CMPA Technical Report Series

15

Effective and Equitable Solid Waste Management

Final Report for a Sustainable SWM System in Velas

October 2015

Indo-German Biodiversity Programme
Conservation and Sustainable Management of Coastal and Marine Protected Areas

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Effective and Equitable Solid Waste Management
Final Report for a Sustainable SWM System in Velas

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Effective and Equitable Solid Waste Management

Final Report for a Sustainable SWM System in Velas

by
Civic Response Team

June 2017

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Indo-German Biodiversity Programme
Conservation and Sustainable Management of Coastal and Marine Protected Areas

Date: 31st October 2015

Prepared by: The Civic Response Team, Aurangabad

This publication has been developed under the project titled 'Conservation and Sustainable Management of Coastal and Marine Protected Areas (CMPA) of the Indo-German Biodiversity Programme, GIZ.

The CMPA Project has been commissioned by the German Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB), under the International Climate Initiative (IKI). It is implemented by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of BMUB. In Maharashtra, Mangrove Cell, Maharashtra Forest Department is implementing the project in three sites i.e. Thane creek, Velas-Dabhol coastal stretch, and Ansure creek.

Indo-German Cooperation on Biodiversity

The governments of India and Germany have fostered a partnership to enhance conservation of India's biodiversity in line with the objectives of the Convention on Biological Diversity (CBD). The partnership includes implementing projects in which protecting the environment takes centre-stage using principles of sustainable development and enhancement of human well-being.

The CMPA Project

The CMPA project is a flag-ship project of the Indo-German technical cooperation supporting the CBD's Aichi targets. The project is funded by the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). It is implemented by the Ministry of Environment, Forest and Climate Change (MoEF&CC), Government of India, and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) on behalf of BMUB.
The overall objective of the project is, "The conservation and sustainable use of biodiversity in pilot protected areas are improved, taking into consideration the economic circumstances of the local population."

The project aims to conserve and manage potential marine protected areas in Maharashtra. The three main components of the CMPA project are: Participatory process, human capacity development, and communication and awareness. The project intervenes at two levels in India: The national level and in selected federal states. It focuses on:

I: Participatory management
Participatory management processes are implemented in pilot protected areas.
II: Capacity development
A capacity strengthening system for supporting participatory management of coastal and marine protected areas is developed for selected states and at national level.
III: Information, education, and communication
Relevant stakeholders have information and are aware about the importance of conserving biodiversity in marine and coastal areas.

CMPA sites in Maharashtra
A series of national and state-level stakeholder consultations involving government representatives, researchers and NGOs led to the identification of three CMPA sites in Maharashtra. These are Thane creek, Velas-Dabhol coastal stretch, and Ansure creek.

1. **Thane creek**: Thane creek opens into Mumbai's harbour and extends over an area of 26 sq kms. Thane creek supports a rich diversity of flora and fauna. It has been declared an Important Bird Area and a wildlife sanctuary.

2. **Velas-Dabhol coastal stretch**: This 60 km-coastal stretch is located in Ratnagiri district, Maharashtra. Habitats in the region include sandy beaches, rocky shores, mangroves, estuaries, coastal plateaus, and moist deciduous forests on hill sides. Beaches along this coast have become popular due to sea turtle nesting sites and efforts by local communities to conserve turtle nests.

3. **Ansure creek**: Ansure creek is located in Ratnagiri district, Maharashtra. It is approximately 6.5 kms long and 250-300m wide. The creek harbours large mud flats and mangrove forests.

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We also thank and acknowledge the efforts of Mr. Mohan, whose strong network in Velas made our work considerably easier and faster. Individuals like Vidya and Vaibhavi contributed to the findings of this report by sharing their time, thoughts, and resources. The Sarpanch and members of the Gram Panchayat also contributed to the findings of this report though their cooperation and enthusiastic participation.

Finally, we would like to express our gratitude to Sahyadri Nisarg Mitra and Kasav Mitra Mandal, whose hard work over the past decade has created a strong network of active residents in Velas. The experience of working with these organisations has created a positive environment for new initiatives and projects amongst the residents.

This report would not have been possible without the support of the rest of the Civic Response Team, who managed our ongoing projects deftly while we worked on building an equitable, practical, efficient, and sustainable solution for Velas village under the auspices of the Mangrove Cell.

Chapter 1

Executive Summary

The main objective of this research and report was to develop a customised, sustainable, and equitable Solid Waste Management (SWM) system for Velas in the context of its geographical location, biodiversity, seasonal tourism cycle, and local lifestyles and resources. The methodology, focus, content, and layout of this report was developed by CRT^ for the GoI-GIZ-CMPA project, as a precursor to the implementation of the SWM solution in Velas by our team.

This report is the result of the research-based phase (phase I) of the Velas SWM project, which was developed jointly by the Mangrove Cell and CRT^. This report is meant to provide CRT^ and the Mangrove Cell with an understanding of the current status of waste generation and management along with a projection of the interventions required to develop an efficient SWM solution for Velas. The implementation of this solution will be carried out in the second phase of this project.

The SWM problem in Velas is compounded by the fact that it has a large floating population, which includes residents who have moved to cities like Mumbai for work and tourists who visit during the turtle festival. During the fieldwork, we realised that the village authorities (Sarpanch, Gram Panchayat, Gram Sevak) have not been able to initiate a formal process or provide relevant training to develop a plan to manage solid waste in the village. We also found that Velas does not have relevant regulations to manage solid waste.

In this report, we focus on the following topics:

1. The current status of SWM in Velas, especially:
   a. The kind of waste generated
   b. Current practices of waste management

2. Challenges and opportunities with regard to local lifestyles and resources

3. An action plan for intervention by GOI-GIZ-CMPA for SWM, which includes:
   a. The technical process
   b. Educational and awareness initiatives required

c. Regulatory and governance framework

Based on the findings of this report and our experience in other villages, we are positive that with the right interventions, an effective SWM system can be implemented in Velas. During the research, we found that the newly-elected Gram Panchayat is enthusiastic about developing and implementing a solution to address the problem of unmanaged garbage in the village. Numerous local youth-groups are eager to participate in the execution of this project. It is also clear that capacity-building of various stakeholders and integration of the informal recycling sector are important elements for the implementation of a sustainable, equitable, and efficient SWM system in Velas. The research revealed two very promising factors in Velas: Residents perceive the collection of garbage in the village as a major problem, and expressed interest in participating in processes to resolve this problem.

Chapter 2

Introduction

2.1. Report brief

The CMPA project is one of the flag-ship projects of the Indo-German technical cooperation supporting the Convention on Biological Diversity's Aichi targets. The overall goal of the project is to contribute to conservation and sustainable use of biodiversity in selected areas along India's coast. This is expected to benefit the local population that is dependent on a healthy marine and coastal ecosystem. To achieve this goal, the project strives to develop participatory processes for the conservation and management of natural resources, while also facilitating capacity development of key sectors and stakeholders crucial for managing coastal and marine biodiversity and protected areas.[1]

One of the key sectors in this process is Solid Waste Management (SWM) in villages and towns located in this coastal stretch. There have been reports of whales, turtles, dolphins, and manatees with plastic bags in their stomach along this coast. This is the unfortunate impact of ineffective waste management systems on marine ecosystems.[2] Coastal towns and villages face the challenge of conserving their fragile ecosystem, while also harnessing the tourism potential of their region.

Velas is one such village. It is famous for the turtle festival, which attracts hundreds of tourists every year. The SWM system in the village is ill-equipped to manage the waste generated collectively by residents and tourists.

2.2. Background of SWM

Traditionally, Solid Waste Management consisted of waste collection, transportation, and disposal. In India, it also includes sweeping streets and cleaning drains. However, as the quantity of waste has increased and its negative impacts have intensified, attention has now shifted towards an integrated and sustainable

[1] http://www.indo--germanbiodiversity.com/index.php?r=project/view&id=1

[2] The Deadly Truth About Trash
HSUS animal caretakers see litter's lethal dangers, *All Animals magazine*, July/Aug 2009.

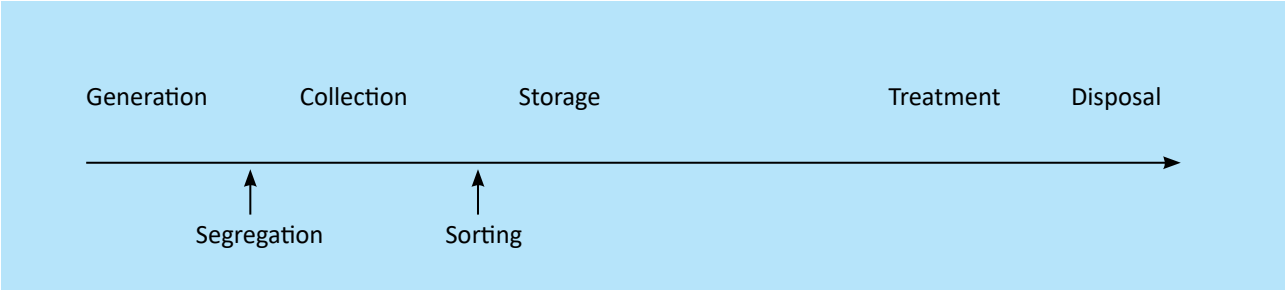
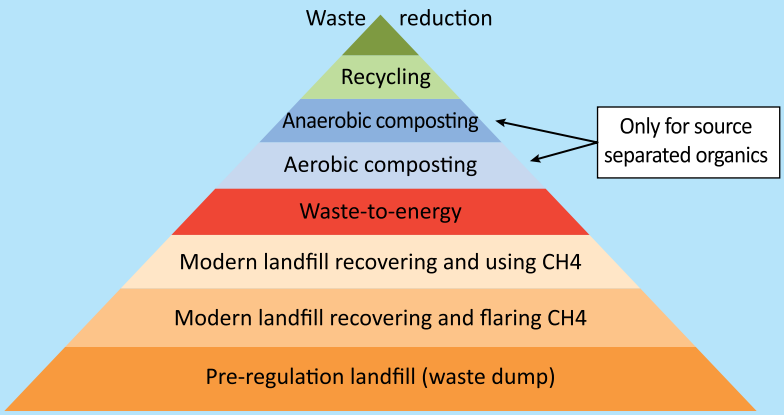


Figure 1: Hierarchy of waste processing systems in SWM (Source: Earth Engineering Center, Columbia University).



approach to SWM. Thus, the processes of waste reduction, source segregation, resource recovery, and scientific treatment have been added to SWM systems.

The flowchart depicted in figure 1 is the most commonly accepted hierarchy of waste management in the world. It has waste reduction and recycling at the top of the pyramid and open dumping of waste at the bottom. The use of techniques for different waste streams that are closer to the top reduces the environmental, health, and social impacts of SWM systems. As one moves towards the apex of this hierarchy, solutions require an increasing amount of participation, regulation, and decentralisation. For instance, waste can only be reduced when consumers are informed to buy responsibly and manufacturers follow regulations to use environmentally-friendly packaging. Similarly, recycling can only be effective when all stakeholders are informed, encouraged, motivated, and forced to comply with regulations of waste segregation at source, proper storage, and cooperation with staff. As we move towards the base of the pyramid, the processes become more centralised with greater environmental, health, and economical impacts.

This report focuses on the use of technologies and processes that complement each other to create a system that is sustainable and convenient for local authorities, residents, and establishments to mitigate the negative impact of waste on the environment, biodiversity, and people.

After analysing SWM laws in India, best practices from across the country, Swachh Bharat guidelines for villages, and the SWM situation in Velas, CRT^ identified six key principles to develop a waste management system for Velas:

1. Three--way source segregation at point of waste generation.

2. Reliable and regular collection of waste by local authorities.

3. Decentralisation of organic waste treatment.

4. Incorporation and capacity-building of local recyclers (bhangarwala, feriwala).

5. Dignity of labour and enhancement of livelihoods.

6. Capacity building of Gram Panchayat members, youth, and households to manage waste in Velas, while having a sense of ownership of the SWM solution in the village

2.3. About Velas

Velas is located on the border of Mandangad district of Maharashtra. The 2011 census records 157 households for Velas but our research revealed that the actual number is around 300, including the area of Narayan Nagar. The village is has gained popularity for its turtle festival, which attracts hundreds tourists every year. The village has benefitted tremendously from the work of the Forest Department and the Sahyadri Nisarg Mitra (SNM) over the last 12 years. The Forest Department, MTDC and GIZ have also contributed to the integration of local communities in biodiversity conservation through the development of tourism and related livelihoods in the village.

In the CMPA Project outline shared with CRT^, the Velas-Dabhol coastal stretch is around 60 kms long. Beaches along this coast have become famous for their sea turtle nesting sites. The habitats in the village includes sandy beaches, rocky shores, mangroves, estuaries, coastal plateaus, and moist deciduous forests on the hillside.[3] The coastal region is closely linked with the Western Ghats, which has been recognised as one of ten global biodiversity hotspots[4].

2.4. About CRT^

CRT^ is a firm that combines research and capacity-building, and partners with clients to implement appropriate solutions to address civic and environmental challenges.
Our Values: CRT^ adheres to the highest standards of integrity and professionalism while proactively partnering with diverse clients to develop creative and knowledge-driven solutions.

Our Belief: Our work is driven by the belief that active citizenship and entrepreneurship guided by research can lead to transformative changes. It is also driven by a belief that there is scope for developing partnerships with various stakeholders, which is anchored by a conviction that individuals and organisations are capable and willing of participating in the process nation-building.

[3] Conservation and Sustainable Management of Coastal and Marine Protected Areas (CMPA) Project

[4] Conservation International.

Chapter 3

Methodology

3.1. Primary data collection

The primary data collection for this project included:

• Observational study: The research study began with observation of current practices and problems in the village. This component focussed on the following points:

– Identification of current practices of waste collection and disposal,

– Identification of informal dumping points,

– Topography of the village and its terrain,

– Local structures of hierarchy, caste-segregation, etc.

• Stakeholder survey: This survey was designed to generate data on current practices of consumption, storage, and disposal of waste. A total of 30 households, which is roughly 10% of the total household population in the village, participated in the survey.

• Semi-structured interviews: The interviews were conducted with key informants to identify social, political, and governance opportunities and challenges in implementing a new SWM system.

• Waste sampling and profile: This study covered more than 25 households and was carried out to estimate the quantity and quality of non-biodegradable waste being generated, and the cost and viability of a collection system.

• Focus group discussions: Three such discussions were organised with the Gram Panchayat, youth groups, and active members of the community to get feedback on the proposed system, and to identify key stakeholders who can play an active role in implementing the solution.

3.2. Secondary data and research work

The off-site research involved a review of SWM legislation and policy at the state and national level, and consultations with SWM experts and practitioners from different parts of the country.

The following legislations and policy documents were identified:

• Municipal Solid Waste (Management and Handling) Rules, 2000

• Plastics Waste (Management and Handling) Rules, 2011

• Maharashtra Non-Biodegradable Garbage (Control) Act, 2006
• Swachh Bharat Guidelines

The experts included:
• Ms. Almitra Patel, Member, Supreme Court Committee on Solid Waste Management
• Laxmi Narayan, SWaCH, Pune
• Ashabai Doke, Nirmal Sahyog, Aurangabad
• Mr. Ramdas Kokare, Ratnagiri
• Mr. Rasik Shah, Malegaon.

3.3. Limitations

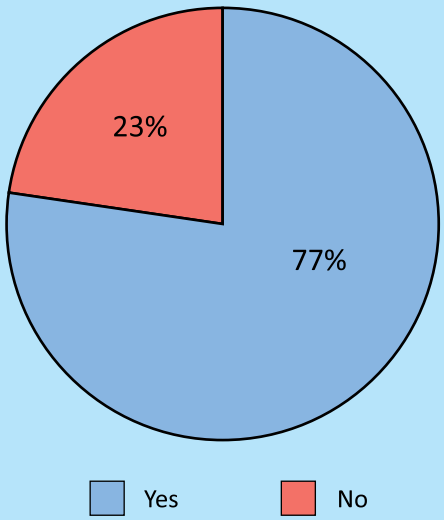
The fieldwork for this project was carried out during the Ganpati festival. Therefore, the quantity and quality of waste differed from other months, including the tourist season. While this is a limitation of the study, it highlights the importance of developing a flexible system that adjusts to seasonal cycles and fluctuations in population, especially the surge in the number of visitors in January-March and during major festivals.

Chapter 4

Data Analysis and Findings

4.1. Local perceptions towards

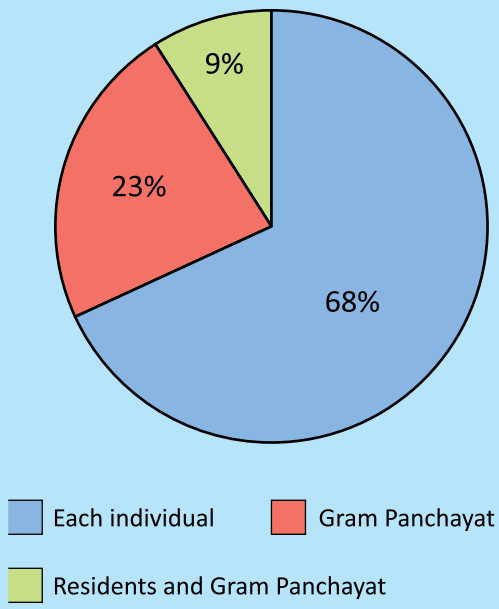
Do you think Velas has a waste problem?



The survey indicated that more than three-fourths of the residents in Velas believe that mismanagement of waste is a major problem.

The survey and interviews highlighted that residents in Velas prioritised issues such as bad infrastructure and lack of local job opportunities. SWM is thus competing with these issues for attention and resource allocation.

Who is responsible for managing your waste?



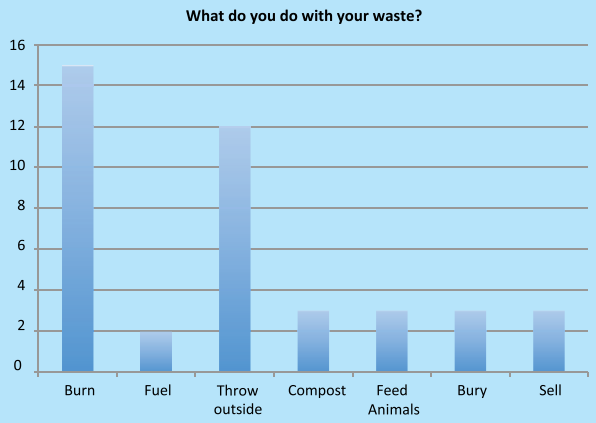
In most urban areas we have surveyed, SWM is regarded as the responsibility of urban local bodies. However, in Velas most respondents assert that SWM is the responsibility of each individual in the village. The lack of dependence on the Gram Panchayat may be an advantage in the implementation of a SWM system with households playing a major role.

In the course of the interviews, we realised that residents who stated that waste was 'not a problem' in Velas actually meant that villagers 'take care of their waste by burning and dumping it away from the village'. While this suggests that people are taking responsibility for their own waste, it also means that burning and dumping of waste are accepted as 'responsible waste management.' Also, the burning of waste away from inhabited areas suggests that people are aware of its negative impacts. This was confirmed through our interviews. Some residents in the village, including youth and elders, stated that burning waste harms human health and the environment.

The main challenge is to maintain the sense of responsibility amongst villagers, while changing their understanding of responsible practices by communicating the ill effects of burning waste and dumping it into the sea. The recommended system must be as convenient, if not more, than the present one.

4.2. Analysis of local behaviour towards waste disposal

Figure 2 Methods of waste disposal used by residents



Currently, the most common practices for SWM are burning and dumping of waste into the *parya* or *nala* (water drains) or a *khadan* (trench) near the sea. This correlates with our observation that most visible waste is in water drains. When it rains, this waste makes its way through the drain network till it reaches the sea.

Figure 3 Informal dumping sites in the backwaters (left) and in the village water drains (right).

Figure 4 Waste burnt at informal dumping sites (left) and waste collecting along shore bends (right)

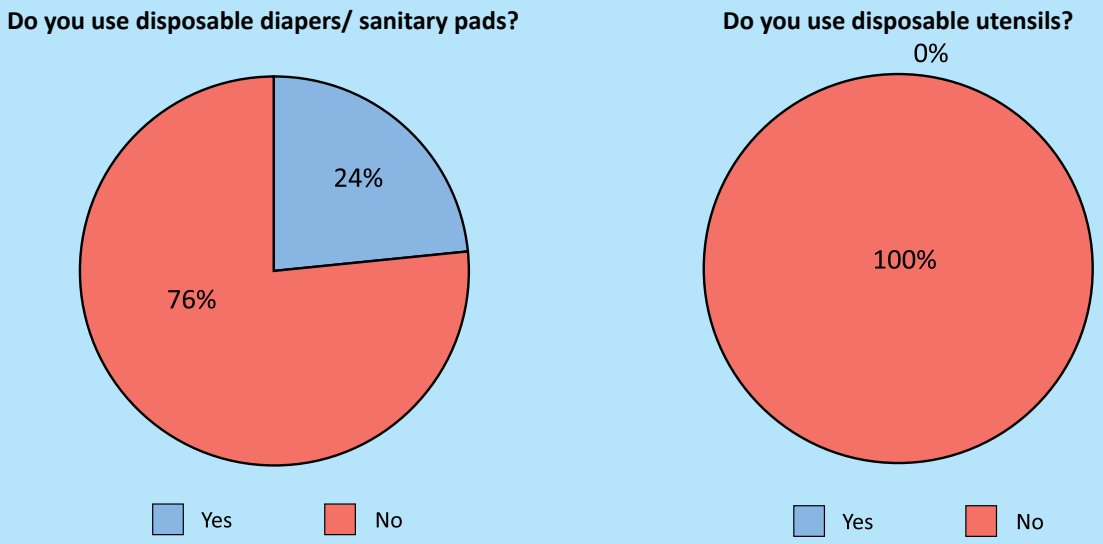
As documented in Figures 3 and 4, waste is commonly dumped in or along *nalas*. Water in the *nalas* is expected to carry the waste to the sea. The remains of burnt waste are often found outside homes, especially early in the morning.

The practice of segregating waste at source and storing it for collection are not common in Velas. Thirty households were surveyed and only one was aware of waste segregation at source. We found that only three respondents stored waste in bins for disposal. Most respondents said that they dumped waste in designated spots in their backyards as soon as it was generated.

In the context of disposable biomedical waste (non-compostable and non-recyclable) the use of sanitary pads and diapers is rising in the village. Around 24% respondents reported that they use sanitary care items either regularly or occasionally. This implies that a significant amount of biomedical waste is generated in Velas.

Figure 5 Awareness levels of residents in Velas

Figure 6 Responses from residents of Velas about the use of disposable items



When asked about disposable cutlery, all the respondents stated that they use reusable steel plates, spoons, and banana leaves. However, thermocol plates are the most common waste item observed in the village, especially during Ganpati festival.

The thermocol plates observed around the village was discussed during the interviews. The respondents highlighted a division between people who reside in Velas permanently and those who have migrated to other places (mainly Mumbai city) for work and return to Velas during festivals. They claimed that non-resident individuals bring disposable items to Velas during festivals. However, our survey revealed that three out of four shops in Velas stocked and sold disposable (including thermocol) plates and cups for local consumption. Thus, the new SWM system will also need to spread awareness amongst the floating population in the village, while also curbing the sale of non-recyclable disposable materials in the village.

Figure 7 improper disposal of sanitary waste (left) and disposable cutlery waste (right) in Velas

CRT^ organised a focus group discussion with Gram Panchayat members, a representative of GIZ, two representatives of SNM, and other interested locals. The issue of thermocol cutlery was discussed at length during this meeting. The local participants stated that it was the most common item found in the garbage generated from the village. The GIZ representative proposed that the Gram Panchayat consider banning the sale and use of such plates in the village. The Sarpanch and the other Panchayat members were very positive about this proposal. This indicates a willingness to make policy decisions for SWM systems in the village.

4.3. Analysing the scope to integrate local informal recycler(s)

The local scrap shops (*kabadiwala/bhangarwala*) are key stakeholders in the recommended system. These shops serve as a link between people who generate recyclable waste and recyclers/manufacturers. A semi-structured interview was conducted with the owner of the nearest scrap shop, Mr. Naimullah Khan whose shop is in Bankot village located 3 kms from Velas. There is great potential to integrate him into the Velas SWM system. He mentioned that two "*feriwalas*"—individuals who go from house-to-house to pick up high-value recyclable waste—bring recyclables from Velas to Bankot on a weekly basis in exchange for grocery items such as potatoes and onions. Mr. Khan said that the *feriwalas* visit Velas at least three times a week but residents in Velas said that they have not seen them in more than a month. There are similar differences in their versions of the items that the *feriwalas* accept. This indicates a lack of communication, coordination, and planning in the logistics of the current informal system of collecting recyclable waste.

The waste recycler collects metal, plastic (of three different grades), paper, glass, and cardboard at his rented shop in Bankot. This material is then sent to Mumbai or Chiplun for further processing. In addition to Velas and Bankot, other *feriwalas* also channel waste from Veshvi, Chipola, and Baghmandla through Mr Khan's shop.

Mr. Khan expressed interest in partnering with the Velas Gram Panchayat to implement a SWM system through which he would be able to access good quality, segregated recyclable waste. He also said that he would be willing to broaden the type of items he accepts based on the quantity and quality of waste being generated. For example, he currently does not collect milk packets as he does not get the required quantities. However, he is willing to

Figure 8 *Feriwalas* (left & right) sorting discarded plastic items at Mr. Khan's scrap shop

collect them in the future if residents provide him unsoiled packets.

Mr. Khan can become an integral part of the SWM solution in Velas. The possibility of strengthening his storage, transportation, and processing capacities may need to be considered as part of the new system.

CRT^ also interviewed the owners of three other informal scrap shop in villages near Velas. They can serve as a backup option to Mr Khan's facility. These recyclers can help extend management systems for recyclable waste to other villages in the vicinity, especially Kelshi and Anjarle. This will maximise the impact of this intervention and reduce the detrimental impact of waste on human health and the environment in this section of the Konkan coast.

4.4. Waste sampling:

Twenty households agreed to store their dry waste for three days. Of these 16 complied effortlessly to the instructions, while the remaining four were not able to follow the instructions properly. Two households stored mixed waste and were not clear on the difference between wet and dry waste. The other two households misunderstood the objective of the exercise and went out to collect plastic from the street.

Figure 9 Profile of waste collected from 16 households

Material	Quantity (kg)	Rate (Rs.)	Value (Rs.)
Plastic I	0.75	16	12
Paper	2	2	4
Plastic II	0.7	2	1.4
Cardboard	0.9	7	6.3
Total	4.35		23.7

In total, we collected 5.95 kgs of dry waste after two days from 16 households in the village.

From this sample, multi-layered packaging material accounted for 1.6 kgs. Such materials are difficult to store and transport for recycling as they are light-weight and in large quantities. Thermocol presents a similar challenge. There is a need to regulate the generation of such waste, while also using improved collection and storage methods, possibly by using bailing machines.

Based on this data, Velas generates an estimated 1.7 tonnes of dry, non-biodegradable waste each month. The volume of this waste makes the

possibility it economically viable to collect such waste once a month. The income generated from recycling this waste may pay for the labour required for a monthly door-to-door collection system and subsequent transportation to the recycler in Bankot.

This exercise also confirmed that segregation can be explained and implemented relatively easily in Velas as most households were able to segregate waste after a three-minute briefing.

4.5. Opportunities and challenges

Opportunities:

- A sense of pride amongst the residents of Velas.
- Recognition that waste management is the responsibility of every individual.
- The use of banana leaves and steel plates in most households.
- Predominant use of cloth diapers and sanitary pads.
- Groundwork for participatory solutions done by SNM (active mitra mandals and bachat gats are already in place).
- Tourism linked to celebrating turtle festivals has generated increased interest in environmental conservation.
- Enterprising scrap-dealer located in Bankot village.

Challenges:

- The perception that burning and dumping waste into the sea are acceptable ways to dispose waste.
- Households currently do not store waste.
- The absence of dealers for household e-waste, hazardous waste and biomedical waste.
- Disposable sanitary pads and diapers are gaining popularity in the village and SWM systems are ill-equipped to handle it.
- The widespread use of thermocol plates and glasses during festivals and weddings.
- The sea deposits waste matter on the beach on a daily basis.

Chapter 5

Recommended Interventions

5.1. System interventions

Figure 10 outlines the recommended system for SWM in Velas in terms of the flow of materials. It also indicates the responsibilities of individual stakeholders.

Figure 10: Flowchart for transfer of materials in the proposed SWM system in Velas

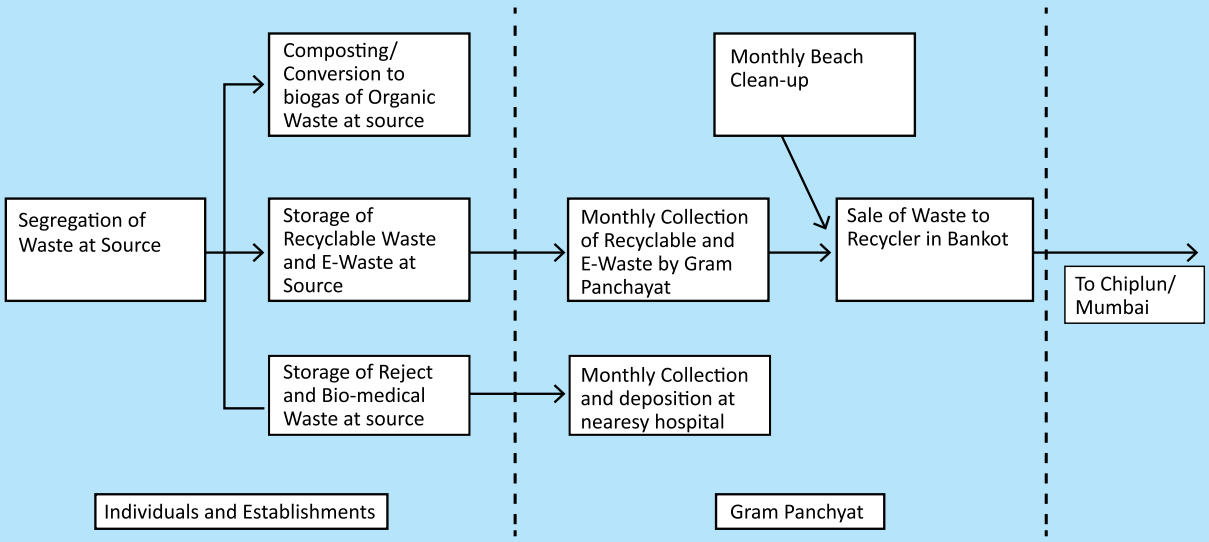


Figure 11: Recommended stages in the proposed Velas SWM system

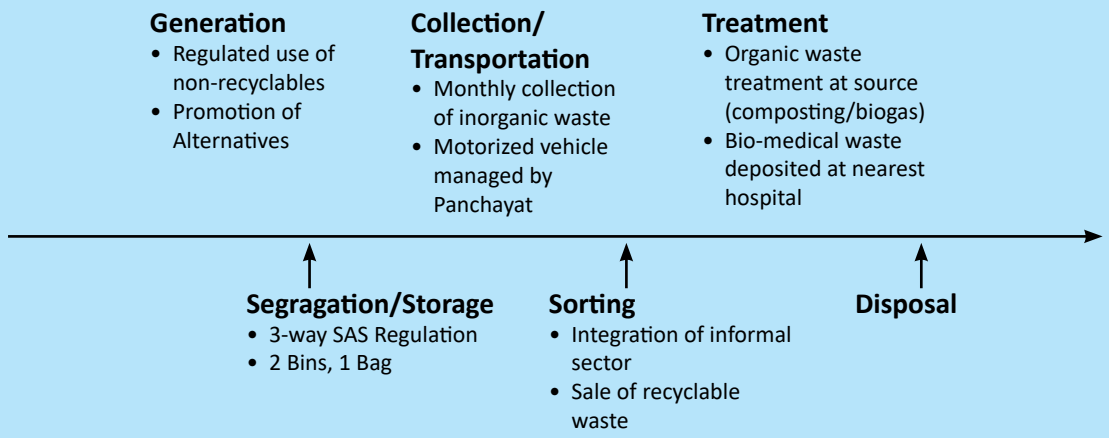


Figure 11 depicts the recommended system for private households and establishments in terms of action points at each stage of the process.

The action points are elaborated below:

Generation:
Reduction of waste is the most effective method of waste management and is only possible at the stage of generation through various interventions. These include:

1. Awareness programmes on the impact of certain materials on human and environmental health.

2. Policy to ban the use and sale of non-recyclable items such as thermocol and simultaneously promote alternatives such as biodegradable plates and cups, which serves as an opportunity for an entrepreneurial venture in the village.

3. Schemes to promote cloth diapers and sanitary pads along with awareness about the detrimental effect that disposables have on the environment. The need to stitch eco-friendly sanitary pads and diapers is another opportunity for an entrepreneurial venture in the village.
4. Promotion of local chips and biscuits as a viable alternative to multi-layered packaged consumer products.

Segregation/storage:
Source segregation is the foundation of any effective SWM system irrespective of treatment technology. It allows optimal use of waste material. It can be implemented through the following measures:
1. Organise a week-long mass awareness drive, including presentations at village meetings, street-corner meetings, door-to-door campaigns, development of visual communication materials etc.

2. After the awareness drive, the Gram Panchayat should enforce source segregation through incentives and penalties.

3. Provide an SWM Kit consisting of two bins for organic and biomedical/reject waste, and a bag for recyclable waste.

Collection/transportation:
The recognition that SWM is the responsibility of each individual is an excellent opportunity to establish systems that decentralise management and reduce the burden on Gram Panchayat:

1. A monthly collection of recyclable and biomedical/reject waste can be done by the Gram Panchayat through a designated auto-rickshaw. Collection can be more frequent if a higher volume of recyclable waste is being generated

2. Organic materials will not be collected and households will be encouraged to compost it.

3. The rickshaw driver(s) can be trained to compost organic waste to generate biogas. The driver(s) can then provide assistance to residents when while collecting waste.

Sorting:
The informal sector (comprising of feriwalas and kabadiwala in Bankot) must be integrated into the system to ensure cost-effective sorting and recycling. Currently, they collect recyclable waste from Velas in an unorganised manner. Through the new SWM system, they can systematically collect clean and dry recyclable waste:

1. The collected recyclable waste will be sold to the scrap shop in Bankot each month.

2. Since the shop is an integral part of the system, we recommend that Mangrove Cell invest in increasing its capacity by providing assistance to purchase basic equipment such as a baling crate/ weighing scale and reinforcing the physical structure of the shop.

3. After being sorted at the shop, the waste will be sold for recycling in Mumbai/Chiplun.

Treatment:
The scrap shop will ensure optimal use of recyclable waste. We propose that organic waste be treated at source by individual households and establishments, while biomedical waste can be sent to the nearest hospital for treatment with their biomedical waste. This will require:
1. Composting workshops in every neighbourhood. We recommend composting for households with fields/gardens and pot-based composting for households without fields/gardens.

2. Ensure availability of composting cultures. Based on our experience, we recommend the use of BioWizard, which has been developed by Zenith Chemicals and is useful for odour-control and as a compost catalyst.

3. Development of a local composting expert. This should ideally be the auto-rickshaw driver who will collect waste from each home and is more accessible.

4. Some residents already have biogas plants to treat their organic waste. Their feedback has been very positive and these plants need to be promoted in the village.

5. Biomedical waste will need to be collected and transported to the nearest hospital. Hospitals are required to have their own treatment plants or hire the services of a professional biomedical waste management agency. Velas can direct its biomedical waste to the appropriate handler through the nearest hospital. The Gram Panchayat may have to pay the hospital for this service.

Disposal:
In our experience, there will be very little residual waste at the end of this process. However, we will observe the process for three months and ensure that residual waste is processed efficiently.

5.2. Qualitative recommendations

Velas requires the following GOI-GIZ-CMPA-driven interventions:

Local ownership of SWM solution:
CRT^ always focuses on developing solutions with local stakeholders rather than impose a system on them. For example, CRT^ documented feedback and suggestions from government authorities, village elders, youth groups, shop owners, home-stay owners, etc through field-visits, stakeholder meetings and focus group discussions. Then, CRT^ asked the Gram Panchayat to submit a letter requesting support from CRT^, GIZ and the Mangrove Cell to implement the SWM system based on this fieldwork. The Gram Panchayat discussed this matter during their Gram Sabha on 8th October, 2015 and subsequently sent a formal request letter. This will now ensure that ownership of the solution will remain with the Gram Panchayat.

Behavioural change amongst residents and visitors

The outcome of the SWM plan in Velas village is contingent on the successful implementation of MSW Rules, 2000. For this, CRT^ proposes that the GOI-GIZ-CMPA project focus on the following interventions:

a. Integrated design campaign: Three-way source segregation of waste into organic, inorganic, and household biomedical waste. This has to be done through a concerted and integrated design campaign through posters and stickers, boards in relevant locations, workshops in schools, door-to-door campaigns, and neighbourhood meetings.

b. Appropriate equipment design: Provide and promote appropriate storage of waste at source: Encourage the use of a dustbin with a lid for organic waste, a large appropriately designed bag for recyclable/inorganic waste, and another bin for biomedical waste and sharps. The collection rickshaw must be equipped with appropriate bags to ensure that the segregated waste does not get mixed.

c. Scientific composting of organic waste: Villagers must be trained on methods of composting. This includes things like layering of waste, use of cow-dung or other bio-cultures, maintaining distance from water-bodies, etc. Workshops and training programmes for home-stay owners, residents, and youth groups will help them understand the process of composting waste. Villagers must also be encouraged to pursue locally available schemes to install biogas plants.

d. Disinfection of biomedical waste and sharps: Villagers and clinics must have access to information and training on appropriate methods to treat biomedical waste. Residents must be introduced to alternate forms of diapers and sanitary pads that are either compostable or reusable.

Governance and regulations

The Gram Panchayat and the Forest Department will be the main agencies to manage the SWM solution in Velas. Their roles will include:

a. Regulation: Adopting policies and regulate processes related to the SWM solution. For example, regulation of disposable materials such as thermocol plates and cups, segregation of waste, allocating responsibilities for beach cleaning, etc.

b. Incentive for proactive residents: The Gram Panchayat, with support from the Forest Department and CRT^, must also include local media to promote sound waste management practices, discourage waste burning and dumping, and reward active residents and authorities with appropriate news coverage.

Integration of informal sector

Thankfully, Velas is located close to two enterprising informal waste recyclers. During the implementation phase of this project, CRT^ will work with either or both of these individuals to ensure maximum uptake of recyclable materials at regular intervals. Mangrove Cell will need to support these individuals by subsidising bailing crates, shredders (if required), increasing storage capacities, improving service provision, appropriate branding, and outreach for capacity building. The integration of informal waste recyclers is needed to make the SWM system sustainable and equitable.

Capacity-building of youth and youth groups

Through our research, we became aware that the youth of Velas are looking for alternate livelihoods. One youth expressed an interest in venturing into the field of solid waste management service provision, while another expressed interest in starting an enterprise to manufacture disposable containers (plates and cups) made from biodegradable materials such as areca leaves. The SWM solution can be driven by the youth, which will empower them to adopt other development-based activities, generate livelihoods, and instil confidence through capacity-building. Various livelihood generating activities can be introduced in this regard:

a. Eco-friendly disposable cutlery manufacturing units

b. Homemade cloth sanitary pads and diapers

c. Home-made cloth and paper bags for sale at shops and other vendors.

d. Training to provide visitors with an SWM orientation and a tour of the village.

5.3. SWM system for public spaces:

Beach Litter Management

- Installation of fixed bins for waste
- Monthly Beach Clean-up (once a week during tourist season)
- Signage along the route to the beach and on the beach, wherever permissible, and of specific design

Street Litter Management

- Mera Aangan Saaf resolution
- Placement of street bins by home stay owners during tourist season

While there is a seasonal inflow of tourists, waste from other villages regularly washes up on Velas beach. In this regard, we recommend the system outlined above for SWM in public spaces.
It is also essential to encourage other coastal towns and villages to adopt SWM systems to prevent their waste from entering and polluting the sea.

We also recommend that public bins be placed on streets during the tourist season. They should be removed in the non-tourist season to ensure that they do not become a dumping site.

5.4. Velas village SWM campaign branding

Awareness programmes will play an important role in implementing an effective SWM system in Velas. In order to maintain continuity and repeat the messages, a concerted awareness campaign will need to be designed and executed. This campaign must have its own brand language that is specific to Velas, or one that is general enough to be extended to the villages covered by the CMPA project and beyond. This campaign identity should extend to all the collaterals developed for the SWM solution, such as stickers to illustrate waste segregation, posters to inform visitors about non-littering and fines, etc. Such a brand identity can extend to the menu and tariff-cards at home-stays to ensure that the message is communicate through all relevant channels in the village. Please see annexure for an example of branding for the Daulatabad Fort's SWM campaign conducted by CRT^ for Archaeological Survey of India, Confederation of Indian Industry and Endress + Hauser.

Chapter 6

Conclusion

Velas, like other villages along the Konkan coast (and indeed all villages across India), is in urgent need of a sound SWM plan and sustained execution. There is a need for concerted research and data collection along with on-field implementation, handholding and capacity-building to enable Gram Panchayats and residents adopt healthy and safe SWM practices.

Velas is a small and remote village, which is located on the periphery of globalisation and consumerism. The youth are seeking alternative means of livelihood and tourism promises to provide new career opportunities. Yet, the upsurge of a floating population, push-marketing campaigns for disposable and packaged consumer products along with an unprepared governing authority will have a detrimental impact on the health of the villages and the biodiversity of the region. In the long term, this will have a negative impact on tourism.

While sea turtles nesting sites on the beach has made Velas a popular tourist destination, it also receives garbage that is dumped in the sea by other villages and towns. Thus, Velas beach will require regular cleanup drives till all villages along the coast develop a effective SWM system that prevents their waste from entering the sea. This was seen on the day following Ganpati Visarjan. Mohan and his team of volunteers operated an efficient *nirmalya* collection system that ensured that no flowers (real or plastic) or decorative items were dumped into the sea in Velas. However, the beach was still littered with these items the next day as other places along the coast had dumped them in the sea. We therefore recommend that SWM in Velas be taken up on a war-footing and then be used as a model for other villages.

Lastly, we would like to thank all the stakeholders, and especially the Mangrove Cell, for making it possible for us to experience the unique village of Velas. We are humbled by its beauty, inspiration, and energy.

Annexure: Samples of Design Elements: Daulatabad Fort SWM, Aurangabad

Developing a brand identity, colour palette, and font

Developing identity--based collaterals/merchandise

Badges

Signage

Bin wraps


BIN PRINT
SPECIFICATIONS:
Screen Printed directly on Bin.
Colour values to be matched
सूखा कचरा
RECYCLABLE WASTE
BIN WRAP
ARTWORK WILL BE DONE IN FOLLOWING SIZES:
190 DIA CIRCLES PRINTED FRONT BACK
SPECIFICATIONS:
Printed front-back on opaque vinyl with UV Coating/Lamination
सूखा कचरा
RECYCLABLE WASTE

The CMPA Project has been commissioned by the German Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety (BMUB), with funds provided under the International Climate Initiative (IKI). The Ministry of Environment, Forest and Climate Change, Government of India (MoEF&CC) has entered into a technical cooperation agreement with BMUB for implementing the CMPA project. BMUB has commissioned GIZ to implement the project jointly with MoEF&CC and state forest departments in selected states of India.

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