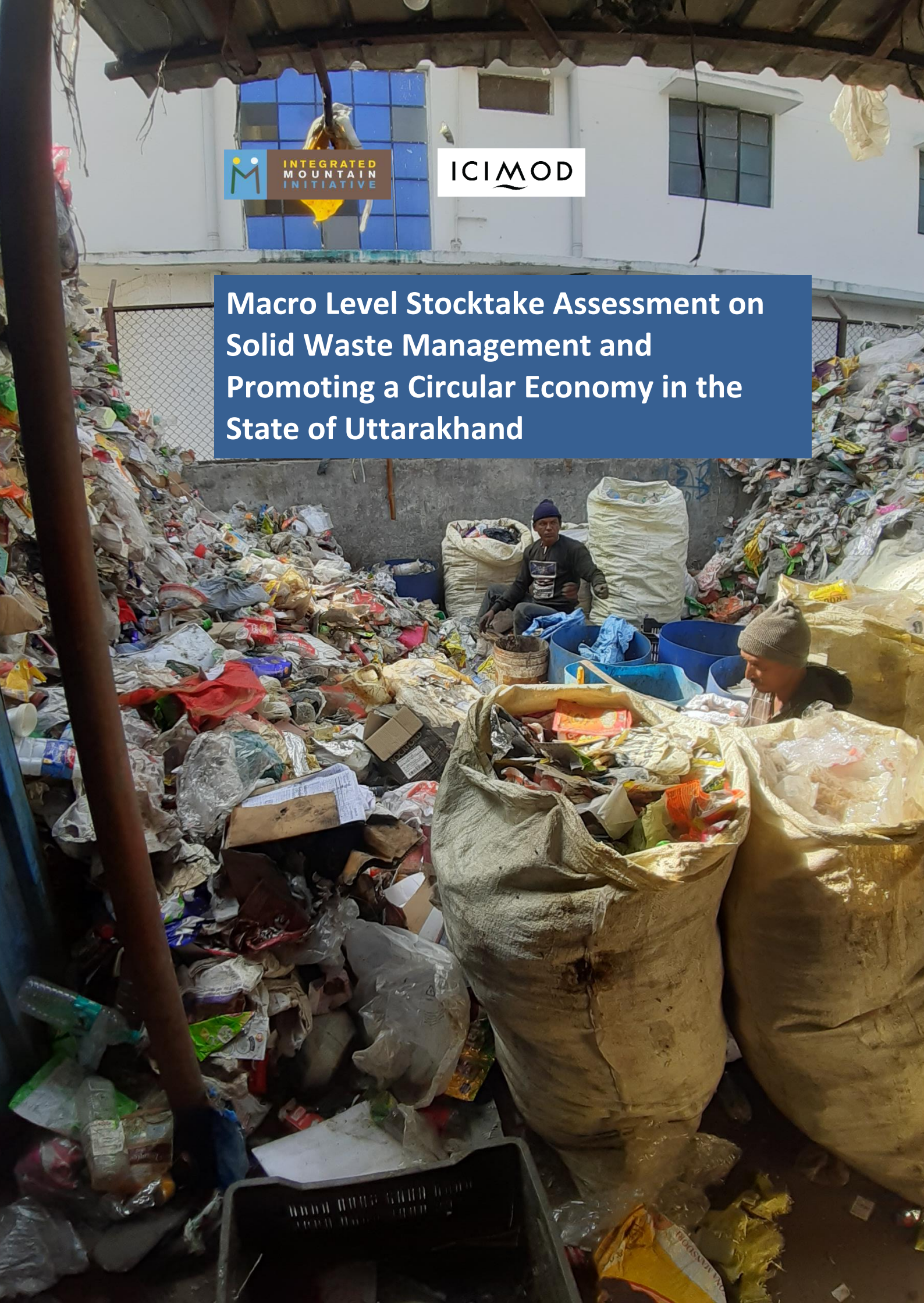

Macro Level Stocktake Assessment on Solid Waste Management and Promoting a Circular Economy in the State of Uttarakhand

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Cover Photograph: Waste being sorted at a material recovery facility by waste workers

Photo credit: Ekta Gupta

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Abbreviations

ADB	Asian Development Bank
ATI	Administrative Training Institute
CAG	Comptroller and Auditor General of India
CAPEX	capital expenditures
CBG	Compressed Biogas
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
CPPGG	Centre for Public Policy and Good Governance
CSE	Centre for Science and Environment
CSR	Corporate Social Responsibility
DPR	Detailed Project Report
DRS	Digital Deposit Refund System
ENVIS	Environmental Information System
EOL	End of Life
EPR	Extended Producer Responsibility
FSSAI	Food Safety and Standards Authority of India
FY	Financial Year
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GOI	The Government of India
GPS	Global Positioning System
GST	Goods and Services Tax
ICCC	Integrated Command Control Centre
ICIMOD	International Centre for Integrated Mountain Development
IEC	Information Education & Communication
IETC	International Environment Technology Centre
IHR	Indian Himalayan Region
IMI	Integrated Mountain Initiative
INR	Indian Rupee
IRP	Indian Resources Panel
KII	Key Informant Interview
LDPE	low-density polyethylene
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act, 2005
MMT	Million Metric Tons
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MRF	Material Recovery Facility

MSW	Municipal Solid Waste
MT	Metric Tons
MW	Megawatt
NGO	Non-Governmental Organizations
NGT	National Green Tribunal
NHAI	National Highways Authority of India
NIMBY	Not In My Back Yard
NIT	National Institute of Technology
NULM	National Urban Livelihood Mission
ODF	Open Defecation Free
OPEX	Operational Expenses
PET	Polyethylene Terephthalate
PP	Polypropylene
PPP	Public-Private Partnerships
PRI	Panchayati Raj Institutions
PVC	Polyvinyl Chloride
PWM	Plastic Waste Management
QR	Quick Response
RDF	Refuse Derived Fuel
SBM	Swachh Bharat Mission
SDFU	Sustainable Development Forum Uttarakhand
SHG	Self Help Group
SMCG	State Mission Clean Ganga
SPCB	State Pollution Control Board
SUP	Single Use Plastic
SWM	Solid Waste Management
THC	The Himalayan Cleanup
TPD	Tons per Day
UDD	Urban Development Directorate
UIRDPR	Uttarakhand Institute of Rural Development & Panchayati Raj
ULB	Urban Local Body
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPCB	Uttarakhand Pollution Control Board
UREDA	Uttarakhand Renewable Energy Development Agency
UUSDIP	Uttarakhand Urban State Development Investment Program
WASH	Water, Sanitation, and Hygiene
WTE	Waste To Energy

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Executive Summary

Uttarakhand, India is witnessing a waste crisis that threatens the wellbeing of people and the environment that is similar to other mountain states in the Indian Himalayan Region. The waste crisis affects people and regions variably with vulnerable communities and regions impacted the most. Waste volumes have gone up drastically, and there has also been a huge change in the type of waste being generated, with non-recyclable plastic waste being the most trashed items. This is the result of a huge shift in the way that production volumes and systems have dramatically changed. The waste crisis is further exacerbated in Uttarakhand, with the drastic increase in tourist and pilgrim footfalls with a large waste footprint that spreads into ecologically sensitive and fragile zones.

The Solid Waste Management Rules, 2016 notified by the Ministry of Environment, Forest and Climate Change (MoEFCC) Government of India, along with a host of specific rules has very clearly outlined the roles and responsibilities of all stakeholders in the waste value chain. There is much impetus given to the implementation of these rules through the national Swachh Bharat Abhiyan (Clean India Campaign). Implementation of these rules, especially in mountain states, has challenges of terrain and geography leading to higher costs, both in rural and urban settings. The waste management rules are not sensitive to the socio-ecological importance and fragility of the mountains do not have appropriate resource allocations.

A rapid study “Macro level stocktake assessment on solid waste management and promoting a circular economy in Uttarakhand” was undertaken by Integrated Mountain Initiative, Sustainable Development Forum Uttarakhand and Waste Warriors in September to December 2024 to develop a macro level understanding on solid waste management systems in emerging hill towns and cities of Uttarakhand, India and analyse potential opportunities and gaps at each node of its value chain to help promote circular economy.

The study has approached the crisis with the need to look at waste beyond the end-of-life management issue to a complete life cycle and circular economic perspective. Waste as a production and consumption issue is core to the study thus circular economic principles and practices are the vision much needed to clean up the present-day mess. The need to look at intersections of justice, equity, food and nutrition security, climate crisis and biodiversity loss and producer responsibility in the waste crisis has been highlighted.

The study was undertaken through key informant interviews, focus group discussions, consultations, workshops and review of literature. Two sites, Srinagar and Bhowali have been studied as representatives of emerging towns of Uttarakhand for greater contextual and lived experience realities understanding of waste management. Gaps in the waste value chain were critically analysed and recommendations are placed at policy, practise, devolution of power, resource allocation, capacities and technologies that need to be appropriate and sensitive to Uttarakhand and the Indian Himalayan Region.

1. Introduction

1.1 The Global Waste Crisis

"*By 2050, the world is expected to generate 3.40 billion tons of waste annually, increasing drastically from today's 2.01 billion tons*" states the 2022 World Bank Report titled What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. The report goes on to highlight the urgency to respond to the waste crisis as well as how the impacts are most for vulnerable sections of society. "*The world is on a trajectory where waste generation will drastically outpace population growth by more than double by 2050. Although we are seeing improvements and innovations in solid waste management globally, it is a complex issue and one that we need to take urgent action on"*. The environmental costs of waste are also highlighted where the world generated 242 million tonnes of plastic waste—12 percent of all municipal solid waste. The report goes on to state that an estimated 1.6 billion tonnes of carbon dioxide– equivalent (CO2-equivalent) greenhouse gas emissions were generated from solid waste management in 2016 and predictions of solid waste–related emissions to increase to 2.6 billion tonnes of CO2-equivalent by 2050 if corrections are not made. Landfills account for 11% of global methane production and have to be tackled with specific focus.

1.2 Indian waste scenario

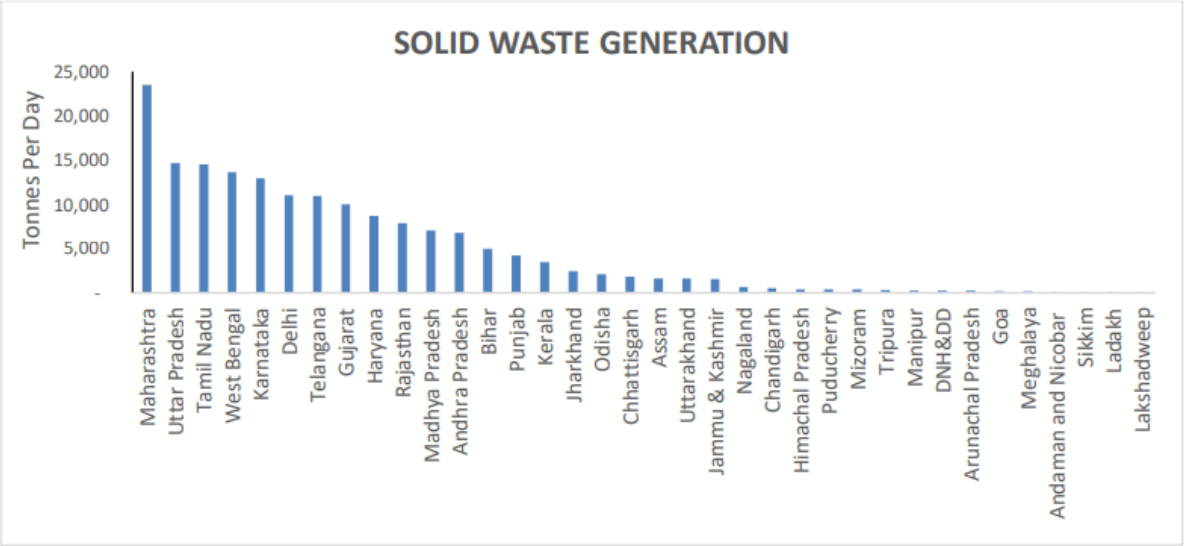
India generates approximately 1,70,339 TPD of municipal solid waste (MSW) and the total waste collected is 1,56,449 TPD, with urban areas accounting for a significant portion of this waste. This translates to overall efficiency 92% with regards to waste collection in the Urban Area including big and small cities (Source - CPCB Annual Report 2021-2022) but it should be noted that collection does not always translate into processed or treated. Rural Areas often lack organized collection systems. The average per capita waste generation in the country is 123.45 gms/ day. Approx. 91,511 TPD (54% of total MW generation) is processed/ treated and 41,455 TPD (24% of total MW generation) is still disposed of at dumpsites. As such, the treatment/ processing or disposal of 37,373 TPD of waste remains unaccounted for. This unprocessed and unaccounted portion of the waste is the gap in the management of solid waste in the country which equates to 46% of the total generated waste. The rapidly changing production and consumption patterns, unplanned rapid urbanisation, population growth have led to increasing waste generation, putting tremendous pressure on existing waste management infrastructure.

India has been named among the 12 nations responsible for 60% of mismanaged plastic waste globally, in the Plastic Overshoot Day report[1]. The United Nations Environment Programme (UNEP)'s country-wise plastic data revealed that India mismanages 85% of its plastic waste. This shows that existing systems are insufficient to manage change in waste profiles that is being experienced in the country.

The Indian Textiles industry reports that more than 1 million tons of textiles are discarded every year, with most of this coming from household sources. While the industry has a recycling potential of 50%, at present only 25% is being recycled/ reused with a limited collection and recycling system for textiles.

1 Plastic Overshoot Day: Report 2024, Earth Action https://www.e-a.earth/plastic-overshoot-day-report-2024/

Figure 1: Solid Waste Generation in India



Source - CPCB Annual Report 2021-2022

India is set to generate 165 million tonnes of waste by 2030 and 436 million tonnes by 2050. As a result, the annual greenhouse gas emissions from Municipal Solid Waste are expected to go up to 41.09 million tonnes by 2030. The need of the hour is therefore a development model based on the circular economy approach that looks at sustainable waste management and optimum utilization of resources - key to an Aatma Nirbhar Bharat (MoHUA advisory on Circular Economy in Municipal Solid and Liquid Waste 2021).

1.3 The Plastic Crisis

The crisis of solid waste has been heightened by the advent of plastics, and India has been highlighted as a nation with plastic mismanagement issues. It is however important to broaden this narrative from being not only an issue of management but highlight the production issue too. The Problem of Plastics, states that "*Plastics production in India has surged over the past 50 years – from 15 million tonnes (MT) in 1964 to 311 MT in 2014 – and is expected to double again over the next 20 years. The growth rate of the Indian plastics industry is one of the highest in the world: plastics consumption is growing at 16 per cent per annum in the country. India's annual demand for plastic packaging stands at 20 MMT – out of this, 15 MMT is met by virgin plastics and 5 MMT from recycled plastic materials. It has also been estimated that 45 per cent of the 20 MMT – nearly 9.6 MMT – is consumed immediately and released as waste into the environment and surroundings.*"[2] Centre for Science and Environment(CSE) further reports in The Plastic Life-Cycle 2022 that "*India consumed 18.45 million metric tonne (MMT) of plastic in the year 2018-19; 59 percent of this went into packaging. This means that of all the petrochemicals produced in the country (29.1 MMT), more than 37 per cent was used to manufacture plastics for packaging applications*.[3]

The impacts of the growing plastic usage is evident everywhere, and it has a serious repercussion not only on waste management processes but also on human and planetary

2 The Problem of Plastics, 2018, CSE https://cdn.cseindia.org/attachments/0.57139300_1570431848_Factsheet1.pdf

3 The Plastic Life-Cycle 2022, CSE https://www.cseindia.org/the-plastic-life-cycle-11509

health. Plastic is found on top of the highest mountains[4], deepest of trenches in the ocean[5], while plastic (microplastic and nano plastic) has been found even inside human placenta[6], blood[7], lungs[8] and testicles[9]. Toxics Link in 2024, found microplastic in all 10 samples of salt and 5 samples of sugar they studied in the Indian market[10]. This is a direct result of the materiality of plastic that does not degrade as well as the excessive production of unnecessary plastic. There is mounting evidence of plastic and its additives being endocrine disruptors, cancer producing, contributing to hormonal disbalance, weight gain, infertility[11] as well as increased risk to heart attack[12].

The paper, "*Production, use, and fate of all plastics ever made"* highlighted this issue when they reported that "*8300 million metric tons (Mt) of virgin plastics have been produced till 2017. As of 2015, approximately 6300 Mt of plastic waste had been generated, only around 9% of which was recycled, 12% incinerated, and 79% had accumulated in landfills or the natural environment*."[13] The fact that only 9% of all plastic produced has been recycled busted the myth of plastic recycling as the panacea of plastic pollution by bringing forth the reality of the limits to recycling. The Himalayan Cleanup (THC) waste audit data since 2018 corroborates the limitations of recycling wherein THC2024 showed over 75% of plastic waste collected was non-recyclable[14]. These non-recyclable plastics are the scourge of waste managers in the mountains as they have no value in collection and processing.

There is also a fundamental flaw in the way plastic is produced where, "*Half of all plastic produced is designed to be used only once — and then thrown away"*. (UNEP 2018[15]) The finite resources of the world cannot sustain a plastic production system where "*Half of the plastic ever manufactured has been produced in the past 15 years*." (World Bank 2018)[16] "*In 2017, packaging production constituted the highest-demanded use of plastic, with 146 million metric tons used"*[17].

1.4 Focus on Uttarakhand

The states, union territories and hill districts of the Indian Himalayan Region (IHR) is home to one of the 34 global biodiversity hotspots provisioning invaluable ecosystem goods and services, supporting 50 million people and constituting about 16.2% of India's total geographical area. The Himalaya is the source of water for the Indo-Gangetic plains and this fragile socio-ecology is in the midst of a waste crisis, especially with regard to plastic waste.

Uttarakhand, a State located in the Northern part of India, often referred as "Dev Bhumi" is largely a hilly State, having international boundaries with China (Tibet) in the north and Nepal in the east is witnessing an increasing waste crisis that threatens the wellbeing of

4 Microplastics found near Everest's peak, highest ever detected in the world National Geographic November 2020

5 Airborne plastic pollution 'spiralling around the globe', study finds The Guardian 2021

6 Microplastics revealed in the placentas of unborn babies The Guardian 2020

7 Microplastics found in human blood for first time The Guardian 2022

8 Detection of microplastics in human lung tissue using µFTIR spectroscopy - L C Jenner et al 2022 Science Direct

9 Microplastics found in every human testicle in study The Guardian 2024

10 Micro Plastic in Salt and SugarToxics Lin 2024 https://toxicslink.org/wp-content/uploads/2024/08/Microplastics%20In%20Salt%20and%20Sugar%20(1).pdf

11 Fact Sheet: The Plastic Threat to Human Health. Earth Day SHEET: THE PLASTIC THREAT TO HUMAN HEALTH

12 Microplastics linked to heart attack, strokes and death, Scientific American March 2024

13 Production, use, and fate of all plastics ever made - Geyer R, Jambeck JR, Law KL. Sci Adv. 2017 Jul 19;3(7):e1700782. doi: 10.1126/sciadv.1700782. PMID: 28776036; PMCID:PMC5517107. But

14 https://www.thehimalayancleanup.in/

15 Our Planet is drowning in plastic pollution UNEP 2018

16 What a waste 2.0, A global snapshot of solid waste management to 2050 The World Bank 2018

17 Plastic production worldwide in 2017 by industrial sector - Statistica 2017

people and the environment. The situation is similar to other mountain states in the Indian Himalayan Region and needs mountain sensitivity in redress.

Waste volumes have gone up drastically, and there has been a huge change in the type of waste being generated, with non-recyclable plastic waste being the most trashed items. This is the result of a huge shift in the way that production systems have changed and the existing waste management systems have not risen to these changes. Waste is now an issue that cuts across urban, peri-urban, semi-urban and rural areas.

Uttarakhand has seen an increase of almost 65 percent in the number of tourists between 2006 and 2016, and tourism contributes to over 50 percent of the state GDP[18]. The waste crisis is further exacerbated with the drastic increase in tourist footfalls along with increasing volumes of pilgrims. Every tourist footstep adds a waste footprint that is not always planned for in the waste management system especially in the IHR. Tourism changes waste profiles and volumes dramatically during the tourist season as well as spreads the waste to remote locations across the mountains of Uttarakhand many of which are ecologically important and sensitive zones. Waste does not always feature prominently in the tourism industry lens but awareness on its importance is growing. With a large section of Uttarakhand being international borders with China (Tibet) in the north and Nepal in the east, waste coming from defence installations are also an important component to consider in the waste management discussions of Uttarakhand.

Uttarakhand's Performance in Swachh Survekshan has been less than encouraging. In 2018, Uttarakhand was ranked among the worst performing states for solid waste management in a report prepared by the Central Pollution Control Board (CPCB), because it did not have a single functional solid waste management plant or sanitary landfill[19]. In the latest edition of Swachh Survekshan, released by the Ministry of Housing and Urban Affairs, Uttarakhand moved from 3rd to 19th position, amongst a total of 27 states. Dehradun secured 68th rank, improving from last year's rank of 69 with a score of 6,579 out of 9,500 and retained the cleanest city position in the state.

1.5 Need for a Circular Economy

There has been a dramatic shift in narrative from linear economic models to a circular economic one with the recognition that the waste crisis is one of the outcomes of the linear models. In linear economic models, waste is treated as a visual and a material problem that needs to be solved by shifting it away from sight and not really treating it and solving the problem. The extraction of resources and their processing, consumption and final disposal into the environment were negatively impacting the environment. Apart from this chain being a capital-intensive process, the availability of the resources is also an important aspect to be looked into in a finite planet. Within this narrative shift, waste is no longer an end of life management issue but has to be looked at from a complete life cycle perspective from extraction, production, transfer, sale, consumption and treatment of material. With the introduction of the term circular economy in the global dictionary, the focus is now shifting towards reusing and recycling of the waste as an alternate resource.

[18] Uttarakhand, DoT 2018

[19] Uttarakhand Among worst states in terms of waste management - September 2018 Times of India

Figure 2: Parliamentary Guidelines on Circular Economy

Source: European Union 2016

The circularity gap report estimates that only 7.2 per cent of the global economy is circular.[20] The circular economy is currently a major focus area not only globally but also in India with the Extended Producer Responsibility Rules having circularity as one of its guiding principles. Circular economy works on the principle that 'waste is not only a waste but a resource'. It is a 'model of production and consumption that involves circularity (sharing, leasing, reusing, repairing, refurbishing, and recycling) of existing materials and products as long as possible extending the lifecycle of products. In practice, it implies reducing waste to a minimum.[21]

In 2015, the Government of India constituted the Indian Resources Panel (IRP) as a step to address India's resource security. IRP is an advisory body under the Ministry of Environment, Forest and Climate Change (MoEFCC). India's annual material consumption as compared to 7 billion tonnes of consumption in 2015 is expected to double to 14.2 billion tonnes by 2030.[22] With the current recycling of goods standing at mere 20 per cent, there is a huge potential for the Indian economy to transform into a circular one.

In September 2022, the Circular Economy Cell (CE Cell) was constituted in NITI Aayog as a dedicated unit to work in the area of circular economy. NITI Aayog has identified 11 focus areas in waste management, to expedite India's transition from a linear to a circular economy.

[20] Circle Economy (2023). The circularity gap report 2023 (pp. 1–64, Rep.), https://www.circularity-gap.world/2023
[21] 2023 Circular economy: definition, importance and benefits, News European Parliament. https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-andbenefits
[22] EAC-PM Working Paper Series EAC-PM/WP/17/2023 https://static.investindia.gov.in/s3fs-public/2023-08/eacp.pdf#:~:text=1.1%20Within%20roughly%20half%20a%20century%2C%20from%201970,populous%20country%20and%20its%20per%20capita%20consumption%20surges.(as viewed on July 31, 2024)

However, much more needs to be done for a more formalised transition to the circular economic regime in India. Shifting towards a circular economy is the need of the hour with growing production and consumption patterns, population dynamics, livelihood opportunities, environmental challenges as well as international commitments.

For ecologically sensitive mountain states like Uttarakhand, that are rich in biodiversity and cultural heritage, and are facing significant challenges due to the growing pressure of tourism, adopting a circular economy approach offers a sustainable solution. By emphasising resource efficiency, waste reduction, and material reuse; circular practices can mitigate the environmental impact of tourism while fostering economic opportunities for local communities. This shift is critical for preserving the ecological integrity of mountain regions and ensuring their long-term sustainability.

2. Project objectives

The overall objective of this assessment is to develop a macro level understanding on solid waste management systems in emerging hill towns and cities of Uttarakhand, India and analyse potential opportunities and gaps at each node of its value chain to help promote circular economy. The specific objectives are listed below -

- Assess the state and local level policy on solid waste management and potentials to promote a circular economy.
- Conduct a macro level stocktake assessment at State level to develop an understanding on solid waste management at each node of the value chain.
- Review and identify existing proven and scalable solid waste management solutions (these can be innovative technology, practical solutions, processes/approach, and pragmatic government schemes or policy instruments etc.) that are relevant to mountain context for promoting circular economy.
- Map out relevant stakeholders (governments, non-governments, researchers, private sectors and donor communities) in each node of the value chain for solid waste management.
- Recommend viable strategies/approaches for solid waste management that best suit emerging hill towns and cities of Uttarakhand, India.

3. Methodology and Approach

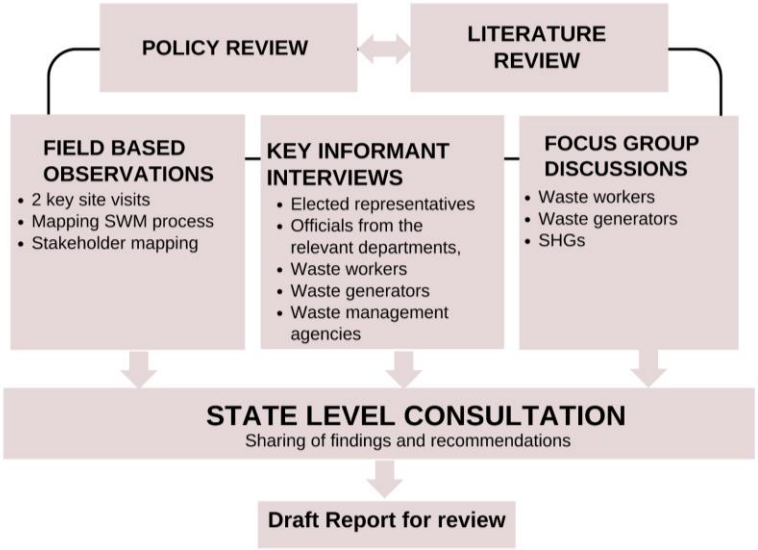
The methodology adopted for undertaking the macro level stocktake assessment of solid waste management is outlined below-

Policy and literature review: Review of policies, guidelines, rules and bylaws for taking a deeper dive into the solid waste management process in the state, as well as from the national perspective. Other relevant literature was also reviewed for bringing in critical insights on the current solid waste management practices and challenges.

Community based observations: Assessment of 2 key sites was one of the main activities conducted as part of the study. Srinagar, District Pauri and Bhowali, District Nainital were chosen to be representative of the changing urbanisation space in Uttarakhand. The waste management process was mapped over a period of 2 - 3 days along the value chain. The

community surveys were undertaken with the sanitation supervisor of Nagar Nigam and Palika to observe the ongoing door to door waste collection process followed by visits to secondary storage sites, open dumping sites, transfer stations and disposal sites. The process also helped in mapping out the key stakeholders along the value chain, and developing understanding on the existing gaps as well as good practices of the operational infrastructure for SWM in place as well as the awareness level of waste workers, operators of processing facilities, residents, and commercials in these areas.

Figure 3: Schematic diagram of methodology adopted



Stakeholder consultations: Stakeholder consultations were conducted through Key Informant Interviews, workshops and community-based interviews with representatives of the waste management sector. KIIs were undertaken with the officials of 2 selected ULBs namely Chief Health Inspector of Srinagar Nagar Nigam and Senior Assistant, Bhowali Nagar Palika, to understand the entire SWM value chain with key challenges and initiatives taken by them. Key stakeholder discussions were also facilitated to gain insights from the different stakeholders such as Nagar Nigam members, waste workers, and NGOs. The community-based study provided a deeper contextual understanding of the state level waste management assessment. The community-based study and stakeholder consultations were conducted in collaboration with Waste Warriors Society, a prominent non-profit working on waste in Uttarakhand.

State level consultation: A state level consultation was organised with key stakeholders from the State government, Urban Local Bodies, State Pollution Control Board, NGOs, CBOs and others. The findings from the community visits were shared with them for validation and further inputs. Key inputs on the current status of SWM, policy and practise gaps in the state and recommendations for the future were discussed with the participants.

The approach was to conduct the assessments along the solid waste value chain keeping focus on the key determinants of policy environment, governance, operational issues, capacities and skills, and community engagement. For understanding of the policy

environment, the various policies, guidelines and byelaws at national, state and local levels were studied for policy gaps as well implementation gaps.

Aspects of governance were analysed through the roles and responsibilities of the various departments, local bodies to look at issues of hierarchies, power structure, financial devolutions, etc.

Under operations the current process of waste management in the state was studied mainly through the field observations in 2 key representative sites. Capacity and skills of the various stakeholders was looked at as well as the efforts made for community engagement. It was however not possible to do in- depth analysis of the entire state due to the short nature of the project.

4. Project Limitations

The limitations faced during the assessment are highlighted below-

1. The short duration of the project and resources was a limiting factor and many of the activities had to be adapted to fit into the given time schedule that affected the quality of work thus specific data on waste of tourism, religious and defence sites could not be highlighted.

2. Getting relevant and the same level of sub-sectoral data from a reliable source was a challenge. This is especially true in case of availability of information or the granular data for mountains is in any way a challenge for all the identified sub-streams of solid waste. In such cases, the analysis is undertaken based on rough figures/ percentages provided by the Department officials, secondary research, other relevant sources etc.

3. While the focus was on undertaking physical meetings with the key stakeholders, to save time and ensure maximum interaction within this limited timeline the one-on-one interactions were held online based upon the convenience of the stakeholder representative.

5. Overview of Uttarakhand's waste status

5.1 State Profile

Uttarakhand, a State located in the Northern part of India, often referred as "Dev Bhumi" was carved out of the Himalaya and adjoining North-Western districts of Uttar Pradesh on November 09, 2000, becoming the 27th State of India. Located at the foothills of the Himalayan Mountain ranges, it is largely a hilly State, having international boundaries with China (Tibet) in the north and Nepal in the east. On its north-west lies Himachal Pradesh, while on the south is Uttar Pradesh. It is rich in natural resources especially water and forests with many glaciers, rivers, dense forests and snow-clad mountain peaks. Char-dhams, four of the most sacred and revered Hindu temples of Badrinath, Kedarnath, Gangotri and Yamunotri are nestled in the mighty mountains. It's truly God's Land (Dev Bhoomi). It has 02 Capitals Dehradun (Temporary) & Gairsain (Summer).

Most of the industries are forest-based. With levels of literacy higher than the national average, the State has abundant availability of quality human resources. Within a short span of its existence, Uttarakhand has emerged as a significant destination for investments in manufacturing industry, tourism and infrastructure.

Table 1: Uttarakhand State Profile

S. No.	Particulars	Statistics
1	Population (2011 Census)	10,086,292
2	Floating Population (2011 Census)	15129438
3	Area (sq km)	53,566
4	Population Density	189 persons per sq km
5	Capital	Gairsain (summer) / Dehradun (winter)
6	Divisions	Garhwal and Kumaon
7	Districts	13
8	Towns	86
9	Villages	16,826
10	ULBs	92
11	Cantonment Boards	9
12	Topography	Approx. 86% mountainous with significant forest cover (around 45.4%)
13	Major Rivers	Ganges and its tributary Yamuna originate from the state's glaciers.

Source: State Policy by Urban Development Directorate, 2017

5.2 Local Bodies in Uttarakhand

Urban: There are 92 Urban Local Bodies (08 Nagar Nigams, Municipal Corporations, 42 Nagar Palika Parishads and 42 Nagar Panchayats) in Uttarakhand out of which 52 ULBs are located in Garhwal Region and 40 ULBs are located in Kumaon Region. Around, 51 ULBs are situated in hilly areas and the rest 41 ULBs are situated in foot hills or plain areas. A recent delimitation exercise in the state has added 10 more ULBs bringing the total to 102, however much of the data presented is based on the older number of 92 ULBs.

Rural: Uttarakhand has a total of 7791 Gram Panchayat Units across its 13 districts, that are given the responsibility of waste management under the Swachh Bharat Mission Grameen.

Table 2: ULBs in Uttarakhand

Municipal Corporations		Municipal Councils		Nagar Panchayats	
Number	8	Number	42	Number	42
Area (sqkm)	155.79	Area (sqkm)	39.01	Area (sqkm)	148.6
Population (Lakh)	15.4	Population (Lakh)	10.5	Population (Lakh)	2.9
Population Density (persons/sq/km)	885.1	Population Density (persons/sq/km)	391.7	Population Density (persons/sq/km)	951.5

Source: Indian Council for Research on International Economic Relations, 2019

5.3 Solid Waste Generation

As per census 2011, 30.23 % of the total population resides in urban areas and 69.77 % resides in rural areas. According to Government of Uttarakhand[23], the state as a whole (urban and rural) is generating approximately 3000 Metric Tons of Solid Waste per day out of which, the waste generated by the urban areas is around 1759.33 TPD of MSW (Annual report CPCB, 2022-2023). 45 to 50% of the waste is biodegradable in nature (State Policy by Urban Development Directorate Dehradun 2017).

Table 3: Status of SWM in Uttarakhand

No of ULBs	92 old + 10 new
Population	3,049,338
Total Waste generated	1759.33 (TPD)
Total Waste collected	1710, 11 (TPD)
Treated	998.354 (TPD)

Source: SWM Annual Report for FY 2022-2023

[23] State Policy by Urban Development Directorate Dehradun 2017 and SWM Annual Report for FY 2022-2023

Out of total waste generation of 1759.33 TPD, around 1710.11 TPD is collected and 998.35 TPD is treated. The total urban waste volume doubles considering the large floating population that visits the state every year.

5.4 ULBs categorised as per Waste Volumes

Based on the population size of the ULBs, the volume of waste generated on a daily basis varies. In Uttarakhand, the following are the numbers of ULBs categorised as per their waste generation. 11 ULBs generate less than 1 TPD among which are Gangtotri, Devprayag, Badrinath and Sri Kedarnath. Bhowali and Munsiyari are among the 18 ULBs that generate between 1 to 2 TPDs. Majority of the ULBs generate between 2 to 5 TPD (30 ULBs) and 5 to 10 TPD (17 ULBs). The ULBs in these categories are Dharchula, Rudraprayag, Joshimath, Uttarkasi, Mussoorie, Almora, etc. The 3 ULBs that generate more than 50 TPD are Dehradun, Haldwani and Haridwar. A detailed break up with the projections done by the Urban Development Department is in the annexure.

Table 4: Categorisation of ULBs

Less than 1 TPD	Between 1 TPD and 2 TPD	Between 2 TPD and 5 TPD	Between 5 TPD and 10 TPD	Between 10 TPD and 50 TPD	More than 50 TPD
11	18	30	17	12	3

Source: SWM Annual Report for FY 2022-2023

5.5 Per Capita Waste Generation

Table 5: Per capita waste generation

Per capita generation kgs/ day	2001	2011	2021	2041
Urban	0.25	0.3	0.35	0.4
Rural	0.1	0.125	0.15	0.2
Floating	0.05	0.075	0.1	0.15
Total	**0.4**	**0.5**	**0.6**	**0.75**

Source: State Policy by Urban Development Directorate Dehradun 2017

5.6 Overview for Rural Area

Table 6: Overview of solid waste for rural areas

No of GPUs	7791
Population	7,036,954
Total Waste generated	Approx 1300 (TPD)

Source: SBM Grameen dashboard

5.7 Total number of Dumpsites

Table 7: Total number of dumpsites in the state

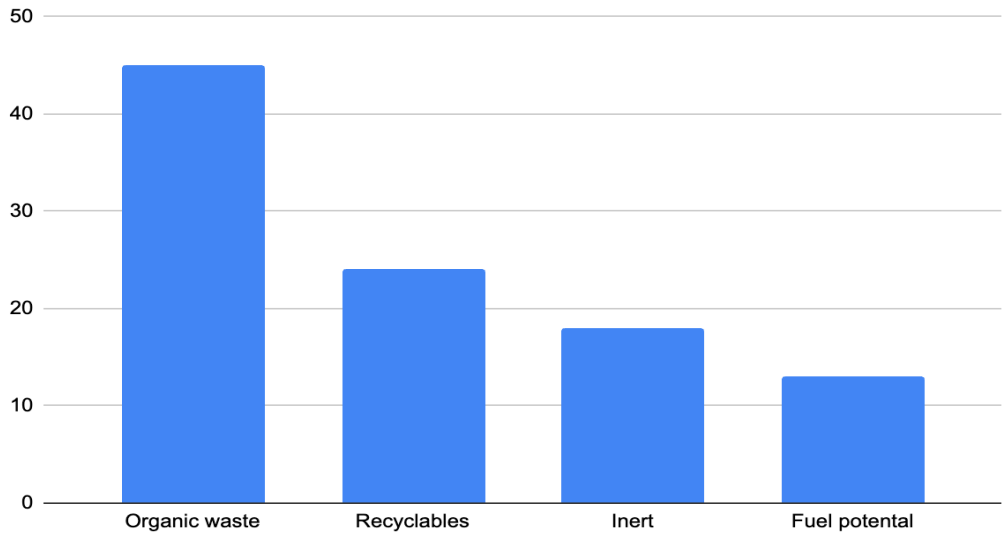
No of dumpsites	19
Reclaimed through bioremediation	4
Partially reclaimed	4
DPR prepared for reclamation	5

Source: Solid Waste Annual Report 2022 -23, SPCB

5.8 Solid Waste Characterization

A study for quantification and characterisation was conducted by the Urban Development Department in 28 ULBs during year 2010-13 as part of the Uttarakhand Urban State Development Investment Program (UUSDIP)[24]. The ULBs identified were 51% from Garhwal and 49% from Kumaon region.

Figure 4: Physical Characterization of the MSW



Source: UUSDIP Study 2010-13

The objective was to ascertain the quantification and characterization of the municipal solid waste generated from the state on a daily basis. This information would help in developing solid waste management strategies and enhance understanding on the technology requirement, infrastructure requirements for SWM, the tools and machineries, etc.

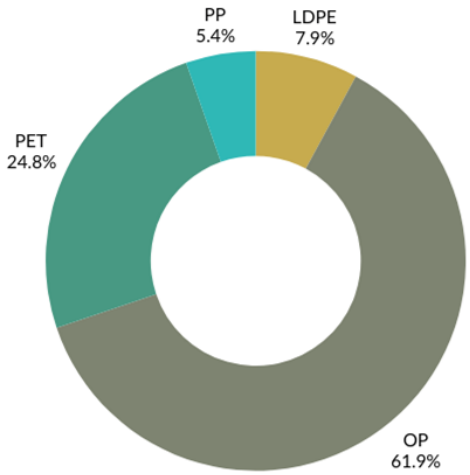
The study findings showed that organic/ wet waste constituted a major portion of total solid waste generated in the ULBs being 45% of the total waste. Recyclable waste was found to be around 24% followed by inert at 18%. The study highlighted that only 13% of waste had fuel potential.

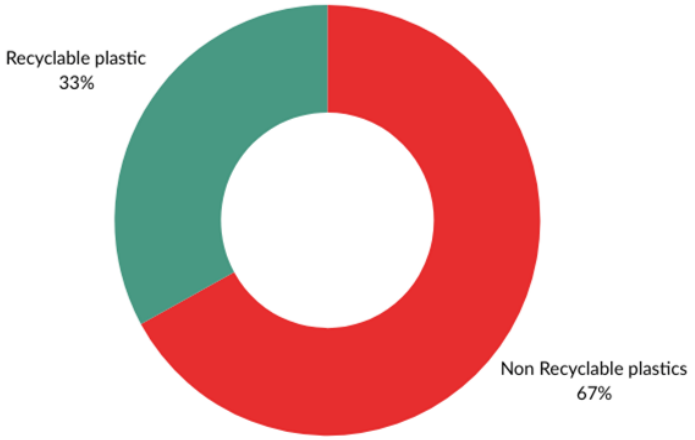
[24] State Policy by Urban Development Directorate Dehradun 2017

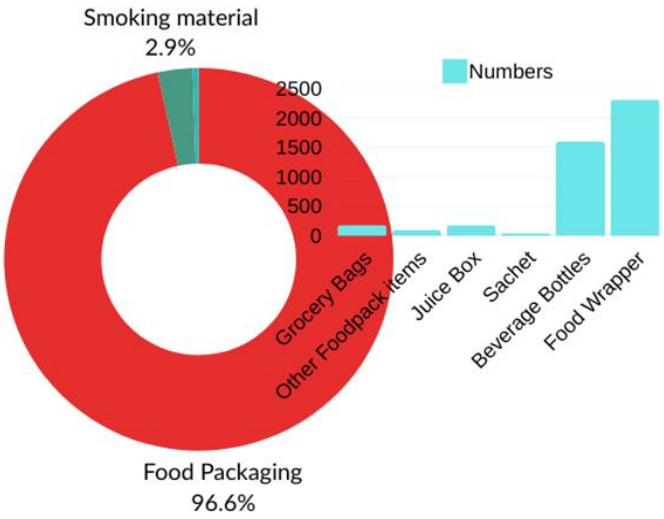
5.9 Plastic Waste Characterisation from The Himalayan Cleanup

The Himalayan Cleanup (THC) is a movement carried out every year by Zero Waste Himalaya with the Integrated Mountain Initiative since 2018 where waste and brand audits of plastic trash collected from across the Himalayan states is undertaken by volunteers. In Uttarakhand, the activity was carried out in 2024 in collaboration with Waste Warriors Society and India Hikes team who picked up and audited around 5937 from 8 key sites.

THC 2024 data showed that over 67% of plastic waste collected in Uttarakhand was non-recyclable, mainly multi-layered plastics and tetrapak which is a challenge for waste managers as they have no real solution. Collection has no meaning with its non-recyclability thus is the most visible form of plastic waste in the environment. Only around 33% was recyclable plastics - PET (24.8%), LDPE (7.9%) and PP (5.4%) but still found in the environment showing that collection, transfer and aggregation is a challenge in the mountain state.







6. Status of Waste Management in 2 selected hill towns

To take a deeper dive into the solid waste management process in Uttarakhand, and for validation of the literature review exercise, Srinagar in District Pauri and Bhowali in District Nainital were chosen to be representative of the changing urbanisation space in Uttarakhand. Mapping of the waste management processes along the value chain was undertaken with key stakeholder as well existing gaps and good practices being documented. Srinagar and Bhowali were studied to give a deeper contextual understanding of the state level waste management assessment. This exercise was undertaken in collaboration with Waste Warriors Society who provided support in coordination and facilitated the interviews.

6.1 Srinagar Nagar Nigam

Srinagar is a city in Pauri Garhwal district in Uttarakhand. It is located at 30.22°N 78.78°E at the left bank of Alaknanda river with an average elevation of 560 metres (1,837 feet). It is the largest city in the Garhwal Hills. It is reached by national highway NH58 from Rishikesh which is about 100 km away and is the last city on the plains of Uttarakhand. Srinagar can also be reached via Kotdwara.

The city is the hottest place in the Garhwal Hills in summers as it is at a low elevation of just 560 m. and the temperature reaches 45 °C on some days from May to July whereas winters are chilly and the temperature can fall to 2 °C in December and January[25].

The town is a hub for important cultural and educational institutes in the Pauri Garhwal district. The town is a major education centre for students and researchers visiting from all over the World. This includes Central University, NIT, Medical College, Sanskrit University etc. The city exhibits a number of temples, monuments and places for tourists to stay and visit. Some of the key tourist attractions are Kamleshwar Mahadev Temple and Dhari Devi Temple.

In the 2011 census, the population of the city was recorded as 37,900 which has now risen to almost 1 lakh as per the discussion with officials of Nagar Nigam.

The general profile of the city is provided below –

[25] Detailed Project Report for Legacy Waste Remediation in Srinagar provided by Nagar Nigam officials

Table 8: City Profile of Srinagar

S.No	Particulars	Statistics
1	Population (2011 Census)	37,900
2	Current Population	1,00,000
3	Floating Population	15000
4	Area (Sq km)	24.87
5	Area (sq km)	21 stretching from Bilkedar to Pehlgaon
6	No. of Wards	40
7	Key tourist attractions	Temples, Monuments and Educational Institutes
8	Waste Generation in TPD	24-25
9	Waste Generation in TPD during Tourist Season	30
10	No. of Bulk Waste Generators	12

Source: Srinagar Nagar Nigam, 2024

Details of Field Survey and KIIs

- The team visited Srinagar Nagar Nigam on 23rd – 24th November 2024.
- Main interaction was held with the Chief Health Officer on current waste management practices and discussed waste collection and processing in Srinagar.
- Visit to the Transfer Station cum MRF was conducted, its operations and process examined.
- Visit to the dumpsite at Girigaon was also conducted to understand the legacy waste status.
- To understand the rural waste management status, the team visited Khola village and interacted with residents and saw the local waste collection and disposal system.
- The team also observed door to door collection of solid waste and condition of secondary storage points with the Supervisor of Nagar Nigam in the city.
- Interactions with the women waste workers was also conducted as part of the field visit.

Findings from field observations and KIIs

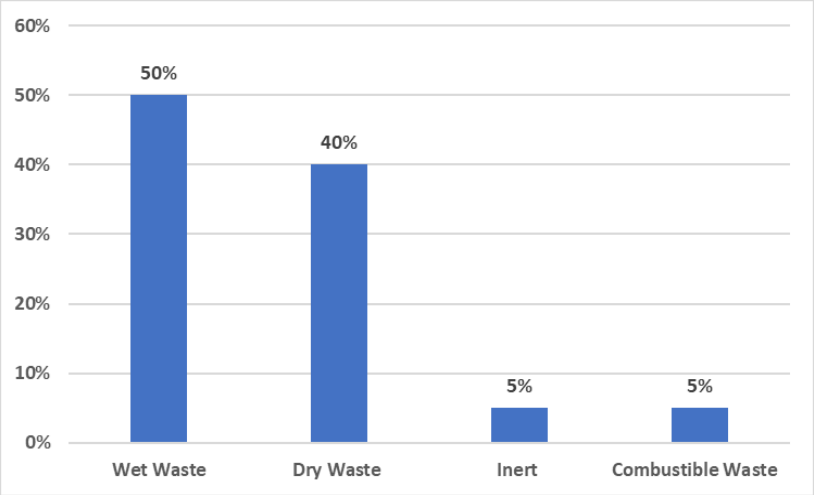
- **Total Waste generated**

As per KII with Chief Health Inspector, Srinagar Nagar Nigam, the city currently generates 24-25 Metric Ton per day of MSW which peaks at 30 Metric Ton per day with the tourist influx.

- **Waste characterisation**

Based on observation of the waste workers, the Chief Health Inspector, Srinagar Nagar Nigam informed that the wet waste constitutes a major fraction of total solid waste generated in the town (50%) followed by dry waste (40%) and combustible and inert waste.

Figure 5: Waste composition of Srinagar



Source: Srinagar Nagar Nigam, 2024

- **Solid Waste Management process**

Srinagar Nagar Nigam manages its waste in the following manner –

Collection process

- The Nagar Nigam has a regular door to door collection system with the engagement of waste workers. The waste is collected and taken to a transfer station for sorting of recyclables, and the leftovers are sent to the final landfill site for disposal at a place called Girigaon.
- This entire operation has been given to a contractor who has the responsibility of waste collection from source of generation to the transfer station and then to the final landfill site.
- The contractor is paid at the rate of INR 1,700/ MT based on a tipping fee model for providing services in the entire SWM value chain.
- A total of 6 vehicles are deployed by the Nagar Nigam to manage the daily waste collection and transportation process.
- The collected waste from the primary sources is stored at temporarily located designated roadside points which is then loaded onto collection vehicles for transport to the Transfer Station.
- The city has 18 dumpsters (secondary storage points) where households that are not serviced by the door-to-door collection drop their waste. Waste from these dumpsters is collected by vehicles every morning.
- Waste workers cover those areas in the hilly terrain which are inaccessible for collection vehicles for waste collection.
- The women workforce were engaged on contractual basis with monthly remuneration of INR 7500/- per month and are provided with required personal protective equipment (PPEs).
- A user fee is levied from the waste generators by Nagar Nigam for providing waste collection services. The fee was INR 30 per month for households and INR 100 per month per Commercial Establishments.

Figure 6: Waste Collection System in Srinagar

Collection Vehicle

Temporarily located Designated Road Side Points

Loading of collected waste in Collection Vehicles

Dumpsters (Secondary Storage Points)

Source: Field Surveys in Srinagar, 2024

- ***Waste Processing and sorting process***

- Sorting of the waste that is collected and transported from the Nagar Nigam is done at the Transfer Station which also has a material recovery facility.
- Some portion of the wet waste is fed to cattle or sent to the Gaushala (cow shelter) operated by Nagar Nigam. The current Gaushala houses 45 cows.
- Dry waste that is taken directly to Transfer Station cum manual Material Recovery Facility is further sorted by the workers that are employed there (around 14 numbers)
- The waste is sorted into 6 – 7 categories by the workers.
- The revenue generated from the sale of recyclables is around INR 25000/- per month for the Nagar Nigam.

- ***Disposal process***

- All waste that is not recovered for recycling is ultimately dumped at the city's landfill which is located in Girigaon.
- The landfill is spread across an area of 1.775 acres and has around 18,000 MT of legacy waste accumulated.
- The Chief Health Inspector, Srinagar Nagar Nigam informed that this legacy waste was transported from transfer station to the landfill with support of the railways under their CSR funds.
- A biomining project to recover the legacy waste has commenced as part of an environmental restoration initiative at the cost of INR 98 Lakhs.

- Out of total 18000 MT of legacy waste, approx. 5500 Tons of legacy waste has been bio mined and around 1200 sqm of area has been reclaimed as reported by Chief Health Inspector, Srinagar Nagar Nigam 2024.

Figure 7: Transfer Station cum manual MRF in Srinagar

Source: Field Surveys in Srinagar, 2024

Figure 8: Girigaon Landfill in Srinagar

Source: Field Surveys in Srinagar, 2024

Insights from Nagar Nigam Official (Chief Health Officer)

- **Capacity and Skills**

Srinagar Nagar Nigam informed that there were no specialised technical person/s appointed for solid waste management in Srinagar, and the existing staff have limited capacity building facilitated for them.

- **Revenue Generation**

Srinagar Nagar Nigam generates revenue through trade licenses, property tax, CSR contributions as well as user fee.

- **Challenges in Waste Management**

- Lack of manpower and resources for the functioning of SWM in Nagar Nigam
- Littering issues in and around the secondary storage points
- Inefficient infrastructure for entire SWM Value Chain
- Lack of waste segregation practices at source, placing additional burden on workers at the facility to manually separate the waste and reduces overall recycling efficiency
- Lack of awareness among waste generators about the importance of separating wet and dry waste at the source
- Seasonal waste challenges due to tourism
- Difficult geographical condition makes waste collection a challenging task
- Lack of suitable lands for the setup of waste processing facilities.

- **Bye Laws of Srinagar**

There are no existing Byelaws for Solid Waste Management. However, Nagar Nigam has issued following byelaws which are as under-

- Gazette Notification for User Charges
- Gazette Notification for Bulk Waste Generators

- **Future Prospects**

The future initiatives in waste management are as under-

- An expansion project of existing Gaushala is under development stage to accommodate 500-700 cattle, with a project cost of INR 3.5 crores
- A Detailed Project Report (DPR) worth of INR 7.8 crores has been approved for the development of a Solid Waste Processing Facility at the Girigaon landfill site

- **Good Practices**

- Enforcing bye laws for User Charges, BWGs, Anti Littering and Anti Spitting
- Engaged Aggregators at Transfer station and employed 14 waste workers
- Engaged 40 SHGs, Space society and Stock tears (NGOs) for conducting IEC activities on segregation, SUPs and selling of recyclable products
- Challan System for the use and distribution of single-use plastics within the city
- Installation of vending machines for cloth bags
- Setup two Waste to wonder parks

6.1.1 Visit to Khola Village: Observations and Insights

A site visit was undertaken to Khola, a rural village which is 7 km from Srinagar, having a population of only 20 families for observing the current waste management practices in the rural areas. The village has not been notified under any Governance structure and thus faces significant challenges in waste disposal.

As per the field observations, currently, the village has no formal waste pickup services and waste is either disposed of on roadsides or down the hill or burned. During the rainy season, waste is often washed away into seasonal rivers, posing environmental hazards. During the interaction with locals & residents, the wet waste is often fed to cattle, providing an informal method of organic waste disposal. For dry waste, a small waste bank has been created possibly under the SBM funding, but it is neither utilized effectively nor maintained properly. During the interactions, the villagers lack basic awareness about waste segregation at source.

Despite all these challenges, the residents of this village have expressed willingness to pay for waste collection services if provided during the interactions. This interaction with Khola village, though not planned, provides insights into the solid waste management scenario of Uttarakhand especially of spaces that are left out from the existing administrative structure.

Figure 9: Khola Village

Khola Village

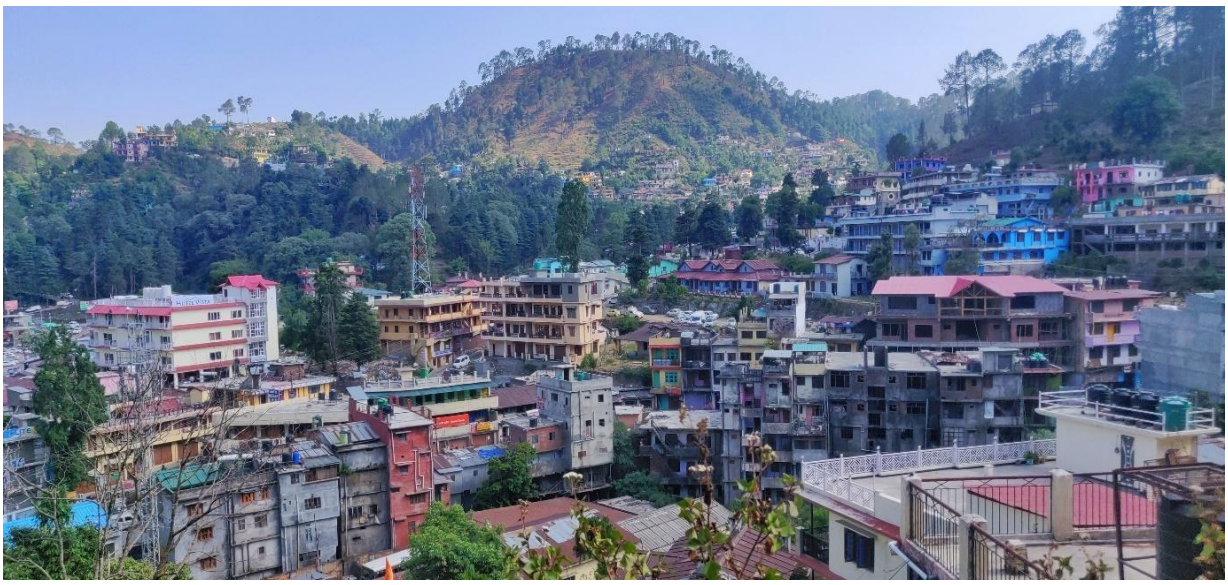
Open Dumping down the Hill

Open Dumping down the Hill

Khola Village Waste Bank

Source: Field Surveys in Srinagar, 2024

6.2 Bhowali Nagar Palika



Bhowali is a town and a municipal board in Nainital District in the state of Uttarakhand, India. It is situated at 29.38°N 79.52°E at a distance of 11 km (6.8 mi) from the city of Nainital, the district headquarters; at an average elevation of 1,654 m (5,427 ft) from sea level. It is the seat of Bhowali tehsil, one of the eight subdivisions of Nainital district.

Bhowali is most known for its T.B. Sanatorium, established here in 1912. It is an important fruit market for all the neighbouring regions and an important road junction to neighbouring hill stations like Nainital, Bhimtal, Mukteshwar, Ranikhet and Almora. It lies close to Ghorakhal, known for Golu Devta temple and Sainik School Ghorakhal. The famous Kainchi Dham temple is about 8 km from Bhowali on Almora road. Famous among locals as the Neem Karori temple, is one of the most revered temples in the area. Its strategic location between two major tourist destinations, Nainital and Kainchi Dham, contributes to its growing popularity among travelers. The average temperature reaches up to 22.8 °C in the month of June and the month of January is characterized by the lowest temperatures with average of 8.8 °C[26].

[26] Climate-Data.org

The general profile of the city is as under –

Table 9: City Profile of Bhowali

S.No	Particulars	Statistics
1	Population (2011 Census)	6,309
2	Current Population	8483
3	Floating Population	10,000
5	No. of Wards	7
6	No. of Households (2011 census)	1428
7	Current No. of Households	2237
8	Location	11 km from the city of Nainital
9	Key tourist attractions	Neem Karori temple in Kainchi Dham and Ghorakhal Temple
10	Waste Generation in TPD	6 – 8
11	Per capita Waste generation	300 gms

Source: Bhowali Nagar Palika, 2024

Details of Field visits and KIIs

- The team visited Bhowali Nagar Palika on 7th December 2024
- The team interacted with the Supervisor of Bhowali Nagar Palika and also observed the waste collection and condition of secondary storage points in the town.
- At the Bhowali Nagar Palika, the team met the Senior Assistant and discussed the current scenario of waste collection and processing being undertaken in Bhowali
- A visit to Kainchi Dham was conducted with Senior Assistant to observe the waste collection process being adopted from commercial areas in Religious town
- The team also visited the dumpsite cum trenching ground to observe existing waste recovery methods being adopted.
- Interaction with landfill operator was conducted for key insights on the process followed for recycling and processing
- KIIs were conducted with the Executive Officer and Junior Engineer, Bhowali Nagar Palika for key insights on present day waste challenges and future prospects.
- Interviews were also conducted with waste collectors to get their perspectives on waste management.

Findings from field observations and KIIs

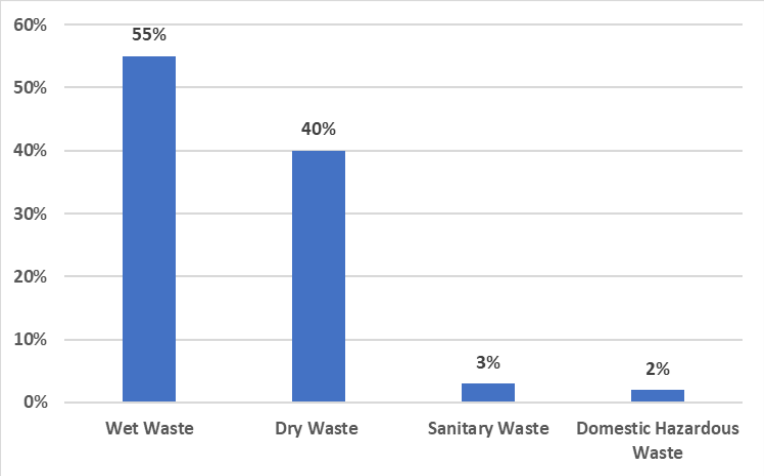
Total waste generated

As per KII with Senior Assistant, Bhowali Nagar Palika, it is established that the city currently generates 6-8 Metric ton per day of MSW including the waste of Kainchi Dham and Ghorakhal.

Waste characterisation

Based on observation of the waste workers, Executive Officer, Bhowali Nagar Palika has informed that wet waste constitutes a major fraction of total solid waste generated in the town (55%) followed by dry waste and a small fraction of domestic hazardous waste.

Figure 10: Waste Composition in Bhowali



Source: Bhowali Nagar Palika 2024

Waste Management System

The existing waste management system in Bhowali is as under-

- Similar to Srinagar, in Bhowali too, the Nagar Nigam has a system of door to door collection using waste workers.
- A private contractor has been given the responsibility of waste collection from source of generation to the transfer station, and temporary waste accumulation points.
- The Nagar Palika pays a fixed amount (approx. INR 8,50,000 per month) to the contractor for collection and transportation of solid waste.
- An additional sum (INR 52,000 per month) is also paid as rent to Haldwani Nagar Nigam for use of its land for further processing and disposal.
- The town is collecting the waste from Kainchi Dham (Religious site) and Ghorakhal by the workers employed by the contractor. The same has been observed during field visit in Kainchi Dham
- The door-to-door collection is carried out twice daily, with residential waste collected in the morning and market waste during both morning and evening.
- A total of 4 vehicles of Nagarpalika and 3 vehicles of contactor are deployed to manage the daily waste collection and transportation process.
- A total of three collection trips are done on a daily basis, out of which, two trips are made to landfill cum trenching ground for waste disposal.
- The collected waste from the primary sources is stored at temporary waste collection points which is then loaded onto collection vehicles for its transportation to the transfer station. The same has been observed during field visit in Bhowali and Kainchi Dham
- The team observed that mixed waste dumping practiced with cattle feeding on it around local transfer station and temporary points.

- As per KII with Supervisor, Nagar Palika, the nominal user fee is levied from the waste generators by Nagar Palika for providing MSW collection services - INR 30 per month per household and INR 100 per month for commercial establishments.
- From the transfer station, the waste is transported to the landfill cum trenching ground in Bhowali where a separate contractor is being hired by Nagar Nigam. The Nagar Nigam pays a fixed amount of INR 4,34,000 per month to the Contractor.
- The Contractor has employed a team of dedicated workers at the MRF to segregate the transported waste at the MRF into various categories and composting of wet waste which in turn generates revenue of INR 50000-60000 per month for Nagar Nigam by selling compost and recyclables to aggregators and recyclers in Haldwani.
- The team has visited the landfill cum trenching and observed one trommel machine for waste segregation, mini MRF cum storage point for separate storage of different type of waste and under construction piece of land for proposed cluster based MRF.

Figure 11: Waste Collection System

Waste Collection in Bhowali

Waste Collection in Kainchi Dham

Source: Field Surveys in Bhowali, 2024

Figure 13: Secondary Storage Points

Source: Field Surveys in Bhowali, 2024

Locally Sanitorium Station (Transfer Station)

Temporary Waste Accumulation Points

Litter Bins

Waste flowing in Open Drains

Figure 13: Dumpsite cum Trenching Ground

Dumpsite cum Trenching Ground

Segregation Unit at Dumpsite

Mini MRF cum Storage Point at Dumpsite

Segregated Material at Dumpsite

Source: Field Surveys in Bhowali, 2024

Insights from Waste workers

Current Role in SWM	Challenges highlighted
Door to door waste collection from households in the morning with help of the garbage collection vehicle. Collection of waste from the markets in the evening. Cleaning of streets and clearing of bins Transfer of waste to the transfer station and segregation	Lack of Source Segregation There is no practice of source segregation in Bhowali. Both wet and dry waste are collected together during the door-to-door collection process. This mixed waste is later transferred to the segregation center, placing additional burden on workers at the facility to manually separate the waste. Lack of Awareness The primary reason for the absence of source segregation is a lack of awareness among residents about the importance of separating wet and dry waste at the source. No significant initiatives or campaigns have been conducted by the government to educate people or promote awareness about waste segregation practices.

	Impact on Waste Management The lack of source segregation not only increases the workload at the segregation center but also affects the efficiency of waste recycling and disposal. Unsegregated waste can lead to contamination of recyclable materials, reducing their usability and increasing the environmental burden.

Insights from interview with Dumpsite operator

The dumpsite operations in Bhowali is being managed by Pavni Environment who provided the following insights on their role and challenges

Current role in SWM	Challenges highlighted
• Employing team of dedicated workers at the MRF to segregate the collected waste at the MRF into various categories. • Composting of wet waste and segregation of recyclables to be sold to aggregators and recyclers in Haldwani. • Maintenance of the landfill site and the machine for waste segregation, mini MRF cum storage point for separate storage of different type of waste.	• The heavy reliance on vehicles for transportation increases operational costs and environmental impact. • Lack of adequate source segregation before waste reaches the MRF increases the workload of workers and reduces overall efficiency. operator, all the recyclables and other remaining waste is transported thrice in a month from Bhowali to the landfill site in Haldwani

Insights from interview with Nagar Nigam Officials (Executive Officer and Senior Assistant)

Capacities and skills

There are no specialised technical person/s appointed for solid waste management in Bhowali and the existing staff have limited capacity building facilitated for them.

Byelaws of Bhowali

Bhowali Nagar Palika has SWM Byelaws in compliance to SWM Rules 2016 and its amendments thereafter is under process.

Challenges in Waste Management

- Lack of manpower and resources for the functioning of SWM in Nagar Palika
- Either waste is dumped in community dustbin or openly dumped in and around the city
- Inefficient infrastructure for entire SWM Value Chain
- Lack of waste segregation practices at source, placing additional burden on workers at the facility to manually separate the waste and reduces overall recycling efficiency
- Lack of suitable lands for the setup of waste processing facilities

- Lack of awareness among waste generators about the importance of separating wet and dry waste at the source
- Seasonal waste challenges due to tourism
- Difficult geographical condition makes waste collection a challenging task

Future Prospects

- Proposal is to set up cluster based MRF for Bhowali (40% share) and Nainital (60% share) at Dumpsite cum Trenching ground in Bhowali measuring an area of 10800 sqft.
- Future plan is to adopt a scientific way of solid waste management with the setup of digital platforms like Integrated Command Control Centre for real time monitoring of collection vehicles.

Good Practices

- Enforcing Plastic Waste Management Rules, Anti Littering and Anti Spitting Byelaws
- C&T contractor and NGO conducts IEC activities and awareness campaigns on regular basis
- Setup of Resource Recovery centres under SBM (U) 2.0
- Enforcing challans and penalty on use of SUPs
- Auction of Construction and Demolition waste that generates some revenues.

Overall Observations from the field visit

- During field visits, the streets and market areas looked clean and well maintained.
- At Srinagar Nagar Nigam, it was observed that the ratio of women to men workforce is typically 4:1 in door-to-door collection, however, no women workforce has been observed at processing or recycling centres.
- During the interactions, the women workforce informed that residents are encouraged to separate waste into wet and dry waste categories before handing it over, but only few households actually practice segregation.
- Majority of the wet waste was observed in mixed form with plastic waste at Transfer Station cum manual MRF during site visit.
- The Transfer Station cum manual Material Recovery Facility is in a state of disrepair and run down condition.
- There was no provision of PPEs for the workers.
- Open waste dumping and littering was commonly observed and there were cows feeding on these dumps, mainly around dumpsters and designated roadside points.
- The user fee for waste collection seemed very low for both households and commercial establishments at both the sites.

7. Key findings from the assessment

The study focused on looking at 5 key overarching determinants for solid waste management in Uttarakhand - Policy environment, governance and institutional processes, operational processes, capacities and skills of the human resource, and community engagement efforts. These are elaborated in below-

7.1 Policy environment

Relevant policies, rules, guidelines, byelaws, etc. that were relevant to solid waste management were reviewed to understand the policy environment at the national, state and local levels, which are outlined in the following section -

Policies at National level: The Solid Waste Management Rules 2016[27] and Plastic Waste Management Rules 2016 (Extended Producer Responsibility amended till date[28]) along with the other rules like e-waste, bio-medical, construction, hazardous, etc. are the main national level policies that specify a number of waste management steps that are to be complied with by all states and their local bodies. These rules were notified by the Ministry of Environment, Forest and Climate Change (MoEFCC) and come under the Environment (Protection) Act, 1986, Government of India.

These rules superseded the Municipal Solid Waste Management Rules which were applicable only in urban areas to be applicable across the urban, rural and other areas, acknowledging the fact that waste extends beyond the urban landscapes. The Rules have very clearly outlined the roles and responsibilities of every relevant stakeholder in the waste value chain from waste generators, to local bodies and pollution control boards. There is much impetus now given to the Implementation of these rules through the Swachh Bharat Missions embedded within various State Departments for both rural and urban sectors.

The Extended Producer Responsibility Framework, 2022 that is drafted under the Plastic Waste Management Rules, 2016 is a critical policy approach that places the onus of managing post-consumer plastic waste on producers, importers, and brand owners (PIBOs). Under EPR, these entities are required to ensure the collection, recycling, and environmentally sound disposal of plastic waste generated by their products.

A notification on Single Use Plastics Ban was also released in July 2021 by the MoEFCC under the PWM Rules of 2016. This notification banned the manufacture, sale and use of single use plastics based on their low utility and high littering potential.

Guidelines for Composting was also released by the MoHUA outlining the various methods and technology that could be adopted for composting solutions by Urban Local Bodies. Organic waste composition is very high and adoption of composting practices would reduce landfill load to a great extent.

[27] There is a call for comments on draft Solid Waste Management Rules 2024 while writing this report which highlights the importance of minimisation of waste by consumers; Extended Producer Responsibility by Bulk Generators; and Extended Producer Responsibility of sanitary waste

[28]There is a call for comments on draft Extended Producer Responsibility 2024 that expands materials beyond plastics

Guidelines for solid and liquid waste management as well as Information Education and Communications have been released by the Ministry of Jal Shakti, under whom SBM Grameen is located.

Table 10: Policies relevant to SWM - National

Name of the Act / Rules	Agency	Key Provisions
Solid Waste Management Rules, 2016	MoEFCC	● All waste generators to segregate waste into 3 categories. ● Bulk generators (any institution with an area greater than 5,000 square metres) to manage their own waste. ● The municipal authorities levy user fees for collection, disposal and processing from bulk generators. ● Any events with gathering of above 100 persons to have waste segregation in place. ● Local bodies across India to decide on user fees.
Plastic Waste Management Rules, 2016	MoEFCC	● Extended producer responsibility for companies to set up a collect back scheme for managing the waste that is generated from their packaging. ● Necessary financial assistance to be made to local authorities for establishment of a waste management system by manufacturers of disposable products such as tin, glass, plastics packaging etc. ● Phase out multi-layered plastics within 2 years (Amended in 2018 to energy recoverable)
Extended Producer Responsibility Rules, 2022	MoEFCC	Producers, Importers, and Brand Owners (PIBOs) have to comply with EPR without directly managing plastic waste on the ground. ● Brand and geography neutrality: Framework is applicable uniformly across all regions and brands in India. ● Choice of EPR models: Producers, Importers and Brand Owners (PIBOs) can adopt any EPR model (except for fee-based) to comply with their obligations. ● National registry and digital platform created for all stakeholders involved in the EPR

		system. ● Ownership of data with the government to protect member data and ensure confidentiality. ● Exclusion of awareness costs from compliance towards fulfilling EPR obligations, except under the fee-based model. ● Circular economy principles to keep plastics within the economy for as long as possible, following the waste hierarchy of Reduce, Reuse, Recycle, Recover, and Dispose. ● Inclusion of informal waste sector ● Minimisation of trade barriers to ensure an effective and efficient national market for recycling. ● Higher EPR costs for non-recyclable plastics to encourage the use of more sustainable materials.
2022 Notification on national ban on single use plastics under the PWM Rules, 2016	MoEFCC	19 single use plastic items, which have low utility and high littering potential prohibited From manufacture, sale and use.
Swachh Bharat Mission - Urban 2.0 - Operational Guidelines October 2021	MoHUA	● Focus on solid waste management and inclusion of rural landscape ● "Garbage Free" status for all cities. ● Segregation at source and 100% door to door collection of solid waste ● 100% management of all fractions of waste ● Promotion of plastic waste management units
Guidelines on usage of Refuse Derived Fuel in various industries, September 2018	MoHUA	● Processing non-recyclable combustible waste with significant calorific value converted to refuse derived fuel (RDF) and can be used as alternative fuel in various industries ● Guidelines and relevant recommendations on utilisation of RDF in various industries in line with the objectives of Swachh Bharat Mission.

Advisory on On-Site and Decentralized Composting of Municipal Organic Waste 2018	MoHUA	● Guidelines on several onsite and decentralised organic treatment methods. ● The decentralised treatment processes have been classified into four categories based on the number of households while considering organic waste generation as 100-200 gm/capita/day, out of the total waste generation of about 400-450 gm/ capita/day. ● The waste to compost systems have been categorized.
Advisory on Material Recovery Facility (MRF) for Municipal Solid Waste, 2020	MoHUA	Guideline on types of MRFs, its constituents, selection criteria for MRFs, process flow, amongst others The MRF have been categories into manual, semi-automatic and automatic based on the capacity requirement and land availability Emphasis to adopt the 3R mantra of reduce, reuse and recycle in principle and in practice for creating circular economy
Advisory on Circular Economy in Municipal Solid Waste and Liquid Waste, 2021	MoHUA	Examines three different categories of municipal solid waste, viz. dry waste, wet waste and construction & demolition waste, and two categories of municipal liquid waste, viz. wastewater and municipal sludge, to suggest practical and concrete steps towards circular economy Elaborated on gaps in policy, regulation & infrastructure with technological options, business and financial models for each sector for accessing the potential of circular economy concepts.
Manual: IEC for ODF Plus 2021	Ministry of Jal Shakti	● The manual has been developed to support rural local bodies in implementing ODF Plus initiatives effectively and efficiently in their settings. ● It provides detailed information on various technologies, estimated cost, Operation and Maintenance (O&M) arrangements, etc. ● This manual should be able to provide comprehensive guidance to achieve effective Solid and Liquid waste management in rural areas.

IEC Guidelines for States and Districts	Ministry of Jal Shakti	● Allocation of 8% total SBM budget for IEC activities. ● At least 60 per cent of their IEC allocation (both Central and State share) on inter-personal communication. ● Matching allocation from State governments to be made.

Policies at State level: There are a number of policies relevant to solid waste management that have been drafted by the state of Uttarakhand for both rural and urban areas. The key one is the Urban Development Department's action plan drafted in 2017 based on the SWM Rules that outline various approaches for implementation of the rules. This plan has been drafted with the goal of having 100% scientific disposal of MSW by the year 2025. It also had the objective of a holistic integrated and cluster-based approach to make the SWM sector self-sustainable and viable and was based on the principles of polluter pay and enhancing collection of user fee. Further the action plan also aimed to integrate the informal sector in the management of solid waste and to promote Extended Producer Responsibility in recycling as emphasized in SWM Rules 2016.

The plan also clearly mentioned that tipping fee to waste collection contractors would be applicable only on the processed solid waste, which was a very progressive goal. Provisions for waste management during major festival seasons and tourism inflow was also included in the action plan. For waste processing, the plan envisages adopting a cluster-based approach with facilities set up to process the waste from multiple locations, and to minimise landfills.

The action plan also had a high focus on technology such as semi underground bins to be placed in urban spaces, that would be lifted using cranes.

With the intent to promote end of life processing in the state, the Waste to Energy policy was drafted in 2019 for outlining the processes and standards for initiating waste to energy projects in the state.

The state also has an Anti- Littering and Anti Spitting Act, 2018 that prohibits any form of leaving out waste in the open, with clear penalty provisions.

SUP bans: The ban on plastics was imposed in Uttarakhand much before the National SUP ban of 2022 and the 2016 Plastic Waste Management Rules. The Uttarakhand Plastic and Other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act was notified in 2013. This ambitious Act had notified a list of plastic types such as PET, PVC, LDPE, etc. that had all been included in the ambit of ban.

Further to this, the Government of Uttarakhand imposed complete ban on sale, use and storage of Plastic carry bags, plates, glasses, cups & packaging Items, vide Notification No. 88/x-3-17-13(11)/2001 in 2017.

In October 2023, the High Court also directed the state government to impose a complete ban on plastic coming illegally from other states and enforce it by imposing strict blockades at state tax and police posts to prevent the entry.

The annual report of SPCB on plastic waste management also reports that a penalty of INR 45 Lakhs against 7 single use plastics manufacturers was also levied for manufacture of banned items. The manufacturers stopped production of banned items and switched to alternatives according to the report.

Tourism Policy: The Tourism Policy has mentioned provisions for waste management in key tourist sites, and also green certification for which waste management is one of the criteria. It also mentions provisions of incentives for tourism entities to invest in waste management infrastructures and avail a reimbursement.

Table 11: Policies and guidelines relevant to SWM - State

Urban Municipal Solid Waste Management Action Plan For State Of Uttarakhand, 2017	Urban Development Directorate	● To address the current needs, constraints and capacity limitations so to achieve "100% scientific disposal of MSW by the year 2025" goal ● To use a holistic integrated and cluster-based approach to make the SWM sector self-sustainable and viable based on the principles of 5R's ● To promote the principles of Polluter to Pay and enhance collection of user fee ● To encourage the waste generators to source segregate waste ● To integrate the informal sector in the management of municipal solid waste. ● To promote Extended Producers Responsibility in promoting recycling. ● To modernize and mechanize the operation and maintenance of Civic and Public Health Facilities in all the ULBs of the State to provide better and healthy living environment for the citizens of the State ● To develop the strategy that provides a 'road map' to completely transform State's SWM sector, transitioning it to an integrated, fully functioning and sustainable system which will serve the ULBs for coming decades ● To generate "civic sense" amongst the masses to uplift the city's sanitation and personal hygiene conditions and raise the hopes for a sustainable common future

		through extensive IEC programs ● To preserve precious lands by creating regional scientific landfills ● To provide extensive jobs and research and development opportunities
Uttarakhand Plastic and Other Non-Biodegradable Garbage (Regulation of Use and Disposal) Act, 2013.	State Government	● Restriction or prohibition on use of nonbiodegradable material ● Prohibition on throwing and burning of nonbiodegradable garbage ● Responsibility given to owners and occupiers for proper disposal of garbage in designated places. ● Listing of types of plastics that are banned
Anti-Littering and Anti Spitting Act 2016	State Government	Urban Local Body or Authorized Officer are authorised to direct persons depositing or causing or allowing to place or deposit any litter, abandoned vehicle, abandoned object or scrap metals in any public place for removal with power to arrest. Occupier to keep footpaths, backyard and private Street clean Any person who commits an offense and is convicted on conviction, shall be punished with such fine, as determined by the State or commit to community service.
Waste to Energy Policy, 2019	Urban Development Directorate	● To promote and facilitate utilisation of MSW/ RDF as alternate sources for generation of energy at affordable cost in a sustainable manner. ● To achieve high standards of cleanliness in the towns and cities ● Implementing waste hierarchy - 3 Rs - Reduce, Reuse, Recycle ● Target to set up 200 MW of waste to energy power plants by the year 2030 ● To create a conducive environment with fiscal and financial regime to develop, demonstrate and disseminate utilisation of waste for recovery of energy. ● Reduce requirement of lands for disposal of MSW

Menstrual Hygiene Management Guidelines	Rural Development Department	● Promoting clean menstrual hygiene practices. ● Provide WASH access for menstruators ● Menstrual health products waste management guidelines
Uttarakhand Tourism Policy, 2023	Tourism Department	● Proper waste management – provision of adequate dustbins, improvement in waste collection capacities and frequencies; ● Elimination of single-use plastics wherever possible, especially in eco-tourism sites. ● Tourism projects to receive financial support for implementing measures such as rainwater harvesting, renewable energy use, waste processing, etc. ● Capacity building on waste management for tourism stakeholders ● Green Certification with waste management as one of the criteria. ● Incentives for waste management investments by tourism units - reimbursement of expenses incurred in O&M of these setups (cap of 0.25% of Maximum Capital Subsidy)

Local level: Bye-laws for solid waste management (SWM) constitute an essential regulatory framework that can encompass all aspects of SWM -- from its generation to final disposal, covering collection, transportation, storing, processing, disposal, monitoring and regulations. Importantly, they also empower local governments to impose penal provisions in case of non-compliance and violation.

The Solid Waste Management (SWM) Rules, 2016 mandate all urban local authorities, village panchayats, census towns and urban agglomerations to frame bye-laws incorporating the provisions of SWM, 2016 within one year from the date of notification and ensure timely implementation. The Rules also say that these local entities should make/amend a bye-law for SWM to be able to provide necessary services to citizens, levy taxes or fines, and collect user fees whenever and wherever deemed necessary.

Bye-laws are the strongest legal instrument at the disposal of local self-governments to enforce sustainability measures while fulfilling their own responsibilities. User fees definition and collection structures, SUP bans, anti-littering byelaws have been drafted by various ULBs to improve the waste management system but these are not mirrored in the rural areas of Uttarakhand.

Gaps identified

The main gap in national policies is that mountain specificities and needs are missing**.** The Solid Waste and Plastic Waste Management Rules while being progressive and being universally relevant have little in it to address mountain specific issues and challenges. The only special mention for the mountains is a section specifically for hilly regions which recommends no construction of landfill on hills and instead in plain areas supported by transfer stations or else setting up of regional sanitary landfills but there is no mention of how this is to be done or where the resources will be allocated for it. Appropriate and adequate resource allocation and support that is reflective of the rich biodiversity, ecological sensitivity and fragility of the Indian Himalayan Region besides specific geographical challenges is needed to address the Himalayan waste crisis.

The Rules do not acknowledge the high cost of managing waste in mountain areas. Even though the interventions of segregation at source, collection, and transportation are universal practices, in mountain areas, these incur higher costs. Without special resource allocations for the mountain states, the viability of all waste management interventions would be extremely challenged.

For the mountains, the rules should specifically disallow technologies like incineration considering its ecological sensitivity. Single Use Plastic Ban should also have stricter provisions for the mountain states due to environmental considerations. The situation now is quite the opposite with the watering down of existing stringent regulations irrespective of plastic thickness in states like Uttarakhand with the implementation of national SUP bans that prohibits only specific types of plastics as well as allows certain thickness of plastic bags and flex to be used.

Mountain states also have not been able to take advantage of the extended producer responsibilities as PIBOs have not been given specific targets for the mountains. There is poor collection coverage in rural areas due to their remoteness that increases the collection cost. This higher cost of collecting in the mountains is not factored in by the brand owner and producers. EPR needs to be used for development of infrastructure, looking at higher per kg rates and more transparent policies that can be implemented on the ground and with clear role of local bodies in the implementation of EPR.

The urgent shift needed from linear systems to a circular one needs to be addressed through the policy spaces which are currently missing, with waste being looked at only from end of life management and not from a full life cycle lens with a cradle to cradle perspective.

At the state level, policies have a high focus on technology solutions which are not environmentally suitable for the mountains, and are also not financially viable. Tourism waste poses one of the key challenges in the state and there is a very high increase in volumes during tourist season. The tourism policy, while pushing the tourism stakeholders into adopting proper waste management, does not identify key steps needed to be taken up, and also has no focus on high tourism zones.

7.2 Governance and Institutional Processes

Solid Waste Management is taken forward within the ambit of the Solid Waste, Plastic Waste and other waste management rules that have been enacted under the Environment Protection Act 1986 notified by the Ministry of Environment and Forests Government of India. The rules empower the Urban Local Bodies and Panchayati Raj Institutions to implement these rules as well as enact byelaws and collect user fees and fines that further the implementation of these rules.

The devolution to local bodies, have been primarily taken forward through the 73rd and 74th Constitutional Amendments that established the Panchayati Raj system in rural areas and Municipalities in urban areas, respectively, providing them with specific powers and functions. This has significantly progressed, enabling Panchayats (rural) and Municipalities (urban) to exercise power and manage finances on a range of subjects listed in the 11th and 12th schedules respectively, marking a substantial step towards decentralised governance.

The elected members of the Nagar Nigams, Nagar Pallika Parishads, Nagar Panchayats in urban areas are empowered to actualise the rules. Urban Development Directorate (UDD) is the administrative department for urban local self-government and they work in tandem with the ULBs to further waste management rules.

Rural Uttarakhand is governed through the Panchayati Raj Institutions (PRIs) with the institutional hierarchy of 13 Zilla Panchyatas, 95 Intermediate Panchayats and 7791 Gram Panchayats and the elected are empowered to implement the waste management rules. The Department of Rural Development is the administrative department for the PRIs who work with the PRI to implement the waste management rules.

Swachh Bharat Mission (SBM), the National Clean India Mission initiated in 2014 is a country wide movement that addresses solid and liquid waste management in India. The Central SBM Urban and Grameen (rural) provides the necessary guidelines and resources to take the mission forward at the state level with dedicated personnel at the state and district levels overseeing and implementing the mission. SBM 2.0 has a strong focus on solid and plastic waste management that includes rural areas.

‘Namami Gange Programme', is an Integrated Conservation Mission, approved as 'Flagship Programme' by the Union Government in June 2014 with budget outlay of Rs.20,000 Crore to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga. Uttarakhand is the birthplace of Ganga and has Namami Gange to address the issue of solid waste management too especially pertinent to solid and liquid waste leakage in Ganga.

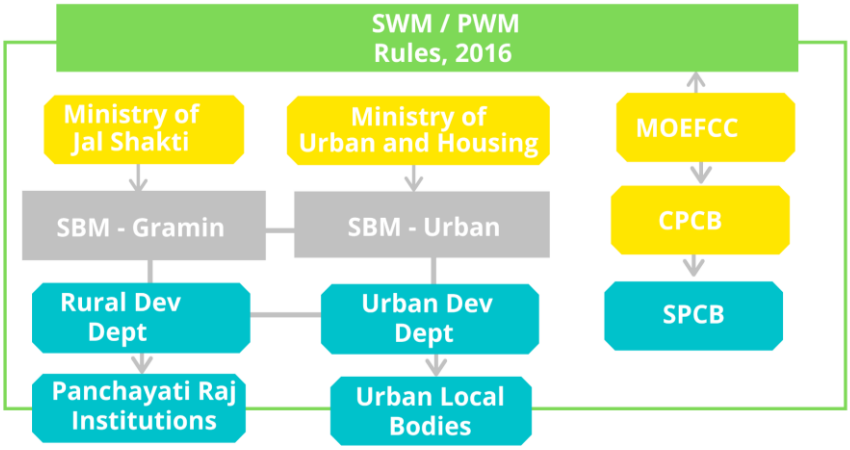
Uttarakhand has 9 cantonment boards that implement the solid waste management rules in their areas including the civil areas of the cantonment boards.

Uttaranchal Pollution Control Board was established in Year 2001 as per Section (4) of Water (Prevention and Control of Pollution) Act, 1974 by Forest and Environment Division, Uttarakhand and they play an important task in contextualising Central Pollution Control Board directives. They monitor and provide annual reports on solid waste management and

importantly take forward Extended Producer Responsibility guidelines under the Plastic Waste Management Rules in Uttarakhand.

There are a number of civil society organisations who partner in implementing the waste management rules and, in many instances, provide key insights with their pilots and innovations that make the rules contextually relevant to Uttarakhand.

Figure 13: Stakeholders for SWM governance



Gaps identified

To take the 73rd and 74th Amendment forward, Article 243G of the Constitution outlines the principle of power devolution to local bodies, allowing state legislatures to transfer responsibilities to Panchayats across 29 subjects listed in the 11th schedule.

However, various studies, clearly elucidate that though the responsibilities of the ULBs/DMC have increased enormously, there has not been a commensurate increase in their powers and funds/finances severely constraining their capacities to perform effectively and deliver the required services.

The main reasons ascertained are administrative, financial and political reasons. The administrative-reasons are mainly the lack of adequate skilled and trained staff/personnel at the ULB. Financial autonomy devolved to the ULB is limited, deficient and insufficient resulting in its heavy dependence on the State Government for funds/finances. Whatever minimal revenue-sources and taxes available with the ULBs and their use is not very promising. Most of the ULBs often fall short of even collecting the basic operation and maintenance costs user charges/fees due to lack of adequate staff; inefficient collection and political resistance towards collection and raising of user charges/fees. Similarly, the tax collection is also not optimum. There is also a lethargy to devolve greater power, functions and fund/finances to the ULBs. All these have cumulatively resulted into half hearted decentralisation where they are to a large extent heavily dependent on the State Government for funds/finances and devoid of adequate functional/financial autonomy.[29]

29 Local Government Finances: Financial Challenges faced by Dehradun Municipal Corporation, Asheesh Joshi 2020

The Key Informant Interviews and the State Consultation provided a deep insight into the governance and institutional processes that are being lived in Uttarakhand at present. While the narrative is shifting to a circular economy the dominant principle and practice is still a linear one with waste being considered an end of life and consumer behaviour management issue. Centralised interventions, technological and infrastructure heavy outlook is still the dominating lens.

Limitations of technical experts and capacities were shared from ULBs and PRIs with just one engineer doubling up for all technical issues in the smaller ULBs who then doubled up as the city planner too.

While there are a number of agencies taking forward the issue of waste there is a challenge of convergence and synergies. Departments tend to work in silos when what is needed is working together at the state level as well as at the local level. The need for greater convergence between tourism, forest, religious boards and waste managers was highlighted. The intersection and coordination needed between the elected and the bureaucrats leaves much to be desired.

There are also issues of roles and responsibilities clarity that results in duplication of activities and interventions when it should be following principles of subsidiarity. For example, it was highlighted that all levels of the PRI are working towards developing plastic management units when the different levels of the hierarchy of the PRI should be focussed on collection and storage; aggregation and transport and finally linkage to treatment.

Issues of insufficient resource allocation as well as not being sensitive to the geography and context of Uttarakhand was also highlighted. The need for untied funds was expressed at all conversations and discussions.

The push for large numbers for tourism and pilgrimages with insufficient integration of waste management policies, practices and infrastructure was stated as a contradiction to the vision of Swachh Bharat Mission. The call for mainstreaming waste management in all interventions were highlighted that included the forest department, its lands and defence institutions and the tourism industry. The need for integration of the many policy and knowledge institutions within Uttarakhand for contextual knowledge generation was considered important.

7.3 Operational processes

The operational part of solid waste management is the most challenging and critical that needs to be undertaken on a daily basis with all waste producers and managers. Adherence to the existing policies and guidelines all along the value chain have to be ensured. This section captures the status of operations of SWM in the state along the value chain drawing insights from existing reports, key informant interviews and from the field observations made during the site visits.

Segregation and Collection

The Annual Report 2023 for Solid Waste submitted by the Uttarakhand State Pollution Control Board to CPCB has reported the following for the urban areas vis a vis source segregation and achievement of door to door collection -

- *House to house collection* - In all 92, ULBs, out of 1152 wards, door to door waste collection was initiated in all the wards. 70% households, shops, institutions, schools etc. have been covered so far for house-to-house collection.

- *Segregation*- Source segregation in all the 1152 wards was initiated, however 40.4% households, shops, institutions, schools, etc. are practicing segregation at source.

The Swachh Bharat Mission (Urban) Dashboard currently reports a processing efficiency of 93% in urban areas in 1293 wards with 94% waste segregation at source and 99% door to door collection. Yet, during visits to Srinagar, Bhowali, Dehradun, it was observed that waste segregation at source is not enforced in the hill towns/ cities. This was also validated during the stakeholder consultations and the key informant interviews. As per the existing practices only dry recyclables like – newspaper, glass bottles, plastic bottles and metal scrap are separated out from the waste stream at generation level.

It was also observed that even if there is some segregation being practiced there is no practice of segregated collection, and the segregated waste brought by households are mixed during the collection process which defeats the purpose of segregation at source. This also disheartens people practising segregation and also points to the lack of planning across the scale of solid waste management.

Around 30-40% of the waste generators segregate high value dry recyclables and sell it to the scrap dealer or Kabadiwala for monetary benefits. Awareness about converting waste to resource is very less amongst the generator, thus efforts to segregate the waste at source is not made. It was also observed that the different types of wastes viz. Biomedical, hazardous, industrial and e-waste including construction debris are mixed with municipal wastes and dumped at the same site.

Difficulties of garbage fee collection from the households is also one of the challenges faced. This has an impact on the resources available for undertaking the process.

In the mountain areas, door to door waste collection service is a challenge due to inaccessible terrain which does not allow vehicles to reach all corners. In such cases, the waste generators are compelled to dispose of their waste at secondary storage points from where the waste is picked up.

The vehicles deployed for waste collection are open vehicles which are not in compliance with SWM Rules 2016. Most often the collection is outsourced based on a tipping fee model which does not promote waste segregation or reduction.

For rural Uttarakhand, while facilities like Plastic Waste Management Units, storage facilities are being built, institutional process of collection and linkages are yet to be made fully functional.

Secondary storage

Secondary storage or vats are common in areas where door to door collection of waste is not achieved. It was observed that these receptacles are very old (discarded ones), small sized or placed at very far places. Secondary storage points generally receive higher daily volumes of waste than what they are designed to handle.

There is no ownership of such places and it ultimately results in illegal open dumping on road sides/ down the hill/ open drains or subjected to open burning. Inadequate infrastructure at secondary storage points and broken bins leads to spilling of mixed waste on the road side, which are accessed by birds and animals, especially cattle. Cows feeding on waste and consuming plastics in the process are common scenes in urban areas.

In Uttarakhand, the issue of indiscriminate dumping of waste has led to the problem of monkeys coming into urban spaces that has increased conflicts with humans.

Nagar Nigam Dehradun and Haridwar have storage areas while other ULBs have temporary storage areas. 10 sites have been notified to be used for storage of construction and demolition waste.

Processing

For the rural sector, solid waste management activities are implemented by the Gram Panchayat and action plans for SWM are to be prepared. GPs can engage an agency/group of individuals or as per protocol prepared by the State Government / District Administration. Agencies for implementation of activities, especially at Block and District levels are to be carefully selected based on their past work experience, technical capability and value for money.

Dry waste is processed at segregation sheds or plastic waste management units where the waste is segregated into different types based on the material. From here, the recyclables are sold to the scrap dealers after being sorted and shredded or sold without any further processing. The ultimate rejects are sent to the landfills for disposal.

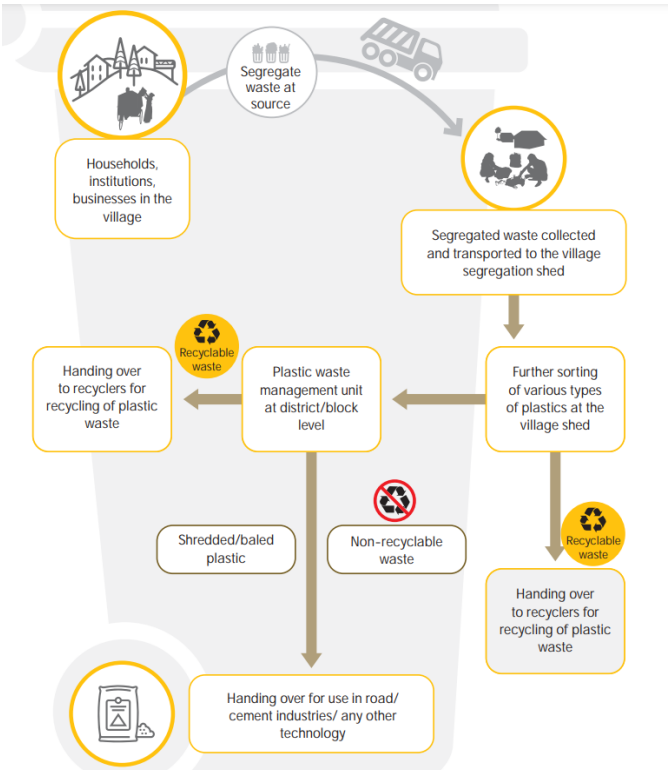


Figure 14: Schematic for managing plastics in rural areas

Source: PWM Toolkit, SBM (G)

For the rural areas, the Swachh Bharat Mission Grameen dashboard reports the following on the status of SWM implementation.

Table 12: Details of SBM Grameen implementation as per SBM Dashboard

Community compost pits	20871
Household biogas	1426
Waste collection and segregation sheds	13050
Plastic waste management units	77
Vehicles for collection and transport	4940

However, no reports are available on the functionality status of these assets, and observation, KIIs and consultations suggest that issues of storage, collection and linkage have not yet been fully developed. Data from the rapid survey conducted as part of the Human Development Report, 2019 in all 13 districts on waste disposal practices showed that over 40% of waste were disposed in open space, 34% in fixed places in the nearby premises and only 3.6% were being given to the waste collection vans

Table 13: Garbage disposal in Rural Areas by Share of Respondents (%)

District	open space	in open drain	some common point in locality	in community dustbin (dustbin)	on the road	private sweeper	municipal corporation van	Fixed place in the nearby premises	others (specify)
Almora	62.8	2.9	0.9	0.0	0.2	0.0	0.0	24.4	8.8
Bageshwar	19.1	0.8	7.3	1.2	0.0	0.0	4.4	10.1	57.1
Chamoli	62.7	2.3	0.5	2.7	0.2	0.2	0.0	27.8	3.6
Champawat	41.9	6.3	1.6	0.4	0.0	0.0	0.0	48.6	1.3
Dehradun	25.9	1.6	4.1	4.1	1.6	6.3	17.1	30.7	8.5
Garhwal	40.8	2.9	7.8	1.8	0.0	0.4	0.2	38.1	8.0
Haridwar	35.3	3.6	17.6	2.4	0.7	1.7	1.9	34.1	2.7
Nainital	16.2	1.0	1.7	2.2	0.2	4.7	11.4	45.0	17.4
Pithoragarh	35.0	0.5	3.6	0.5	0.0	0.0	0.0	58.6	1.8
Rudraprayag	15.7	0.5	14.6	6.0	0.0	0.0	2.5	54.9	5.7
Tehri Garhwal	45.9	1.7	11.0	1.2	0.0	0.2	0.0	38.7	1.4
Udham S. Nagar	65.4	4.3	2.6	0.7	0.0	0.5	0.2	24.5	1.7
Uttarkashi	14.7	2.9	17.3	5.0	0.8	0.2	4.3	20.4	34.5
Total	**40.3**	**2.6**	**7.0**	**2.0**	**.4**	**1.5**	**3.6**	**34.0**	**8.7**

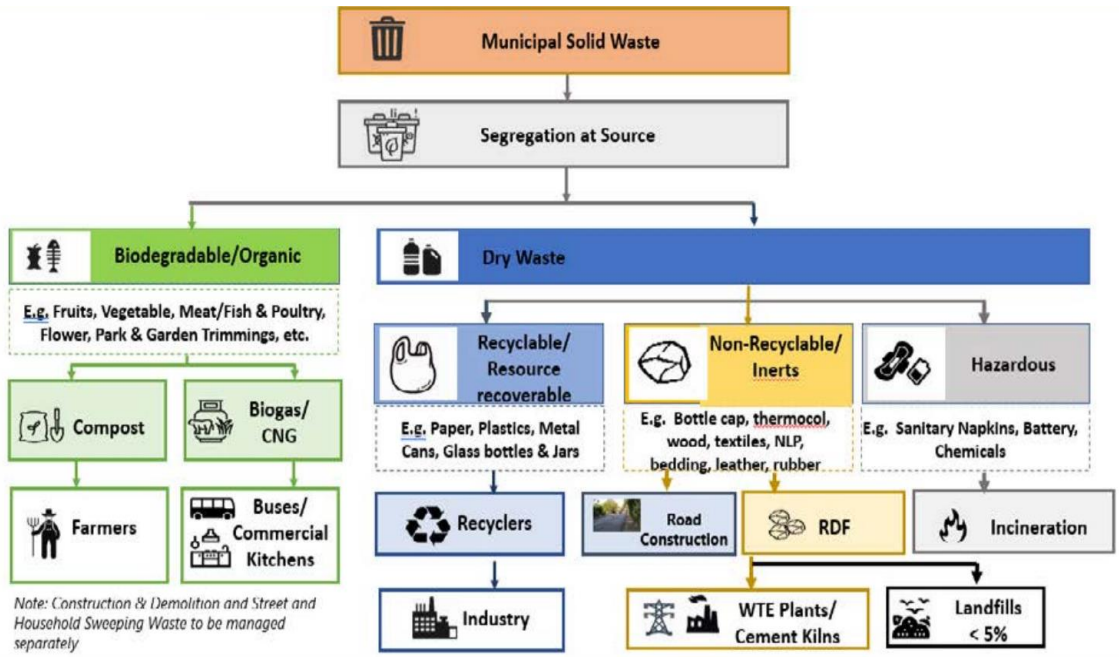
Source: Human Development Report, 2019

Table 14: Provisions for managing solid waste in rural areas under SBM (G)

SLWM Activities	Village level SLWM Activities/	Village Size	Financial Support
		Upto 5000 Population	Solid Waste Management: Upto Rs.60 per capita Grey Water Management : Upto Rs.280 per capita
		Above 5000 Population	Solid Waste Management: Upto Rs.45 per capita Grey Water Management : Upto Rs.660 per capita
		Note:- 1. 30% of amount will be borne by the GPs by their 15th Finance commission grants. 2. Each village can utilize a minimum of total Rs. 1 lakh based on their requirements for both solid waste and greywater management.	
	District Level SLWM Activities	Plastic waste management unit (one in each block)	Upto Rs.16 lakh per unit
		Faecal sludge Management(FSM	Upto Rs.230 per capita
		GOBAR-Dhan projects	Upto Rs.50 lakh per District
Community Sanitary Complex(CSC)	Rs.3 Lakh. Note:- 30% of this will be borne by GPs from 15 FC.		

For the ULBs of Uttarakhand, the SBM Urban 2.0 guidelines outlines the following for management of solid waste. Management of wet waste is to be done by composting or biogas/ CNG. For dry waste, recyclable resources are to be recovered by recyclers and sent to recycling stream, non-recyclable inserts are to be used in roads or as RDF in cement kilns or WTE plants, and incineration is the recommended method for disposing hazardous waste.

Figure 15: Management of solid waste

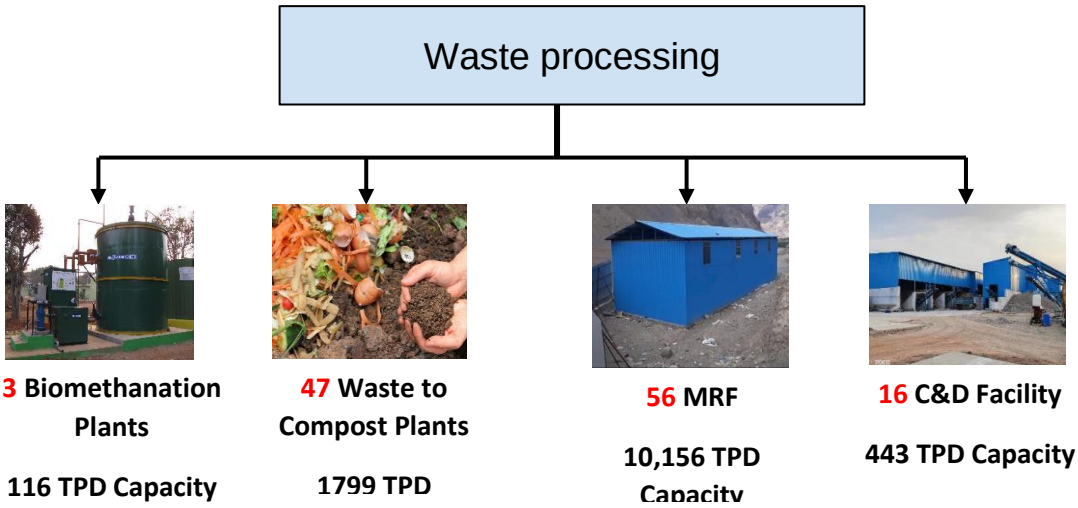


Source: SBM Urban Guide 2.0

The following is reported in the Annual Report of 2022-23 of SPCB for waste processing.

- The state is targeting to have around 65 processing facilities for the 102 ULBs.
- For 53 ULBs, the sites have been purchased.
- For the remaining 12 the process for statutory approvals was underway.

Figure 16: Current status of waste processing units in Uttarakhand



Source: SBM Urban Dashboard

Waste Processing Agencies in Uttarakhand

The State Pollution Control Board lists the following for waste processing agencies in the state.

Plastic waste processors	45
Hazardous waste recyclers	25
E Waste recyclers	8

On the Central Pollution Control Board portal, the details for plastic waste processors are as follows

Total registered PWPs	104
Mechanical recyclers	195
End of life processors (waste-to-oil)	3

Source: CSE Report - EPR Portal insights

Role of NGOs in Waste Processing

In Uttarakhand, the non-government sector has played a big role in setting up models of decentralised waste management for waste processing. Waste Warriors Society has been actively working in the state since more than a decade and has pioneered replicable models of waste management in many places, while improving the conditions of waste workers, and creating sustainable livelihoods and services. Their model of working with Paryavaran Sakhis around Corbett National Park has been pathbreaking in integrating women into sustainable waste management that provides them with dignity and a steady income. Their pilots in working with the Forest Department on waste management also have created pathways for much needed convergence. Waste Warriors Society works with local bodies and provides support in setting up and managing material recovery facilities.

An Integrated Decentralized SWM Model at Nathuawala, Dehradun has also been implemented by NGO Feedback Foundation. This demonstrable and scalable SWM Model with Sanitation Park has been developed for wider replication across the state. Door-to-door collection of segregated waste is done by collection boys which is then brought to the sanitation park. The segregated waste is categorised as wet waste or biodegradable, dry waste or recyclables (i.e. plastics, wood, metals, paper, paper board, glass, textiles etc.), domestic bio-medical and domestic hazardous waste. Wet waste is composted and used in the park. Dry waste/recyclables are sorted into 30 categories, based on their economic value, washed and stored in designated separate chambers, and sold to identified vendors, or converted to value-added products. Domestic bio-medical and domestic-hazardous wastes are stored safely and transported to a treatment plant/authorized vendor for safe disposal.

Disposal

Limited space in the mountains poses a very big challenge for waste disposal. The issue of pollution from mixed waste dumping is also serious for the mountains which are ecologically fragile. Affected communities are mostly those who are already marginalised which adds further to their challenges.

According to State Government data, Uttarakhand currently has 19 dumpsites. Bioremediation has been completed for 4, and for 4 it is partially completed. These bioremediation processes are very costly for the state. Bioremediation without changes in the entire management system is also a challenge as waste is generated on a daily basis.

Gaps identified

Uttarakhand, like many Indian states, faces significant operational gaps in managing solid waste, particularly given its unique geographic, demographic, and environmental challenges.

Even after 8 years of the Solid Waste Management Rules, 2016 being implemented and the action plan drafted by the state in 2017, waste segregation at source remains a challenge. This is one of the main observations from the field visits and also critical insights provided by all stakeholders. Collection of unsegregated waste derails the entire chain of the processes that follow, and increases the efforts to be put in by the waste workers in the value chain. Segregation at source is made possible through consistent and regular IEC engagement with communities and investing in building community stewardship. It needs to be followed by

investing in a system that is based on collection of segregated waste. In areas where NGOs operate, segregation at source has been achieved with use of innovative strategies, and similar processes can be adopted by the other local bodies.

Importantly the focus is still centralised treatment and taking all the collected to a disposal site for treatment when wet waste can and should be managed through composting, biomethanation and use as animal feed as close to the source as possible.

On the issue of tipping fee arrangement for waste contractors, the SWM action plan has clearly mentioned that the fee shall be based on the amount of waste processed. It was observed this is yet to be brought into practice. Tipping fee models, where waste managers are paid a fee based on the volume or weight of waste they collect and dispose of, poses several challenges for effective and sustainable waste management. It incentivises higher waste generation and does not focus on waste reduction and segregation which is contradictory to the goals of sustainable waste management and circular economy.

The main challenge encountered for waste processing is unavailability of land in the mountains. With limited waste segregation being practiced, workers have to handle mixed waste at these sites. Manual segregation of mixed waste at this stage is very difficult for the waste workers and also a health hazard. Beside mixed waste dumped together also lowers the value of recyclables, and ends up keeping them away from the recycling stream. At the same time biodegradables also become contaminated with the plastics and treatment becomes a challenge.

For wet waste, composting, biomethanation solutions are highly feasible options. However, composting in the high altitudes does pose a challenge in the mountain areas. Some of the remote areas of the mountains have challenges of access to recycling centers. The cost to transport the recyclable to recycling centers or the discards to the nearest cement kiln for burning becomes a costly affair.

Table 15: Summary of the Operational Processes and Gaps thereof

STEP	**ISSUES / CHALLENGES**	**RESULT**
Collection and transportation	Focus on collection and transport to centralised disposal site rather than decentralised treatment at source. Behavioural challenges ● Difficulties in garbage fee collection ● Implementing segregation at source ● Implementing waste reduction practices	Limited resources collected for SWM Very little segregation at source Increasing non- recyclable waste Wet waste being taken at great effort to centralised point rather than treatment at source which reduces quality of wet waste treatment.
	Limited vehicular access Odd / irregular timings for collection Secondary vats Tipping fee to contractors does not	Open dumping of waste Overflowing waste dumps Dissatisfied citizens

	promote segregation or reduction	
	Limited number of workers	Household coverage not achieved
Secondary storage	Space availability issue Encourages open dumping Mindset about waste - NIMBY	No ownership and stewardship of waste Leads to increased human wildlife conflict
Transportation	Higher costs in the mountains Limited access No segregated collection Limited number of vehicles	Efficiency of collection challenged Backlog of waste that remains uncollected
Processing	Unsegregated waste collection Limited technology options for the mountains (High altitude composting) Promotion of technology solutions that go against circular economy such as Waste to energy / incineration. Lack of skilled resources Limited Access to recycling centers Higher costs for handling High volume of non-recyclables	Difficult to recover recyclables and biodegradable from mixed waste. Improper technology adoption. Technology failure due to improper segregation Non-recyclables become a burden to waste managers resulting in overfilling of landfills
Disposal	Limited land availability in the mountains Ecological fragility of the landscape Affected communities	All forms of waste reaching the landfill and not just inserts Overfilled landfills Costly bioremediation process

7.4 Capacity and Skills

Waste profiles and volumes have dramatically changed over the recent years with changing production and consumption patterns and thus capacities and skills of waste managers have to match this change.

The insights from KIIs and State level consultation highlighted the gaps of limited trained personnel managing waste where a few individuals have to shoulder multiple responsibilities both at the PRIs and ULBs. These individuals have to perform all the technical roles needed to take forward sustainable solid waste management from planning, design of infrastructure, institutional processes to education and awareness with limited training on the complex nature of present day sustainable solid waste management. The limitations of capacities and continual capacity building of the elected members in solid waste management was also expressed as a challenge. This was validated by the observations made In Srinagar and Bhowali that there are no technical people appointed for solid waste management. Current staff mentioned that they had received no training related to solid waste management.

The findings of KIIs and consultations are corroborated in the “Performance Audit Report on Implementation of 74th Constitutional Amendment Act for the year ended 31 March 2021,

Government of Uttarakhand" by CAG which shows that there was an overall shortfall in manpower ranging from 62 to 75 *per cent* in ULBs. The highest shortfall lies with the centralised staff which provide leadership to the municipal bureaucracy. Shortage is also observed in the cadre of Junior Engineers and *Paryavaran Paryavekshak* cadre. The GOI highlighted the need for a National Training Policy in January 2012 with directives for the State to formulate their training policy that is yet to be done in Uttarakhand but undertakes training with the Administrative Training Institute.

The state consultation, while highlighting gaps and challenges in capacities and skills, convergence, role responsibility clarity, it also provided insight of the dominant narrative of waste being end of life consumer action and not from a circular economy perspective. Issues of implementation of extended producer responsibility had limited critical analysis.

7.5 Community Engagement through IEC

Community engagement is essential for sustainable waste management that is taken forward through Information Education Communication which is an important component of the Swachh Bharat Mission Grameen and Urban. These are conducted to raise citizen awareness on segregation, composting, single use plastic bans and taken forward with a multimedia approach of posters, billboards, videos, miking of messages.

IEC guidelines have also been developed for both Grameen and Urban from the respective ministries that provide detailed instructions and ideas for IEC campaigns. The key components of the guidelines are-

- Allocation of 8% total SBM budget for IEC activities.
- At least 60 per cent of their IEC allocation (both Central and State share) is on inter-personal communication.
- Matching allocation from State governments to be made.

IEC campaigns led from the National level are also duly observed at the state level. Some of these key campaigns are Swachhata Hi Sewa from September 17 - October 2nd, Swachhata Pakhwadas, etc.

Nomination of SBM Ambassadors is also an important means to spread the message of Swachh Bharat and this is clearly mentioned in the SBM Guidelines for states to adhere to. In 2017, popular Bollywood star Akhsay Kumar was named as Uttarakhand's brand ambassador for Swachh Bharat Mission. More updated information on this could not be obtained.

The Dehradun Municipal Corporation has engaged self-help groups (SHGs) to conduct door to door awareness campaigns for promoting waste segregation at source, user fee collection and monitoring of cleanliness in the city. Similarly, they have engaged NGO for conducting IEC activities as well as identification and monitoring of Garbage Vulnerable Points (GVPs) or littering points on a regular basis for its timely removal or converting them into beautification spots. Similar approach of using SHG women for awareness is a commonly adopted by other urban local bodies as well.

Figure 17: Source: Sample IEC material from the Manual- IEC for ODF Plus - SBM (G)

Gaps identified:

The main gap with regard to IEC in the state is that very little focus has been given to this important issue. A report on IEC spending for the states has reflected that Uttarakhand had spent only 5.6% of its allocated budget for IEC. Most of the efforts for IEC are also focused on conducting big events. Though these are important for raising awareness on the issue, such an approach has its limitations. These one-off activities that are high budget do not have the necessary impact that can be brought through consistent and regular campaigns that address behavioural change issues.

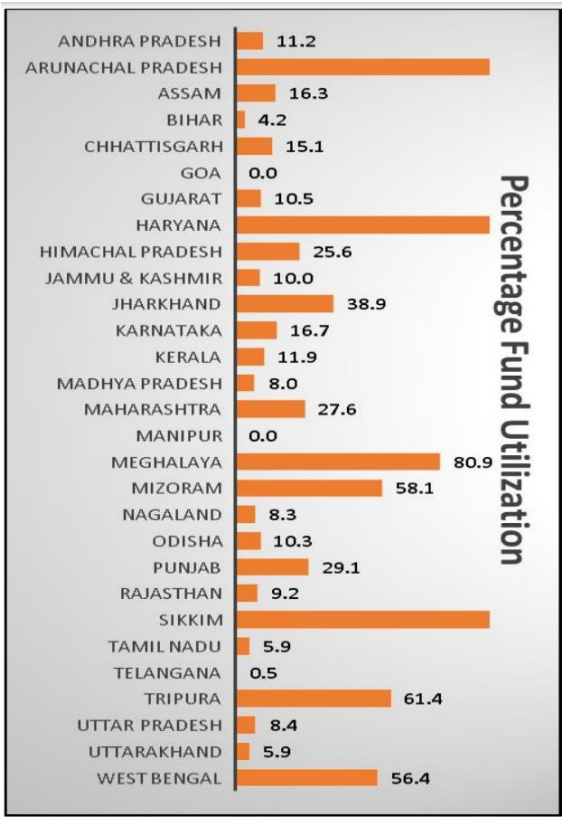


Figure 18: Percentage IEC fund Utilization by States in 2016-17

7.6 Stakeholder Mapping

Solid waste management is a complex process involving a wide range of stakeholders at multiple levels in each node of the value chain. Right from individuals who generate waste to housing societies, businesses and institutions and its management by the waste managers, everyone is a stakeholder in the process. Waste moves from where it is generated to the ultimate disposal site going through a series of processes implemented by multiple actors, informal and formal, along the chain. Identifying the relevant stakeholders at each node of the value chain is a critical aspect for making the waste as everyone's business and not only the responsibility of Government Authority.

Table 16: Key Roles and Responsibilities of Stakeholders in SWM Value Chain

SNo	Stakeholder Type	Specific to Uttarakhand	Major Roles & Responsibilities
Segregation			
1	All Waste Generators (Households, Commercial establishments, Institutes, Industries, Consumers, tourists, cantonments and defence institutions, religious institutions, educational institutions etc.)	• Rural households • Urban households • Hotel Industry • Religious sites - Kedarnath, Gangotri, Yamunotri, Badrinath, Haridwar, Rishikesh. • Defence establishments • 9 Cantonments	• Segregate waste at source • Treat wet waste at source or as close to the source through composting, biomethanation or animal feed so no biodegradables are landfilled • Store waste safely prior to collection • Pay waste management fees/taxes • Reduce waste through conscious consumption • Participate in community recycling programs • Maintain cleanliness of waste storage areas • Report illegal dumping and service issues
2	Supporting Stakeholders	NGOs • Waste Warriors Society • SDC Foundation • Feedback Foundation • Recykal Pvt Ltd • Nature's Buddy	• Pilot sustainable waste management initiatives • Develop educational materials and curricula • Conduct community workshops and training • Organize waste reduction campaigns and IEC activities • Monitor and evaluate behaviour change • Partner with schools and institutions • Provide technical support to communities • Document and share best practices • Train community waste champions

Collection and Transportation			
3	ULB and PRIs	102 ULBs 7791 PRIs 9 Cantonment Boards	● Plan and optimize collection schedules and routes ● Maintain fleet of collection vehicles ● Train and supervise collection staff ● Handle citizen complaints and service issues ● Enforce waste collection bylaws ● Monitor waste collection records & service quality
4	Private Companies / NGOs	**Private Companies** Srinagar - M/s Bhopal Singh Chaudhary Bhowali - Niwaran Sewa Samiti **NGOs** Waste Warriors (pilot projects) Recykal Pvt Ltd (pilots in religious sites)	● Conduct door-to-door collection ● Follow prescribed collection routes ● Handle different waste streams separately ● Safe transportation of waste to secondary storage points ● Maintain collection equipment ● Report service issues ● Interface with waste generators ● Participate in regular training ● Report citizen complaints and service issues
5	Informal Waste Collector	Ragpickers Waste merchants Scrap dealers	● Provide door-to-door service ● Collect recyclable materials ● Sort and segregate waste ● Sell materials to recyclers ● Support waste segregation
Recycling & Processing			
6	Waste processors - Dry Waste	SPCB has listed out 78 waste processors CPCB has listed 104 plastic waste processors and 195 mechanical recyclers. Dehradun Nagar Nigam ● Indian Pollution Control Association (IPCA) ● Dev Bhoomi Recycling Pvt Ltd ● Waste Warriors Swachhta Kendra ● The scrapify ● KABHADI-Recycling & Waste Management	● Setup the processing facility at designated land of the Municipal Authority ● Manage facility operations ● Maintain quality standards ● Operate sorting equipment ● Coordinate with recyclers/ waste suppliers/ processors ● Market recycled materials and compost ● Monitor plant operations and maintain records ● Train facility staff ● Maintain facility cleanliness ● Handle rejected materials ● Ensure worker safety and emergency

		Srinagar Nagar Nigam ● Fahim Brothers	protocols ● Ensure environmental compliance
7	Wet Waste processors	Bio gas ● Uttarakhand Renewable Energy Development Agency (UREDA)	Biomethanation as a solution to wet waste
		Composting ● Organic Uttarakhand ● Waste Warriors ● Servoday Group ● Charekha India ● Earth5R	Diverse composting options as a solution to wet waste
8	Pollution Control Boards	Uttarakhand Pollution Control Board	● Set monitoring protocols ● Conduct regular inspections ● Test emissions and discharges ● Issue compliance reports ● Investigate complaints ● Enforce regulations ● Maintain monitoring equipment ● Train inspection staff ● Review facility records
Disposal			
9	Landfill Operators and Municipal Workers	ULBs and private companies Bhowali Nagar Palika ● Pavni Environment Pvt Ltd	● Process the legacy waste through biomining ● Manage the waste disposal ● Municipality allocate resources, budget and enforce regulations ● Monitor and control gas emissions and leachate systems ● Maintain access roads and equipment ● Control vectors and odors ● Train facility staff ● Manage closure plans ● Monitor site operations and maintain records ● Ensure worker safety and emergency protocols ● Ensure environmental compliance
10	End of life processors	CPCB has listed 3 EOL processors for Uttarakhand	

11	Pollution Control Boards, Urban Development Directorate		● Issue operating permits and licenses ● Conduct regular inspections ● Monitor compliance ● Enforce regulations ● Handle public complaints ● Review monitoring data ● Set environmental standards ● Train inspection staff
12	Environmental / Technical Consultants		● Design monitoring systems ● Conduct impact assessments ● Recommend improvements ● Train facility staff ● Review compliance ● Develop management plans ● Investigate issues ● Provide expert testimony ● Support permit applications
Waste Reduction			
13	Sustainable packaging	Anand Matta Trading Co	● Focus on waste reduction measures ● Alternatives to SUPs
Policy, Regulation, and Governance			
14	National level	Ministry of Environment, Forest, and Climate Change (MoEFCC) Ministry of Housing and Urban Affairs Ministry of Drinking Water and Sanitation	● Develop national policies ● Set environmental standards ● Coordinate enforcement ● Manage reporting systems ● Update regulations ● Provide technical guidance ● Coordinate stakeholders
		Central Pollution Control Board	Create guidelines Monitor sector performance
		Namami Gange Programme	Effective abatement of pollution, conservation and rejuvenation of National River Ganga.
		National Green Tribunal (NGT)	Adjudicates on SWM-related legal disputes and violations.
		National Institute of Urban Affairs	Platform for knowledge and capacity building on WASH including solid waste management

15	State level	● Uttarakhand State Planning Department ● Rural Development Department ● Urban Development Directorate ● State Mission Clean Ganga (SMCG), Namami Gange ● Uttarakhand Environment Protection and Pollution Control Board ● Uttarakhand Tourism Board ● Cantonment Boards	Provide guidelines Monitor Capacity building Education and Awareness Implement
16	Local Bodies	ULBs and PRIs Cantonment Boards	● Actualise waste management rules into practise at ULB and PRI level ● Develop local bylaws ● Allocate resources ● Coordinate services ● Handle public engagement ● Manage contracts ● Monitor performance ● Train staff ● Handle emergencies ● Maintain infrastructure
Financing and investing			
17	Government sources	Swachha Bharat Missions Grameen and Urban	Overarching National Body that provides vision, resource and guidelines to solid and liquid waste management across India
18	Multilateral Agencies	World Bank, ADB, UNEP, UNDP and others provide financial and technical assistance for SWM initiatives.	● Assess project viability ● Structure financing ● Monitor implementation ● Provide technical assistance ● Evaluate outcomes ● Manage risks ● Coordinate stakeholders ● Share best practices
19	Private Sector/ Producer Companies	Financial Institutions like banks and their foundations. Corporate Organisations All producer companies whose plastics are disposed in Uttarakhand	● CSR funds available for waste management. ● Invest in pilots for sustainable waste management ● EPR funds for managing plastic waste ● Set targets for recycling prescribed types of plastics ● Partner with NGOs and

			Government ● Support innovation ● Coordinate partnerships ● Share best practices
20	Microfinance Institutions	Uttarakhand State Rural Livelihood Mission	Provide funding to SHGs and informal sector workers
Monitoring and Research			
21	Research Institutions and Universities	Doon University Forest Research Institute Wildlife Institute of India Wadia University Graphic Era Hill University University of Petroleum and Energy Studies Centre for Public Policy and Good Governance (CPPGG)	● Conduct applied research ● Develop technologies ● Train professionals ● Share knowledge ● Support innovation ● Evaluate impacts ● Provide expertise ● Build capacity
22	Informal Sector Organizations		● Organize waste pickers ● Advocate for rights ● Provide support services ● Coordinate activities ● Build capacity ● Share information ● Manage conflicts ● Support formalization
Awareness, Capacity Building, and Advocacy			
23	Government Institutions	Uttarakhand Institute of Rural Development & Panchayati Raj (UIRDPR) Administrative Training Institute (ATI) ENVIS Centre FSSAI (Eat Right Initiatives)	Training and Capacity Building Education, Awareness and Outreach
24	Non-Governmental Organizations (NGOs)	● Waste Warriors ● Social Development for Communities Foundation ● Nature's Buddy	Promote public awareness and capacity building for effective SWM.

25	Media and Advocacy Groups	Integrated Mountain Initiative Sustainable Development Forum of Uttarakhand Waste Warriors Zero Waste Himalaya	Informed coverage and OpEds on solid waste management

Engagement of Informal Sector in Waste Management

Besides the formal channels through which waste is managed by the local bodies, there are existing networks of the informal sector which play a key role in collection and processing. These networks operate through the ragpickers who provide door to door collection services for recyclable waste. The most common items picked up by them from the households are glass bottles, metal items, cardboard, and paper. PET items and other recyclables are also picked up from both households as well as from secondary vats, roadside litter, etc. The network of rag pickers sell the collected recyclable to scrap dealers, who further process the waste before sending it to recycling stations.

There is no reliable data available that estimates the amount of waste collected and processed by the informal sector as well as their integration into the waste management system and institution.

8. Case studies of good practices of Solid Waste Management in Uttarakhand

Case Study 1 – Paryavaran Sakhi Model- promoting Gender Equity and Social Inclusion

Started formally in 2021, this initiative thrives in the eco-sensitive sub-Himalayan region around Jim Corbett Tiger Reserve in Uttarakhand. The model has engaged women from diverse backgrounds, equipping them with entrepreneurial roles for effective waste management amid challenges like social barriers, gender norms and limited livelihood opportunities.

Operational in Kaniya, Ringora, Himmatpur Dotiyal, Dhikuli, Kyari, Sawal Deh East and Sawal Deh West, the model has employed 21 dedicated sakhis (local women) across these seven panchayats, one of which is a Van Panchayat. These sakhis, in addition to their household responsibilities, farm work and taking care of cattle, performs door-to-door dry waste collection, segregation in designated waste banks, and sale of recyclable waste. Furthermore, the women handle awareness campaigns, record keeping, organising cleanup drives and focused group discussions, baling of waste, and on-boarding new community members.

Beyond monetary gains, this work has granted them recognition in their communities and by government bodies. Initially, the sakhis received a compensation of Rs 350 per workday on a monthly basis. To enhance sustainability, the model underwent a transformation into an entrepreneurial framework.

The women now earn their wages from the user fee generated from door-to-door collection and sale of recyclable waste. The model not only promotes gender equity but also provides an alternative livelihood, particularly vital for women unable to participate in the demanding tourism industry (which thrives in Corbet)

Figure 19: Paryavaran Sakhi Model

Source: Waste Warriors Society

Case study 2: Digital Deposit Refund System

In 2022, Kedarnath in Uttarakhand became the first city in India to establish a Digital Deposit Refund System (DRS), converting pilgrim-led waste management into a sustainable environmental preservation model Post COVID-19 pandemic, pilgrim numbers surged to approximately 50,000 everyday, which caused significant environmental concerns due to increased littering.

The Kedarnath District Administration, in collaboration with Recykal, a clean tech start-up, and local shopkeepers, launched DRS to address this. Digital DRS encourages pilgrims like you to return used plastic packaging at collection centres for a deposit refund of Rs. 10/-. Customers have to purchase QR-coded food packets and they will be charged an extra Rs.10 for each pack. After consumption, they can deposit the trash at Recykal refund/ collection centres nearby and scan the QR code before disposal. The Deposit of Rs.10 refund for each pack returned shall be made to them. The collected waste was processed by recyclers, and data was shared with the district administration for monitoring.

The DRS achieved a 52 percent return rate for bottles and containers, with widespread acceptance from priests, pilgrims, shopkeepers, and sanitation workers. The DRS app maintained a 99.9 percent uptime, ensuring seamless operations through efficient QR code tracking. The initiative was recognised nationally as India's inaugural Digital Innovation in Deposit Refund Systems.

Kedarnath's "Waste to Wisdom" initiative showcases how collective efforts and innovative strategies can transform waste management into an opportunity for environmental sustainability, setting a new standard for pilgrim cities across India. For this innovative solution, the Govt. of Uttarakhand received the Digital India Award 2022 from Hon'ble President for successfully implementing Digital DRS Phase I.

Source: Tales from 75 Cities - Journey of Swachhta by MoHUA

Case study 3: Decentralised waste management at Harrawala, Dehradun

The Waste Warrior Society has established a model for decentralised waste management in ward no. 97 in Harrawala, Dehradun through setting up of a Material Recovery Facility (MRF) and Composting unit, which are key steps towards sustainable waste management. Since its inception, this model has played a pivotal role in reducing landfill dependency by source segregation, sorting, processing, and recycling waste materials efficiently. Behavioural change methods, focusing on community engagement, proper source segregation, daily segregated collection, and responsible disposal are the key components of this intervention with the following achievements-

- Collection Coverage - 1400 households actively segregating waste & handing over to 4 collection vehicles
- Source segregation went from 57% to 84%, improving dry waste quantum sent for recycling via MRF.
- Collection - 517.38 MT of dry/wet waste by 8 green workers
- Recycled - 396.07 MT of dry waste recycled
- Community Outreach - 1667 households and 162 commercials
- Waste to Wealth Initiative - collection of dry waste separately for 450 Households with service coverage in entire Dehradun, focusing exclusively on dry waste

MRF facility of 5 TPD capacity - Dry waste is meticulously sorted into 32 categories by 16 trained green workers, facilitating the efficient recovery of recyclable materials such as plastics, paper, glass, metals, etc. Materials such as plastics, metals, glass, paper, and textiles are meticulously sorted into specific subcategories. Hazardous waste is set aside for safe disposal. Sanitary waste is disposed of through SPCB authorized vendors. The sorted plastics and other recyclables are compressed into compact bales for efficient storage at the MRF & cost-effective transportation to recyclers

Figure 20: MRF Harrawala

In-Vessel Composting for Wet Waste of 1 TPD capacity - Wet waste is processed in an in-vessel composting unit installed at the MRF generating high-quality compost within a few weeks

Figure 21: In-Vessel Composting at MRF Harrawala

Plastic Credits - Plastic credits are tradable certificates representing the collection, recycling, or removal of a specific amount of plastic waste from the environment. They are part of a market-based mechanism that allows organisations to offset their plastic footprint by funding waste management initiatives, often supporting sustainability and circular economy efforts. At Harrawala MRF, the sorted recyclables, particularly plastics, are sold to certified recyclers through Recycling Partnership which in turn generates revenue for MRF operations. There is a process for availing plastic credits wherein the recycler submits the recycling certificate to the partner for its validation and thereafter, facilitates credit generation based on documented recycling. (Source: Waste Warriors Society)

Case Study 4 - Joshimath's Community-Driven Waste Management Success

Joshimath, Uttarakhand is a gateway to numerous Himalayan treks and sacred pilgrim sites like Badrinath and Hemkund Sahib. With a population of around 16,709 that swells to nearly half a million during the pilgrimage season, the town faced significant environmental challenges, particularly in managing plastic waste. Recognising the urgency, Nagar Palika Parishad Joshimath, with the support of the local community, in 2010, implemented an innovative Material Recovery Facility (MRF), transforming the town's waste into a resource.

Source: Tales from 75 Cities - Journey of Swachhta by MoHUA

The MRF collects, segregates, and compacts solid waste, a task made even more challenging by the town's rugged terrain. With a dedicated team of sanitation workers, the project has empowered the local community by offering stable employment and generating income from the sale of recyclable materials. Initially starting with seven sanitation workers earning Rs 250 per day, the team has since expanded, with each worker now earning Rs 550 per day, reflecting the success of the initiative.

Regular plastic waste collection and processing have fostered environmental consciousness among residents, drastically reducing litter. The revenue generated from selling recyclable materials has not only provided livelihoods for marginalised workers but also bolstered the municipality's funds.

Since December 2022, over 1.3 million kilograms of inorganic waste have been compacted and sold, generating more than 1 crore in income. The compactor machine, gifted by the Tourism Department, has played a vital role, processing up to 150 kilograms per bundle of plastic waste, helping maintain Joshimath's pristine environment and reducing litter. This initiative has earned the town prestigious awards, including the Chief Minister Nirmal Nagar Excellent Puraskar during 2010-2011 and 2016-2017. Today, Joshimath has become a model for waste-free towns.

Case Study 5 – IPCA's EPR Model for Plastic Waste Management

- EPR places the responsibility of managing post-consumer waste on the producers, importers, and brand owners.
- It mandates collection, segregation, recycling, or co-processing of waste, especially plastic waste.

Components:

- Awareness generation programmes for segregation at source with different stakeholder (here waste segregation is focus)
- Capacity building of waste workers
- Plastic waste collection from different source (residential societies, commercial establishments, institutes, municipalities, authorized scrap dealers, etc)
- Transportation of collected waste to Material Recovery Facilities (MRFs)
- Channelization of segregated plastic waste for recycling/co-processing
- Segregation of plastic waste into different categories at MRFs
- Setting up the infrastructure for recycling of low-commercial value plastic waste.

Results (FY 2023-24):

- Collected 2545.043 MT of plastic waste in Uttarakhand for recycling.
- Established a strong network of stakeholders across India: 79 ULBs, 31 recyclers, 7 co-processors, and 101 PIBOs.

Impact:

- Empowered 30,000 waste workers through training and resources.
- Improved community awareness and increased source segregation.
- Diverted significant amounts of waste from landfills, reducing GHG emissions.
- Generated economic opportunities in recycling and co-processing sectors.

Benefits of EPR:

- **Improves waste collection:** Creates organized systems for managing waste.
- **Enhances recycling infrastructure:** Supports the development of material recovery facilities and recycling plants.
- **Reduces landfill dependency:** Decreases waste sent to dumpsites.

Promotes collaboration: Involves producers, ULBs, recyclers, co-processors and informal sectors.

Case Study 6 – The Baini Sena Revolution Empowers Women and Transforms Cities in Haldwani

In the bustling city of Haldwani, the largest in the Kumaon region of Uttarakhand, a unique initiative called "Baini Sena" has transformed the landscape of solid waste management. This initiative, named after the Kumaoni term "Baini," meaning sister, epitomises the power of women's participation in civic activities. The city faced numerous challenges in managing its waste effectively. A scarcity of human resources, minimal monitoring of sanitation work, lack of a robust grievance redressal system, and low citizen involvement plagued the city's sanitation efforts. The monthly collection of user charges was around Rs 6 lakhs, underscoring the Inefficiencies in the system as the user charge was low.

However, in October 2022, Haldwani underwent a significant transformation in its waste management system. The city's Municipal Corporation planned to involve women self-help groups (SHGs), already registered under the DAY-NULM scheme, to manage and monitor sanitation work comprehensively. What began as an effort to improve waste collection has since evolved into a model of sustainable urban governance and women's empowerment. By November, these women were on the streets, tackling the city's waste management challenges head-on. They underwent rigorous training, covering waste collection techniques and public relations. Equipped with identity cards and supported by nodal officers, the SHGs were assigned specific wards to manage. A control room was set up to handle grievances and ensure smooth operations, while the Baini Sena monitored cleanliness, raised awareness about waste segregation, and promoted the ban on single-use plastics.

Through regular dialogue and effective service delivery, they won the community's trust. The results were transformative: user charge collections surged from Rs 6 lakhs to Rs 32 lakhs. and each SHG member earned an average of Rs 14,000 per month. Furthermore, waste collection reached 85 percent of households, significantly improving cleanliness and sanitation standards in the city. (Source: Tales from 75 Cities - Journey of Swachhta by MoHUA)

9. Challenges of solid waste management in Uttarakhand

Uttarakhand is experiencing waste volumes that are going up drastically, and there has been a huge change in the type of waste being generated, with non-recyclable plastic waste being the most trashed items. This is the manifestation of the shift in production systems and the existing waste management systems that have not risen to these changes. In 2018, Uttarakhand was ranked among the worst performing states for solid waste management in a report prepared by the Central Pollution Control Board (CPCB), because it did not have a single functional solid waste management plant or sanitary landfill[30]. A major fraction of wet biodegradable waste remains unattended and untreated and find its way to the dumpsites which is a significant contributor of methane production and other GHG emissions and even leading to landfill fires[31].

The following challenges for Uttarakhand are summarised below -

Existing Policies lack Mountain Sensitivity

The main gap in national policies is that mountain specificities and needs are missing**.** The Solid Waste and Plastic Waste Management Rules while being progressive and being universally relevant have very little in it to address mountain specific issues and challenges.

Higher Costs for Managing Waste

Uttarakhand being a mountainous state presents numerous challenges for sustainable solid waste management by virtue of their remoteness, topography, scattered settlements, sensitive and fragile ecosystems, lack of infrastructure and road networks, and poor institutional and financial capacity.

The high costs incurred in managing waste in the mountains does not meet up the costs recovered from user fees or from sale of recyclable waste. Compared to the plains, costs incurred at every step for SWM implementation is higher in the mountains, yet there is universality in policy and resource allocation. The waste sector requires an everyday intervention with a combination of human resources and infrastructure needs, and in the context of the mountains, these costs get further multiplied due to inaccessibility issues and the higher cost of living. Innovative means for fulfilling tasks of collection, transport and treatment are yet to be devised for the mountains, and this needs to be backed with proper planning and resource allocation. Below are few examples of how higher costs impacts waste management in the mountains-

- For remote areas with scattered settlements, aggregation of waste is a costly affair, and running costs of waste management units such as resource recovery centers or plastic waste management units are high.

- Higher costs for collections that give very low returns lead to only high value items like certain glass items (beer bottles), cardboard, metal, PET, etc. being collected
- PWM Guidelines specify use of residual waste (soiled paper, soiled cloth, contaminated plastics, multi-layer, packaging materials, other packaging materials, pieces of leather, rubber, tyre, polystyrene, wood etc.) from landfills to be used as

[30] Uttarakhand Among worst states in terms of waste management - September 2018 Times of India

[31] Methane emissions from open dumpsites in India- CSE 2023

fuel in cement kilns. In mountain areas, the cost of transportation of such waste is very high. More importantly, burning waste skips opportunities for reuse and recycling, thus contravening the principles of a circular economy.

- PWM Guidelines also promote 'plastic roads' which is using plastic waste in making roads. The issues of toxicity of such roads as well as limitations of types of plastic uses (mostly recyclable) in this type of road building is contradictory to the principles of circular economy

- Waste to Energy is also being promoted in a big manner but burning waste removes the changes of recovery and recycling, does not highlight toxicity issues sufficiently and also is based on meeting basic volumes of waste to be burnt that goes against reduction and minimisation of waste.

Much of the other recyclable and non-recyclable waste, therefore ends up being trashed- either openly dumped in public spaces, rolled down steep hills or into streams making recovery impossible or being burnt.

Gaps in Policy to Practice

Policies that were laid out with clear timelines in mind have seen poor implementation on the ground. These gaps have been taken cognizance of by the National Green Tribunal that has given guidelines to the state for complying with the rules with strict timelines. [32]

- Very few local bodies in the state have made model bye laws and operationalised SWM and PWM Rules.
- Single use plastic bans and prohibition have seen limited success.
- Dilution of the state bans eg: There is a complete ban of plastic bags according to the state level rules however the national SUP ban allows bags beyond 120 microns and 60 GSM.
- Alternatives to plastics are not strengthened
- Open burning of waste of all kinds, categorically prohibited by an NGT order of 2016 and state laws, is still carried out.
- Interdepartmental convergence through the formation of State Level Advisory Bodies, have gaps in the formation and regular functioning.
- Extended producer responsibility 2022 for plastic waste management has had limited success in the mountains due to its lack of mountain sensitivity and geographical neutrality of targets and this includes Uttarakhand.
- Tipping fee to be taken only on the processed waste is still based on collection and transport of overall waste.

Waste burden from Tourism, Religion and Defence

NITI Ayog 2018 report states that the IHR receives about 100 million tourists yearly and is projected to increase to 240 million by 2025. Uttarakhand has seen an increase of almost 65 percent in the number of tourists between 2006 and 2016, and tourism contributes to over

[32] https://www.mpcb.gov.in/sites/default/files/solid-waste/order0207202014012021.pdf

50 percent of the state GDP[33]. Around 15,63,278 pilgrims visited in 2022 as compared to 1,30,551 and 2,42,712 pilgrims in 2020 and 2021 respectively. The Government of Uttarakhand has restricted the number of pilgrims to 13,000 per day, but during community interactions stated that the number exceeds during May to July of every year.
Every tourist adds a waste footprint that is not always planned for in the waste management system especially in the IHR. Tourism changes waste profiles and increases volumes dramatically during the tourist season as well as spreads the waste to remote locations across Uttarakhand, many of which are ecologically sensitive and important zones. Waste does not always feature prominently in the tourism industry lens but awareness on its importance is growing.

It has been observed that when areas become popular with tourists, the non-biodegradable waste fraction such as plastic packaging, multi layered plastics, tetrapaks and glass generated in these areas tends to increase. In addition, adventure tourism generates specific types of waste associated with climbing equipment and supplies such as tin cans, oxygen bottles, batteries, ropes, and tents. When this happens, waste systems must adapt to changing waste compositions which is not up to speed in the present context. Tourism affects the types of waste generated, and thus will have a cascading effect on how this waste is collected, where it is transported to, and how it is treated and disposed of.[34]

Uttarakhand also bears the burden of waste coming out of religious tourism such as the famous Char Dham, Kainchi Dham, Shri Tughnath Temple, Har ki Pauri, Shree Neelkanth Mahadev Temple etc. many of which are ecologically sensitive and important zones. Pilgrims and the support service have a huge waste footprint with limited bring treatment or back your waste initiatives. Specific items like offerings, clothes as part of the rituals and single use plastic raincoats left behind besides food and beverage packaging have been an added burden in the pilgrim pathways.

Along with the pilgrims comes indiscriminate disposal of solid waste including plastics, animal waste, human waste, equine dung/waste/carcasses on and around the tracks and in the valley. The issue also includes insufficient public toilets including soak pit toilets that are overflowing with waste. When the number of pilgrims is higher, owners of mules and horses strive to make the most excursions in a single day, harming the mules and horses in the process. The National Green Tribunal (NGT) has put forward the directions against large scale unregulated violation of environmental norms along the pilgrim tracks of Kedarnath, Hemkund Sahib, Yamunotri and Gomukh pilgrimage centres in Uttarakhand[35]. The order states that more than 19 lakhs pilgrims visit such places and about 20,000 equines are used in a season with no infrastructure to handle environmental issues arising out of such visits and related activities.

With a large section of Uttarakhand being international borders with China (Tibet) in the north and Nepal in the east, waste coming from defence installations are also an important component to consider in the waste management discussions of Uttarakhand. Food waste in high altitudes from defense installations is a specific challenge as these food piles have

[33] Uttarakhand, DoT 2018

[34] Sustainable SWM in Mountain areas, 2021 by World Bank

[35] NGT Order no. 561/2022 in the matter of Urvashi Shobhna Kachari Vs UOI & Ors. dated 08.02.2023

multiple impacts including prompting the growth of feral dogs who compete with snow leopards in the landscape.[36] Waste management in these high altitudes needs commitment and special technology.

Focus on Centralised Solutions and Unsuitable Technology

The SBM guidelines specify decentralised management of waste. This has yet to be actualised in practice and most strategies focus on centralised solutions for dealing with the waste problem. In the urban context, collection of waste from different localities and transport of the collected waste to a central landfill site outside the town limits with minimal treatment has been the standard approach for urban local bodies.
Not in my backyard has been the commonly followed principle globally so far as waste is concerned and waste has always shifted from one place to another, (usually urban to rural, richer to poorer) and mountain cities in Uttarakhand have been no exception. Resource and infrastructure support have all been directed for implementing strategies that work around the theme of centralised intervention. Overflowing landfills are proof that the system is flawed and no longer working.

Unsuitable technology for the mountains are promoted as quick fix solutions.

Limited Financial Resources

Mountain states are quite complex with issues of coordination and financing, to poor infrastructure and the ability for treatment and disposal, and the same is the case in Uttarakhand. While local self-governments have the legal authority to define necessary regulations related to SWM, there is limited technical capacity and importantly limited financial resources with the local self-governments. Local self-government institutions in the mountains often operate with constrained budgets for waste management, making it difficult to invest in essential waste infrastructure or services.

The following key factors contribute to these constraints:

- Existing waste management policies are not sensitive to the mountains, and resource allocations coming out of it are insufficient for the mountains.
- Resource allocation is population based and accounted for the plains that do not consider the higher cost of living in the mountains. Unit costs allocated for the plains are insufficient for the mountains.
- Being further removed from power, mountain local self-government institutions have challenges accessing and unlocking available government grants and external financial aid.
- User fees for waste collection and processing are a critical revenue stream, but limited awareness, community ownership and poor tracking mechanisms reduce the effectiveness of these collections.
- Inefficient fee collection leads to revenue leakage and limited funds available for operational expenses (OPEX).
- The SWM Rules clearly prescribe higher fees for waste services to be paid by bulk generators, but collection from bulk generators remains a challenge.

36 In Uttarakhand, dozens of feral dogs sterilised to save snow leopards in the Upper Himalaya, September 2023 Times of India

- Many ULBs invest heavily in capital expenditures (CAPEX) but struggle to sustain operations due to limited funds for ongoing operational costs (OPEX).
- The financial resources allocation does not factor in the floating populations like migrant worker population, students as well as tourists who all require waste management services.
- Most tourist revenue does not reach local authorities, whereas the responsibility of providing waste services rests with them
- There are very few circular businesses, and these require financing support at various stages. Lack of identification of such businesses and extending financial support result in failure of such businesses creating a slip back.

No Incentives to Encourage Recycled Products/ Alternatives

There are no incentives for industry to enter the recycling business and/or research and develop upstream solutions/ circular alternatives. Currently the recycled products and alternatives fall under the same GST brackets as the products made from virgin materials thus there is no provision to encourage use of recycled products/alternatives.

10. Recommendations

10.1 Guiding Principles for circular economy in the mountains

Focus on Closing the Plastic Tap

Waste is a design flaw[37] and systemic changes that design waste out of the system must be the top most priority of waste management strategies. Research and development of sustainable products and packaging with incentives and investment is key to reduce the waste load to landfills and reduce plastic pollution. This change in narrative is key to addressing the plastic pollution crisis at a local and global level which is a dramatic shift from the existing end of the pipeline solutions that predominantly shifts the problem only. Extended producer responsibility must design out plastic waste especially problematic non-recyclables in the long run and support waste managers in the immediate.

40% of all plastic produced is single use plastic that is unnecessary and can be done away immediately. Policies at the regional, state and local levels that totally stop single use plastic is key to reducing load on landfill and plastic leakage into the environment. Further phasing out of Multi Layered Plastics as originally proposed in the Plastic Waste Management Rules 2016, but subsequently relaxed, must be taken up again as these are one of the most problematic types of plastics with no real recycling solution. Promotion of incentivising reuse, refill and bring your own movements also promote reusable usage thus reducing single use plastic in the landfill.

Recognition of Mountain Sensitivities / Fragility

Uttarakhand which is part of the Indian Himalayan Region (IHR) is a fragile socio-ecology of great biodiversity and ecological significance which is being subjected to significant degradation that is further threatened with impacts of climate change. The geography also throws up challenges of waste management in terms of difficulty in access and retrieval and remoteness of spread. The ecological importance and sensitivity and challenges of waste management has to be considered and acknowledged with provision of appropriate legislation and additional resources and support to address the plastic pollution and waste crisis in the Himalaya and Uttarakhand.

Decentralised Approach

Decentralised interventions and keeping it as close to the source are most efficient in ensuring maximum recovery of materials from the waste stream. Segregation at source with segregated collection mechanisms and at the least ward level recovery centres for storage of dry recyclable waste would be most appropriate especially in the mountain context. Promotion of linkages to recycling with every household, community, business and institutions taking responsibility for their own waste through segregation and resource recovery would address the challenges of the mountain context.

Decentralised composting with appropriate technologies and options that address altitudinal issues and no biodegradables to landfills policy promotion goes hand in hand in managing waste as well as climate action.

[37] Prof Don Norman, Director, The Design Lab University of California

Ultimately a basket of diverse options piloted with policy support, good governance and with a clear scaling up pathway to the entire landscape is needed. Institutional representatives need to champion the cause and lead by example. Technology must be appropriate, contextualised and not taken forward in a technocratic top down manner.

People Centric

Uttarakhand is rich in cultural and religious diversity and this diversity must be integral to managing waste. Traditional food systems of the mountains support agrobiodiversity and healthy and holistic lifestyles with none of the attendant plastic waste issues that modern processed food systems bring. These traditional food systems must be revived, encouraged and supported as a sustainable and desired alternative to processed food products. Cultural contexts of materiality of waste, traditional institutions, faith-based organisations as well as cultural behavioural patterns sensitivity are critical for sustainable waste management. Waste management needs to be made every day with people's participation and ownership central to all processes and action. There is a need for waste management to be a peoples' movement or a Jan Andolan.

A large portion of recycling in the context of India is led by informal waste workers and rag pickers who remain in the fringes of society and even outside of the ambit of waste management institutions. The non-recognition and lack of organisation of informal waste workers is all the starker in mountain regions. In many cases such workers are from outside the state. There is a need for integration of informal waste workers and rag pickers in the waste management institution and processes and acknowledge their contribution, institutionalise their role based on dignity and equity. The role and action of informal waste workers and rag pickers must be incentivised.

Waste management is very closely linked with human behaviour and how people perceive and respond to the crisis. In most cases this has received the least attention in waste management systems that are devised. More often than not, only technological interventions are promoted as ultimate solutions for managing waste overriding the human aspect that is critical to make even these technological solutions function. Very negligible investments, both in terms of time and resources are allocated. Awareness and education campaigns have to be sustained. carefully designed, consistent and sufficient to bring about crucial shifts in human behaviour.

Even technology investment correspondingly requires certain systemic changes that come only through shifts in human behaviour. The most essential basis of good waste management is segregation at source and this can happen only if consistent time and resources are invested to promote it.

Investment on consistent and contextual behavioural change communication amongst all stakeholders including waste administrators, political leadership and waste producers is critical for waste management and reduction in plastic pollution.

Beyond Boundaries

Mainstreaming waste management to all departments, institutions and walks of life is critical in bringing about systemic changes required so that it does not end up being an end of the pipeline action undertaken by waste managers and departments only.

Interdepartmental, interinstitutional convergence beyond defined institutional/ departmental boundaries is needed as everyone is a waste producer and responsible for waste management. Waste knows no boundaries and especially in the mountains, cooperation and collaboration beyond administrative and geographical boundaries is crucial to address the waste crisis. With the geography and history of the mountains, certain towns and cities have evolved to be hubs that also provide linkages to recycling and this role needs to be promoted, incentivised and developed that is not limited by state boundaries.

The Indian Himalayan Region is a borderland area and international boundaries do not stop the flow of waste. Transboundary and international cooperation and coordination must be made explicit in the agenda of waste management.

Intersectional and Transdisciplinary

Waste has to intersect with public health, food and nutrition security, climate crisis and biodiversity loss to be more effective and impactful. There is an interconnectedness that becomes more explicit day by day and this interconnectedness can only be taken forward through a transdisciplinary lens.

Circular Economy Focus

India has given a great impetus for a shift to a circular economy and a MoHUA 2021 report, Circular Economy for Solid and Liquid Waste explains that a typical linear economy adopts a 'take-make-waste' approach, whereas circular economy places emphasis on 'true recycling' of materials, i.e. converting the waste resource back to its original form, without sacrificing quality or integrity in the process. This, in turn, not only contributes to the development of sustainable business models but also reduces emissions and increases efficient use of natural resources.[38]

European Union 2016 Brief goes on to explain that "The circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. In practice, it implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible thanks to recycling. These can be productively used again and again, thereby creating further value."[39] The impetus given to circular economy must be central to waste management policies and practise and taken forward in an urgent manner.

Gender Equality and Social Inclusion

Waste production and management are not gender neutral, either in concept or in practice (UNEP 2016; International Environment Technology Centre [IETC] 2015; UNEP 2015). Women often bear the brunt of waste collection and disposal tasks, particularly in rural, poor and informal settings. This disproportionate burden impacts their health and safety. Women are often responsible for household waste segregation and collection, contributing significantly to the initial stages of the waste management process as well as the active

[38] MoHUA advisory on Circular Economy in Municipal Solid and Liquid Waste 2021

[39] Closing the loop New circular economy package European Union Brief 2016

involvement of women in informal recycling activities, where they play a crucial role in sorting and recycling materials, particularly paper and plastic. Yet, these roles are not fully acknowledged nor compensated.

Furthermore, caste-based discriminations exacerbate inequalities, with lower-caste communities often bearing the brunt of waste collection and disposal duties, facing occupational hazards, and experiencing social stigma. Inclusive waste management systems must consider women's specific needs and perspectives, address caste-based discrimination, and empower marginalised castes and communities.

10.2 Specific Recommendations

Bridging the Policy to Practice Gap

2016 was the year that the waste management rules were promulgated in India and these rules capture the basic universality of sustainable waste management. Yet after 8 years the basics of the rules are yet to be fully implemented. It is critical and urgent that these rules are implemented in its letter and spirit.
Extended Producer Responsibility brought as a panacea for plastic pollution has been toothless in its implementation in the mountains and Uttarakhand with its geographical neutrality and brand agnostic stance. The complexity and lack of mountain specificity keeps producers away from the mountains meeting their targets elsewhere as well as making waste managers actions financially not viable within the EPR regime.

Policy amendments to bring in mountain specificities for specific EPR targets for mountain states that include appropriate mountain financial rates needs to be advocated.

Updating and revisiting the Uttarakhand Solid Waste Management Action Plan, 2017 could be the first step in moving towards a circular economy. The plan should include both rural and urban spaces as well as tourism, religious sites and cantonments.

No Biodegradables / Recyclables to the Landfill Policy

A policy and practice that has a vision of no biodegradables to the landfill has intersectional benefits. Biodegradables are quick to rot, large in volume and weight thus have collection and transport issues. Yet they can be efficiently managed at source or in the immediate neighbourhood through composting, biomethanation or as animal feed that not only resolves the problem but offers livelihood options while being a climate action. Source management of biodegradables dramatically reduces the cost of collection and transportation.

Strengthening Single Use Plastic (SUP) Bans

India banned 19 single use plastic items in 2022 based on their utility and environmental impact yet many of them are still in circulation. Since they are low in utility and high in environmental impact it is imperative that the ban is made effective fully.

- The SUP bans allow bags of beyond 120 microns and 60GSM to be used and this reverses Uttarakhand's earlier complete plastic bag ban. Plastic bag bans in Uttarakhand should be implemented irrespective of thickness especially for its high impact, low value as well as for the socio-ecological importance and fragility.
- Promote SUP alternative industry with supportive infrastructure and incentives provided that would encourage the production of alternatives in large volumes.

- Expand SUP definition to include problematic plastics as the existing ban covers 3 to 5% of all plastic that mostly comes from small producers.

Promote Refill, Reuse, Repair Solutions

Promotion and incentivising Refill, Reuse and Repair products and processes reduce waste generation and central to a circular economy.

- Scale up the deposit return systems that are being piloted in Uttarakhand
- Incentivise industries and services promoting reuse systems including reusable cutlery with key line department taking stewardship and leading by example
- Promote Refill systems where everyday products can be bought in refillable containers.
- Strengthening drinking water access in key sites and locations that reduces the use of single use plastic bottled water. This can be strengthened by banning single use plastic bottled water in the state.
- All government events are taken forward with reusables and refillable.

Adopt Decentralised Practices for Managing Waste

The State has set up around 56 MRFs in various ULBs for recycling and channelization of dry waste material in the Mountain areas under SBM (U) 2.0. However, the remote areas of the mountains and high altitudes have challenges of accessibility to recycling/ recovery centers. Therefore, it is of utmost importance to engage communities and build capacities for taking the ownership of operating and maintaining waste management systems and infrastructure. Tourists and pilgrims must be made responsible to bring back their waste and to respective MRFs. Thus, the development of MRF with communities makes it adaptable to different geographic and cultural contexts, offering a sustainable solution for waste management.

Shift from 'Tipping Fee' Model to 'Tipping FREE' Model'

There is a need to revamp the conventional tipping fee approach. In the current tipping fee model the Collection and Transportation companies are being paid based on the quantum of waste being collected and transported to one location, mostly the dumpsites or the waste processing facility nearby. This is one of the key reasons for not achieving sustainable waste management in big ULBs and the cause of high carbon footprint in terms of CH4 emissions from all the dumpsites. Hence it is recommended that ULBs should adopt "Cost of Service Delivery Model" instead of "Tipping Fee Model" for collection and transportation of MSW on PPP basis. The model includes measurable Key Performance Indicators ("KPIs") for providing performance-based services which will strengthen the waste segregation at source, efficient door to door waste collection, minimization of solid waste sent to landfill site by diverting the minimum required segregated quantity to Decentralized Processing Units and rest to Centralized Waste Processing Facilities. Similarly, the small ULBs can streamline the process for effective implementation of the door to door collection through integration of SHGs based waste collection models.

Suitable Technology Adoption

A judicious choice of technology is essential for resource recovery and processing and disposal of municipal solid waste in Mountain State. It is important to utilize the resources by employing a combination of decentralized and centralized waste processing technologies suitable to the mountain context.

Real Time Data Monitoring of Waste Management

Real time data that is collected, transmitted and processed immediately or within a short time span, using sensors, communication networks and data analysis tools can play a vital role in improving the efficiency, effectiveness and sustainability of waste management systems by providing accurate and timely information about the status, quality and quantity of waste in different stages of the waste management process through GPS and Integrated Command Control Centre (ICCC).

Cluster based Approach for Waste Management

Waste management approaches for various ULBs of Uttarakhand should be based on their waste generation capacities, population size, and geographic constraints. Given the varied waste generation rates and unique challenges posed by the state's topography, the approach needs to be focused on decentralised solutions for smaller ULBs and cluster-based systems for larger waste generators. Clustering ULBs enables economies of scale, shared infrastructure, enhanced waste treatment capacity and minimum waste disposal at landfills. Clusters would be based on geographical proximities as well as communication connectivity.

Promoting Local, Healthy and Unpackaged Food.

Food creates the most plastic waste as there is a dramatic increase in the consumption of packaged and processed food in India and across the IHR. Most food items come wrapped in multi-layered plastics and not only has waste implications but also impacts the health of the consumer. A multi-pronged strategy is required to address this packaged food and waste crisis

- Promoting traditional and local food and local food markets that are unpackaged and healthy is needed. Policy, resource support and ease of business must be established that enable farmers markets and local food stalls to thrive.
- Mid-day meals must be based on local food sourced from local farmers
- Strengthening bans of junk food in educational institutions and their sale near them must be implemented.
- Front of label packaging of sugar, salt and fat content with proper labelling and warning must be enforced.
- Eat right campaigns must be sustained and made integral to educational processes.
- Food offerings in religious ceremonies and places of worship must, with the help of religious leaders and bodies, be encouraged to be locally prepared and sourced and free of any plastic packaging.

Appropriate Financial Allocations

The challenges as well as the importance and fragility of the mountains must be acknowledged with appropriate financial and resource allocations across all waste managers and institutions.

- Higher financial allocations for the mountain's local self-government institutions for waste management from the center as well as ensure there is sufficient untied funds
- State ensures appropriate allocation of funds to the local self-government institutions for waste management.
- CSR policy for waste management for the state.

- Consider various forms of sustainable financing (e.g., user fees, taxes, gate fees, EPR, etc.)
- Public-Private Partnerships (PPP): Engaging private sector companies in the construction, operation, and maintenance of SWM infrastructure through PPP models. This can help reduce the financial burden on ULBs while ensuring efficient waste processing

- Corporate Social Responsibility (CSR): Partnering with corporates to fund community-based SWM initiatives, especially for ULBs with less than 10 TPD waste generation, under CSR activities.
- Revenue Generation: To ensure the financial sustainability of SWM systems, various revenue streams could be explored and implemented:

    - User Charges: Recovery of O&M expenses through levy of user charges on households, commercial establishments, and institutions based on the quantity and type of waste generated

    - Sale of Compost and Recyclables: Revenue from the sale of compost produced at composting facilities and recyclables such as plastics, metals, and glass recovered from MRFs.

    - Offer incentives for residents and businesses such as tax rebates or reduced user charges or disincentives such as enforcement of penalty for non-compliance

Manage waste from Tourism, Pilgrimage Sites and other Sites of Importance

Uttarakhand is blessed with important and famous religious and tourism sites that bring in large amounts of people in specific periods of time. Many of these sites have been promoted and improved for the visitors without waste management infrastructure. Location of these sites and practices also throw up specific waste management challenges that have to be addressed. It is imperative that waste is mainstreamed in tourism and pilgrimage sites through specific waste management policies, practices, institutions and infrastructure. Uttarakhand having 9 cantonments, and a large international border has to have defence institutions integrated into the waste management systems. Specific strategies and technologies are also needed especially for high altitude outposts

Investing in Building Capacities and Leadership

Capacity of key personnel, both at the level of critical understanding of waste, technical knowhow as well as for community mobilisation and leadership drive is one of the most important factors for waste management. There is a need for capacity building of the ULBs, PRIs and waste managers to critically understand the issue of solid waste and devise sustainable strategies to address it in Uttarakhand. To drive and motivate the personnel involved in waste management as well as the community, there is a need for strong motivated political and bureaucratic leadership at the highest level. States and cities who have achieved success in SWM have shown that such type of leadership is paramount for success.

- Institutionalise and integrate capacity building for a wide range of stakeholders including elected leaders on solid waste management.

- Local self-governance leaders focussed multidisciplinary capacity building programmes designed and taken forward.
- The role of traditional bodies is of paramount importance and constitutionally recognised. Leaders of traditional institutions must have contextualised and regular capacity building programmes on waste management.
- The Religious Tourism and Defence Institutions leadership capacity building has to be designed and delivered that addresses the specific waste scenario of these important institutions. Continuity in capacity building is important for the defence personnel as there is constant replacement of such personnel in forward posts.
- CBOs/ NGOs / Volunteer training that create a pool of knowledgeable leaders who provide exemplary action on an everyday level would mainstream community action and ownership of waste management.
- Waste entrepreneurs and green service providers are much needed. Capacity building, incubating and nurturing waste entrepreneurs and green service providers must be taken forward with a green business model that provides essential and innovative waste management services across.
- Elected Leaders, Ward level leaders, government functionaries must lead by example in implementing the plan for waste management in their lives.
- Senior officials of ULBs/ PRIs should be frequently exposed to developments taking place in various parts of the State and Country by participation on exposure visits, seminars, workshops and training courses.

Continual Education and Awareness: Innovative and Impactful IEC

Waste is an everyday issue that needs continua education and awareness that is targeted and focused to different stakeholders. The changing narrative of waste and the need for circularity needs sustained education and awareness that bring about changes in knowledge, attitude, behaviour and everyday practise. Investment in design, using a multimedia lens and creating impactful and effective information and education communication materials is key to bring about desired behavioural change for sustainable waste management.

11. Conclusion

Uttarakhand has challenges of waste that is a result of present-day linear production systems as well as changing consumption patterns that are not matched with waste management systems. The narrative of waste management in itself is limited when one looks at the dramatically changing production and consumption patterns that has resulted in the waste crisis. The waste management rules while being progressive are not sensitive to socio-ecology of the Himalaya, the importance and fragility. They do not acknowledge and promulgate for the specific issues of waste management in the mountains as well as allocate appropriate resources.

Uttarakhand is further challenged with extreme tourist and pilgrim footfalls as well as defence installations that require targeted and convergent action. The waste crisis impacts public health and wellbeing of people and the environment and ecology. There is an urgent need to shift out from linear economic models to a circular one to truly address the waste crisis. Waste needs to be designed out of the system in the long run. There is also an immediacy to improve the existing management system and implement the waste management rules promulgated by the MoEFCC and taken forward through the Swachh Bharat Abhiyan. But at the same time, the existing waste management policies need mountain sensitivity with appropriate resource allocations for it to truly achieve Swachata.

The issues of waste need to intersect with public health, food and nutrition security, climate crisis and biodiversity loss and be addressed with a transdisciplinary and transboundary lens. The macro assessment of solid waste management of Uttarakhand is an important stepping stone in not just addressing waste in Uttarakhand but has great application to the entire Indian Himalayan Region and beyond.

Annexures

Annexure 1: State Consultation Workshop

State Consultation Workshop

December 12th, 2024

Title: Macro Level Stocktake Assessment on Solid Waste Management and Promoting a Circular Economy in the State of Uttarakhand

Venue: Conference Hall, Swami Nityanand Auditorium Building, Doon University, Dehradun

Introduction

The state consultation workshop titled "Macro Level Stocktake Assessment on Solid Waste Management and Promoting a Circular Economy in the State of Uttarakhand" was held on December 12th, 2024, at the Swami Nityanand Auditorium Building, Doon University, Dehradun. Jointly organized by the Integrated Mountain Initiative (IMI), ICIMOD, Sustainable Development Forum Uttarakhand (SDFU), and the Doon University, the workshop aimed to assess the current state of solid waste management (SWM) in Uttarakhand and explore strategies to integrate circular economy principles into waste

management practices. Discussions during the event included policy frameworks, technological advancements, community engagement, and sustainable business models. The participation of experts, NGOs, policymakers, and local stakeholders made it a comprehensive platform to brainstorm solutions for the region's growing waste crisis, particularly the issue of plastic waste.

The objectives of the workshop were multifaceted. It aimed to assess existing policies on solid waste management and evaluate their potential for promoting a circular economy. A macro-level stocktake assessment was conducted to develop a comprehensive understanding of solid waste management across all nodes of the value chain. The workshop sought to review and identify proven and scalable solutions for solid waste management while mapping out relevant stakeholders involved at each node of the value chain. Furthermore, it focused on recommending viable strategies and approaches tailored to address the unique challenges of emerging hill towns and cities in Uttarakhand, India.

Session 1: Inaugural Session

The workshop commenced with an inaugural session, followed by the presentations by the expert members. Dr. G.S. Rawat, Councilor, IMI, delivered the welcome address, setting the tone for the day's discussions. This was followed by opening remarks by Mr. Roshan Rai, Secretary, IMI, who introduced the project objectives and emphasized the importance of transitioning toward a circular economy.
Highlighting the pressing issue of plastic waste in the Himalayan region, Mr. Rai referenced Annie Leonard's quote, "There is no such thing as a way; when we throw anything away, it must go somewhere." He pointed out the alarming changes in the Himalayas, which are no longer pristine and untouched. He stressed that not a single patch of ground is free from plastic waste and detailed the challenges posed by garbage and landfill burns in the region. Citing the rapid filling of sanitary landfills in Gangtok within three years, he explained the growing urgency for better waste management practices.

Mr. Rai also reflected on initiatives like the Mountain Legislature Meets in Darjeeling and Leh, which emphasized extended producer responsibility (EPR), and cleanup campaigns such as the Plastic Freedom Challenge, which has been active since 2016. Policy briefs prepared under this initiative have focused on plastic waste management in the Indian Himalayan Region (IHR). He discussed Swachh Bharat Mission 2.0, which aims to enhance material recovery facilities (MRF), composting, and bio-methanation but faces challenges in segregation at source, user fees, and managing legacy waste. He envisioned Swachh Bharat Mission 3.0 with mountain-specific targets, promoting reuse and refill revolutions, and implementing strategies like naming and shaming top polluters. He also highlighted the results of the Himalayan Cleanup, where 75% of collected plastic waste was non-recyclable, and 84.2% of this consisted of food packaging. His remarks concluded with a call for immediate action to integrate circular economy principles into the region's waste management framework.

The Secretary of Uttarakhand Pollution Control Board (UPCB) inaugurated the session with key insights for adoption of sustainable waste management practices in Mountain State. Highlighting the responsibility of every waste generator, the Secretary UPCB has conveyed that behaviour change and door to door collection is a challenge in the State. The Secretary

UPCB has stressed upon the existing challenges in the entire supply chain and linkages with aggregators and recyclers which renders the EPR regime and existing MRFs non-viable due to inaccessibility of waste collection routes in the State. He addressed that, there should be a mental framework for IEC activities, training and capacity building programs to inculcate behaviour change with better discipline to feel responsible for their own waste. This should go hand in hand while developing the skills of waste managers like those of informal waste pickers who are managing our waste on a daily basis. He stressed the fact that the impact of the SBM program has faded out from the general public in subsequent years for adopting waste segregation at source in two dustbins (green and blue). He announced that Uttarakhand has introduced Deposit Refund System (DRS) for effective recycling activities in tourist areas, Char Dhams etc, conducting waste assessment in tourist areas through third party and also promoting the use of plastic waste in NHAI roads. He stressed upon unavailability of baseline data on EPR compliances for which the Government needs to be more data oriented through digital based systems. He raised concern over a new WTE plant being set up in Kashipur which has its own challenges in a fragile ecosystem. He emphasised that there is a need to activate new systems for promoting circular economy principles while linking local communities into the EPR regime i.e. benefit to all. In the last, he mentioned a waste logo on the “Kude se Kundan” (Garbage to Gold) concept and “Arth hai toh arth hai, nahi toh anarth hai!.” This captures the essence of the phrase, emphasizing that meaning or purpose brings order, while its absence leads to disorder or futility

This session was further followed by key insights from Manoj Tiwari, Panchayati Raj Institution. He conveyed that there is a 3 tier Panchayati Raj System. There is a Central and State Finance Commission as a grant for SWM and Sanitation services. He stressed upon the fact that, there is lack of linkage of recyclers with panchayats which is a challenge for them to streamline the SWM process as there is lack of Govt support in this endeavour. He emphasised that there is a need to do linkage with BWGs for waste management in small towns like setting up a separate unit in the Institute. He emphasised that there should be separate department for waste management in the villages for building accountability in the entire SWM Value Chain. He highlighted the need for role and responsibility delineation across the PRI for SWM

Mr. Gaurav, SWM Expert, Urban Development Directorate has conveyed the statistics of Solid Waste Management in Uttarakhand. He stressed upon the fact that, there are land constraints in peri-urban sensitive areas and getting environment clearances for SWM projects like Waste to Energy is an additional challenge in the State. He emphasised that there should be a strict enforcement mechanism with obligations & penalties, community engagement in decentralized waste management and promotion of SHG based segregation and door to door collection model. The department has introduced a policy on WTE in Uttarakhand, SUP policy, Anti littering & Anti Spitting policy and Deposit Return Scheme (DRS)

The representative of Nawami Gange shared all the intervention efforts undertaken under the programme to address the issue of solid and liquid waste leakage in Ganga.

Session 2: Expert Presentations

The inaugural session was followed by expert presentations, where a diverse panel of specialists shared insights and success stories of their innovative practices while highlighting gaps and constraints specific to the hilly regions of Uttarakhand. They also sighted macro- and micro-level models, gave examples of certain temples and universities having their own waste management units. They also talked about the Waste to energy plant in Kashipur and digital repository rules.

Mr. Vishal Kumar, CEO, Waste Warriors Society and Youth Warriors' Society. The motto of his organization is based on reduce, reuse, and recycle and focused on community-based waste management models. He talked about the segregation shed centre, a solid waste management unit at the periphery of the village.

- He discussed initiatives like segregation shed centres and solid waste management units at village peripheries, particularly his own Material Recovery Facility (MRF) at Harrawala, Dehradun. He outlined ongoing campaigns such as "Plastic Laao, Aata Pao," and "Aa Ab Laut Chale," emphasizing challenges like the waste (blue and green) segregation norm in the city, public awareness, resource limitations, inventory management of sanitary waste and hazardous garbage, and role duplicity in waste management departments. He also highlighted short-, mid-, and long-term solutions, focusing on community outreach as a core strategy.

- The Harrawala Material Recovery Facility (MRF) in Dehradun serves as a model for sustainable waste management. Since its establishment, the facility has played a pivotal role in reducing landfill dependency through systematic source segregation, processing, and recycling. Located in Ward 97 of Dehradun, the MRF is part of a broader initiative that includes door-to-door waste collection under the Model Ward Program and the "Waste to Wealth" initiative, which extends dry waste collection services to Resident Welfare Associations (RWAs) across the city.

- The facility's waste management practices emphasize comprehensive segregation into categories such as dry, wet, sanitary, and inert waste during collection. This categorization ensures efficient processing and recycling of materials. Over its operation, the facility has managed significant volumes of waste, including 130,156 kilograms of dry waste, 48,844 kilograms of inert waste, 40,747 kilograms of wet waste, and 13,902 kilograms of sanitary waste. Dry waste undergoes meticulous sorting into 28 categories, enabling the recovery of recyclable materials like plastic, paper, glass, and metals.

- Harrawala MRF also focuses on community outreach and public engagement. Programs like "Plastic Laao, Aata Pao" incentivize individuals to exchange plastic waste for wheat, fostering participation in waste collection efforts. Additionally, the facility organizes cleanup drives and composting initiatives to promote sustainable practices. Currently, 34 households actively practice home composting, contributing to organic waste reduction.

- The facility's operations are supported by a dedicated team of 25 green workers, 16 segregation workers, 4 collection drivers, and 5 vehicle helpers. The team ensures

the seamless collection, sorting, and processing of waste. Seven collection vehicles are used to serve households and establishments across the ward. Despite these successes, Harrawala MRF faces challenges, including low public awareness, resource limitations, hazardous waste handling, and market rate fluctuations for recyclables.

- To address these challenges, the facility has laid out a forward-looking plan that includes upgrading equipment, expanding service areas, and initiating innovative recycling projects. Efforts to improve source segregation and enhance operational efficiency are central to these plans. The MRF also envisions transitioning toward financial self-sustainability through better resource management and increased community involvement.

- Harrawala MRF exemplifies the potential for integrating community engagement with sustainable waste management solutions. Its efforts contribute significantly to reducing landfill dependency and environmental impact, making it a critical component of Dehradun's waste management infrastructure.

Mr. Ajay Garg, from the Indian Pollution Control Association (IPCA), highlighted market-driven solutions for recycling and emphasized sustainable waste management initiatives. They are working at the pan-India level, and their project focuses on decentralized waste management. He cited Tamil Nadu as a state with exemplary solid waste management practices. He discussed IPCA's national-level projects, including the "My 10kg Plastic Campaign," "Plastic Neutral," and Bisleri's "Bottles for Change" programs, as well as the "Zero Waste" campaign. He also introduced innovative projects like "WAYU" (Air Purifier Units) and "Project MASS," which transforms plastic waste into sustainable seating solutions. Mr. Garg emphasized the importance of capacity building and behavioural change for achieving long-term success.

- The Indian Pollution Control Association (IPCA), a non-profit organization founded in 2001, has been at the forefront of waste management and environmental sustainability initiatives across India. Recognized for its work in plastic waste management and Extended Producer Responsibility (EPR) action plans, IPCA operates in over 33 states, focusing on innovative projects that promote circular economy principles. This report summarizes the macro-level waste management strategies and specific initiatives undertaken by IPCA, particularly in Uttarakhand.

- Sustainable Waste Management Projects: IPCA has pioneered multiple projects to address waste segregation, recycling, and treatment, with the overarching goal of promoting sustainable practices and mitigating environmental impacts. The organization's efforts include the "Mantra for Advance Sustainable Solution" (MASS), which has successfully diverted significant quantities of waste from landfills while reducing greenhouse gas emissions. The initiative in Uttarakhand has transformed 350 metric tons of low-value plastic waste into 10,000 recycled school desks for government schools, saving approximately 210 metric tons of virgin timber.

- Segregation and Recycling Efforts: Through its Segregation of Waste for Recycling and Treatment (SORT) initiative, IPCA has developed decentralized waste management systems, treating over 1,287 metric tons of organic waste and

producing 172 metric tons of compost. This has offset over 120,000 kg of CO_2 equivalent greenhouse gas emissions. Infrastructure developments include nine Material Recovery Facilities (MRFs) in locations such as Delhi, Ghaziabad, Greater Noida, and Patiala, capable of segregating and processing plastic and organic waste.

- Pollution Control and Air Quality Management: IPCA's air quality improvement projects include installing low-cost air quality monitoring sensors and 107 WAYU purifiers in pollution hotspots like Gurugram and Ballabhgarh. Additionally, the green belt development initiatives in Rudrapur, Uttarakhand, have enhanced carbon sequestration through the planting and maintenance of trees like Monoon longifolium. These projects contribute to reduced particulate matter levels and overall air quality enhancement.

- Community-Based Campaigns: Public engagement is central to IPCA's approach. Campaigns like "My 10 Kg Plastic," "Bottles for Change," and the "Zero Waste Campaign" have educated and involved thousands of citizens, promoting waste segregation and responsible waste disposal. For instance, the "Bottles for Change" program, supported by Bisleri International Pvt. Ltd., has collected over 200 metric tons of plastic waste while raising awareness through more than 50 campaigns.

- Extended Producer Responsibility (EPR): IPCA has emerged as a leader in implementing EPR frameworks across India. Partnering with 101 brands and 79 urban local bodies (ULBs), the organization has successfully recycled over 4 lakh metric tons of plastic waste. In Uttarakhand, 7,254 metric tons of plastic waste have been processed for recycling, reducing environmental impact and promoting circular economy practices.

- IPCA's holistic waste management initiatives exemplify the potential of integrating innovative recycling technologies, decentralized waste management, and community-driven approaches to address pressing environmental challenges. In Uttarakhand, these efforts have not only improved waste management infrastructure but also significantly contributed to environmental sustainability and resource conservation. The organization's work underscores the importance of a circular economy in achieving long-term ecological balance and reducing the environmental footprint of human activities.

Srinagar (Garhwal Division) and Bhowali (Kumaon Division) Nagar Nigam representatives shared insights into local waste management practices.

- Baseline Assessment and Key Findings were presented by Mr. Pradeep Khandelwal and Ms. Ekta Gupta, highlighting sectoral challenges such as waste segregation, compliance gaps, and the quantum of waste generation.

- The workshop focused on understanding waste generation trends, assessing the status of two emerging hill towns, namely Srinagar and Bhowali, proposing localized technological solutions, and outlining actionable strategies to improve solid waste management. These two towns were specifically studied to provide insights into the unique challenges faced by such regions.

- Waste generation trends in Uttarakhand reveal a daily production of approximately 3,010 metric tons of municipal solid waste (MSW). Of this, 44.76% is biodegradable, while 55.24% is non-biodegradable. Despite a collection efficiency of 90–95%, gaps remain in processing capacities, with only 58% of waste being processed. The remainder adds to legacy waste issues, highlighting the need for immediate action.

- The presentation identified several challenges in SWM across the state. Limited segregation at the source significantly hampers recycling and processing efforts. Tourism exacerbates the waste burden, especially with single-use plastics, while inadequate infrastructure for waste collection, recycling, and disposal compounds the problem. Citizen engagement and awareness remain limited, further affecting the adoption of sustainable practices. Policy enforcement, particularly concerning Extended Producer Responsibility (EPR), faces significant hurdles. Financial and geographical constraints also pose barriers to implementing comprehensive waste management solutions.

- The state of waste management in emerging hill towns like Srinagar and Bhowali provides a microcosmic view of these broader challenges. Srinagar, with a population of 100,000 (including 15,000 floating population), employs private contractors for waste collection and relies on a manual Material Recovery Facility (MRF). Efforts like biomining of legacy waste and implementing anti-littering bylaws demonstrate progress. However, issues such as inadequate infrastructure and dependency on external recyclers persist. Bhowali, with a smaller population of 8,483, follows a cluster-based approach for waste disposal involving nearby towns. Despite manual segregation practices at the dumpsite, the lack of EPR mechanisms, high transportation costs, and limited awareness among residents highlight ongoing challenges.

- They (Ms. Gupta & Mr. Khandelwal) emphasized several strategies to address these challenges. Ensuring 100% segregation of waste at the source by all generators is fundamental. Decentralized waste management solutions were proposed for towns generating less than 10 TPD of waste, while cluster-based integrated management systems were recommended for towns generating more than 10 TPD. The adoption of EPR frameworks was highlighted as a crucial step to enhance recycling and material recovery.

- Technological interventions form a cornerstone of the proposed solutions. Establishing MRFs for sorting and recycling single-use plastics, setting up bio-methanation plants for biodegradable waste, and developing bio-CNG/CBG plants for energy recovery were identified as viable options. Promoting home composting solutions like Khamba composters was also encouraged. In addition, fostering public-private partnerships (PPP) and engaging local NGOs, startups, and private enterprises were recommended to ensure sustainable operations. Awareness campaigns and incentives for sustainable practices aim to drive community engagement, while digital monitoring systems are proposed to track waste management progress.

- Key recommendations from their study include strengthening policy enforcement, particularly the SWM Rules 2016 and PWM Rules 2016, to mandate segregation and recycling. Scaling up waste-to-energy technologies such as Refuse-Derived Fuel (RDF) and biomethanation plants is necessary to manage residual waste effectively. Financial sustainability can be achieved by leveraging user fees, CSR funds, and revenue from recycling. Capacity building for municipal staff and integrating informal waste pickers into formal systems are crucial for operational efficiency. The adoption of digital platforms to monitor waste management activities will further streamline processes and ensure accountability.

- The presentation concluded with a clear roadmap for moving forward. Detailed surveys in project areas, comprehensive analyses, and the preparation of actionable recommendations will form the foundation of the final report. Collaborative efforts among stakeholders aim to establish sustainable SWM practices and integrate circular economy principles across Uttarakhand. This initiative represents a significant step toward addressing the waste management crisis in the region while fostering environmental sustainability and economic development. Best practices such as anti-littering/spitting, benches made from metallic drums installed in public places, vending machines installed for cloth bags, challan systems for single-use practices showcased positive impact in the region.

Representatives from NGO Parashakti talked about their “Har Ghar Paudha Campaign.” Another NGO, Eco Group Society, showcased grassroots-level waste management initiatives such as awareness generation at schools, residential complexes, and corporate defaulters.

Mr. Ghandharv Gopal Joshi, CPPGG from the Uttarakhand State Planning Department, discussed state-level policy implications, advocating for penalizing non-compliance and incentivizing positive behaviour. He emphasized the need for an integrated approach for peri-urban scenarios and a livelihood-oriented (MGNREGA) strategy for rural areas. He highlighted sludge and liquid waste management initiatives under Namami Gange, ensuring no solid waste is dumped into the Ganges. He also showcased Sweden’s negative in waste generation and octopus technology.

Lastly, Mr. Vipin Kumar, a Consultant, spoke about the challenges of integrating advanced technologies into existing waste systems. He identified issues such as bringing multiple stakeholders under one roof is a complex task, weak supply chains, lack of infrastructure, dumping garbage in forest or hillside valleys, and door-to-door collection challenges, particularly in the hilly terrain of Uttarakhand.

Session 3: Group Activity with Thematic Round Table Discussions

After the lunch break, Session 2 commenced group activity with thematic round table discussions moderated by Mr. Roshan Rai and Ms. Ekta Gupta. Participants were divided into four different groups to deliberate on specific themes:

1. Solid waste value chain and statutory compliance,
2. Policy and market-based instruments,
3. Waste management models and technologies, and

4. Capacity building and public engagement.

The first group focused on segregation practices, waste sources, and regulatory challenges, while the second group explored carbon trading, GHG emissions, and market-based models for integrating circular economy principles. The third group evaluated feasible recycling technologies and scalable waste management practices tailored to Uttarakhand's unique context. The fourth group emphasized community engagement and skill development to promote sustainable waste management practices. Following the discussions, the collaborative effort of each group presented their findings during the group presentation session. These presentations outlined key policy recommendations, priority areas for technological adoption, and strategies to enhance public and institutional capacities.

Group 1 - Waste Value Chain and Statutory Compliance: Discussions in this group highlighted critical challenges in waste segregation, collection, and processing. Major issues included poor awareness of segregation practices, inadequate infrastructure, and ineffective implementation of statutory by-laws. Models like Harrawala Ward 97 and Dhanola Village were cited as successful examples, though replication efforts are hindered by insufficient government support. Proposed solutions emphasized the adoption of decentralized waste processing through Material Recovery Facilities (MRFs), digital refund systems for waste characterization, and extensive awareness campaigns targeting households and schools.

Group 2 - Policy and Market-Based Instruments: This group focused on integrating policies with market-based solutions to reduce greenhouse gas emissions and develop circular economy frameworks. Participants noted gaps in Extended Producer Responsibility (EPR) alignment with local waste generation patterns and the absence of effective carbon trading platforms. Suggested measures included biomining and remediation of dumpsites, engaging communities near forest areas for waste management, and mandating the reuse of processed products. Policymakers were encouraged to explore carbon credit potential and establish state-specific solid waste management frameworks.

Group 3 - Recycling Technologies and Scale-Up Models: Challenges in this group centered on the technological and logistical difficulties of managing waste in hilly terrains and eco-sensitive zones. The absence of sewer lines and limited land suitability for sanitary landfill facilities further complicate waste management. Participants advocated for research into decentralized technologies and emphasized the need for small-scale, economically viable waste processing units. The group recommended scaling up models like those developed by IPCA and Waste Warriors, emphasizing decentralized processing with minimal transportation distances to reduce environmental impact.

Group 4 - Capacity Building and Public Engagement: This group identified gaps in community participation and the need for skill development among waste handlers. Safety concerns for rag pickers and low public awareness of waste management practices were highlighted. Proposed interventions included phased training programs for waste workers, incorporating waste management topics into school curricula, and leveraging the influence of religious leaders for community engagement. Regular capacity-building initiatives and health check-ups for ragpickers were also recommended.

The group activity and parallel round table discussion underscored the need for a multi-faceted approach to solid waste management, integrating policy reform, technological innovation, and community participation. Addressing these challenges will require coordinated efforts between government agencies, NGOs, and local communities. The workshop emphasized the importance of decentralized waste management systems, capacity building, and the integration of market-based instruments to promote a circular economy in Uttarakhand. This collaborative framework provides a roadmap for sustainable solid waste management practices in the state.

Closing Session

The closing session, moderated by Dr. G. S. Rawat, featured summary remarks by Mr. Ramesh Negi, President, IMI, who emphasized the importance of actionable strategies and cross-sector collaboration. Way forward by Mr. Pradeep Khandelwal, from the State Pollution Control Board (SPCB) provided additional perspectives on regulatory challenges. And gave insight on the "*Kude se Kundan*" (Garbage to Gold) concept and "*Arth hai toh arth hai, nahi toh anarth hai*!." This captures the essence of the phrase, emphasizing that meaning or purpose brings order, while its absence leads to disorder or futility."

Mr. Roshan Rai, Secretary, IMI, delivered the vote of thanks, acknowledging the contributions of all participants and stakeholders. The state consultation workshop concluded with several key outcomes and recommendations. First, participants stressed the need for robust policy frameworks to support segregation, recycling, and compliance while promoting incentives for circular economy business models. Second, integrating scalable recycling technologies and innovative waste management practices was identified as a priority. Third, strengthening IEC (Information, Education, and Communication) campaigns was recommended to improve public participation and awareness. Finally, capacity building through skill training for waste management professionals was emphasized as a critical component for sustainability.

The workshop successfully facilitated a multi-stakeholder dialogue, fostering actionable insights to address Uttarakhand's solid waste management challenges. By fostering collaboration among policymakers, NGOs, industry leaders, and communities, the event laid the foundation for sustainable waste management practices and circular economy integration in the state. This initiative serves as a vital step towards addressing the growing waste crisis in the region while promoting environmental sustainability and economic development

INTEGRATED MOUNTAIN INITIATIVE | ICIMOD | SDFU SUSTAINABLE DEVELOPMENT FORUM UTTARANCHAL | DOON UNIVERSITY

ATTENDANCE SHEET

STATE LEVEL CONSULTATION WORKSHOP

Macro level stocktake assessment on solid waste management and promoting a circular economy in the State of Uttarakhand

12 December 2024 | 10:00 am - 05:00 pm | Venue- Conference Hall, Swami Nityanand Auditorium Building, Doon University, Dehradun

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Annexure 2: List of stakeholders for Key Informant Interviews

1. Dehradun Municipal Corporation

S.No.	Name	Department
1	Gopal Ram Binwal	Assistant Municipal Commissioner, Nagar Nigam
2	Rajveer Chauhan	Assistant Municipal Commissioner, Nagar Nigam
3	Mahipal	Sanitary Inspector, Nagar Nigam

2. Urban Development Directorate (UD)

S.No.	Name	Department
1	Rohitash	Assistant Director, UD Dept
2	Manoj Pandey	State Mission Manager, UD Dept
3	Gaurav Chamoli	SWM Expert, UD Dept

3. Waste Warrior Society (NGO)

S.No.	Name	Department
1	Naveen Kumar Sadana	Associate Director and Brand Ambassador Swachhta Survekshan
2	Satendra Singh	Operational Manager, Harrawala MRF
3	Riya	Research Associate, Corbett Team

4. Srinagar Nagar Nigam

S.No.	Name	Department
1	Sashi Kumar Singh Panwar	Chief Health Inspector, Nagar Nigam
2	Gayatri Bisht	Assistant Municipal Commissioner, Nagar Nigam
3	Ravi Raj Bangari	Assistant Municipal Commissioner, Nagar Nigam

5. Bhowali Nagar Palika

S.No.	Name	Department
1	Sudhir Kumar	Executive Officer, Nagar Palika
2	Saurabh Bish	Junior Engineer, Nagar Palika
3	Priyanka Joshi	Account Clerk, Nagar Palika
4	Indu Kumar Kapil	Senior Assistant, Nagar Palika
5	Sunny Kumar	Pavni Environment Pvt Ltd (Dumpsite contractor)
6	Rajesh ji	Sanitation Supervisor, Nagar Palika
7	Gaurav	Data Entry Operator, Nagar Palika

Annexure 3: Estimated Projection Trends

The town wise current and projected population and waste generation details are as follows:-

Table 17: Cities with MSW Generation Less than 1 TPD

S. No.	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041		Increase in MSW generation in TPD
			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population Growth Rate (%)	Increase Rate in MSW Generation (%)	
1	Sri Kedarnath	Nagar Panchayat	612	0.23	1720	0.95	181	313	0.72
2	Gangotri	Nagar Panchayat	1100	0.33	3168	1.27	188	285	0.94
3	Kirti Nagar	Nagar Panchayat	1517	0.46	1972	0.79	30	72	0.33
4	Nandprayag	Nagar Panchayat	1641	0.49	3200	1.28	95	161	0.79
5	Gaja	Nagar Panchayat	1800	0.54	2496	0.94	39	74	0.40
6	Lamb Gaon	Nagar Panchayat	2330	0.7	2340	1.21	0	73	0.51
7	Dogadda	Nagar Palika Parishad	2423	0.73	3150	1.26	30	73	0.53
8	Dwarahat	Nagar Panchayat	2749	0.82	3574	1.43	30	74	0.61
9	Dev Prayag	Nagar Panchayat	2868	0.86	3442	1.38	20	60	0.52
10	Badrinath	Nagar Panchayat	2307	0.87	8405	4.62	264	431	3.75
11	Ukhimath (New)	Nagar Panchayat	2920	0.88	3796	1.52	30	73	0.64

Table 18: Cities with MSW Generation Between 1 TPD and 2 TPD

S. No.	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041		Increase in MSW generation in TPD
			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population n Growth Rate (%)	Increase Rate in MSW Generation (%)	
1	Pipalkoti	Nagar Panchayat	3521	1.06	4577	1.83	30	73	0.77
2	Munsiyari (New)	Nagar Panchayat	3620	1.09	4706	1.88	30	72	0.79
3	Nauvgaon (New)	Nagar Panchayat	3875	1.16	5038	2.02	30	74	0.86
4	Satpulli (new)	Nagar Panchayat	4226	1.27	5494	2.2	30	73	0.93

5	Tharali	Nagar Panchayat	4482	1.34	5827	2.33	30	74	0.99
6	Bhikiyasain	Nagar Panchayat	4570	1.37	6630	2.38	45	74	1.01
7	Swargasharam Jauk (N)	Nagar Panchayat	4669	1.4	6070	2.43	30	74	1.03
8	Chaukutiya (New)	Nagar Panchayat	4796	1.44	6235	2.49	30	73	1.05
9	Gularbhoj	Nagar Panchayat	4829	1.45	11021	2.51	128	73	1.06
10	Ranikhet Chiniyanoula	Nagar Panchayat	5100	1.53	6278	2.65	23	73	1.12
11	Purola (New)	Nagar Panchayat	5306	1.59	6898	2.76	30	74	1.17
12	Chamiyala	Nagar Panchayat	5306	1.59	6898	2.76	30	74	1.17
13	Kap Koth (New)	Nagar Panchayat	5365	1.61	6975	2.79	30	73	1.18
14	Narendra Nagar	Nagar Palika Parishad	6034	1.81	8608	3.44	43	90	1.63
15	Pokhari (New)	Nagar Panchayat	6119	1.84	8854	3.54	45	92	1.70
16	Bhowali	Nagar Palika Parishad	6308	1.89	8200	3.28	30	74	1.39
17	Shaktigarh	Nagar Panchayat	6309	1.89	7239	2.9	15	53	1.01
18	Didihat	Nagar Panchayat	6522	1.96	8479	3.39	30	73	1.43

Table 19: Cities with MSW Generation Between 2 TPD and 5 TPD

S. No.	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041		Increase in MSW generation in TPD
			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population Growth Rate (%)	Increase Rate in MSW Generation (%)	
1	Barkot	Nagar Panchayat	6720	2.02	8736	3.49	30	73	1.47
2	Dharuchula	Nagar Palika Parishad	7039	2.11	9151	3.66	30	73	1.55
3	Gangolihaat (New)	Nagar Panchayat	7112	2.13	9246	3.7	30	74	1.57
4	Mahuadhabra	Nagar Panchayat	7326	2.2	9524	3.81	30	73	1.61
5	Augustmuni (new)	Nagar Panchayat	7367	2.21	9577	3.83	30	73	1.62

6	Lohaghat	Nagar Panchayat	7926	2.238	10304	4.12	30	84	1.88
7	Kaladhungi	Nagar Panchayat	7611	2.28	9894	3.96	30	74	1.68
8	LalKuan	Nagar Panchayat	7644	2.29	9937	3.97	30	73	1.68
9	Beri Naag (New)	Nagar Panchayat	7641	2.29	9933	3.97	30	73	1.68
10	Bhimtal	Nagar Panchayat	7722	2.32	10039	4.02	30	73	1.70
11	Ghansali (New)	Nagar Panchayat	7771	2.33	10102	4.04	30	73	1.71
12	Chamba	Nagar Panchayat	7775	2.33	10108	4.04	30	73	1.71
13	Gauchar	Nagar Panchayat	7955	2.39	14631	5.85	84	145	3.46
14	Banbasa (New)	Nagar Panchayat	7990	2.4	10387	4.15	30	73	1.75
15	Karanprayag	Nagar Panchayat	8283	2.48	14268	5.71	72	130	3.23
16	Nanakmatta	Nagar Panchayat	8478	2.54	3029	4.41	-64	74	1.87
17	Gairsain (New)	Nagar Panchayat	8665	2.6	11265	4.51	30	73	1.91
18	Doiwala	Nagar Panchayat	8705	2.61	11317	4.53	30	74	1.92
19	Chinyalisaur (New)	Nagar Panchayat	8844	2.65	11497	4.6	30	74	1.95
20	Bageshwar	Nagar Palika Parishad	9079	2.72	11803	4.72	30	74	2.00
21	Rudraprayag	Nagar Palika Parishad	9313	2.79	15000	6	61	115	3.21
22	Harbartpur	Nagar Panchayat	9771	2.93	13966	5.59	43	91	2.66
23	Sultanpur Patti	Nagar Panchayat	9848	2.95	11753	4.7	19	59	1.75
24	Kelakhera	Nagar Panchayat	10929	3.28	13149	5.26	20	60	1.98

25	Champawat	Nagar Palika Parishad	11029	3.31	24878	9.95	126	201	6.64
26	Jhabrera	Nagar Panchayat	11186	3.36	1452	5.82	-87	73	2.46
27	Dineshpur	Nagar Panchayat	11342	3.4	23663	9.47	109	179	6.07
28	Mahuakheragang	Nagar Panchayat	12584	3.78	28022	11.21	123	197	7.43
29	Vikasnagar	Nagar Palika Parishad	13927	4.18	20840	8.34	50	100	4.16
30	Khatima	Nagar Palika Parishad	15087	4.53	25139	10.06	67	122	5.53

Table 20: Cities with MSW Generation Between 5 TPD and 10 TPD

S. No.	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041		Increase in MSW generation in TPD
			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population Growth Rate (%)	Increase Rate in MSW Generation (%)	
1	Joshimath	Nagar Palika Parishad	16709	5.01	29997	12	80	140	6.99
2	Selaqui	Nagar Panchayat	16880	5.06	5941	8.78	-65	74	3.72
3	Shivalik Nagar (New)	Nagar Palika Parishad	17302	5.1	22499	9	30	76	3.90
4	Bhagwanpur (New)	Nagar Panchayat	17304	5.19	22495	9	30	73	3.81
5	Uttarkashi	Nagar Palika Parishad	17840	5.24	22724	9.09	27	73	3.85
6	Tanakpur	Nagar Palika Parishad	17622	5.29	22909	9.16	30	73	3.87
7	Piran Kaliyar	Nagar Panchayat	19201	5.76	22333	9.98	16	73	4.22
8	Gadarpur	Nagar Palika Parishad	19289	5.79	25076	10.03	30	73	4.24
9	Sitarganj	Nagar Palika Parishad	19978	5.99	28455	11.38	42	90	5.39
10	Chamoli-Gopeshwar	Nagar Palika Parishad	21447	6.43	42879	17.15	100	167	10.72
11	Laksar	Nagar Panchayat	21760	6.53	28288	11.32	30	73	4.79
12	New Tehri	Nagar Palika Parishad	24012	7.2	31216	12.49	30	73	5.29
13	Kotdwara	Nagar Palika Parishad	25440	7.63	40925	16.37	61	115	8.74
14	Pauri	Nagar Palika Parishad	33031	7.63	45527	16.37	38	115	8.74

15	Srinagar	Nagar Palika Parishad	20091	7.63	40925	16.37	104	115	8.74
16	Bazpur	Nagar Palika Parishad	25513	7.65	33167	13.27	30	73	5.62
17	Muni-Ki-Reti	Nagar Palika Parishad	28636	8.59	43000	17.2	50	100	8.61

Table 21: Cities with MSW Generation Between 10 TPD and 50 TPD

S. No.	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041		Increase in MSW generation in TPD
			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population Growth Rate (%)	Increase Rate in MSW Generation (%)	
1	Almora	Nagar Palika Parishad	34125	10.24	47178	18.87	38	84	8.63
2	Mussoorie	Nagar Palika Parishad	28897	10.84	38396	21.12	33	95	10.28
3	Kiccha	Nagar Palika Parishad	41810	12.54	108885	43.55	160	247	31
4	Jaspur	Nagar Palika Parishad	50520	15.16	87820	35.13	74	132	20
5	Nainital	Nagar Palika Parishad	41377	15.52	45712	25.14	10	62	9.62
6	Manglaur	Nagar Palika Parishad	52994	15.9	68892	27.56	30	73	11.66
7	Ramnagar	Nagar Palika Parishad	54787	16.44	102615	41.05	87	150	24.61
8	Pithoragarh	Nagar Palika Parishad	56044	16.81	133036	53.21	137	217	36.40
9	Rishikesh	Nagar Palika Parishad	70499	26.44	149542	82.25	112	211	55.81
10	Roorkee	Nagar Nigam	118188	35.46	185676	74.27	57	109	38.81
11	Kashipur	Nagar Nigam	121610	36.48	233060	93.22	92	156	56.74
12	Rudrapur	Nagar Nigam	154514	46.35	404705	161.88	162	249	115.53

Table 22: Cities with MSW Generation More than 50 TPD

	ULB	ULB Status	2011	2017	2041	2041	Difference Increase from 2017 to 2041	

S. No.			Population	MSW Generation in TPD	Population	MSW Generation in TPD	Population Growth Rate (%)	Increase Rate in MSW Generation (%)	Increase in MSW generation in TPD
1	Haldwani	Nagar Nigam	171351	64.26	222756	122.52	30	91	58.26
2	Haridwar	Nagar Nigam	231139	86.68	423618	232.99	83	169	146.31
3	Dehradun	Nagar Nigam	583679	218.88	1168101	642.46	100	194	424

Note:

- The projection trends are as per State Policy by Urban Development Directorate Dehradun 2017
- Figures for MSW generation calculated on average of 300 gcpd (2011), 400 gcpd (2041)
- Figures for MSW generation for cities of Dehradun, Haridwar, Rishikesh, Haldwani, Mussoorie, Nainital, Badrinath and Sri Kedarnath calculated based on 375 gcpd (2011) and 550 gpcd (2041) to include floating population.
- Floating population for all towns not considered as individual city figures not available
- Includes population and waste generation estimates only for Urban Local Bodies and does not include areas under peri-urban and rural area. The peri urban areas surrounding the ULBs clusters as well as the villages enroute should be included for estimation of waste generation and during further appraising the efforts to set-up the new infrastructure on the state level