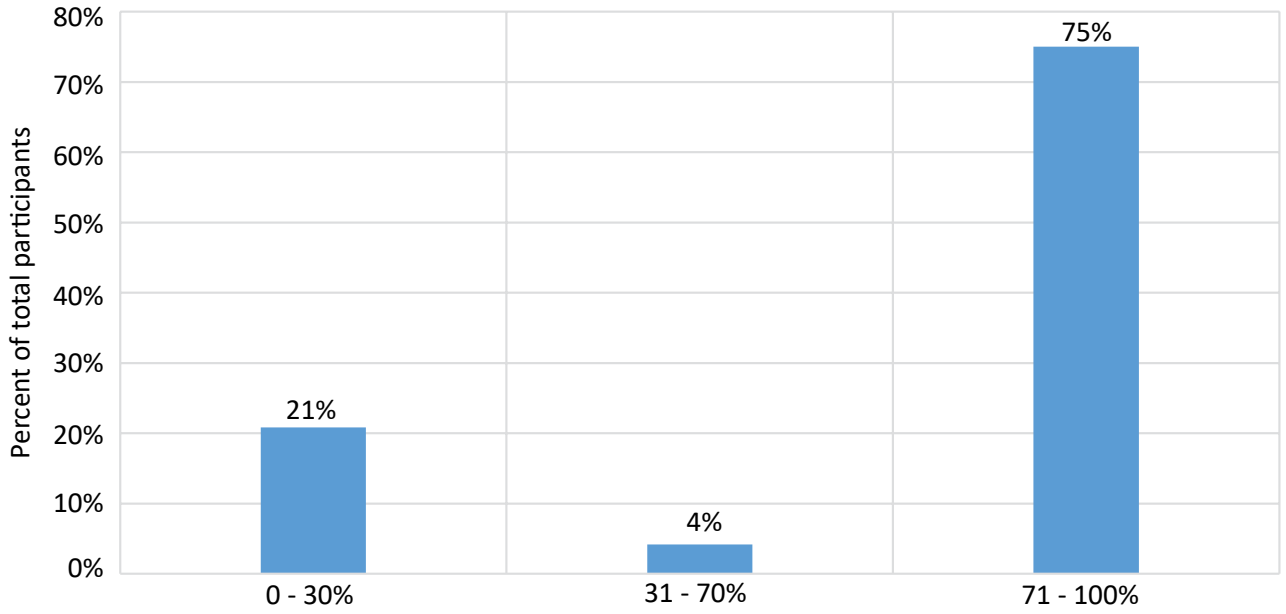
Another 7 participants attended only selective sessions i.e. either wastewater management or faecal sludge and septage management. Most of these participants belonged to the state government and wanted to gain knowledge in the field which is prioritized by the state government.

By measuring the attendance of the participants, it can be seen that the participants were successfully engaged in the session and were continuously learning throughout the training program. The same can be observed through the session feedback provided the participants in the Chapter 5.

5.2 Quiz

Out of the 48 participants, 36 participants attended all the 8 session quizzes and the final online quiz. There were 10 participants who did not attempt most of the quizzes. The main reason for this was lack of familiarity with the tool used for conducting the quiz. In the feedback forms, certain participants also responded that getting accustomed to online tools was a challenge.

Figure 18: Participation in quiz

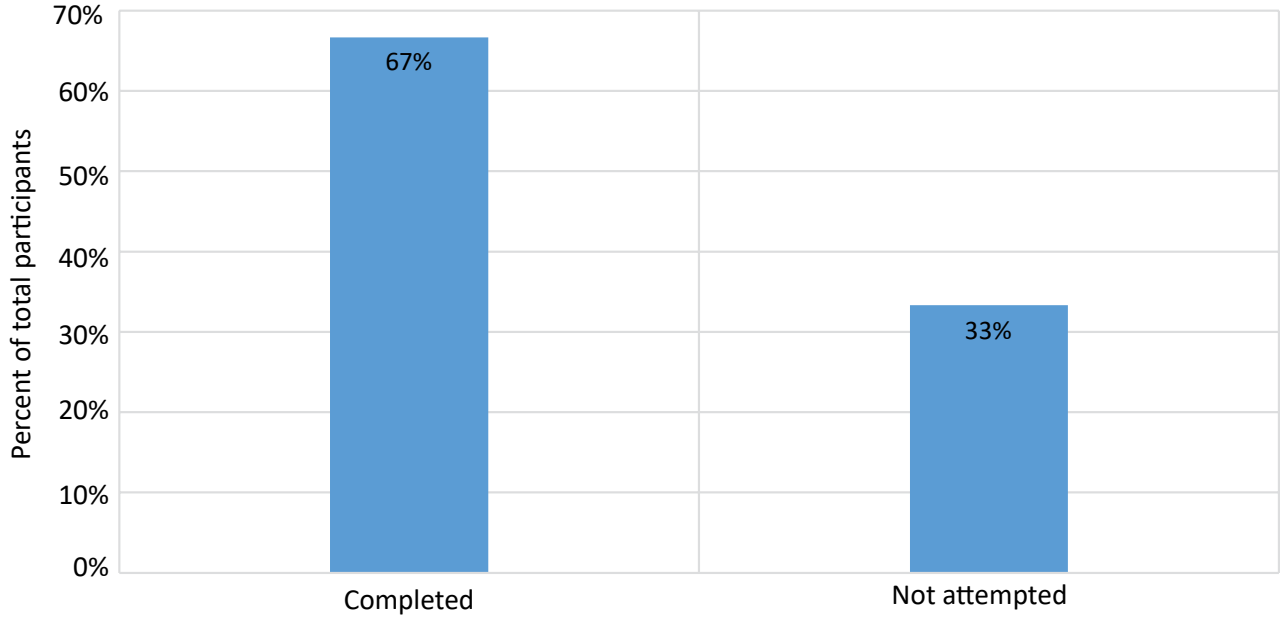


The quiz were designed in a way that the participants had to recall the learnings from the session and apply it in order to find the solution. This reinforced the key take away from each session. Multiple choice questions along with True and False and Fill in the Blanks based questions were set up in the quiz.

5.3 Exercise

Out of the 48 participants, 32 participants attempted the exercise and submitted the solution for assessment. It was observed that participants who had attended all the sessions and attempted all the quizzes had completed the exercise.

Figure 19: Completion of Exercise



The exercise was developed on case methodology wherein the first chapter put forward a case of city. All the data pertaining to the WASH infrastructure was provided in the chapter. The subsequent chapters were exercises linked to the theory on sessions conducted during the training program. A dedicated time slot was provided for discussing the methodology and the approach for completing the exercise.

5.4 Certification

Out of the 48 participants, 32 (67%) participants successfully completed the training program and received a certificate. During the discussion with the participants, it was seen that one of the reasons for such a high success rate of completion was mainly due to live training sessions. The same was also observed through the response provided by the participants as illustrated in the next chapter.

Annexure 1

List of Resource Persons

Table 3: List of Resource Persons

SR NO.	NAME OF THE RESOURCE PERSON	ORGANIZATION	ROLE	Profile Photo
1.	Ms Sreevidya Satish	Ecosan Services Foundation	Moderator	
2.	Mr Dhawal Patil	Ecosan Services Foundation	Lead Trainer	
3.	Mr Saurabh Kale	Ecosan Services Foundation	Lead Trainer	

Annexure 2

List of Participants

The following table presents the details of the participants who attended the Integrated Wastewater and Septage Management Training.

Table 4: List of Participants

Sr.No	Organisation Name	Nominations	Designation	Email ID
1	Uttar Pradesh State Official	Mrs. Amita Varun	Executive Officer, Sardhana, Meerut	nppsardhana@gmail.com
2	Jharkhand State Officials	Mr. Anup Kumar	City Manager, Bundu	anupwp1975@gmail.com
3		Ms. Vineeta Kumari	Junior Engineer, Bundu	dtvineeta@gmail.com
4		Mr. Anant Kumar Khalkho	City Manager, Gumla	ananti1509@gmail.com
5		Mr. Rajesh Oraon	Junior Engineer, Gumla	rajesh.oraon@yahoo.com
6		Mr. Anand Murmu	Junior Engineer, Gumla	anandmurmu353@gmail.com
7	Madhya Pradesh State Officials	Mr. Shivendra Thakur	Sub-Engineer, Chhindwara	shivendra.thakur18@gmail.com
8		Mr. Mahesh Awasya	Sub-Engineer, Chhindwara	awasyam4@gmail.com
9		Mr. Shivram Pandram	Sub-Engineer, Chhindwara	shiv.prasad750@gmail.com
10		Mr. Antar Singh Tawalr	Assistant Engineer, Khandwa	antarsingh.03@gmail.com
11		Ms.Varsha Ghidode	Assistant Engineer, Khandwa	varshaghidode96@gmail.com
12		Mr. Sanjay Shukla	Assistant Engineer, Khandwa	shuklasanjay760@gmail.com
13		Mr. Bharat Surjaye	Sub Engineer, Khandwa	bharatsurjaye44@gmail.com
14	Rajasthan State Officials	Mr. Deepak Singhal	Asst. Engineer	deepak.cese@gmail.com
15		Mr. Vishwas Singhal	Asst. Engineer	vishwas.cese@gmail.com
16		Ms. Ambika Kavia	Asst. Engineer	akswm2017@gmail.com
17	Uttarakhand Jal sansthan, Dehradun	Mr. Abdul Rasheed	Asst. Engineer	aaaabdulrasheed@gmail.com
18	Tamil Nadu Rural Development Department	Mr. SK Gowthaam	State Consultant - SBM (G)	gowtham.sk.93@gmail.com
19	Orissa Water Supply & Sewerage Board (OWSSB)	Mr Ratindra N Mallick	Project Director	ratindram@gmail.com
20		Ms. Suryabarti Majhi	DPE	smajhi17hud@gmail.com
21		Ms. Sangeeta Shaw	DPE	pdslscowssb@gmail.com
22		Mr. Basanta Prasad Dhakua	Project Engineer	pepmuseptagebbsr@gmail.com
23	ATI, Kolkata	Mr. Kaushik Ghosh	Assistant Professor	kaushik.gh@gmail.com

Sr.No	Organisation Name	Nominations	Designation	Email ID
24	IPE Global	Mr. Mithun S Anand	Manager	manand@ipeglobal.com
25		Ms. Sakshi Godara	Regional Planner	sgodara@ipeglobal.com
26		Mr. Nitish Kumar	WASH Consultant	planner.nitish@gmail.com
27		Mr. Sumit Kuliyal	Urban Planner	sumitkuliyal@gmail.com
28	NIUM, Hyderabad	Ms. Krati Gupta	Knowledge Manager	krati.g@nium.org.in
29		Ms. Jyoti Ahlawat	Knowledge Manager	jyoti.a@nium.org.in
30	MCRHRD, Hyderabad	Mr.B.Vijaykumarreddy		vijay2761@gmail.com
31		Mr. Rambabu		rambabuc@mcrhrdi.gov.in
32		Mr. M. L. Prasanna Kumar		mlprasannakumar@gmail.com
33		Mr. Subramanyam		ssmanyamstp2@gmail.com
34		Mr. Vidyasagar		segwmc@gmail.com
35		Mr. Krishnarao		Paruvelli.Krishnarao@gmail.com
36		Mr. T Om Prakash		omprakash.vasv27@gmail.com
37		Mr. P Vani		Vaniposu@gmail.com
38	AIILSG, Delhi	Mr. Sanket Thorat	Project Coordinator	sanket.thorat@aiilsg.org
39		Mr. Mohammed Harsh	Project Officer	mohammed.harsh@aiilsg.org
40	CDD Society	Ms. Debisha		debisha.s@cddindia.org
41		Mr. Anantha Moorthy		anantha.m@cddindia.org
42	CEPT, Ahmedabad	Ms. Jinal Chheda		jinal.chheda@cept.ac.in
43		Mr. Yash Barve		yash.barve@cept.ac.in
44		Ms. Nupur Soni		nupur.soni@cept.ac.in
45	WASHi	Mr. Pankaj Kumar	Sanitation & FSSM Specialist	pankajkumar@washinstitute.org
46	ASCI, Hyderabad	Mr. Prakash Katarapu		prakash@asci.org.in
47		Mr. Rajamohan Reddy		rajmohan@asci.org.in
48	Consultant	Ms. Ankita Gupta	Independent Consultant	ankitagupta137@gmail.com
49	ESF, Pune	Mr. Ajinkya Barmukh		ajinkya.barmukh@ecosanservices.org
50	NIUA_SCIAP	Ms. Tavishi Darbari	Research Associate	tdarbari@niua.org
51		Ms. Sonali Mehra	Research Associate	smehra@niua.org
52		Mr. Kaustubh Parihar	Project Associate	kparihar@niua.org
53		Mr. Gaurav Thapak	Research Associate	gthapak@niua.org
54	NIUA_SCBP	Ms. Umra Anees	Programme Officer	uanees@niua.org
55		Ms. Gauri Srivastava	Programme Officer	gsrivastava@niua.org
56		Ms. Laila Khongthaw	Programme Officer	lkhongthaw@niua.org
57		Mr. Parth V Kamath	Consultant	parthvk@outlook.com

Annexure 3

Detailed Session Wise Agenda

Date	Session & Description	Resource Person	Duration (Min.)
Tuesday, 15 September 2020	Welcome	Depinder Kapur	5
	Introduction to training and Ground rules	Sreevidya Satish	10
	Session 1a: Sustainable Sanitation and Water Management	Dhawal Patil	25
	Session 1b: Sanitation Systems	Saurabh Kale	20
	Video: East Kolkata Wetlands	Dhawal Patil	10
	Question and Answers	Dhawal Patil & Saurabh Kale	10
	Introduction to Classmarker	Akshay Agarwal	5
	Closing remarks: Exercise 1 and 2	Sreevidya Satish	5
Wednesday, 16 September 2020	Welcome	Sreevidya Satish	15
	Session 2a: Sanitation Technologies	Saurabh Kale	30
	Session 2b: Building Sanitation Systems	Dhawal Patil	30
	Video: Bhandewadi Sewage Treatment Plant		5
	Question and Answers	Dhawal Patil & Saurabh Kale	5
	Closing remarks: Exercise 3	Sreevidya Satish	5
Thursday, 17 September 2020	Welcome	Sreevidya Satish	15
	Session 3a: Liquid waste management	Saurabh Kale	30
	Session 3b: Aspects of Decentralized Wastewater Management	Dhawal Patil	30
	Videos: Arvind Eye Hospital		5
	Question and Answers	Dhawal Patil & Saurabh Kale	5
	Closing remarks: Exercise 4	Sreevidya Satish	5
Friday, 18 September 2020	Welcome	Sreevidya Satish	15
	Session 4: Decentralized Wastewater Management	Dhawal Patil	40
	Videos: Feynan Eco Lodge and NaWaTech	Dhawal Patil	15
	Question and Answers	Dhawal Patil & Saurabh Kale	5
	Mentimeter feedback on Wastewater Management session	Akshay Agarwal	10
	Closing remarks	Sreevidya Satish	5

Date	Session & Description	Resource Person	Duration (Min.)
Monday, 21 September 2020	Welcome	Sreevidya Satish	15
	Session 5: Understanding Faecal Sludge and Septage Management	Saurabh Kale	45
	Video: FSSM- Sinnar Maharashtra	Dhawal Patil	15
	Question and Answers	Dhawal Patil & Saurabh Kale	10
	Closing remarks: Exercise 5	Sreevidya Satish	5
Tuesday, 22 September 2020	Welcome	Sreevidya Satish	15
	Session 6a: Stakeholder Management	Saurabh Kale	30
	Session 6b: FSSM Planning	Dhawal Patil	30
	Video: FSSM- Bhubaneshwar, Odisha		5
	Question and Answers	Dhawal Patil & Saurabh Kale	5
	Closing remarks: Exercise 6	Sreevidya Satish	5
Wednesday, 23 September 2020	Welcome	Sreevidya Satish	10
	Session 7a: Faecal Sludge and Septage Treatment	Dhawal Patil	20
	Session 7b: Financial Aspects of FSSM	Saurabh Kale	20
	Session 7c: O&M cost of FSSM	Dhawal Patil	10
	Question and Answers	Dhawal Patil & Saurabh Kale	10
	Mentimeter feedback on FSSM session	Akshay Agarwal	10
	Closing remarks	Sreevidya Satish	5
Thursday, 24 September 2020	Welcome	Sreevidya Satish	10
	Session 8: Wastewater Treatment Principles and Technologies	Dhawal Patil	10
	Videos: Sewage Cure, MBBR, SBT		15
	Question and Answers	Dhawal Patil & Saurabh Kale	10
	Closing remarks	Sreevidya Satish	5
Friday, 25 September 2020	Welcome	Sreevidya Satish	10
	Question and Answers	Dhawal Patil & Saurabh Kale	20
	Session quiz assessment	Akshay Agarwal	10
	Final assessment		20
	Vote of thanks	Depinder Kapur	15
		Dayanand Panse	

National Institute of Urban Affairs
1st Floor, Core 4B, India Habitat Centre, Lodhi Road,
New Delhi - 110003. INDIA Tel: (91-11) 24643284 011- 24617517
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