CHALLENGES AND OPPORTUNITIES FOR A CLEANER PANCHAYAT

AN ASSESSMENT OF SOLID WASTE MANAGEMENT IN WANDOOR GRAM PANCHAYAT, SOUTH ANDAMAN, ANDAMAN & NICOBAR ISLANDS

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Executive Summary

With increasing waste generation due to changes in lifestyle and increasing tourist inflow, effective management of waste needs to be a priority for Andaman & Nicobar Islands (ANI). Unmanaged waste poses a threat to the health of the communities and ecosystems of the islands. The solid waste management system in place in ANI is still at a nascent stage and faces multiple challenges in both coverage and efficiency. Waste management was identified as an issue in coastal communities of ANI through a Health & Environment Needs Assessment conducted by Dakshin Foundation in 2019. Dakshin has been working to improve the health of ecosystems and wellbeing of the community in Wandoor Gram Panchayat and Junglighat since 2019.

In 2022, Dakshin with the support of PricewaterhouseCoopers (PwC) India Foundation initiated a project to streamline the waste management system in Wandoor Panchayat by identifying gaps, strategizing actions and supporting the GP for critical resources and infrastructure required to expand its coverage and efficiency. To plan necessary interventions which are fine-tuned to the needs on ground, it was imperative to build an in-depth understanding of the system and the issues the system faced. Hence, an assessment was undertaken to understand the system through the perspective of all the major stakeholders involved, starting from the waste generators and users of the system to the administration.

This assessment shows that there are multiple issues clogging up the solid waste management system at Wandoor. Improper segregation of waste at the source, either households or commercial establishments, lead to decreased efficiency of the system to properly deal with the dry waste. While intensive secondary segregation takes up a lot of human resources, the Panchayat is further restrained by low user-fee collection and low revenue sources. This restricts its ability to increase coverage to further households. Lack of plan and funds for repair and maintenance of essential equipment for waste management has also been identified as a major issue. Being situated at the periphery of protected areas, waste management at tourist spots such as beaches need more coordination among various stakeholder departments. While Panchayat requires support in terms of infrastructure and human resources for efficiently expanding coverage which would subsequently lead to increased revenue generation, intensive public education through Information Education Communication (IEC) displays and awareness campaigns is required to build a shared understanding and internalising of proper waste management practices at an individual, household and community level. The learnings from the assessment guided the interventions by Dakshin to streamline the system.

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List of Abbreviations

AMC	-	Annual Maintenance Contract
ANET	-	Andaman & Nicobar Environment Team
ANI	-	Andaman & Nicobar Islands
ANM	-	Auxiliary Nurse Midwife
BDO	-	Block Development Office
CBO	-	Community Based Organization
COVID	-	Coronavirus Disease
CPCB	-	Central Pollution Control Board
DCF	-	Deputy Conservator of Forest
DRM	-	Daily Rate Mazdoor
EDC	-	Eco Development Committee
FWS	-	Fisheries Welfare Society
GP	-	Gram Panchayat
GPDP	-	Gram Panchayat Development Programme
HH	-	Households
IEC	-	Information, Education & Communication
IP&T	-	Information, Publicity & Tourism
IV	-	Intravenous
LBS	-	Lohabarrack Sanctuary
LED	-	Light Emitting Diode
MoDWS	-	Ministry of Drinking Water and Sanitation
MRF	-	Material Recovery Facility
MGMNP	-	Mahatma Gandhi Marine National Park
NGO	-	Non-Governmental Organisation
OSR	-	Own Source Revenue
PET	-	Polyethylene Terephthalate
PHC	-	Primary Health Centre
RD	-	Rural Development
SBM	-	Swachh Bharat Mission
SDG	-	Sustainable Development Goals
SHG	-	Self Help Group
SWM	-	Solid Waste Management
TSC	-	Total Sanitation Campaign
ULB	-	Urban Local Body

1. Introduction: The Growing Problem with Waste

With an exponentially growing population and rapidly changing lifestyles, waste generation is also exponentially increasing. The world generated approximately 2.24 billion tonnes of solid waste in the year 2020, which is expected to rise by 73% to 3.88 billion tonnes by 2050 (Kaza et al, 2018). This increase is far higher than the projected population growth over the same period. South Asian countries are expected to see a 100% increase in their annual waste generation by 2050. Less than 20% of the global waste gets recycled, and this is even lower for developing countries (Kaza et al, 2018).

Improper management of solid waste has an extensive and long-term impact on the environment and ecosystem. Burning of waste releases toxic gases leading to an increase in air pollution. Landfills with heavy metals, chemicals, and solvents can also leach out to the ground water table. A significant amount of solid waste finds its way out to the oceans where it threatens fragile marine and coastal ecosystems. Environment pollution also leads to disease transmission through breeding of vectors and respiratory problems. Oceanic pollution can result in pollutants like microplastics, heavy metals, and other contaminants finding their way back into the human food chain directly impacting human health (Ferronato and Torretta, 2019; Roy et al 2018).

Though poor waste management affects everyone in the world, it has far reaching and immediate consequences for many vulnerable sections of society. This includes people whose habitations and work environment are put in hazardous conditions increasing their exposure to pollutants and also communities whose livelihoods depend on fragile ecosystems being threatened by waste and pollution (Gutberlet and Uddin, 2018).

While waste management has been a priority of nations across the world, problems like unplanned development with low priority to waste management systems, inadequate funding and infrastructure for waste management, and lack of public awareness and legislative enforcement have been significantly hindering meaningful action on the ground (Spoann et al, 2018; Sinthumule and Mkumbuzi, 2019; Godfrey et al, 2019).

1.1 Waste Management in India

As per a planning commission report in 2014, India was generating 62 million tonnes of waste annually, which was projected to reach about 150 million tonnes by 2030. (PIB, 2020). Sanitation and waste management has been a focus of the Government of India, right from the 1st Five Year Plan, though the initial focus has been on improving access to sanitation and reducing open defecation in both urban and rural areas. The first formal sanitation programme was launched in 1954. Some significant legislations dealing with waste management in India include the Water (Prevention and Control of Pollution) Act, 1974 (which led to the establishment of the Central Pollution Control Board), the Air (Prevention and Control of Pollution) Act, 1981, the Environment Protection Act, 1986, The Hazardous Wastes

(Management and Handling) Rules, 1989, the Bio-medical Waste (Management and Handling) Rules, 1998, and the Municipal Solid Wastes (Management and. Handling) Rules, 2000. The Government of India launched the Total Sanitation Campaign (TSC) in 1999, initially focusing on access to sanitation. However, solid and liquid waste management was formally included in the TSC guidelines in 2006 (Ghosh, 2016).

In 2014, Government of India launched the Swachh Bharat Abhiyan (SBM) aimed at universal sanitation cover and solid waste management. The Mission has two sub-components, SBM Urban and SBM Gramin/Rural. The implementation of SBM Gramin is carried out by Panchayati Raj Institutions, which have a significant role according to the Constitution 73rd Amendment Act of 1992 which includes sanitation in the 11th schedule (Mohan, 2017).

The Solid Waste Management rules were amended in 2016 to include rural areas and mandates waste segregation at source into three categories: wet, dry, and hazardous. It directs for collection of user-fees, penalties for non-segregation and littering, and guidelines for the storage and disposal of different types of waste.

The Swachh Bharat Mission (Grameen) Phase-II has been sanctioned for an outlay of Rs. 140881 crores in February 2020 to be implemented from 2020-21 to 2024-25 with a central focus to ensure that effective Solid and Liquid Waste Management systems to be instituted in every Gram Panchayat of the country (MoDWS, 2018).

1.2 Challenges of Waste Management in Rural India

Studies showed that waste composition in rural areas, consisting of wet waste, recyclable waste, and non-recyclable waste, is different from that of urban waste due to the differences caused by lifestyle, income variation, and resource availability (Wang et al, 2018, Patwa et. al 2020). Even though people living in rural areas of lower middle-income countries generate less waste than any other place, there is a lot of plastic waste being generated. This is because cheap plastic packaging materials are accessible to rural communities and even to remote villages (Gómez-Sanabria, 2022; Jambeck et al, 2017).

The issue of plastic pollution affects a broad range of rural habitats, such as coastal and island communities, and poses a threat to both land and sea ecosystems. Many Asian countries lack the necessary infrastructure and ability to track the flow of plastic waste in rural communities (Mihai et al, 2021). The trend of annual rural plastic waste generation per capita is increasing in other countries such as Malaysia and China at a rate of 2% and 8–10%, respectively (Latifah and Yiing, 2014; Pan et al, 2017).

Rural areas with weak waste management services commonly see poor waste disposal practices such as dumping in floodplains, riverbeds, coasts and other commons. Even rural communities with waste collection programs can experience illegal dumping due to poor collection frequency

and enforcement, inadequate infrastructure, and sanitation fees. In some cases, there is plastic waste collection happening but due to no processing facilities it leads to open burning or dumping (Mihai and Grozavu, 2019). Many villages across India are struggling with waste management due to issues with infrastructure and human resources and a lack of awareness among the population (Pandey, 2022).

Despite glass being highly recyclable, littering of glass waste is an emerging problem across the country in both urban and rural landscapes. This problem is amplified in regions popular with tourists, which may also be ecologically sensitive areas. This is evident from the experience of Goa where glass waste (consisting mostly of alcohol bottles) makes up to 33 percent of the beach litter by weight. This problem escalates during peak tourist seasons. There is waste collection and segregation at places across Goa, however very little of the glass waste gets collected and most of it is littered across popular tourist spots. According to an article by Mongabay India in the month of January 2020, the waste treatment plant in North Goa received only 250 KGs of glass debris from across 27 Gram Panchayats, as opposed to 11,000 kgs of plastic waste, highlighting a gap in the collection and recycling system of glass bottles (D'Mello and Sekar, 2021). Similar examples of glass bottle littering at popular tourist sites are reported from across the country. These bottles and broken glass pieces not only pose a hazard to people, but also to the wildlife living around these tourist spots (Chatterjee, 2017; Ananth, 2016).

Menstrual waste management has emerged as a challenge, especially in rural India. It is estimated that more than 12.3 billion sanitary pads are used in India every year (Malviya, 2019). Only 36% of menstruating women use sanitary pads in India but through extensive menstrual education, use of safer menstrual hygiene products including sanitary pads also is increasing. (Muralidharan, 2018). But this increases the problem of unsafe disposal of sanitary pads. Swachh Bharat guidelines state that sanitary pads should be segregated from other solid waste before disposal and then it should be incinerated. However, due to taboos and stigmas attached to menstruation, segregation and handing over to waste collectors are avoided by women who prefer either burning, burying or dumping it in the open. A significant portion of sanitary waste ends up in landfills (MoDWS, 2018; van Eijk, 2016; Gupta, 2022).

1.3 Waste Management in Andaman & Nicobar Islands

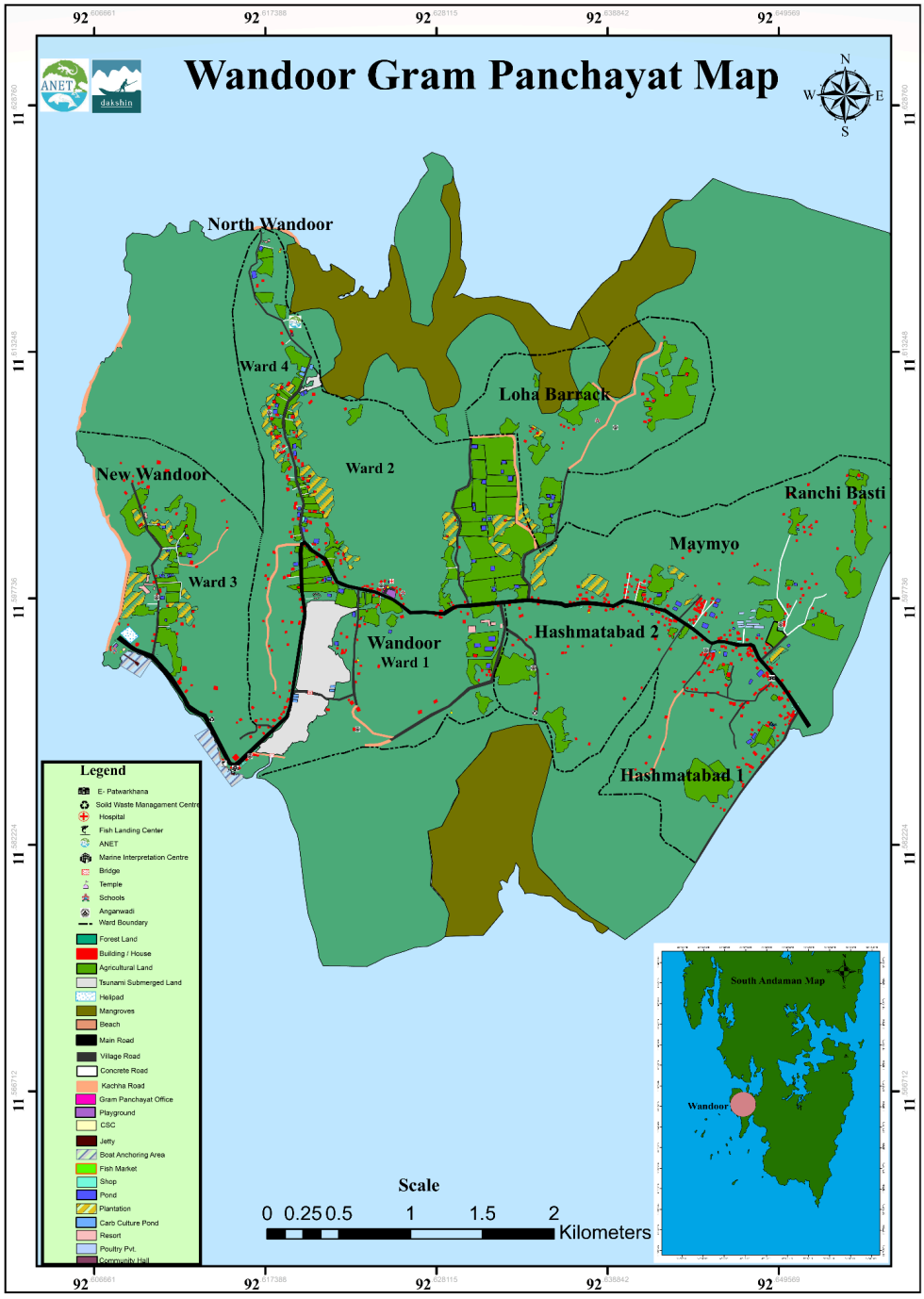
Tropical islands like Andaman and Nicobar Islands are home to complex and fragile ecosystems ranging from coral reefs, to beaches, mangrove creeks and tropical forests. Besides being an ideal destination for thousands of tourists every year, the local fishing communities are also dependent upon the health of the coral reefs and creeks for their livelihoods. The increasing waste generation, both by local practices and tourist footfall threatens the coastal and marine ecosystems and the health of the community. The geographical isolation of these islands presents unique challenges to waste management, as limited land availability complicates local processing efforts, necessitating the transportation of waste to the mainland for further treatment. Highly tourism-dependent areas generate more waste due to improper disposal by tourists and hotels,

leading to development of waste hotspots and landfills. Furthermore, mismanaged waste and littering at tourist destinations can reduce the tourism appeal of these destinations, negatively impacting those who depend on tourism and allied activities for their livelihoods. Insights from Swaraj Dweep, formerly known as Havelock Island, one of the most popular tourist destinations in Andaman shed light on how waste management is becoming one of the biggest challenges for these popular islands. Lack of staff for waste collection and disposal, open burning of waste, littering by locals and tourists and low levels of enforcement and penalties, have led to the development of landfills and pollution of the coasts, creeks, reefs and forests. The situation is further exacerbated by the arrival of garbage from other Southeast Asian countries brought in by current and wave action (Sharma, Bijoor and Ramesh, 2019). These problems have been reported from across tropical islands such as Bali and Gilli Trawangan (Indonesia), Langkawi (Malaysia), and Galapagos (Ecuador) which also face growing waste generation from local and tourism activities. Investment in critical infrastructure and human resources for waste management, improving local technology for on-site processing and recycling, continuous campaign and public education, stricter enforcement and penalties, and a circular economy of waste management are some of the steps that can help islands manage their waste more sustainably (Widyarsana and Agustina, 2020; Willmott and Graci, 2012; Nadi et al, 2011; Castillo and Hardter, 2014).

In the Andaman & Nicobar Islands, there are 70 Gram Panchayats and one Municipal council. In 2020-2021, the islands generated approximately 89 tonnes of waste per day, out of which 82 tons were collected and treated while 7 tons were landfilled (CPCB, 2020-21). House-to-house collection of solid waste in rural areas of Andaman & Nicobar Island (ANI) covers up to 50% of the total households, with 90% of the waste segregated at the source. There is an old landfill site at Brookshabad, Port Blair which is undergoing the process of bio-mining by the Port Blair Municipal Corporation. The Gram Panchayats have also identified 17 dumping sites containing legacy waste, 7 of which have been cleared. Despite the considerable progress in waste management in ANI, there are still numerous ground level gaps that make it difficult for local bodies to manage the increasing waste, especially from tourist inflow (CPCB, 2020-21; Sharma et al, 2019).

The Andaman & Nicobar Islands Rural Areas Solid Waste Handling and Management Bye-Laws were notified by the Directorate of Rural Development and Panchayati Raj Institutions in 2019. Gram Panchayats are the implementing agencies for solid waste management in the Union Territory. The 70 Gram Panchayats have been clubbed under 26 SWM clusters. Panchayats are empowered to collect user fees and impose on-spot penalties for violators (Andaman and Nicobar Administration Secretariat, 2019). While the decentralisation of the waste management system has led to significant improvements on the ground, rural local bodies continue to face several challenges. Improving the cost effectiveness of the overall waste management system is essential for long-term sustainability and to empower rural local bodies to independently manage and process their waste (Jain, 2021).

1.4 A Profile of Wandoor Gram Panchayat



Map 1: Map of Wandoor Gram Panchayat

Wandoor Gram Panchayat (GP) is located in the west of South Andaman District, under the Ferrargunj Tehsil. Wandoor Gram Panchayat consists of five villages: Wandoor, Hasmatabad, Lohabarrack, Mamyo and Ranchi Basti, and is divided into 8 separate wards. The GP is situated close to the Mahatma Gandhi Marine National Park (MGMNP) and the Lohabarrack Crocodile Sanctuary (LBS). As per the Antyodaya survey 2020, Wandoor GP consists of 856 households (HHs) with a population of 3232. It has a total area of 217.84 hectares. Wandoor GP is home to

different communities that settled here over the last seven decades but the majority of the population is Bengali. In 1949, the government settled Bengali refugees from East Bengal in Wandoor. This settlement was followed by migration of other Bengalis, Ranchi people, Tamilians and Telugus in the subsequent decades. People within Wandoor are primarily engaged in the livelihoods of fishing, tourism and agriculture.

There are various community institutions that exist within the Wandoor alongside the Gram Panchayat. These are the Youth Clubs, Self Help Groups (SHG), and a Fisheries Welfare Society (FWS) which was non-functional. The Youth Clubs are involved in assisting the organising of sports and cultural events. The SHGs are functional but none of them have taken up any group entrepreneurial activities.

Until the Tsunami of 2004, agriculture was predominantly practised in Wandoor, alongside fishing. Fishing practices in Wandoor have transformed over the years, based on market demands.

1.5 Need for the Assessment on Solid Waste Management (SWM) in Wandoor

An assessment of the environmental issues and health needs of fisher communities was conducted by Dakshin in South Andaman in 2020, which helped in identifying some key issues in the community (Mondal, 2020). Among many other problems, waste management at Wandoor emerged as a significant issue. Improper disposal of waste leads to it being either burned or dumped in creeks. Despite the initiation of a solid waste management system in Wandoor, it is still struggling to manage the waste generated in the area. The Wandoor Panchayat had requested assistance from Dakshin Foundation in implementing SWM in Wandoor.

Dakshin is working on streamlining SWM in Wandoor as a part of the SeaChange initiative. Dakshin's SeaChange initiative aims to secure healthy ecosystems and foster thriving fishing communities by improving ecological, social and economic outcomes for communities and ecosystems. This project on streamlining SWM in Wandoor has been funded by PricewaterhouseCoopers (PwC) India Foundation. The activities planned under this project are designed to engage with different stakeholders such as the Panchayat, forest department and hotels to work with them to streamline the solid waste management within the Panchayat and on the beaches. Details of the project components are mentioned in section 1.6.

To effectively optimise the SWM in Wandoor, there was a need to understand the SWM system and its functioning, identify various stakeholders and their roles, gather their perception of the system and develop an understanding of the different problems in the system. This assessment can guide us in planning our future engagement and fine-tuning our interventions with the Panchayat to work towards a more efficient waste management system. Understanding the drivers of user behaviour can help us develop better strategies to drive behavioural change of users within Wandoor Panchayat.

1.6 Components of the Solid Waste Management Project in Wandoor

The various components of the SWM project that is being undertaken by Dakshin Foundation are mentioned below:

1. Assessment of current status and challenges faced in the Wandoor area with regards to waste management.
2. Sensitising different stakeholder groups on the need to improve current waste management systems, including impacts on health and environment through awareness sessions.
3. Improving waste management systems on the beaches of Wandoor.
4. Improving the waste management within Wandoor Gram Panchayat.
5. Consulting the hotels & restaurants within Wandoor to prepare best practices guidelines.
6. Discussing & identifying opportunities for waste-based livelihood for SHGs of Wandoor.

2. Objective of the Assessment & Methodology

The objective of the assessment was to understand the current status and challenges of Solid Waste Management (SWM) in Wandoor with respect to different stakeholders. To carry out the assessment, mapping of stakeholders was undertaken and a questionnaire was created (Annexure 3). The identified stakeholder groups were:

a. Households (HH)
b. Commercial Establishments
c. SHGs
d. Youth Clubs
e. Sanitation workers
f. Gram Panchayat Office (GP)
g. Rural Development (RD) Department
h. Forest Department
i. Tourism Department
j. Health Sub-centre

2.1 Sampling method

The following sampling methods were used in selecting the respondents from different stakeholder groups:

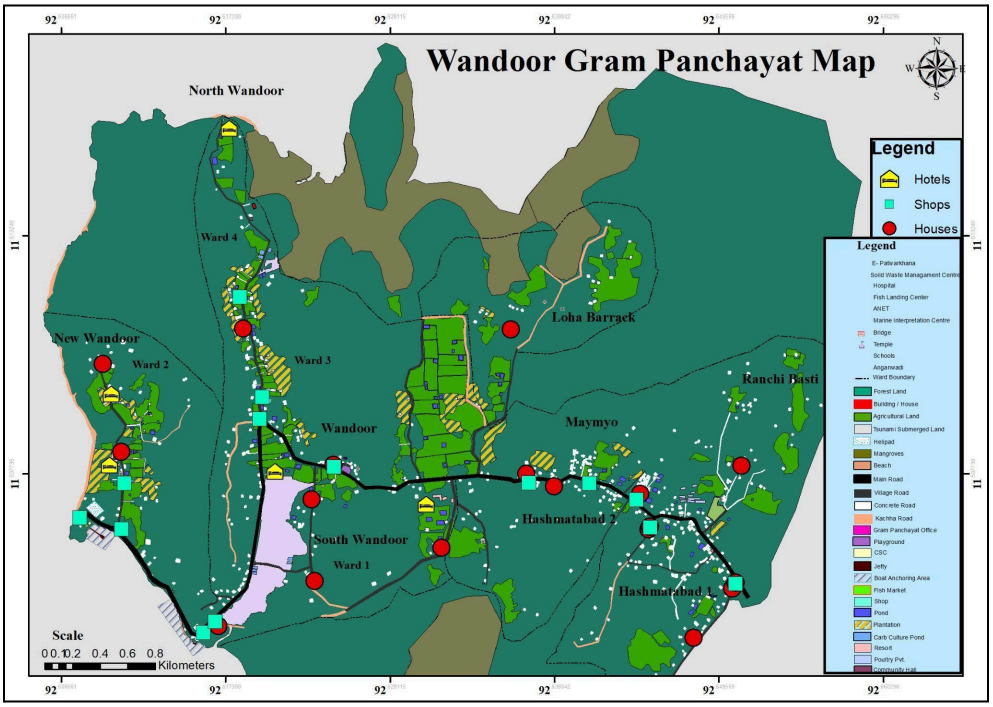
a. **Purposive sampling:** Households, Shops, Hotels.
   These respondents were selected ensuring that the sample was geographically representative across all wards of Wandoor. Both users and non-user households of the SWM system were interviewed to understand their perspective.
b. **Expert sampling:** Sanitation workers, Gram Panchayat officials, RD department officials, Forest Department Officials and Tourism Department Officials.

These respondents were selected based on their knowledge, relevance and degree of influence in the SWM system within Wandoor.

c. **Convenience sampling:** SHGs and Youth clubs of Wandoor.
These respondents were selected based on ease of access and availability of time for the groups.

2.2 Sample size

Number of Households: 16 HH across 8 Wards
Number of Shops: 14 shops across 8 wards
Number of Hotels: 5 hotels
Number of CBOs: Two (One SHG and one Youth Club)



Map 2: Map of Wandoor Panchayat showing the samples of HH, shops and hotels

A semi-structured interview guide was prepared for each stakeholder group and the interviews and discussions with all respondents were conducted between November 2022 to January 2023. For the SHGs, youth club and sanitation workers focused group discussions were conducted. Regular beach observations were done at both the New Wandoor Beach and North Wandoor beach during the same period to assess the tourist footfall and understand the waste generation pattern at the beaches. Secondary data on the SWM system at Wandoor on the amount of waste baled and sold from SWM centre and the user-fee collection data were also obtained from the GP. Based on the data collected, a thematic analysis was done which was used to develop an overview of the functioning of the SWM system in Wandoor. For each stakeholder group, the waste generation patterns, the relationship between the stakeholders and the SWM system and the key issues emerging from each was analysed, which have been discussed in the next section.

3. Results: An overview of the Solid Waste Management system in Wandoor

3.1 SWM cluster set-up under Gram Panchayat

Under the 73rd Amendment, the Gram Panchayat is the smallest unit of governance. Gram Panchayats are also tasked with the waste management within their jurisdictions as per the 11th schedule.
The initial operations of waste management within Wandoor consisted only of collecting waste from the beaches and handing it over to the SWM centre in Chouldhari. Prior to 2015, Wandoor used to be a revenue village under Humfrygunj Panchayat. In 2018, there was an initiative from the RD department to start solid waste management within the Panchayats. The RD had clubbed three to four panchayats together to form a SWM cluster which shared the processing infrastructure to process the dry and sanitary waste. Wandoor GP was allocated the SWM cluster centre which is shared by Guptapada and Humfrygunj GPs.

In December 2019, the construction of the SWM cluster centre at Wandoor began with a fund of Rs. 63 lakhs sourced from SBM - Gramin. The construction of the centre was completed in a year's time and an additional fund of Rs. 6 lakhs was provided under SBM - Gramin by RD Department to GP in order to support the initiation of solid waste collection within the cluster. In addition to these funds, the RD Department procured baling machines, incinerators & e-carts for all the SWM clusters within South Andman. There was also a temporary segregation shed at New Wandoor which was used till the segregation shed at the cluster centre was complete in March 2023.

Image 1 & 2: SWM cluster centre (Hashmatabad), Wandoor Gram Panchayat

Image 3: Old Segregation centre at (New Wandoor jetty) of Wandoor Gram Panchayat

Each panchayat employs sanitation staff who collect dry waste and hazardous wastes (excluding sanitary napkins and diapers). This waste is collected from the dustbins installed near the households and public areas or directly from the doors of the users i.e., households, shops and hotels. The sanitation staff try to screen the waste for wet waste and sanitary napkins and collect the rest of the waste in sacks. At the end of collecting waste, they transport these sacks to the SWM cluster centre where it is segregated based on the type of material, such as plastic, metal, paper, cardboard and so on. These segregated wastes are baled into cubes using the baling machine. Once a sufficient number of bales are accumulated, the sanitation supervisor asks the empanelled contractor to pick up the bales from the centre. These bales are weighed, listed and billed according to the rates finalised with the contractor.

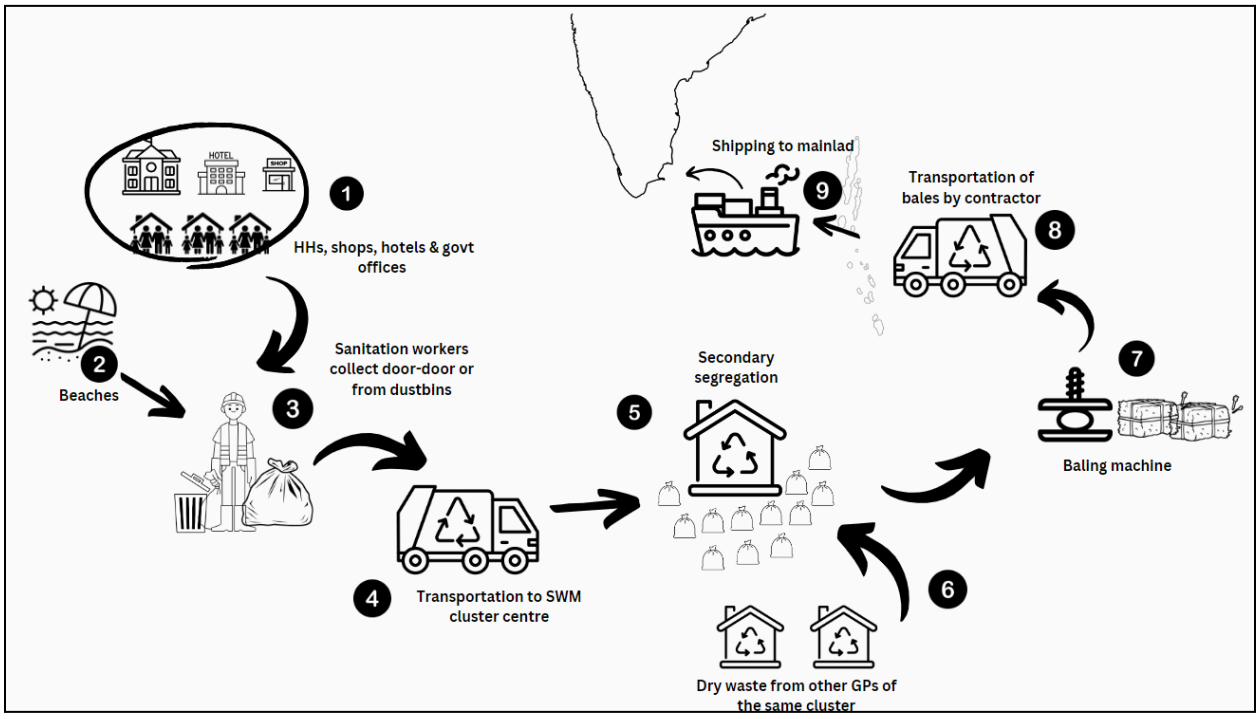


Figure 1: A representation of the SWM system in Wandoor

3.2 Sanitation workers under SWM system

At the time of the assessment, the Wandoor GP had 10 sanitation workers and collected dry waste from 220 HHs & 76 commercial establishments (this includes shops & hotels). Their responsibilities mainly include - collection, transportation, segregation, and baling of waste. Additionally, the staff is responsible for cleaning the beaches at Wandoor, removing animal carcasses, cleaning and housekeeping at Panchayat level meetings/events, the weekly village market and other miscellaneous duties as and when required. Guptapada and Humfrygunj GPs follow a similar set-up, employing their own staff for waste collection and segregation. These workers visit the SWM cluster centre at Wandoor to bale their segregated waste. Wandoor Panchayat has an understanding with the other Panchayats whereby Wandoor's sanitation staff manages the SWM cluster centre and assists the other Panchayats' staff in baling their waste. In return Wandoor will receive the proceeds from the sale of all processed waste at the centre.

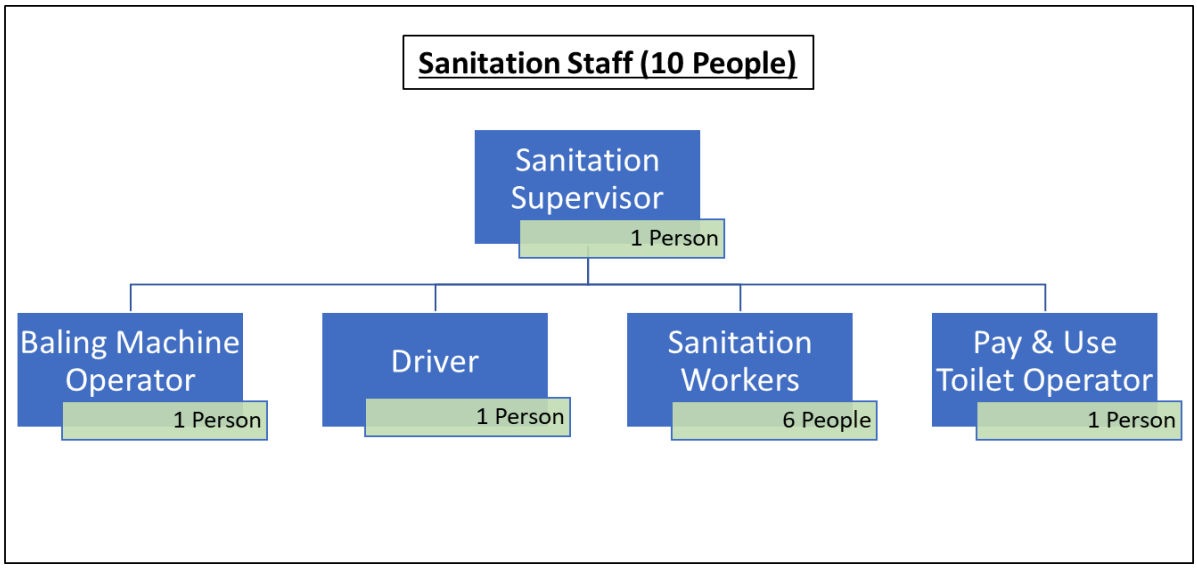


Figure 2: An organogram of the sanitation staff at Wandoor

Image 4: Sanitation workers using the e-cart to collect waste from users

3.3 User-fee collection

The RD department has provided a guideline to Gram Panchayats for setting user fees for households and commercial establishments. They have provided a differentiated user fee list for commercial establishments according to the type & scale of operations.
As of December 2022, the Wandoor GP

Sl. No.	Agencies	User charges per month (in Rs.)
1	House holds delivering segregate waste to the sanitary worker	50
2	Grocery & Small Shops	150
3	Departmental Shop & Big Shop	Minimum 300
4	Hotels (This does not include restaurant user fee)	
	a) Less than 500/- per day tariff	Minimum 500
	b) More than 500/- per day tariff	No.of Rooms*10*30
	c) Hotels with more than 500/ - per day rariff and those who serves complementary bottled water in rooms.	No.of Rooms*15*30
5	Restaurants	
	a) AC Restaurants	No. of seats*3*30
	b) Non-AC restaurants (That serves full meals)	No. of seats*2*30
6	Dive Shops	No. of employees/ DMs/ Instructors*5*30
7	Vegatables and meat shops	300
8	Private/ Government establishments	300
9	Goverment School & Colleges	150
10	Others (Commercials)	50 to 100
	a) street vendors	

Table 1: User-fee structure prescribed by the RD department

3.4 Waste Generation

As of December 2023, Panchayat collected waste from 220 households. The workers manage to collect waste from 50-60 HH in a day. In addition, they also collect waste from approximately 40 shops. All this waste was collected in sacks that weigh 7-8 kgs on an average, and were deposited at the segregation centre for further sorting of the waste. They collected 60-70 sacks of waste in a week from households, shops, hotels and beaches within Wandoor. According to our estimation, around 2.2 tonnes of waste was being generated in Wandoor every month.

However, as the cluster receives waste from Guptapada and Humfrygunj Panchayats also, the total waste processed by it is above 3.6 tonnes per month as estimated by the amount of waste sold by the Wandoor GP (detailed in next section). In addition to these, there are piles of unsegregated waste backlog and segregated glass waste in all the three Panchayats.

Sl. No.	Particulars	Weights (in Kgs)
1	Sacks per week	60 - 70 sacks

2	Weight per sack	7-8
3	Average weight per day	70 [= (65)*(7.5)/(7)]
4	Waste collected from the beach per week	35
5	Average waste per month	2240 [= (70*30) + (35*4)]

Table 2: Estimation of the waste generated within Wandoor as of November 2022

3.5 Sale of Waste by the Panchayat

The waste generated at the SWM cluster is segregated into various categories such as plastics, paper, tin, metals, glass etc. The segregated waste is baled into cubes and sold to the empanelled waste contractor i.e., CM Scrap Traders, which was finalised by the RD department for all the clusters within South Andaman.

Image 5: Baled waste stored at the SWM cluster centre

The table mentioned below (Table 3) contains details of the rate of each type of waste that was finalised by the RD department & CM Scrap company. In addition, it shows the breakdown of the dry waste for July 2022 and the average monthly proceeds from waste sold in 2022.

Sl.No.	Particulars	Approved Rates (Rs.)	Average waste sold monthly in 2022 (Kgs.)	Average monthly revenue for 2022 (Rs.)
1	Plastics	5.2	458.2	2382.6
2	Multi-layered Plastics	2.2	714.9	1572.8
3	Cardboard	2.6	457.2	1188.7
4	Tin	1.6	187.3	299.7
5	PET Bottle	5.2	50.2	261
6	Tetra Packs	2.2	192.6	423.7
7	Paper	2.6	909.5	2364.7
8	Clothes	1.2	240.1	288.1
9	Foot wear	1.2	95.5	114.6
10	Aluminium	56	53.6	3001.6
11	Glass	0.5	1013.8	506.9
Totals			3629.1	12404.5

Table 3: Dis-aggregated data of waste sold to the contractor

4. Identifying challenges and opportunities through multi-stakeholder assessment

4.1 Gram Panchayat

The key personnel engaged in waste management at the Panchayat Office include the Pradhan, Panchayat Secretary and a data entry operator. The Panchayat Office has designated a sanitation supervisor to oversee the daily activities related to waste management. The sanitation workers primarily work on collection and segregation of waste, assisted by a worker responsible for driving the vehicle and making the bales. The sanitation supervisor oversees their management and collection of user-fees.

Equipment procured for SWM within Wandoor:

The Panchayat and RD department have procured various equipment required for SWM over the last few years. In 2020, the RD department had procured an e-cart, a baling machine and an incinerator, required for waste collection and processing. Additionally, the Panchayat had procured dustbins, collection sacks, gloves and boots over the last two years. In 2020, the Panchayat procured some community & household dustbins, 10 pairs of rubber gloves and boots for the workers. In 2022, the Panchayat procured an additional 100 dustbins and a pack of use-and-throw gloves. For over a year, the Panchayat has not provided boots or gloves that are cut-resistant. Some of the sanitation workers have purchased rubber gloves and jackets on their own.

The incinerator procured by the RD department was claimed by the manufacturer to have a capacity of 8-10 pads per cycle and 80-100 pads per day. According to the sanitation workers, the incinerator could only process 3-4 pads per day and broke down shortly after installation. The RD department was informed, but the machine remains non-functional.

The baling machine was non-functional in September & October 2022 and had to be repaired. Due to a lack of trained professionals and response from the RD department, the Panchayat had to hire a lathe machine operator to fix the machine. While the baling machine became operational again, it did not apply the same pressure as before. This issue, coupled with frequent power cuts further restricts the output of the machine. The figure 3 below shows the condition of essential equipment and supplies for SWM in Wandoor.

Finances:

The sources of revenue for the Panchayat are matching grants from the RD Department, sale of waste and collection of user fees. In December 2022, the Panchayat also began operating a pay & use toilet at the New Wandoor beach to further increase their Own Source Revenue (OSR). The average OSR generated from collection of user fee, sale of waste and pay & use toilet respectively was Rs. 12777, Rs. 12404 and Rs. 13000/- per month during the assessment period.
Sanitation workers collect user fees from households, shops and hotels within Wandoor. Though there is a graduated fee structure for commercial establishments provided by the RD department, the Panchayat has a simplistic fee structure as explained in the table below (Table 4).

Type of User	Estimated No. of users covered as of November 2022	User fee
Households	220	50
Shops	60-65	150
Dhabas/small hotels	3	300
Hotels	5	500

Table 4: Type of users, their numbers and corresponding user fees

The Panchayat gets proceeds from sale of its dry waste to CM Scrap, an empanelled waste contractor with whom the RD department has signed a contract for the sale of different types of dry waste at a predetermined approved rate. This contractor buys the waste from the Panchayat and transports it to the mainland.

Sl. No.	Particulars	Approved rates (Rs.)	July (Kgs)	August (Kgs)	September (Kgs)	October (Kgs)	November (Kgs)	December (Kgs)	Average waste sold monthly in 2022 (Kgs.)	Average monthly revenue (Rs.)
1	Plastics	5.2	826	178	-	-	426	450	458.2	2382.6
2	Multi-layered Plastics	2.2	674	780	-	-	433	757	714.9	1572.8
3	Paper/ Cardboard	2.6	197	326	-	-	305	100	457.2	1188.7
4	Tin	1.6	231	54	-	-	325	241	187.3	299.7
5	PET Bottle	5.2	74	0	-	-	116	29	50.2	261.0
6	Tetra Packs	2.2	181	56	-	-	194	226	192.6	423.7
7	Paper	2.6	973	778	-	-	1067	773	909.5	2364.7
8	Clothes	1.2	477	0	-	-	0	69	240.1	288.1
9	Foot wear	1.2	366	0	-	-	0	0	95.5	114.6
10	Aluminium	56	102	0	-	-	69	45	53.6	3001.6
11	Glass	0.5	0	4488	-	-	0	0	1013.8	506.9
Totals			4101	6660	0	0	2935	2690	3629.1	12404.5

Table 5: Dis-aggregated data of the waste sold to the contractor from July 2022 till December 2022

The RD department provides a matching grant based on the overall Own Source Revenue (OSR) that the Panchayat collects. The quantum of grant provided is up-to three times that of the OSR collected by the Panchayat and the Panchayat relies on it to manage its expenses. Thus, increasing OSR through the SWM system is a priority for the Panchayat.

The Gram Panchayat has taken up “Clean and Green Panchayat” as a focus localised SDG theme and wishes to gradually expand its coverage to all households and establishments within its jurisdiction. The Panchayat had also purchased additional 100 dustbins of 120 L to increase its collection efficiency and coverage. However, these expansion goals are challenged by multiple constraints on the Panchayat.

Issues Identified:

1. **Lack of funds:** The panchayat is dependent on the OSR it generates from SWM and the matching grant it receives from the RD department for the majority of its finances. The issues in funding arises for the following reasons:
    a. **Insufficient user-fee collection:** Only about 52.9% of the total covered households regularly pay the user-fee. To address this, the Panchayat plans to link provision of other services like water & electricity to non-payment of SWM user fee.
    b. **Insufficient coverage of households:** Expanding the coverage of households under the SWM system will help generate more user-fee. However, the Panchayat is unable to do so due to shortage of workforce.
    c. **Reduction in matching grants:** there is also a reduction in the amount of grants received by the Panchayat based on the percentage of unutilised funds from the previous years.

2. **Position of dustbins:** The current weekly collection schedule has led to certain dustbins, especially those at the junctions, filling up rapidly. Moreover, some of the dustbins are not placed in accessible locations, resulting in littering at the junctions.
3. **Backlog of unsegregated waste:** The baling machine does not function efficiently, which, coupled with the shortage in workforce, has resulted in a piling up of unsegregated waste at the segregation centre. The baling process is unable to keep up with the collection pace.
4. **Segregation at household level:** Due to improper segregation at the household level, sanitation workers spend a significant amount of time carefully separating the wet and hazardous waste from dry waste. This hinders their ability to expand their collection reach.
5. **Sanitary Waste:** As the incinerator is non-functional, the Panchayat is not collecting sanitary pads and diapers from the households. Furthermore, even in the event of collection of sanitary waste, it will be a struggle to convince households to separate their sanitary pads from the dry waste, as some households conceal their sanitary pads within their dry waste.
6. **Maintenance and repair of equipment:** There is a lack of support for maintenance and repair of equipment like incinerators and baling machines. The Panchayat does not have guidelines or warranty documents for the machines. The fluctuating voltage levels also have negative effects on the machines.

4.2 Sanitation workers

The sanitation workers are responsible for collecting dry waste from all households and commercial establishments, cleaning the beach and segregating and baling the waste. Besides this, they are also tasked with other activities related to cleanliness of the village.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
First Half	Beach waste collection & cleaning	Collection	Collection	Collection	Collection	Beach waste collection & cleaning	Holiday
Second Half	Cleaning & Segregation	Segregation	Segregation	Segregation	Segregation	Cleaning & Segregation	Holiday
	Baling continuously occurs on all working days						

Table 6: Weekly schedule of the sanitation workers

Their days are spaced out in such a way that they spend 4 days in collection, segregation, and transport of waste from HHs, shops and hotels. During the week, workers collect waste from households once a week and from hotels twice a week. On the days of collection, they collect waste from 50-60 households between 7 AM to 1 PM and begin segregation from 1:30 PM. On Monday & Saturday, some workers are assigned to collect waste from the beaches & clean the surrounding areas. The others continue to segregate and bale the collected waste. Bailing of the segregated waste occurs daily, based on the functioning of the machine.

These workers are employed on a 6-month contract and paid monthly at a prescribed daily wage rate (Rs. 529/- in April 2023). The sanitation workers are the interface of the government and citizens and are responsible for the daily operation of the solid waste management system. Given their central role, issues emanating out of other stakeholder groups directly affect their functioning. Conversely, unresolved issues at the sanitation staff level can lead to various challenges across all stakeholder levels.

The issues faced by sanitation workers are listed below. Point 1 to point 4 are issues which arise during their work with the users & citizens while the remaining points are due to issues in planning, funding and prioritisation by the administration.

1. **Dealing with mixed waste** - some users dispose of hazardous and wet waste along with dry waste. These issues are exacerbated when large events or marriages are conducted within the Panchayat where people dispose of single-use plates along with leftover food. The sanitation workers have found razors, batteries, syringes, sharp objects and sanitary napkins while segregating the dry waste.
2. **Ineffective warnings on segregation** - Despite warnings from sanitation workers when encountering improper waste segregation, such as sanitary napkins or wet waste mixed with dry waste, there are repeated violations. The sanitation supervisor has noted several instances of repeated non-compliance.
3. **Non-payment of user fees** - The sanitation supervisor has said that convincing people to pay user fees is an uphill task. Most non-paying households are concentrated in specific regions. The user fee collection data obtained for 8 months of 2022 (Annexure 2) corroborates his experiences on field. The average household user fee collection for 8 months of 2022 stood at 52.9% of the households which were covered.
4. **Collection of waste at North Wandoor beach** - the sanitation workers did not collect waste from North Wandoor beach due to unresolved conflict between some community members and the administration.
5. **Lack of safety equipment:** The Panchayat faces challenges in providing appropriate safety gear for sanitation staff. Essential items such as cut-resistant gloves, boots, goggles, and masks are lacking. As a result, workers handling mixed waste are at increased risk, highlighting the need for better-equipped safety measures.
6. **Accumulation of waste in the segregation shed:** There is a noticeable backlog of waste in the segregation shed, including e-waste stored in one corner and numerous sacks of glass bottles. The empanelled waste contractor hasn't purchased glass waste since a few months leading to significant accumulation. This situation poses a serious health hazard to the workers and the public near the shed.
7. **Assignment of tasks beyond the scope of SWM**: the sanitation workers are often engaged in tasks beyond their primary duty, including clearing carcasses, operating the pay & use toilet, assisting in the organisation of events at the community halls and clearing out clogged gutters.

8. **Lack of adequate number of workforce:** The current workforce is insufficient to ensure timely collection and segregation of waste, especially considering their additional responsibilities. This shortage is evident from the backlog of unsegregated waste. As the Panchayat expands its coverage, the need for a larger workforce will become critical to maintain effective waste management.


Image 6 & 7: Sanitation workers segregating waste at the Wandoor waste segregation centre

4.3 Households

Semi-structured interviews with 16 households across 8 wards in Wandoor revealed that household waste primarily consists of plastic, paper, glass, metal, clothes, sanitary waste, and other wet wastes, in decreasing order of weight. Plastics, glass, and paper constitute the majority of the waste by weight. Plastic waste includes single-use covers, sachets, and bottles, while paper waste comprises cartons, cardboards, and papers. Most glass waste originates from alcohol, oil, and other bottles.

Image 8: Data collection at household level for baseline assessment of Wandoor Solid Waste Management

Eleven households reported waste collection by the sanitation workers and the remaining either dumped their waste on unused public land near their houses or burnt it. One of the households from where sanitation workers were collecting the waste also reported that they burnt some of their dry waste. Only one household reported composting wet waste, while another feeds it to their livestock. Rest of the households disposed of it in the surrounding area. A suggestion was made by a household for the Panchayat to also collect wet waste. Households not yet covered by the collection system expressed a desire for inclusion under the system to better manage their waste.

Image 9 & 10: Waste dumped near some households in Maymyo

At Maymyo, one of the respondents reported disposing of their waste on an open patch of public land used by around 10 households in the area, as waste collection by the Panchayat had not yet commenced during the assessment period. However, a respondent mentioned that they do not segregate dry and hazardous wastes, indicating that segregation might be a challenge when collection starts, as sanitation workers typically do not accept mixed wastes.

Out of the 11 households where collection was taking place, eight stated that they segregated their wastes into dry and wet waste before handing the dry waste over to the sanitation workers. Of these eight households, only two households clearly stated that they further segregated out the hazardous wastes such as sanitary pads and diapers.

Most households reported that their waste is collected once a week. The sanitation workers visit the households to collect waste directly from them or from the dustbins provided by the GP. During the interviews, seven of the households reported the absence of dustbins in their locality and expressed that having community dustbins nearby would facilitate easier waste disposal. One of the households mentioned that there were “No dustbins here, need dustbins here. If we keep bags out, dogs come out and eat it”. Recently, the Panchayat has expanded collection in previously unserved areas and has installed dustbins covering areas where some of the respondents reside.

Half of the households indicated awareness of the negative impacts of improper waste disposal, citing health, hygiene, and unpleasant odours as major concerns. All households with waste collection services have to pay a monthly user fee of 50 rupees, except the houses on the fringes of Wandoor and Humfrygunj who were served by the workers of Humfrygunj and have not been asked for a user fee. One respondent felt that despite generating minimal waste, they were paying the full user fee, while other households generating more waste did not pay any fee and instead burnt their waste in their yards. Two respondents mentioned that they had been warned by the Panchayat about potential disconnection of their electricity and water supply if the user fee was not paid. Another respondent questioned the necessity of the user fee, noting that the Panchayat receives funds for solid waste management from the Rural Development department

Issues identified:

1. The SWM system at Wandoor is yet to expand to many areas of the Panchayat. As a result, most households lack proper means to manage their dry waste.
2. Improper segregation of waste at household level and lack of awareness on why segregation is necessary causes issues during waste collection. This challenge is expected to grow as collection expands to more households.
3. The unavailability of properly sized community dustbins has been identified as another issue leading to improper waste management and littering.
4. Due to the frequency of waste collection (at the moment weekly), some dustbins become overfilled resulting in littering around them.

4.4 Shops

Fourteen shops were interviewed in 7 wards of Wandoor Gram Panchayat. The most common type of dry waste generated by the shops are plastic and paper. More than half the shops also generate wet waste like chicken waste, tea leaves, leftover food etc. The average weight of dry waste generated is nearly 4 kgs per week. In addition, some shops also generate outliers in the waste stream, such as razors, hair & e-waste. The Panchayat collects dry waste from approximately 50 shops out of a total of 65 shops across the 8 wards. The user fee for shops is Rs. 150 per month and most shops have their waste collected on a weekly basis.

Some shops have been provided with shared dustbins. There are common dustbins of different sizes for the shops that are located at the beaches and for the shops at the junctions along the main road. However, despite these provisions , there is a significant amount of waste littered around the shops and in the drains, mostly discarded by the customers. The used razors at the barber shop are sometimes disposed of along with dry waste. While some e-waste is sold to scrap dealers, a considerable amount of e-waste and appliances can be found littered along the roads.

Shops that aren't yet connected to the waste collection network feel that the process is taking too long to reach their area. Many shops that also sell tea, snacks, chicken etc express a need for wet waste collection services. Some shop owners also face challenges with segregation of the waste, particularly with plastic bags used for meat or other edibles. Occasionally expired unopened packaged edibles are disposed of with dry waste. One respondent who sells coconuts at the New Wandoor beach noted that in areas where the jurisdiction of Panchayat and Forest Department is blurred, there is often confusion regarding responsibility for waste collection. .

Issues identified:

1. There is a need to plan the quantity of dustbins according to the frequency of collection. The 120 L dustbins are insufficient at junctions where there are multiple shops. When these dustbins fill up, the shop owners are unable to ensure proper waste disposal.
2. Some shopkeepers don't have clarity on segregation.
3. There is a lack of accountability among businesses, shopkeepers and customers to keep their immediate surroundings free of litter.
4. On an average, only 60% of the due user-fees from the commercial establishments covered by the SWM system is collected every month.
5. Mismanagement of waste occurs in the fringe areas where the jurisdictions of Panchayat and the Forest Department meet, such as near the beaches.

4.5 Hotels

Interviews were done with all the 5 hotels operating within Wandoor. Of these, 4 hotels rent out their rooms for tourists, while another is planning to build and start renting out cottages in the future. Three of these hotels also have regular visitors to their bars. Notably, three of these establishments are located next to the beachfront.

Hotel Number	Type of Establishment	No. of Rooms	Max. No. of Occupants	Estimated waste collected per week
H1	Hotel/Restaurant/Bar	40	100	300 bottles & 75 Kgs
H2	Hotel/Restaurant/Bar	23	65	30 bottles & 37.5 Kgs
H3	Hotel*/Bar/Restaurant	25*	60*	300 bottles & 15 bottles
H4	Hotel/Bar	5	15	220 bottles & 15 Kgs
H5***	Hotel/Game Fishing	4	12	NA**

Table 7: Details of hotels within Wandoor and the estimated waste collected per week.
* Denotes that the Hotel rooms for H3 are under construction and will be operational by the next tourist season
** There is no estimate of waste collected as they do not give their waste to the sanitation workers.
***H5 should be considered as a residence that occasionally receives guests.

All the hotels have separate dustbins for wet & dry waste. The hotels with bars store the empty glass bottles and tin cans separately. Except for H5, all the hotels mentioned that they give away their segregated waste to the sanitation workers, who collect it twice a week. These hotels are paying Rs. 500/- month to the Panchayat for the waste collection.

Two hotels, H1 & H4, mentioned generating a significant amount of wet waste and are looking for solutions and suggestions for proper management of the same. These two hotels have taken proactive steps to be more environmentally conscious, such as installing a key card system to conserve electricity, setting up sewage treatment plants for water reuse, creating ponds for rainwater harvesting, using wet waste to feed livestock, and using glass bottles as a coarse aggregate in constructions. Most hotels have shown interest in improving waste management within their premises and surrounding area. However, despite these efforts, littering persists on the beach near the beachfront hotels.

Issues identified:

1. Despite the hotels' interests and the Panchayat's efforts, some waste is still not properly managed, especially near the beach.
2. Hotels generating significant amounts of wet waste are unable to properly dispose of or compost it, especially during peak tourist seasons when the volume of waste spikes.
3. High volumes of glass bottles are generated from hotel bars/restaurants.
4. The hotels have common dustbins for all types of waste both in rooms and common areas. Hotel H4 mentioned receiving mixed waste from the rooms.

4.6 Health Sub centre

The nearest Public Health Centre (PHC) is located at Manglutan, approximately 5 km from Wandoor Panchayat. There is a health sub-centre at Wandoor, which generates both dry and hazardous wastes. The dry waste consists of cardboard boxes, papers, plastic bottles etc. The hazardous waste or medical waste includes medicine, medicine packaging material, used injections, cotton gauze etc. On average, 2 kgs of dry waste and half a kilo of hazardous medical waste is generated at the sub-centre per week. The sanitation staff of the Panchayat do not collect medical waste from the sub-centre due to the lack of a mechanism to deal with medical waste. The medical waste is required to be collected separately and sent to Manglutan PHC for safe disposal. However, the PHC only collects used injections from the sub-centre. The other medical waste such as IV bottles, medicine strips/containers, cotton and gloves are not collected by the PHC. As a result, the medical & dry waste generated at the sub-centre is either burnt or landfilled.

Issues identified:

1. The dry waste generated by the sub-centre is not being collected by the sanitation staff due to the occasional mixing of dry and hazardous waste and there being no mechanism to deal with the hazardous waste at a Panchayat level.
2. There is no mechanism for disposing of hazardous medical waste, both at the sub-centre at Wandoor and the PHC at Manglutan.

4.7 Community based organisations

Two focused group discussions were conducted with the members of a women self-help group (SHG) and a youth club to understand their functioning and their perception on waste management at Wandoor.

The SHG is active, holding regular meetings and savings. and maintaining financial stability with consistent savings. Despite their interest in entrepreneurial activities, they face challenges such as lack of leadership and insufficient information on market linkages. While the SHG members expressed interest in up-cycling enterprises (such as making bags out of reused waste products), they are concerned about the profitability and market demands for such products.

The youth club has a history of assisting other groups in organising clean-up drives within Wandoor, recognising waste management as a pressing community issue. They are willing to continue these efforts in the future. However, political divisions within the community (and the CBOs) have hindered collaboration between the Panchayat and some of the clubs.

Image 11: Meeting with a Self-help group of Wandoor

Issues identified:

1. Though SHG members may be interested in up-cycling enterprises, extensive capacity building and business plan development, along with market linkages are necessary for this to be a viable business opportunity.
2. Youth club members are important stakeholders in collective action on civic issues. facilitation of dialogue between these CBOs and the Gram Panchayat is required to leverage their support for solid waste management in Wandoor.

4.8 Rural Development Department

The Rural Development Department supports the Panchayat by providing guidelines, funds/grants and management plans. The Block Development Officer (BDO), along with the respective Gram Panchayat officials are responsible for waste management in the Panchayats. The Gram Panchayats receive funds from SBM and grants from the RD department for operational purposes. The department also regularly assesses the SWM work being implemented at the GP level.

There are limited methods to process or recycle the waste within the Islands. At the moment, the strategy for dealing with segregated waste is to send it to the mainland for further processing. The contractor responsible for buying waste from the Gram Panchayats of South Andaman and transporting it to the mainland has been empanelled by the RD department. However, the contractor collects glass waste very infrequently. During our interaction with the RD Director in November 2023, he acknowledged the challenges in managing solid waste in the Islands and mentioned that the department is planning to engage an additional 512 sanitation workers across the Union Territory. Furthermore, he highlighted the need to explore various possibilities for processing waste within the islands such as recycling plastic wastes into bricks for footpath construction and using glass bottles as construction material for roads.

According to the BDO, the major issues of waste management at Wandoor include a shortage of workers, non-payment of user fees, and segregation of waste at source. Based on their assessments, Wandoor requires an additional 9 sanitation workers to cover the entire Panchayat.

Issues identified:

1. Glass waste is not getting collected regularly by the empanelled contractor, resulting in a piling up of glass bottles across the district.
2. Delays in payment from CM Scrap Traders, the empanelled waste contractor.
3. There is a need to explore alternative waste processing methods that can be implemented within the islands.
4. The equipment procured by the RD department for Solid Waste Management, such as the baling machine and incinerators are not functioning properly. There is also a lack of support at GP level for repairing or availing warranty services.

4.9 Forest Department

As the North Wandoor beach is part of the Lohabarrack Crocodile Sanctuary (LBS), it falls under the jurisdiction of the Forest Department. Earlier, the New Wandoor beach was also under LBS but has since been denotified from the sanctuary boundaries for tourism purposes. The department has installed basic sign-boards on the beaches providing written instructions on appropriate tourist behaviour. The department staff acknowledge that waste management at both beaches is becoming a significant problem due to the increasing number of visitors. Occasional clean-up drives are organised by the department, especially at the North Wandoor Beach. However, no mechanism is in place to ensure regular waste collection from the beaches by the department. The department believes that tourists need to be better informed about waste management through enhanced signage detailing segregation of waste, the impact of plastic on wildlife, and humans and warnings against littering. At present there are no entry-fees or penalties for littering, which could be potential methods to generate revenue to maintain beach cleanliness.

Issues identified:

1. There is a lack of comprehensive management plan to ensure regular cleaning and waste management on the beaches.
2. There is a need for increased collaboration between the Panchayat, sanitation workers, and the Forest Department to develop effective waste management plans for the beaches.

4.10 Information, Publicity & Tourism (IP&T) Department

Wandoor is an emerging tourist destination. The Mahatma Gandhi Marine National Park was previously a popular attraction offering recreational activities such as glass-bottom boat rides to nearby islands. However, COVID related lock-downs, increasing crocodile attacks and new regulations mandating fibre-body boats have led to a steep decline in tourist activity in MGMNP, which is expected to start once new boats are operating. Besides this, all tourist footfall is due to the two beaches in Wandoor.

The IP&T Department has employed 7 lifeguards for the beaches of Wandoor, who report to the Forest Department Officials for their daily activities. Among the 12 responsibilities listed in the lifeguards' job description, only two pertain to waste management on the beaches, stated as follows:

1. Keep assigned area clear of all hazards and remove the same as required eg. broken glass etc. (Point 10)
2. Maintaining cleanliness of the beaches. (Point 12)

The department also undertakes beach clean-up activities under Swachh Bharat Mission occasionally.

Issues identified:

1. Though the lifeguards are hired by the Tourism department, they function under the supervision of the Forest Department officials and there is a lack of clarity on their responsibilities towards waste management.
2. The IP&T Department is not involved in the planning and implementation for waste management at the Wandoor beaches.

4.11 Beach observation

We have observed and documented the footfall at both New Wandoor and North Wandoor beaches over a period of two months during peak tourist season (15th Dec 2022 to 15th Jan 2023). These observations were conducted for 30-60 minutes during peak tourist hours. Estimates of local and non-local tourists have been made under the assumption that most non-local tourists would visit in vehicles bearing yellow-plate (commercial registration), while the local tourist would visit in vehicles bearing white plate (personal registration).

Of the two beaches, New Wandoor sees the highest tourist footfall, being the more popular spot, whereas North Wandoor is less known and less crowded. The crowd peaks on weekends or major holidays like Christmas and New Year's Day. There is an uptick in the non-local tourists during the holiday season, which gradually tapers down as the season ends. Concurrently, the number of local tourists rises as non-local tourism declines. North Wandoor mostly has local tourists who come for picnics.

Earlier, both the beaches were part of the Lohabarrack crocodile sanctuary's forest range but the coast of New Wandoor beach and the immediate stretch of sea near it from the sanctuary has been denotified for tourism development. The adjacent forest remains under the jurisdiction of the Forest Department as it is designated a reserve forest.

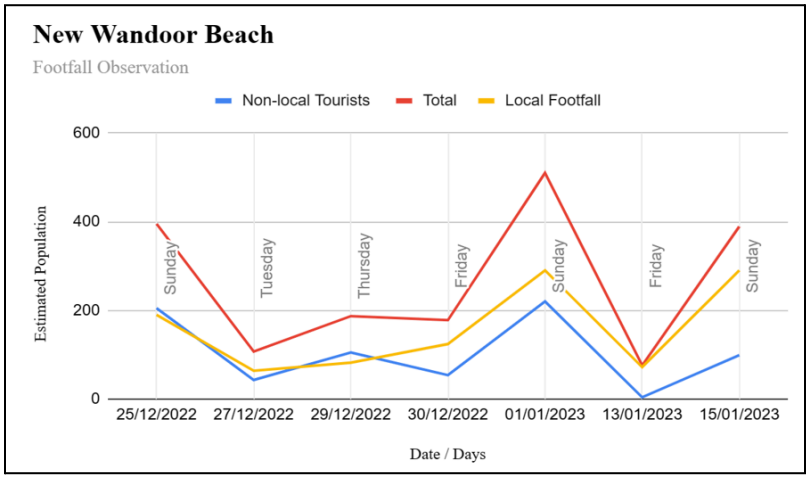


Figure 3: Footfall observation of New Wandoor Beach

New Wandoor beach has a line of shops and a few different sized dustbins used by the shops and the tourists. According to The Forest Guard from Mahatma Gandhi Marine National Park (MGMNP), an average of 150 people visit the New Wandoor beach daily. Observations during December 2022 and January 2023 indicated an average footfall of 310 people per day on the weekends.


New Wandoor


New Wandoor


New Wandoor


North Wandoor


North Wandoor


North Wandoor

Image 12: Littering at the beaches of Wandoor

The New Wandoor beach has more than 10 shaded spots under trees where tourists, both local and non-local, gather for picnics, leading to litter accumulation in these areas, turning them into small waste hotspots. . The common waste items include single-use plastic bottles, paper plates, aluminium cans, snack packets, and glass bottles. The sanitation workers focus on cleaning the areas closest to the coast and do not extend their efforts to the hotspots where people gather. Visitors often dispose of mixed waste into the dustbins and there are no options for segregated bins at the beach. The sanitation workers clear the dustbins near the beaches twice a week, and do basic beach cleaning along the coast. Police officers from Manglutan (Humfrygunj police station) organised a beach clean-up along with the Panchayat and sanitation workers in January 2023. Clean-ups are undertaken by various government departments and politicians. However, the waste collected around the beach does not include waste dumps near the mangroves and interior parts of the beaches.

The North Wandoor beach has similar spots where tourists congregate for picnics. Based on vehicle observations at the North Wandoor beach, it is estimated that over 60 people visit the beach on some weekends. The type of waste littered is similar in nature but more widespread compared to New Wandoor beach. There is only one 120 L dustbin installed by the forest department which fills up quickly and is insufficient. The sanitation workers do not cover the

North Wandoor beach due to an unresolved conflict between the family staying beside the beach and the Panchayat. The forest department occasionally conducts beach clean-up drives. However, without a regular waste collection mechanism, different stretches of the beach become littered very quickly, with some waste entering the sea with tides.

Issues identified:

1. Waste and litter at the beaches are primarily due to visitors, necessitating the promotion of better waste management behaviour among the visitors, both local and non-local.
2. There are no sign-boards at North Wandoor related to waste management and very limited sign-boards at New Wandoor.
3. Multiple waste hotspots are developing where the beach meets the vegetation-line, commonly used by visitors for picnics.
4. There are no segregated dustbins on the beach, and more dustbins are required at various points to address the issue of waste hotspots.
5. There are no processes/penalties in place to address littering at the beach.
6. Besides clean-up drives, there are no comprehensive management plans to handle waste along the entire stretch of the New Wandoor and North Wandoor beaches.

5. Roadblocks in streamlining SWM in Wandoor

Engagement with all stakeholders involved in the SWM system in Wandoor has highlighted several key points at various levels that need to be addressed to ensure efficient waste management in the Panchayat. This section discusses these emerging issues and their links to different parts of the system. The issues have been categorised under four broad themes; planning and coordination, equipment and infrastructure, user behaviour, and human and financial resources .

5.1 Limitations with Human and Financial resources

Expanding the reach of waste collection requires consideration of whether the workers and available resources within the SWM system can handle the additional load. There is a need for more than double the current sanitation workers to initiate comprehensive waste collection across the entire Panchayat area. The houses in Wandoor GP are widely spaced, requiring significant effort to collect waste from each household. It is challenging for the sanitation workers to remote households or areas without motorable roads. Additionally they clean and collect waste from the beaches and further segregate the dry waste further into different categories which is a very time-consuming process. Besides these responsibilities, they are also engaged in other works for Panchayat.

Hiring more workers is only feasible with increased funding. The system is constrained by limited funds, a situation exacerbated by inefficient user-fee collection. The limited workforce

and issues with equipment extend the time required for segregation and restricts the Panchayat's ability to expand the collection area. It is crucial for the RD department, Panchayat and the sanitation supervisor to have a shared understanding of these issues and constraints at various stages and to develop a feasible, adequately funded action plan for the next stages of expansion. Moreover, the empanelled contractor responsible for buying the waste from the Panchayats is delaying the payments of the waste sold and has not accepted glass waste for the since many months and it is an issue which needs urgent action.

5.2 Equipment and Infrastructural Issues

Equipment such as incinerators, baling machines, and e-carts are crucial to the efficient functioning of the SWM system. While these machines were provided to the Panchayat by the RD Department, there is a lack of clarity in their maintenance and repair. The Panchayat faces significant difficulty in repairing any of the equipment. The incinerator at Wandoor is not functional, and there are no technicians in ANI who can repair it. The baling machine which performed significantly below its capacity was temporarily fixed by a lathe machine technician. The e-cart is unable to carry heavy loads nor can it negotiate steep roads. The hired vehicle's fare significantly raises costs and cannot be relied upon due to issues at the vendor's end. The unavailability of transport vehicles, a baling machine and an incinerator hampers the efforts of the sanitation workers.

Support from the RD department is necessary to coordinate with the companies that supplied these machines to ensure continued technical support during and after the warranty period. In the absence of this support, the Panchayat is left with no choice but to get the machines repaired from local technicians who might not have sufficient expertise. Furthermore, it is essential to prioritise the safety of the workers who have to manage & segregate mixed waste. It becomes pertinent to provide them with appropriate safety gear such as cut-resistant gloves & boots, safety glasses and masks.

5.3 Issues related to User Behaviour

Waste generators, including households, commercial establishments and tourists are the most crucial stakeholders in the waste management system. Strengthening waste management behaviour at the source is essential for improving the SWM system in Wandoor. Segregation of waste remains a major challenge, as sanitation workers often receive mixed waste from some households and commercial establishments. This increases the time and energy invested by sanitation workers in secondary segregation of the waste, who spend two days a week on this task. This not only diverts their time from their collection duty but also restricts their ability to expand services to more households. Additionally it exposes workers to health risks as they handle hazardous (glass, sharp objects & sanitary napkins) and rotting wet waste during segregation .

Despite numerous warnings of potential penalties, proper waste segregation by many households is still lacking . This issue is compounded when expanding to newer households who want to take benefits of the SWM system but are reluctant to put in the efforts to segregate their waste beforehand. There is considerable reluctance to pay the user-fee for waste collection, which hinders the Panchayat's ability to efficiently run the system. It directly affects the OSR generated by the Panchayat, leading to reduced matching grants from the RD department. Another concern in Wandoor is littering and open dumping of waste. Tourists contribute significantly to the issue, and improper disposal can result in littering public land, beaches, mangroves, forests and creeks. To address these challenges, public education and IEC campaigns are necessary to highlight the importance and steps for proper waste disposal. Such efforts should target both locals and tourists to promote responsible waste management practices along with provisions for on-spot penalties for violators.

5.4 Planning and coordination issues

Effective governance of a system requires transparent communication between all stakeholders involved, including citizens, sanitation workers, PRI members and various departments. While there is regular communication between the Panchayat and the Sanitation workers, there is a need for a mechanism to regularly review the work and discuss the emerging problems with all the PRI members. Additionally, ward members should support the sanitation workers in engaging with citizens who are either not segregating their waste or not paying the user-fee in time. Many citizens lack complete information on how the local SWM system works, highlighting a knowledge gap. Building awareness of the system will lead to greater transparency and increased public engagement.

It is also important to clearly define the tasks and roles of the sanitation workers so they can prioritise waste management work and avoid being assigned duties beyond their primary responsibilities. The Panchayat requires additional support from the RD Department in terms of operational & financial planning to improve SWM within the cluster. Issues such as repair and maintenance of essential equipment and irregular collection by the empanelled waste contractor need to be addressed at the RD Department level.

Although the two beaches of Wandoor are major tourist attractions, waste management at the beaches faces hurdles due to a lack of coordination among the responsible stakeholders. While the sanitation workers clean a portion of the New Wandoor beach and the forest department also organises occasional clean-up drives at North Wandoor beach, the absence of a regular waste collection system results in rapid littering. Enhanced communication between the Gram Panchayat and the Forest Department is necessary to build a system for cleaning and waste collection from the beaches, and to strategize on changing visitor behaviour regarding littering. The life-guards hired by the Information, Publicity & Tourism (IP&T) department have minimal involvement in waste management, but can be a helpful stakeholder in spreading awareness and maintenance of cleanliness in the beaches.

5.5 The vicious cycle of waste management in Wandoor

The SWM system in Wandoor is caught in a vicious cycle of interlinked challenges. The limited finances available to the Panchayat reduces its ability to hire additional workers. Availability of limited workers coupled with the need for secondary segregation (due to improper segregation at source) reduces the workers' capacity to cover more users. The deteriorating condition of the equipment further hampers their efficiency. The reduced coverage along with non-payment of user fee, significantly reduces the OSR, which in turn impacts the grants received from the RD department. The limited funds available restricts the Panchayat's ability to enhance the system by increasing coverage, hiring additional workers, purchasing equipment, setting aside funds for maintenance and unforeseen events.

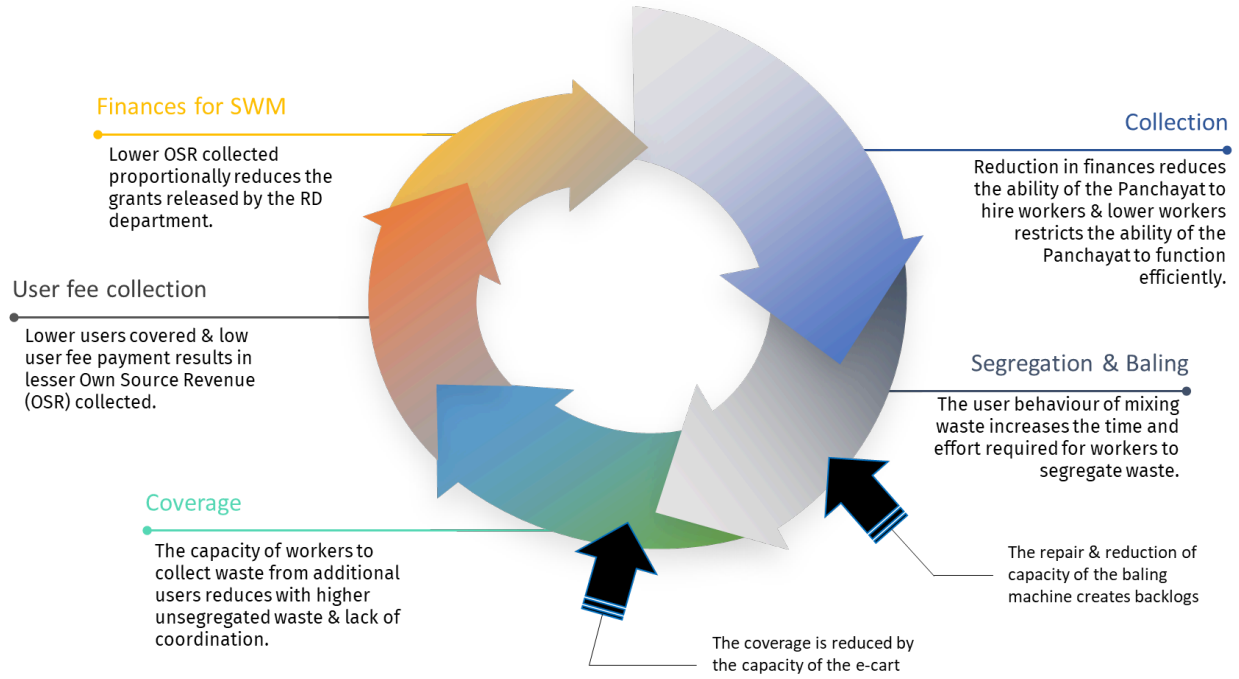


Figure 4: This cycle describes how various factors affect the different stages of the SWM system and leads to a reduction in the capacity of the system to properly manage waste.

6. Towards a cleaner Gram Panchayat

6.1 Shifting tracks to a Virtuous Cycle

To transition the SWM system from its current challenges, a combination of strategic interventions is required. Each intervention can help nudge the system away from the vicious cycle towards a virtuous one i.e., a cycle of events where one improvement drives subsequent enhancements, leading to overall system optimization.

Interventions aimed at changing user behaviour- such as reduced littering and promoting waste segregation-can significantly reduce the time spent by the sanitation workers on litter collection and secondary segregation. Additionally, functional equipment and safety gears will also increase the capacity of the system to manage higher volumes of waste. The Panchayat also needs support to increase their human resource, allowing for increased coverage of newer areas, which in turn can boost user-fee collection. An increase in the OSR will lead to greater financial resources for the Panchayat to invest in the SWM system ensuring long term stability and sustainability.

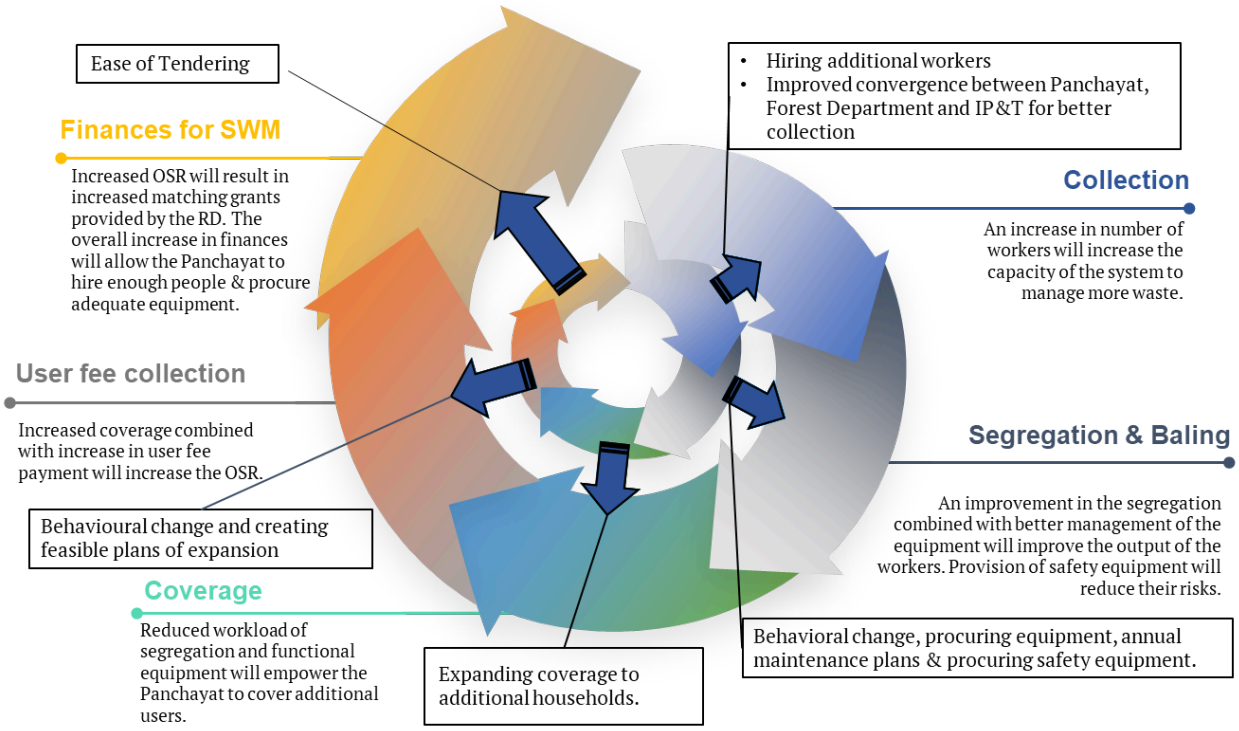


Figure 5: This cycle describes how incorporating these solutions at different stages of the process will push the SWM system towards a virtuous cycle.

6.2 Interventions required to improve SWM

This assessment has identified key challenges present within the SWM system and the constraints in efficiently scaling up the current system to cover more households within the Panchayat and to ensure cleaner beaches in Wandoor. Based on insights gathered from discussions with different stakeholders and our assessment of the challenges, we recommend the following interventions to improve the SWM system in Wandoor GP, separated into four categories:

Requirement of more human and financial resources:
The assessment highlights the need for additional sanitation workers and financial resources to increase the coverage of the SWM system across the entire Panchayat. Based on the assessment, we have estimated the approximate number of sanitation workers and other resources required to expand the end-to-end SWM system in Wandoor.

1. Drawing from the current capacity for collection and segregation by each sanitation worker, we determined that one sanitation worker can collect waste from 30 households and segregate waste from 25 HHs weekly. Analysis of the data shared by the sanitary supervisor, indicates a shortfall in segregating waste from 5 HHs. This shortfall exists despite allocating more than a third of the overall workdays for segregation. An additional worker is required to address this shortfall. Thus, the current process of segregation requires interventions to reduce the time taken (Annexure 5).
2. The build of unsegregated waste at the cluster centre causes two major problems; excessive work time is spent on segregation and there is limited space to store all the waste at the cluster centre. This issue is expected to intensify as the Panchayat increases the scale of operations. This needs to be addressed in two ways; increasing the pace of segregation and creating sufficient storage. The first part of the solution requires adopting an assembly line technique to speed up the segregation. utilising a conveyor belt such as the one designed by TrashCon (TrashCon, 2022) or used in Indonesia (Jervin Kabigting, 2019) could reduce the time required for sorting waste. Similar technologies for sorting have been used in Material Recovery Facilities (MRFs) designed by Saahas & Green Worms (Saahas Zero Waste, 2023; Green Worms Waste management, 2023). The second part of the solution involves construction of additional storage space.
3. At current efficiency, the Panchayat would need a total of 32 workers to cover 850 households of Wandoor. These workers would need equipment with the capacity that corresponds to the waste generated by these households.
4. The Panchayat & RD department should place the safety of sanitation workers at a higher priority. Given that the workers need to manage various types of hazardous waste and are vulnerable to contract diseases, they should be provided with appropriate safety equipment, insurance coverage and access to bathrooms. The workers should be protected from sharp objects, acids, alkalis, toxic fumes and microbes. The gloves, boots, jackets, glasses, helmets and masks procured should provide sufficient protection against the substances mentioned above.bathrooms should have functional water connections and sufficient supply of anti-microbial soap.
5. The financial resources required for these enhancements are significant. The administration will need to financially support the procurement of necessary equipment. Additionally, a sum of Rs. 4.48 lakhs is required for the salaries of the workers at the current payscale. Considering the matching grants, a sum of 1.1 lakhs would be required as OSR on a monthly basis.

6. The Panchayat, in collaboration with the RD Department should develop strategies to increase its OSR through various means and use this fund effectively in the SWM system.
7. The commercial and governmental establishments and events can be charged a user fee in accordance with the SWM guidelines. Empowering the Panchayat to enforce these fees will enhance the collection process. Successful fee collection from these establishments, according to the guidelines, will significantly increase the revenue. There needs to be an increase in fee for the bars as they generate a large amount of glass waste. The current user fee does not cover the cost of multiple trips required to collect these glass bottles, leading to financial strain on the Panchayat.

Efficient use of Equipment:

Effective equipment utilisation is essential in all three aspects of waste management:collection, segregation and baling. There are various issues related to equipment that impact the efficiency of the SWM system. Potential ways of prolonging the life, upkeep, maintenance, ensuring availability of appropriate mechanics and funds are outlined below.

1. The equipment procured by the administration should realistically match the requirements of the current system. For example: the procurement of the incinerator by the RD department can be improved in the following areas; accurate estimation of sanitary & diaper waste (Annexure 6), selection of an incinerator with the appropriate capacity, verification that the advertised capacity matches the estimated need, and ensuring that the machine specifications comply with environmental standards for gas and ash composition. Only machines that have demonstrated reliable performance for more than a year should be considered for further vetting and testing before mass procurement.
2. The Panchayat requires a larger vehicle for transport, more space for storage and segregation, a baling machine with higher capacity and appropriate safety equipment (Annexure 5).
3. The procurement process should involve an Annual Maintenance Contract (AMC) with the vendor to station dedicated service person(s) in ANI. During the contract period, mechanics/service persons within ANI should be certified by the vendor that they possess the requisite skills to fix the equipment. Additionally, the maintenance contract should include regular training sessions for the operators of baling machines, incinerators and e-carts, and to ensure timely repair & maintenance of the equipment.
4. The Panchayat and RD need to formulate a comprehensive maintenance plan for the equipment both for the immediate and long-term needs. The RD department could compile a contact list of all the mechanics capable of servicing the baling machine and electric vehicle. In addition, the Panchayat should maintain options of hiring vehicles at all times in case of issues with the current hired pickup vehicle or e-cart, allowing for temporary replacements or vendor changes as necessary.
5. For long-term planning, the Panchayat must ensure that the equipment procured for the SWM system works efficiently and has a prolonged lifespan. It is recommended to set

usage limits, regularise maintenance checks, and provide training for workers on proper usage guidelines. Furthermore, the basic usage guidelines for each machine should be printed and displayed on the machines at the time of installation in each cluster.

6. The Panchayat should allocate a portion of their annual revenues to cover unforeseen repair and maintenance expenses, and for annual maintenance checks.

Changing User Behaviour:

There is an urgent need to promote behaviour change in the community to foster responsible participation in the system. Additionally, exploring penalties for repeated violators, as per the guidelines, can be considered.

1. Changing user behaviour towards better segregation and user fee payment can begin with conducting awareness campaigns, sharing important IEC content on WhatsApp groups and putting up sign boards. These sessions and IEC content must contain a general introduction to the importance of SWM, the SWM system in Wandoor, the need for user fee, the effects of unsegregated waste and small changes people can make to reduce, reuse and recycle waste. There can be stickers on dustbins indicating the types of waste that can go into the dustbins.
2. The shift from single use plastics needs to be encouraged. The Panchayat could procure reusable glasses and plates to rent out during large gatherings, such as weddings or pujas, where significant amounts of single-use cutlery are used and often mixed with food waste. Simultaneously the production of compostable alternatives such as arecanut plates, containers and cups can be promoted by the RD department through subsidies provided to CBOs for procurement of requisite equipment.
3. The Panchayat can implement graduated sanctions to regulate garbage dumping, non-segregation, and non-payment of user fees. In addition, exploring methods used by other local bodies to regulate user behaviour and adopting suitable sanctions for this context is necessary. For example, some communities in the outskirts of Hanoi, Vietnam, have put in place sanctions such as warnings by the sanitation workers and exclusion from community groups or functions for violators (Richardson, 2003).
8. There needs to be discussion with the community on how they handle the hazardous and sanitary waste. The Panchayat doesn't collect hazardous or sanitary waste due to a non-functional incinerator for sanitary waste. However, the users sometimes mix it with dry waste, posing challenges for the sanitation workers. A system needs to be created to handle hazardous and sanitary waste. Promoting the use of menstrual cups, cloth diapers and cloth pads could help in reducing the amount of sanitary waste generated by households. Once a system for handling hazardous waste is in place, the Panchayat could install separate bins for dry and hazardous waste.
9. Hotels, resorts and shops should be encouraged to adopt environmentally friendly practices and sensitise their guests and visitors regarding proper waste management practices.

10. Engaging citizens and CBOs with the SWM system is essential to build awareness and ownership for a cleaner Panchayat. This can be done through ward-wise reviews of SWM works, considering citizens' concerns, organising community clean-up drives and providing tokens of appreciation for exemplary initiatives/participation.

Planning and Coordination between stakeholders:

There are various challenges and issues that arise during the implementation of an activity especially when multiple actors are involved in operationalising different aspects. Some of these challenges can be offset by proactive planning for anticipated and unforeseen circumstances. The following points discuss the need for planning and coordination requirements across different actors involved in solid waste management.

1. The Panchayat should develop an annual, a feasible plan of action that considers the existing constraints & resources available. The major constraints on increasing collection from households are: limited human resources, limited operational hours of the e-cart, reduced capacity of the baling machine, non-segregation and non-payment of user fees, and limited financial resources. Once these capacities & constraints are acknowledged, it becomes possible to foresee and plan for the additional resources required for effective action.
2. It is critical to institutionalise regular planning meetings involving relevant representatives from the implementing agencies i.e., sanitation supervisor, experienced sanitation staff, Panchayat secretary, State Nodal Officer (SBM Gramin), RD department, PRI members and other relevant officials. These meetings should be designed to understand the issues from the perspective of implementers, brainstorm possible solutions, create feasible short-term action plans, and understand the requirements for long term planning to expand system coverage. This should include a discussion on developing an efficient schedule, sufficient transport vehicles, hiring of staff and addressing the need for new or replacement equipment.
3. An annual conference can be organised with the participation of users, implementing agencies, interested government and private agencies, regulatory agencies, technical experts, entrepreneurs and policy experts. The purpose of the conference would be to assess the progress made in the previous year, the issues faced, explore newer and more economical interventions and provide a platform for policy experts to understand and advocate for necessary reforms in the system with stakeholders.
4. The RD Department should ensure that the waste contractor adheres to regular and timely waste collection, including the collection of glass waste. The tender should include provisions allowing the Panchayats to engage alternative contractors In case of continued inefficient services. In addition, a clause for termination of the contract could be considered if these issues persist.
5. Effective coordination is required between the Panchayat, Primary Health Care (PHC) centre and the sub-centre to establish a practical system for the proper disposal of medical waste from the sub-centre.

6. Improving waste management at the beaches requires regular coordination between the Forest Department, IP&T and the Panchayat. Together, these entities should prepare a plan and implement a mechanism to keep the beaches clean and litter free, while also sensitising the visitors on better waste management practices. A coordinated effort between the three agencies could delineate responsibilities between forest departments' daily rate mazdoors (DRMs), lifeguards and sanitation workers in maintaining cleanliness in and around the beaches.

Annexure 1: Interventions by Dakshin Oct 2022 - Nov 2023

Based on the learnings from the assessment, Dakshin has shortlisted and fine tuned its intervention to address specific issues and bottlenecks. Dakshin has been working closely with the Wandoor Gram Panchayat and the Rural Development Department to build strategies to improve the SWM system in Wandoor. Some of the activities undertaken by Dakshin are summarised here.

1. **User behaviour:**
    - Designed and installed IEC boards at important community junctions and beaches highlighting the impact of waste on health and ecosystems and the importance of segregation at source.
    - Installed segregated dustbins at New Wandoor & North Wandoor beaches with IEC stickers to promote segregation by visitors.
    - Conducted multiple community awareness sessions focussing on understanding the effect of waste on our lives, how the system at Wandoor works and what role the users play. These interactive sessions use various tools like PPTs, Posters and community games to engage people in the conversation.

2. **Human & Financial Resources:**
    - Supported the Wandoor Gram Panchayat to engage three additional sanitation workers for one year to help them expand their coverage and streamline their operations.
    - Built strategies with the GP to increase OSR which resulted in key actions such as revising user-fee for hotels and initiating parking fees collection etc.

3. **Stakeholder meetings:**
    - Conducted regular meetings with different stakeholders to understand their roles, interests and challenges in solid waste management to identify opportunities for bringing improvement in the system.

Image 13: Segregation game “Shoot on Goal” being played by community members

Annexure 2: User fee collection (Jan 2022 - Nov 2022)

Sl. No.	Month	Households				Commercial establishments				Total user fees collected (in Rs.)
		Households	User fee collection (in Rs.)	Estimated Collections for 100% payment (in Rs.)	% of HH paying user fee	Commercial establishments	Actual Fee collected (in Rs.)	Estimated Collections for 100% payment	Estimated % of user fee collected from Comm. Est.	
1	January	170	5280	8500	62.12%	74	5350	12900	41%	10630
2	February	170	4950	8500	58.24%	74	8200	12900	64%	13150
3	March	170	4020	8500	47.29%	74	11350	12900	88%	15370
4	April	180	4730	9000	52.56%	74	8400	12900	65%	13130
5	May	185	4690	9250	50.70%	74	6100	12900	47%	10790
6	June	-	-	-	-	-	-	-	-	-
7	July	210	200	10500	1.90%	74	9360	12900	73%	9560
8	August	215	9170	10750	85.30%	76	8350	13200	63%	17520
9	September	-	-	-	-	-	-	-	-	-
10	October	-	-	-	-	-	-	-	-	-
11	November	220	6510	11000	59.18%	76	5560	13200	42%	12070
12	Average	190	4944	9500	52%	74.5	7834	12975	60%	12778

Table 8: User fee collections (Jan 2022 - Nov 2022)

Annexure 3: Wandoor GP's Monthly User fee report for February 2023

Monthly report format on User-Fee SWM Bye Laws Compliance By Gram Panchayat

Name of the Gram Panchayat :- Wandoor — Feb-23

Month	Total No. of Households	Total No. of Commercial Establishments	No. of HHs covered for collection of User-Fee	No.of Commercial estiblishments covered for collectionof User-fee	Amount collected from HHs as User-fees	Amount recived from commercial establishments as User-Fee	Total Amount collected	Amount Collected in the form of fines for breach of SWM Bye Laws	Quantity of Dry-Waste Collected	Quantity of Wet Waste Collected	Reasons for shortfall of User-Fee Collection	Reasons for shortfall of Waste Collection
1	2	3	4	5	6	7	8	9	10	11	12	13
	856	76	310	76	11280	7950	19230	Nil	3500kg	-	1) Households refusing to give garbage when they were told to pay user fees, due to Lockdown	1) Shortage of Sanitary staffs,

Table 9: Wandoor GP's monthly report that illustrated the Panchayat's performance on indicators such as number of users, user fee collected etc.

Annexure 4: Questionnaire for stakeholders

A. Gram Panchayat Office: (Pradhan and PRI members)

Current status of Waste Management

1. Present waste collection method, timings, and quantity of waste per day and weekly?
2. How many workers are working now and how many vehicles does the panchayat have?
3. Who is responsible for overseeing the implementation?
4. What are the gaps and problems being faced in the waste management work in the panchayat?
5. Are there any other schemes available for waste management like SBM Gramin?
6. Where is current funding coming from and what are other funding sources?

7. Why is the government not providing enough funding to complete the waste collection work for the entire Wandoor panchayat?
8. Any other NGO or local village groups working at Wandoor regarding waste management?
9. Are there any rules and regulations enforced by Panchayat on the households, shops or resorts such as fines?

Future Plans

10. Do you have any new plans to extend waste collection in the Wandoor GramPanchayat?
11. Any new plans/proposals for waste management at Wandoor (such as involving SHGs in collection)?
12. Do you have any plans to upcycle waste?

B. Forest Department:

Current Status

1. As both the beaches of Wandoor are under the Forest department, how is the dept managing the waste on these beaches and if there is anything done to manage the waste in the ocean (like ghost nets, plastics)?
2. Is there anything done for the waste dumped in the creeks and mangroves? How is the waste in these sites managed?
3. What kinds of waste are generated at the beaches? What is the quantity of wet and dry waste generated per day/week?
4. How many sanitary workers are involved in clearing the beach?
   Are they employed by the forest department or by the Panchayat?
5. Do you organise any cleanup drives at these beaches or on the beaches of MGMNP? If so, what is the quantity of waste collected? What kinds of waste are they mainly?
6. What are the number of tourists- mainland and local visiting these beaches?
7. Do the mainland tourists litter more or local tourists?
8. Where does the revenue come from for beach maintenance, sanitary workers and cleanup drives? Is that sufficient?

Future Plans

9. Do you have plans to increase awareness to the visitors about not littering?How?
10. Any plans to increase patrolling on the beach, fines etc?
11. Any plans to upcycle waste collected from the beaches?
12. Any new ideas for waste management at Wandoor?
13. Would you be open to collaborating with Dakshin to increase awareness amongst visitors or other issues that you've identified as critical?

C. Hotels and Restaurants

1. What is the hotel's maximum capacity? How many rooms and total beds do you have & no. of individuals hotel can accommodate.
2. When is peak season, and how many rooms get occupied?
3. How many hotel staff are there from all teams - cleaning, reception, kitchen, etc.?
4. Do you store waste in your hotels or restaurants? If yes, what is the mode/means of storage of waste? If not, how do you dispose of your waste?
5. Do you have regular waste collection in your area from the panchayat?
6. How often is the collection (per week / day)? Is it sufficient?
7. How much is the hotel paying the panchayat?
8. How is wet waste and dry waste handled?
9. Apart from panchayat collection, is there any other agency you use for waste collection?
10. How much does the service provider charge per month?
11. How often do you use the waste collection service? Specify the time of visit of waste collection services?
12. How much waste is generated per day/week? (kg)
13. What does the hotel do with its wet waste?

(If they are not already composting their wet waste, ask them if they have any interest in composting?)

14. What do they do with poultry waste, where is it disposed of?
15. What kind of Plastic and hazardous waste is generated in your hotel or restaurants?
16. Do you know how your service provider disposes your collected waste?
17. Does the hotel upcycle any of its waste into useful products for the hotel space?
18. Do you think current systems are appropriate and sufficient? What are the gaps that you see? Do you have any new plans or suggestions to improve waste management work in Wandoor?

Other practices - Water, electricity, environmental footprint.

1. What types of light bulbs / tube lights are used in the hotels? [LEDs are longer lasting with lower energy usage - energy star products]
2. Do the rooms have key cards, xx shere lights get switched off automatically?
3. Does the hotel have electricity back up when there is a power cut? If so, what inverter / generator do they use?
4. Where does the hotel's daily use water supply come from?
5. If any self rainwater harvesting is done, how many litres of water?
6. What are the challenges they face when it comes to water, especially in peak tourist season?

D. Households

1. What are the major waste generated at your home (ask approx quantity)?
2. How do you dispose of the waste you generate?
3. Do you separate different types of waste at your home?
4. Are there any large bins in your area?
5. Do you have regular garbage collection in your area?
6. How often do the sanitary workers come for collection?
7. How much do they charge per month?
8. What according to you are some of the problems which arise due to improper waste disposal?
9. What is the main issue with the current solid waste management system in the Wandoor? Do you have any suggestions to improve waste management work in the Wandoor?

Households generating large amounts of waste

10. What do they do with poultry waste, where is it disposed of? Useful to know from the croc point of view?
11. How is the waste managed during celebrations such as weddings, pujas?

E. Small Shop Owners

1. Majorly what kinds of waste is generated from your shop and approx how much quantity per day/week?
2. How do you generally manage your waste?
3. Is the waste collected from your shop and how frequently?
4. What do you do with your wet waste?
5. Are you paying any charges to the waste collector for waste disposal? If so, how much?
6. What can be done for better waste management in Wandoor? What could be the responsibilities of different stakeholders.

F. Sub Centre Wandoor

1. What kind of waste is generated at the sub centre?
2. How much medical waste is generated each week?
3. Where do you dispose and how?
4. Is there any collection happening from the sub centre?
5. Do you have any suggestions to improve waste management work in the Wandoor?

G. Youth clubs

1. Have you conducted any clean-up drives at Wandoor?
2. Do you get any funds for camp?
3. How much waste is collected in each camp?
4. Do you think, at present, waste management work is going well? If so, how and why? If not, why not?
5. Do you know some of the main problems with the current solid waste management system in Wandoor?

H. Rural Development

1. What are the schemes under RD dept on waste management?
2. How is the work on waste management overseen under RD?
3. What kind of support is provided to Panchayats by RD?
4. How much funds are allocated to each Panchayat for Waste management?
5. Who is in charge of implementing and overseeing the process in a Panchayat?
6. Are there any new schemes coming?
7. What is the next step after segregation of waste in segregation centres?
8. Are there any plans to involve SHGs?
9. Is the current system operating smoothly? If not, what are the areas for improvement/ongoing challenges?
10. How are you planning to tackle the shortage of sanitary workers for collection?

I. Tourism Department

1. Do you have details of how many tourists visit a day at Wandoor?
2. Does the tourism dept have any plans to improve waste management on the tourist spots in Wandoor?
3. Are there any funds allocated for waste management to the department?
4. Does it regulate the waste management in hotels and resorts?

J. Sanitary Workers

1. How many sanitary workers currently work in Wandoor panchayat?
2. Do you work under the Panchayat?
3. Does any sanitary worker work with the forest or tourism dept?
4. How many days do you work in a week?
5. Where do you go for waste collection?
6. How many households do you collect the waste from?
7. What waste do you collect?
8. What is the amount of waste you collect from households?
9. Do households give segregated waste?
10. Do they give sanitary waste?
11. What other hazardous waste do they give?
12. What is the amount of waste you collect from beaches? Which beach?
13. What kind of waste is collected from the beaches?
14. What do you do with the waste after collection?
15. Do you record the amount of waste collected daily in any register?
16. How much do you get paid?
17. Who is your supervisor?
18. Does anyone come to check your work?
19. What are the issues, if any, that you face during your work?
20. Do you think the current system of waste management is sufficient? If not, what needs to improve?

H. Self Help Group Women

1. Are you a part of an SHG? If yes, what is the name of the group?
2. How often do they meet as a group?
3. What activities do you do as part of their group with the money?

4. Would they be interested in taking training to initiate additional livelihood generation activities?
5. Do you know that creating products from waste could generate income?
6. Would you like to learn some methods to create products from waste?

Annexure 5: Estimating the contribution of addition of one member to the sanitation staff

The method of calculation:

1. Estimation of the work done on an average week in the current system that has 12 sanitation workers. Of these 12 workers, one worker mans the toilet at the beach.
2. Calculating the workdays and output for each task (collection, segregation, baling and cleaning) separately for 25 workdays. Calculating the percentage of the workdays assigned for collection, segregation, baling and cleaning.
3. Calculating the workdays and output of 1 worker based on the percentage previously calculated.

Information:

1. One sanitation worker is assigned to the toilet at the New Wandoor beach on all days.
2. The cluster centre accepts waste from 2 other Panchayats within the cluster. One Panchayat sends 2 workers for assistance in baling. Whereas the other doesn't send any workers for assistance. This requires Wandoor to contribute 2 workers per week to bale the waste of one Panchayat on an average.

Assumptions:

1. 25 working days
2. Equal contribution of all workers.
3. Proportional increase in output with an increase in each worker.
4. Ceteris paribus applied for other variables in the system (equipment malfunctions, events, other tasks assigned, leaves and unforeseen events)

- Workdays and outputs for a week:

	Collection		Segregation		Baling		Cleaning	Total workdays
	Workdays	Bastas	Workdays	Bastas	Workdays	Bales		
Monday	7	42	1	8	1	4	2	11
Tuesday	8	27	0	0	3	7	0	11
Wednesday	0	0	8	22	3	7	0	11
Thursday	0	0	8	22	3	7	0	11
Friday	0	0	8.5	25	1	7	1.5	11
Saturday	3	25	0	0	3	4	5	11
	18	**94**	**25.5**	**77**	**14**	**28.7**	**8.5**	**66**

*the highlighted cells refer to the days when Guptapada's waste is baled at the cluster. The effort and output of Baling has been adjusted to show the involvement of one worker from Wandoor on these days.

Table 10: Weekly output of sanitation workers of Wandoor.

- Quantifying the shortfall in segregation in terms of additional work required:

  Collection output of 1 worker/workday = 94/18 = 5.22 *bastas*
  Segregation output of 1 worker/workday = 77/25.5 = 3.02 bastas
  Baling output of 1 worker/workday = 28.7/14 = 2.05 bales

Shortfall of *bastas* segregated per week = 94-77 = 17 *bastas*
Additional work days required per week to clear the weekly shortfall = 17/3.02 = 5.6 workdays

Therefore, for the current no. of workers, current waste collected and the rate of segregation; there is a need to hire an additional worker to bridge the shortfall in segregation.

- Quantifying the number of workers required for expansion to all households in Wandoor (850 HHs):
  Given that the current system is able to collect waste from 330 households with 11 workers on field; we can say that one person can cater to waste from 30 households. Using this metric, the number of workers required to collect waste from 850 households is 29. In addition, we would have to estimate the number of workers required to clear the shortfall.

  Additional work days required to meet the shortfall in segregation = 5.6*29/11 = 14.8 workdays per week.
  No. of workers required = 14.8/6 = 2.5 workers ~ 3 workers
  Therefore, to cover nearly 850 households the Panchayat would need (29+3) 32 workers.

- Workdays and outputs for one person for collection, segregation, baling and cleaning:

	Proportion of workdays	Workdays/ month	Output/ workday	Corresponding output	Workdays/week	Output/week
Collection (output in bastas)	27.3	7	5.22	35.6	1.6	8.5
Segregation (output in bastas)	38.6	10	3.02	29.2	2.3	7.0
Baling (output in bales)	21.2	5	2.05	10.9	1.3	2.6
Cleaning	12.9	3	-	-	1	-

Table 11: Calculation of work days and outputs per person.

- Shortfall in segregation per person per week:
  No. of HH covered per *basta* = (330 HH)/(94 *bastas*) = 3.5
  Collection output per person per month = 35.6*3.5 = 125 HH
  Collection output per person per week = 8.5*3.5 = 30 HH
  Segregation output per person per month = 29.2*3.5 = 102 HH
  Segregation output per person per week = 7*3.5 = 25 HH
  Shortfall of waste segregated from HH per week per person = 30-25 HHs = 5 HHs

Annexure 6: Estimating the number of sanitary pads and diapers received by the SWM Cluster at Wandoor

Data/assumptions used for estimation:

1. No. of females in the cluster (Wandoor + Humfrygunj + Guptapada) in 2018[1] = 4367
2. No. of children in the cluster within the ages of 0-3 years in 2018[2] = 72
3. Percentage of menstruating women (12-45 years) in India in 2014[3] = 55%
4. Percentage of women using sanitary napkins within Wandoor[4] = 75%
5. Percentage of people using sanitary pads willing to give it to the sanitary workers[5] = 50%
6. SWM collection coverage (as a % of households)[6] = 40%
7. Annual population growth rate in India[7]= 0.8%
8. Average pads used by a female in a month = 10
9. Average pads used for a child in a day= 4

With the help of these data points, we will estimate the daily capacity of the incinerator that is required. We arrive at the capacity required based on the following calculations:

1. Projection of number pads received by the sanitary workers from females:

The projection of female population in the cluster in 2023 = 4367*(1+0.008)^5 ~ 4544
Number of menstruating women in the cluster today = 55% of 4544 = 2499.2
~2500
No. of women who will give pads = (No. of menstruating women)*(SWM coverage)*(Usage of sanitary napkins)*(menstruating females willing to give napkins) = 2500*(40 %)*(75 %)*(50 %)
~ 375
No. of pads received per month from females = 375*10 = 3750
No. of pads received by the sanitary workers from females per day = 3750/30 = 125
Assuming peak usage to be 2*(average pads per day), the peak pads the cluster might receive
= 2*125 = 250

2. Projection of number of children's pads received by the sanitary workers:

The projection of population of children (0-3 years) in the cluster in 2023 = 72*(1+0.08)^5 ~ 75
No. of pads used by a child in a day = 75*4*(0.4) = 120

3. Total capacity of incinerator required at the cluster in 2023:

The cluster must be able to process around **250 sanitary pads and 120 diapers in a day** in 2023.
The number of cycles of the incinerators should factor in the limited working hours and the limited availability of the electricity. Assuming each cycle to last for half an hour, the pads that are received daily should be incinerated within 5-6 cycles.

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[1] Mission Antyodaya Data (2020)
[2] Mission Antyodaya Data (2020)
[3] Nearly 55% of Indian women menstruate (35.5 crores out of 65 crores of females) as per a report by Geertz et al. (2014).
[4] Assumption based on interaction with locals.
[5] Assumption based on interaction with locals.
[6] The collection in Wandoor will expand to a 100 more HHs in this year. This amounts to 350 HHs out of 856 which is nearly 40%.
[7] World Bank data (2021).

Annexure 7: User fee charges & total number of users (agencies) as of 2022

Sl. No.	Agencies	User charges per month (in Rs.)	Total number of agencies
1	House holds delivering segregate waste to the sanitary worker	50	1112
2	Grocery & Small Shops	150	52
3	Departmental Shop & Big Shop	Minimum 300	1
4	Hotels (This does not include restaurant user fee)		
	a) Less than 500/- per day tariff	Minimum 500	
	b) More than 500/- per day tariff	No.of Rooms*10*30	1
	c) Hotels with more than 500/ - per day rariff and those who serves complementary bottled water in rooms.	No.of Rooms*15*30	3
5	Restaurants		
	a) AC Restaurants	No. of seats*3*30	
	b) Non-AC restaurants (That serves full meals)	No. of seats*2*30	2
6	Dive Shops	No. of employees/ DMs/ Instructors*5*30	
7	Vegatables and meat shops	300	4
8	Private/ Government establishments	300	2
9	Goverment School & Colleges	150	3
10	Others (Commercials)	50 to 100	
	a) street vendors		

Table 12: User fee rates as per RD department with list of agencies filled out by Wandoor Gram Panchayat

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