

Integrated Solid Waste Management Plan
for
City of Matale, Sri Lanka

Prepared by

National Cleaner Production Centre

in association with

Matale Municipal Council

and

United Nations Environment Program



Executive Summary

City of Matale a small city in the Central province boasts a history dating back to over two millennia but today developing into a commercial and residential suburban city. The Municipal Council of Matale has faced similar problems like all other local government authorities in carrying out effective solid waste management to the satisfaction of the community. The Mayor of Matale and his elected representatives as well as the key Government officials are committed to make the city of Matale Clean & Green.

Recognizing the commitment and the request for assistance by Matale Municipal Council (MMC), International Environmental Technology Centre(IETC) of United nations Environmental Program (UNEP) in Japan decided to provide technical and financial assistance to develop a ISWM action plan for Matale. National Cleaner Production Centre, Sri Lanka an institute under UNIDO was identified as the local partner to provide technical assistance and serve as the local counter part. The three partners enter into formal agreements and the project was launched in November with a awareness seminar and a training workshop conducted by Mr Surya Chandak, Deputy Director and Mr Mustaq Memon, Program officer of UNEP-IETC.

The scope of the ISWM included compiling a waste inventory of Matale with quantities and characterization of all the wastes. The summary waste generation and its fate is shown in **Figure 1**. This was followed by a assessment of the existing solid waste management practices, including policies and regulatory framework, institutions, technology, finances. These studies led to development of a Vision, Mission, Goals and Objectives based on the short term and long term targets of the MMC (**Figure2**)

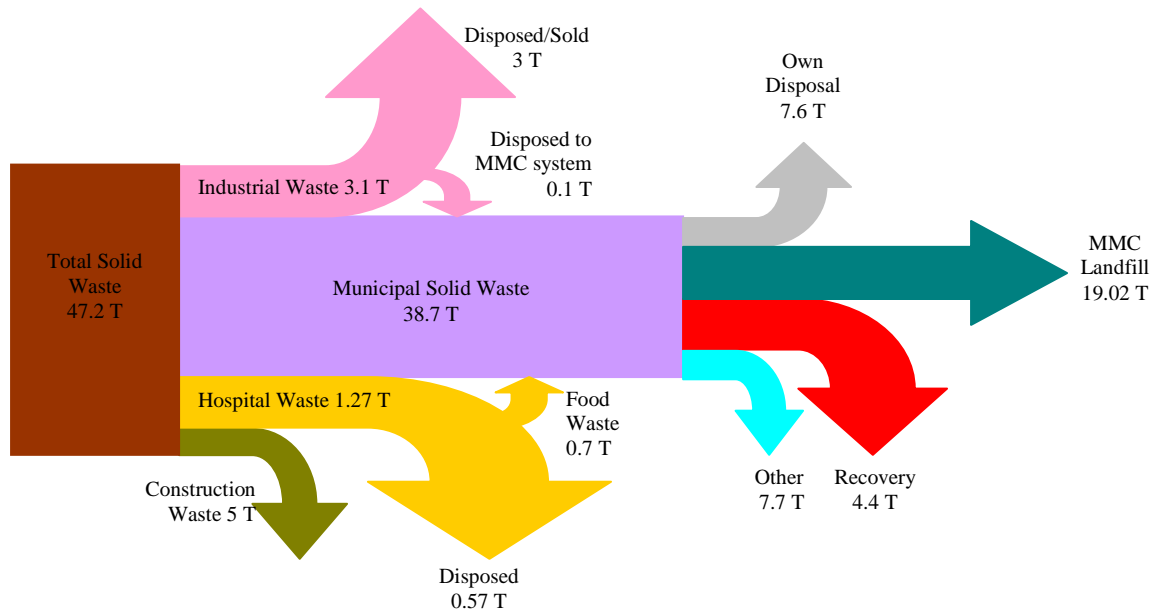


Figure 1: Total Waste Flow Within MMC

The ISWM plan was developed to meet the above expectations and stakeholder concerns. The plan has three basic elements. They are pilot projects, schemes and sub projects. These schemes which are based on five main themes are shown in the **figure 3**.

The key achievements expected from the plan are resource efficiency, recovery of resources and value addition, community participation through empowerment and a Clean & Green Matale city. The results of these pilot projects, schemes and sub projects will be evaluated using the KPI developed as shown in chapter 9.

The successes achieved in developing the ISWM plan will be disseminated to other local government authorities for replication through awareness workshops. The effectiveness of the plan and its implementation will be evaluate through stakeholder consultations.

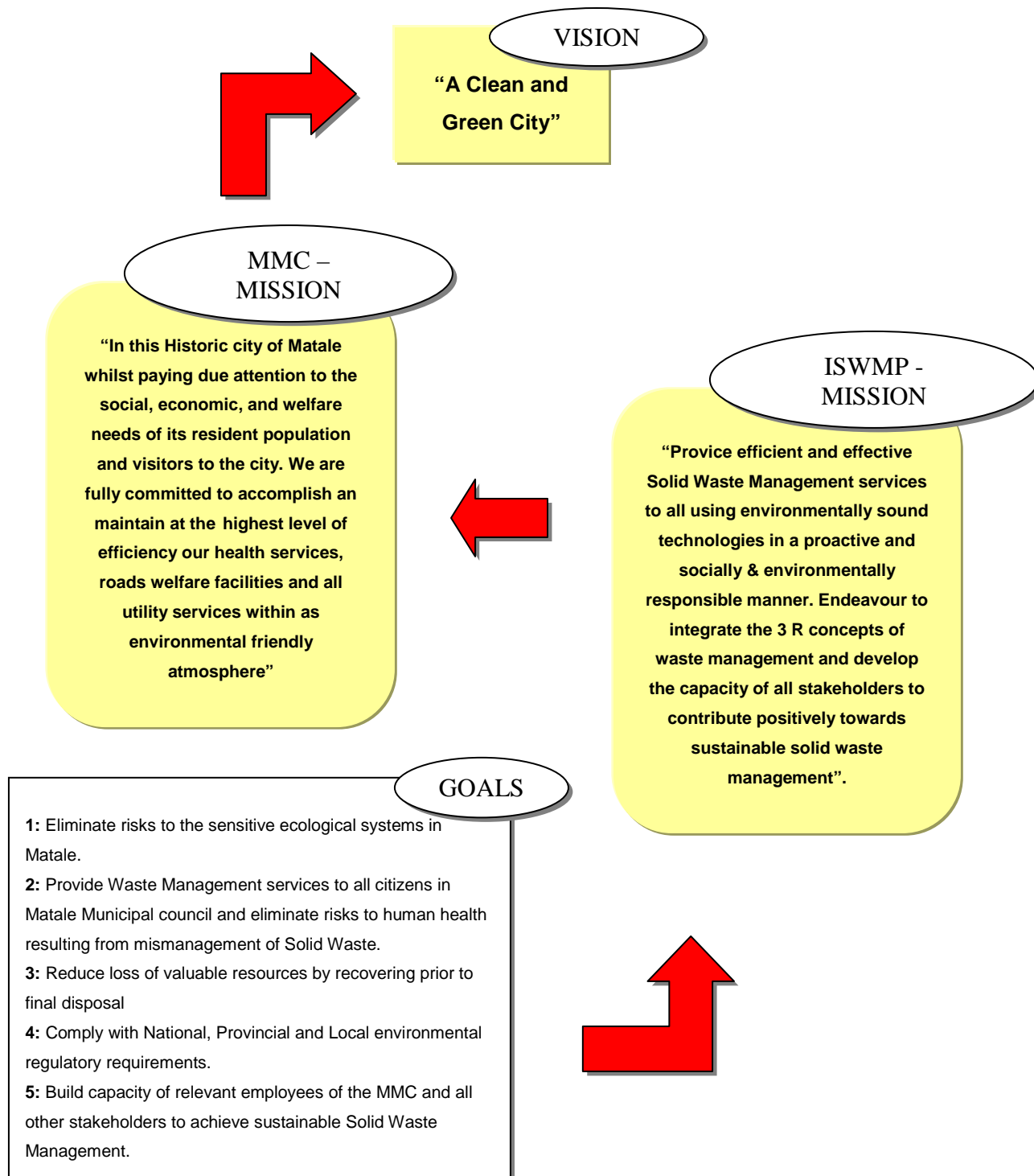


Figure 2: Vision, Mission and Goals of ISWM Plan

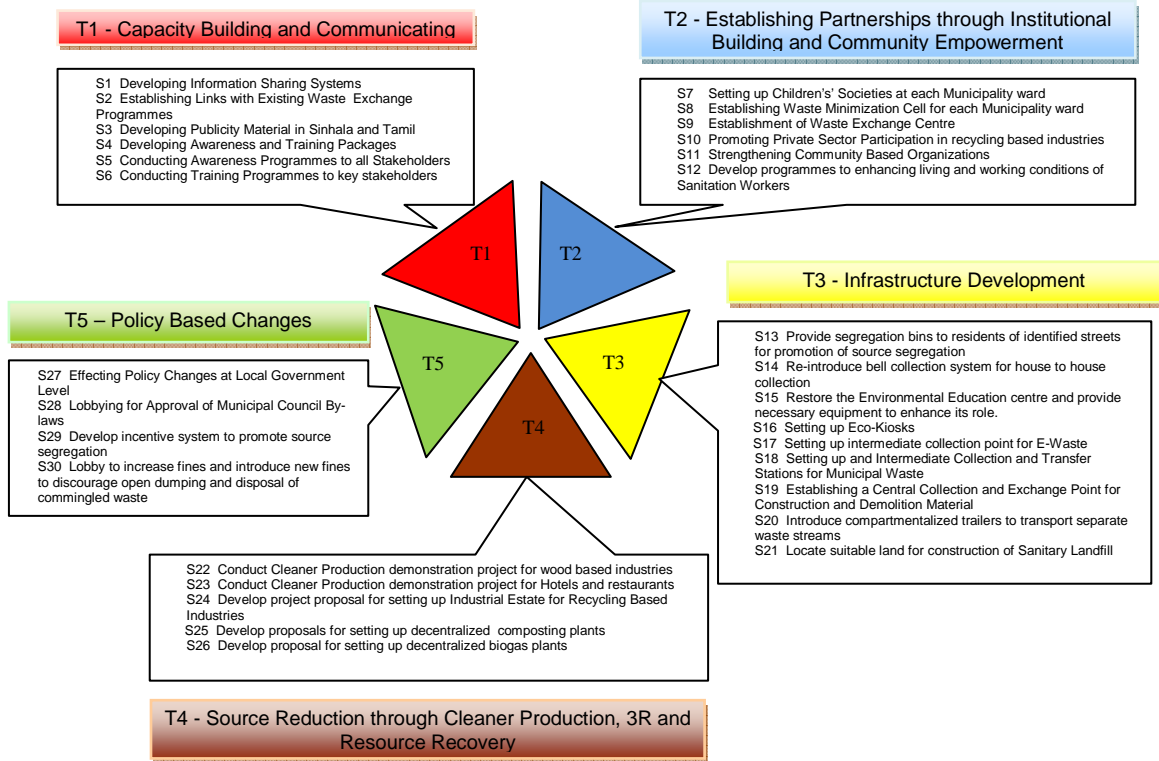


Figure 3: Themes & Schemes

Table of Contents

Executive Summary

List of Tables

List of Figures and Graphs

Acronyms

Preface

Chapter 1: Integrated Solid Waste Management and its Relevance to Matale

- 1.1 Background to the Project
- 1.2 Project Scope
- 1.3 Integrated Solid Waste Management
- 1.4 ISWM Plan for Matale
- 1.5 Organization of the Report

Chapter 2: Base Line Information

- 2.1 Waste Inventory
 - 2.1.1 Solid Waste Disposed within the Matale Municipality
 - 2.1.1.1 Residential Waste
 - 2.1.1.2 Commercial and Institutional Waste
 - 2.1.1.3 Industrial Waste
 - 2.1.1.4 Healthcare Waste
 - 2.1.1.5 Construction and Demolition Waste
 - 2.1.2 Material Recovered Prior to Disposal
 - 2.1.3 Solid Waste Disposed Through Other Mechanisms
 - 2.1.4 Waste Disposed off at MMC Landfill
 - 2.1.5 Total Waste Generation
- 2.2 Characteristics of Waste
 - 2.2.1 Moisture Content, Ash Content and Calorific Values of MSW
- 2.3 Projection of Solid Waste Generation from 2007 - 2025
 - 2.3.1 Municipal Waste
 - 2.3.1.1 Projection Based on Population and GDP growth
 - 2.3.1.2 Effect of Proposed Expansion of the Boundaries of MMC
 - 2.3.2 Industrial Waste
 - 2.3.3 Healthcare Waste

Chapter 3: Analysis of Existing Solid Waste Management System

- 3.1 Legal Framework
 - 3.1.1 Policies at National Level
 - 3.1.2 Laws and Act at National Level
 - 3.1.2.1 National Environmental Act
 - 3.1.2.2 Other Laws and Acts
 - 3.1.3 Provincial and Local Levels
 - 3.1.4 Technical Guidelines
- 3.2 Institutional Framework

- 3.2.1 Roles and Responsibilities of Relevant Authorities, Institutions and Organizations
 - 3.2.1.1 National Level
 - 3.2.1.2 Provincial Level
 - 3.2.1.3 Local Level
- 3.3 Financial Mechanism
 - 3.3.1 Total Income Generation for the Matale Municipal Council
 - 3.3.2 Income Generation through Environmental Services Offered
 - 3.3.3 Total Expenditure for Solid Waste Management by the Matale Municipal Council
 - 3.3.4 Summary of Financial Situation of Solid Waste Management at MMC
- 3.4 Technology Used
 - 3.4.1 Primary Collection and Transport
 - 3.4.1.1 MC Assisted Collection of Municipal Solid Waste
 - 3.4.2 Treatment
 - 3.4.2.1 Sorting Centres
 - 3.4.2.2 Scavenging
 - 3.4.3 Final Disposal
 - 3.4.3.1 Municipal Land Fill
 - 3.4.3.2 Open Burning
 - 3.4.4 Recycling and Resource Recovery
 - 3.4.4.1 Central Composting Plant Operated by NGO “Sevenatha”
 - 3.4.4.2 Home Composting
 - 3.4.4.3 Recycling
- 3.5 Gaps, Barriers and Constraints
 - 3.5.1 Regulatory Frame Work
 - 3.5.2 Institutional Framework
 - 3.5.3 Financial Mechanism
 - 3.5.4 Technology
 - 3.5.4.1 Collection
 - 3.5.4.2 Treatment
 - 3.5.4.3 Final Disposal
 - 3.5.4.4 Recycling and Resource Recovery

Chapter 4: Targets and Goals Set for Matale MC

- 4.1 Vision| for Matale Municipal Council
- 4.2. Mission of Matale Municipal Council
- 4.3 Target Setting for Matale MMC
 - 4.3.1 Qualitative Targets
 - 4.3.2 Quantitative Targets

Chapter 5: Stakeholder Concerns

- 5.1 Framework Developed for Waste Management Actions
- 5.2 High Priority Issues
 - 5.2.1 Segregation at Source
 - 5.2.2 Collection

- 5.2.3 Transportation
- 5.2.4 Treatment
- 5.2.5 Final Disposal
- 5.2.6 Recycling and Resource Recovery
- 5.3 Medium Priority Issues
 - 5.3.1 Source Segregation
 - 5.3.2 Collection
 - 5.3.3 Transportation
 - 5.3.4 Final Disposal

Chapter 6: Framework for Waste Management Action Plan

- 6.1 Overall Approach
- 6.2 Vision
- 6.3 Mission
- 6.4 Goals of the ISWM Plan
 - 6.4.1 Relationship between Goals and Targets of ISWM Plan
- 6.5 Strategic Action plan (Policy, Voluntary and Technological Measures)
 - 6.5.1 Strategies for Waste Reduction
 - 6.5.1.1 Policy Changes and Economic Tools
 - 6.5.1.2 Voluntary Actions
 - 6.5.1.3 Technological Options
 - 6.5.2 Strategies for Source Separation
 - 6.5.2.1 Policy Changes and Economic Tools
 - 6.5.2.2 Voluntary Actions
 - 6.5.2.3 Technological Options
 - 6.5.3 Strategies for Collection & Transport
 - 6.5.3.1 Policy Changes and Economic Tools
 - 6.5.3.2 Voluntary Actions
 - 6.5.3.3 Technological Options
 - 6.5.4 Strategies for Transfer Stations /Sorting Centres
 - 6.5.4.1 Policy Changes and Economic Tools
 - 6.5.4.2 Voluntary Actions
 - 6.5.4.3 Policy Changes and Economic Tools
 - 6.5.5 Strategies for Biological & Thermal Treatment
 - 6.5.5.1 Policy Changes and Economic Tools
 - 6.5.5.2 Voluntary Actions
 - 6.5.5.3 Policy Changes and Economic Tools
 - 6.5.6 Strategies for Reuse, Recycling and Resource Recovery
 - 6.5.6.1 Policy Changes and Economic Tools
 - 6.5.6.2 Voluntary Actions
 - 6.5.6.3 Technological Options
 - 6.5.7 Strategies for Final Disposal
 - 6.5.7.1 Policy Changes and Economic Tools
 - 6.5.7.2 Voluntary Actions
 - 6.5.7.3 Technological Options

Chapter 7: Schemes Developed for the ISWMP

7.1 Introduction

7.2 Description of Schemes under ISWM Plan

Chapter 8: Assessment of Technologies for Implementation of ISWM Plan

8.1 Introduction

8.2 Segregation and Sorting Technologies

8.2.1 Source Segregation

8.2.2 Waste Picking/Scavenging

8.2.3 De-centralized Sorting Centres

8.3 Waste Collection and Transportation Technologies

8.3.1 Waste Collection Hand Tools

8.3.2 Roadside Waste Collection Bins

8.3.3 Waste Collection and Transportation Vehicles

8.3.3.1 Small Scale Collection Vehicles / Muscle Powered Vehicles

8.3.3.2 Non-compaction Trucks

8.3.3.3 Compactor Trucks

8.3.4 Waste Collection Route Design and Operation

8.3.5 Intermediate Transfer/Collection Points

8.4 Waste Recovery and Reuse Technologies

8.4.1 Intermediate Processing Technologies

8.4.1.1 Collection

8.4.1.2 Separation

8.4.1.3 Size Reduction

8.4.1.4 Screening

8.4.1.5 Compaction

8.4.1.6 Transporting/Handling of Waste

8.4.2 Recycling Technologies

8.4.2.1 Recycling of Plastic Waste

8.4.2.2 Recycling of Paper and Cardboard Waste

8.4.2.3 Recycling of Construction and Demolition Waste

8.5 Waste Treatment Technologies

8.5.1 Thermal Conversion Technologies

8.5.1.1 Combustion

8.5.1.2 Gasification

8.5.1.3 Pyrolysis

8.5.1.4 Drawbacks of Incineration Technologies

8.5.2 Biological and Chemical Conversion Technologies

8.5.2.1 Aerobic Conversion

8.5.2.2 Anaerobic Conversion

8.5.3 Physical Technologies

8.6 Disposal Technologies

8.6.1 Open Dumps

8.6.2 Controlled Dumps

8.6.3 Sanitary Landfills

8.6.4 Drawbacks of Sanitary Landfills

- 8.7 Comparison of Centralized Vs. Decentralized Technology Options
- 8.8 Recommendations
 - 8.8.1 Waste Segregation

Chapter 9: Special Projects Identified under ISWM Plan

9.1 Pilot Projects

9.1.1 Source Segregation at Household Level

- 9.1.1.1 Description of Project
- 9.1.1.2 Resources Required
- 9.1.1.3 Budget
- 9.1.1.4 Time Frame

9.1.2 Waste Minimization at Schools

- 9.1.2.1 Description of Project
- 9.1.2.2 Resources Required
- 9.1.2.3 Budget
- 9.1.2.4 Time Frame

9.2 Sub Projects

- 9.2.1 Decentralized Biogas Plant for Market Waste
- 9.2.2 Biogas Plant for Hospital Waste
- 9.2.3 Decentralized Biogas Plants for Other Municipal Waste
- 9.2.4 Decentralised Composting Plant
- 9.2.5 Establishment of Waste Exchange Platform
- 9.2.6 Community Based Projects to Strengthen MMC relationship with Community
- 9.2.7 Preparation of Proposal for Setting up Waste Recycling Park (Eco-park)
- 9.2.8 Preparation of Awareness Raising Material on Hazardous Waste Management

Chapter 10: Information and Communication Systems

- 10.1 Introduction to Communication
- 10.2 Stakeholder Groups Identified for Communication of Plan
- 10.3 Activities Identified for Information Dissemination

Chapter 11: Resource & Institutional Considerations of Implementing ISWM Plan

11.1 Introduction

11.2 Resource Considerations

11.2.1 Financial Considerations

- 11.2.1.1 Financial Expenditure for the Existing Solid Waste Management Program
- 11.2.1.2 Financial Resource Requirement for Implementing ISWM Plan
- 11.2.1.3 Changes in the Financial Requirements for Solid Waste Management

11.2.2 Human Resource Requirements for ISWM Plan Implementation

11.2.3 Transport Equipment Requirement for ISWM Plan Implementation

11.3 Institutional Mechanism Required

- 11.3.1 Proposed Actions to Strengthen Institutional Mechanism
 - 11.3.1.1 Institutional Capacity Building
 - 11.3.1.2 Restore the Environmental Education Centre (EEC) and provide necessary equipment to enhance its role
 - 11.3.1.3 Strengthening Roles of Community Based Organizations
 - 11.3.1.4 Setting up of Waste Minimization Cells
 - 11.3.1.5 Develop Community Based Projects to Strengthen MMC relationship with Community
 - 11.3.1.6 Promoting Private Sector and Local Chamber Participation in recycling based industries
 - 11.3.1.7 Policy Based Changes

Chapter 12: Monitoring of Progress of ISWM Plan

- 12.1 Introduction to Key performance Indicators
- 12.2 Selection of Indicators
 - 12.2.1 The use of KPIs by different Stakeholders
- 12.3 Selection of Indicators
- 12.4 Summary of Selected Indicators

List of Tables

| |
|---|
| Table 2.1: Characteristics of Waste Disposed by Households |
| Table 2.2: Per Capita Residential Waste Disposal |
| Table 2.3: Summary of Commercial Waste Disposal |
| Table 2.4: Average Daily Waste Disposal by Major Waste Generators |
| Table 2.5: Composition of Commercial Waste |
| Table 2.6: Per Capita Waste Disposal for Selected Commercial Establishments |
| Table 2.7: Average Daily Disposal of Institutional Waste per Unit |
| Table 2.8: Per Capita Waste Disposal by Institutions/Organizations |
| Table 2.9: Estimated Waste Generation from Other Sources (Not Included in the Study) |
| Table 2.10: Estimated Total MSW Disposal from Major Sources |
| Table 2.11: Daily Industrial Waste Disposal |
| Table 2.12 a: Hazardous Waste Generation and Disposal at Government Hospital |
| Table 2.12 b: Waste Generation and Disposal at Government Hospital |
| Table 2.13: Estimated Recycling of Waste |
| Table 2.14: Composting of Organic Waste |
| Table 2.15: Other Solid Waste Disposal Mechanisms |
| Table 2.16: Estimated and observed daily waste disposal at the dumping site |
| Table 2.17: Total Solid Waste Generated in the MMC Area |
| Table 2.18: Total Municipal Solid Waste Generated in the MMC Area |
| Table 2.19: Estimated total daily MSW generation |
| Table 2.20: Average Moisture Content and Calorific Values of Waste at Landfill |
| Table 2.21: Net Calorific Values of Waste Components on “as received” Basis |
| Table 2.22: Average Dry Weight of Material Disposed at the Landfill |
| Table 2.23: Municipal Solid Waste Generation Pattern from 2002 – 2007 |
| Table 2.24: Projection of Municipal Solid Waste Generation (2007 – 2025) |
| Table 2.25: Projected Municipal Solid Waste Generation Following Expansion |
| Table 3.1: Total income for Matale Municipal Council (2005 – 2007) |
| Table 3.2: Income from the Environmental Services offered |
| Table 3.3: Breakdown of Expenditure for Solid Waste Management |
| Table 3.4: Summary of Expenditure for Solid Waste Management |
| Table 3.5: Expenditure for Solid Waste Management based on Stages |
| Table 3.6: Summary of Income and Expenditure for 2005, 2006, 2007 |
| Table 3.7: Expenditure on Solid Waste Management per Capita and per Ton |
| Table 3.8: Collection Routes and Frequency |
| Table 3.9: Vehicle and Other Equipment Used for Waste Collection, Transportation and Handling |
| Table 6.1: Relationship between Goals and Targets of ISWM Plan |
| Table 7.1: Links between Themes, Schemes, Goals and Objectives of ISWM Plan |
| Table 7.2: Categorization of Schemes Based on Phases of Solid Waste Lifecycle |
| Table 10.1 Identified Stakeholders and Target Groups |
| Table 10.2: List of Identified Activities for Information Dissemination |

Table 10.3: Activity Matrix for Information Dissemination
Table 11.1: Comparison of Income and Expenditure for MMC
Table 11.2: Breakdown of Expenditure for Solid Waste Management
Table 11.3: Estimated Costs for Proposed Schemes
Table 11.4: Estimated Costs for Proposed Pilot Projects and Sub Projects
Table 12.1: Stakeholder use of KPIs

List of Figures

Figure 1.1: Integrated Solid Waste Management Concept
Figure 1.2: Information required for preparation of ISWM Plan
Figure 1.3: Process of Preparing ISWM Plan for Matale
Figure 2.1: Total Waste Flow Within MMC
Figure 2.2: Dry basis percentages of materials dumped at the site daily
Figure 2.3: Municipal Solid Waste Generation for Past 6 Years
Figure 2.4: Projected Municipal Solid Waste Generation Based on Different Growth Rates
Figure 2.5: Projected MSW Generation Based on Planned Expansion of MMC Area
Figure 2.6: Projected Healthcare Waste Generation
Figure 3.1: Institutions and Agencies Involved in Solid Waste Management in Matale MC
Figure 3.2: Solid Waste Management Organizational Structure at MMC
Figure 3.3: Comparison of Funding Received by MMC from 2005 – 2007
Figure 3.4: Breakdown of Expenditure for 2005
Figure 3.5: Breakdown of Expenditure for 2006
Figure 3.6: Breakdown of Expenditure for 2007
Figure 3.7: Expenditure per Stage per Year
Figure 3.8: Yearly Comparison of Expenditure per Capita and per Ton
Figure 3.9: Map showing Waste Collection Routes
Figure 6.1: Vision, Mission and Goals for ISWM Plan – Matale MC
Figure 7.1: Schemes of the ISWM Plan
Figure 10.1: Information and Communication Systems for ISWM Plan
Figure 11.1: Existing Institutional Mechanism for SWM
Figure 12.1: Role of KPIs in the Overall Plan Development and Implementation Process

Acronyms

| | |
|----------|--|
| ISWM | Integrated Solid Waste Management |
| GDP | Gross Domestic Production |
| LG | Local Government |
| SWM | Solid Waste Management |
| MC | Municipal Council |
| MMC | Matale Municipal Council |
| JICA | Japan International Cooperation Agency |
| NGO | Non Government Organization |
| MSW | Municipal Solid Waste |
| MOH | Medical Officer Health |
| PHI | Public Health Inspector |
| SPHI | Senior Public Health Inspector |
| LKR | Lankan Rupees |
| 3R | Reduce – Reuse – Recycle |
| IETC | International Environmental Technology Centre |
| PPE | Personal Protective Equipment |
| CBO | Community Based Organization |
| CDO | Community Development Organizations |
| PIN | Project Idea Note |
| PDD | Project Design Document |
| CDM | Clean Development Mechanism |
| USD | United States Dollars |
| ITI | Industrial Technology Institute |
| SMED-SPX | Small & Medium Enterprise Developer- Sub Contracting Partnership Exchange |
| NCPC | National Cleaner Production Centre |
| FCCISL | Federation of Chamber of commerce and Industry of Sri Lanka |
| UNEP | United Nation Environmental Program |

| | |
|---------|--|
| NSWMSC | National Solid Waste Management Support Centre |
| SME | Small & Medium Enterprises |
| ISWM | Integrated Solid Waste Management |
| IDB | Industrial Development Board |
| CEA | Central Environmental Authority |
| CSR | Corporate Social responsibility |
| MOE&NR | Ministry of Environment & Natural Resources |
| UDA | Urban Development Authority |
| RDA | Road Development Authority |
| CP | Cleaner Production |
| DPDHS | Deputy Provincial Director of Health Services |
| LPG | Liquid Petroleum Gas |
| ERU | Emission Reduction Units |
| IUCN | International Union for Conservation of Nature |
| PET | Polyethylene Teraphthalate |
| HDPE | High Density Polyethylene |
| LDPE | Low Density Polyethylene |
| PVC | Poly Vinyl Chloride |
| RDF | Resource Derived Fuel |
| NIMBY | Not in My Back Yard |
| WEX | Waste Exchange |
| UNESCAP | United Nations Economic and Social Commission for Asia and the Pacific |
| EEC | Environmental Education Centre |
| KPI | Key Performance Indicators |
| PDCA | Plan – Do – Check – Act |
| EPL | Environment Protection License |
| IEE | Initial Environmental Examination |
| NEA | National Environmental Act |
| EIA | Environmental Impact Assessment |
| WHO | World Health Organization |

Preface

Matale city is an important regional trade centre situated in central province which has to provide services to 75,000 people with the daily floating population. The city has over 8000 trade establishments and over 200 small industries.

The main issue faced by the Matale Municipality is the management of the daily solid waste. Though there have been several initiatives to improve the effectiveness of the solid waste management the authorities have failed improve the efficiency and effectiveness of the system. The main problems identified are the lack of community awareness and participation, priority on end of pipe disposal, use of inferior technology, placing no economic value on wastes and lack of basic infrastructure.

To address this situation, Honourable Mayor of Matale identified a clear need for integrated solid waste management (ISWM) and requested UNEP-DTIE-IETC to develop an ISWM Plan for Matale. ISWM Plan is to be based on assessment of the current practices of waste management, including quantification and characterisation of waste generated from all sources; the identification of gaps in the current system including lack of recycling. ISWM Plan was required to include the specific schemes/actions to implement technologies, policy framework including economic instruments, and awareness-raising and capacity building.

It is within the above context that Matale Municipality and UNEP agreed to launch the project on "Integrated Solid Waste Management Plan for Matale Municipality". It was aimed at developing an Integrated Solid Waste Management Plan (ISWM) Plan to address the issue of solid waste being generated from all the sources including domestic, commercial, healthcare and industrial sources.

The project was based on the concept of integrated solid waste management based on 3R (reduce, reuse and recycle) approach so that the waste

constituents are recycled and reused to the maximum possible extent and the development of the city can take place in harmony with the environment. The project consists of the following main elements:

- (a) Baseline data collection: (source identification, quantification and characterization of different types of waste including industrial, municipal, commercial, agricultural sectors and special wastes such as medical waste, including projections for future waste generation);
- (b) Assessment of present waste management system: (assess the efficacy and effectiveness of the existing waste management system covering all aspects; waste collection, segregation, transportation, treatment and disposal);
- (c) Setting up targets for ISWM keeping in view the vision and mission of Matale Municipality and Government of Sri Lanka;
- (d) Identifying issues of concern: (identify and prioritize issues of concern so that they could be addressed in a systematic and effective way in the project, covering all areas such economic, technical, environmental and social);
- (e) Development of an Integrated Solid Waste Management (ISWM) Plan (Based on the results of the earlier four elements, an Integrated Waste Management Plan is developed to address the issues identified and tackle the problem of solid waste in a comprehensive manner) and specific schemes/actions for implementation.

This document, prepared in consultation with project partners and local stakeholders, is the ISWM Plan that provides a set of policy options for the generation, collection, transformation, transfer stations, treatment and disposal of

wastes (including recycling and reuse). The Plan will serve as a roadmap for dealing with solid waste in Matale Municipality. Based on the Plan, a supportive framework (including awareness raising and capacity building, policy tools, technologies etc.) and specific schemes/actions (Chapter 7) have been developed for implementation.

Chapter 1: Integrated Solid Waste Management and its Relevance to Matale City

1.1 Background to the Project

Matale city is an important regional trade centre situated in central province which has to provide services to 50,000 people including a daily floating population. The city has over 8,000 trade establishments and over 200 small medium and large scale industries.

The main issue faced by the municipal council of Matale is the management of the solid waste generated on a daily basis through human activities. Though there have been several initiatives to improve the effectiveness of the solid waste management the authorities have failed improve the efficiency and effectiveness of the system. The main problems identified are the lack of community awareness and participation, priority on end of pipe disposal, use of inferior technology, placing no economic value on wastes, and lack of basic infrastructure.

The top management of the Matale Municipal Council is very keen to make Matale a clean and green city by streamlining the solid waste management and then converting the natural land spaces available in the city to green gardens in order to attract more tourists to visit the city. Therefore, development of an Integrated Solid Waste Management (ISWM) Plan with systematic interventions to facilitate the Matale Municipal Council authorities to improve their waste management performance has become an urgent and important task.

The project (preparing the ISWM Plan) will be carried out by National Cleaner Production Centre Sri Lanka on behalf of the United Nations Environment Programme - International Environmental Technology Centre for the Matale Municipal Council.

The preliminary activities carried out as precursors to the development of the ISWM Plan include waste quantification and characterization, assessment of gaps in current

waste management system, setting targets for ISWM, and the identification of stakeholders concerns regarding ISWM. The Plan itself will cover all the waste streams and all the stages of waste management (segregation, collection and transportation, material recovery, treatment and resource recovery, and disposal). The ISWM Plan also includes identification of appropriate technologies, waste exchange platform for recycling waste, and awareness raising package on ISWM including hazardous waste management. Basic designs of a Waste Recycling Industry Park, Biogas Plants and Composting plant will also be developed concurrently.

The main objectives of the project are:

1. Promote Integrated approach to Solid Waste Management with focus on reducing, reusing and recycling waste streams;
2. Build capacity at national/local level through hands-on involvement and training;
3. Demonstrate the process of developing an ISWM Plan at local level to facilitate its replication at other towns; and
4. Support the implementation of Bali Strategic Plan at local level.

1.2 Project Scope

The project develops an integrated solid waste management plan encompassing Municipal Solid Waste, Industrial Waste, Hazardous Waste, Construction and Demolition Waste and E-waste generated within Matale Municipal Council. The plan would cover all the aspects in the solid waste life cycle from generation to final disposal.

This report will only outline and discuss the identified schemes and the resource requirements and capacity building which will be required to effectively implement them under the ISWM Plan. Furthermore the plan will carry out a preliminary evaluation of SWM technologies available and highlight technologies most appropriate to Matale.

1.3 Integrated Solid Waste Management

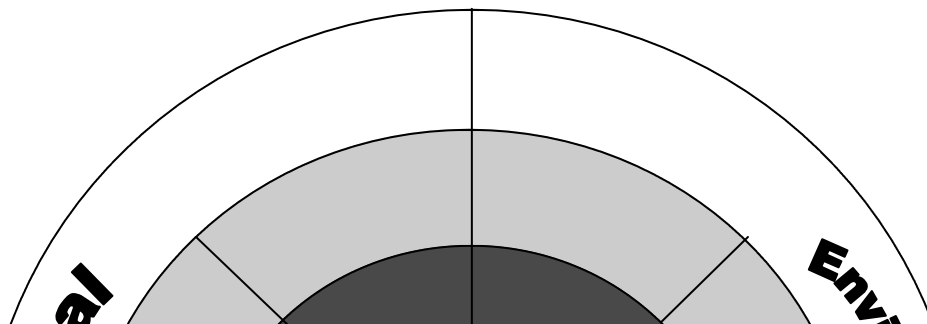
Cities around the world are facing an increasing growth in population as well as shares in GDP growth. In addition to this the lifestyles have become more complex adding to the increase in the consumption of Natural Resources. All these factors have resulted in generation of large volumes of solid wastes with varied composition and quality. A significant portion of this waste can be categorized as toxic or hazardous having direct impacts on human and environmental health.

The complexity and costs of Solid Waste Management is a heavy burden on local government bodies especially in developing nations. In many cases the LG bodies do not have efficient or effecting solid waste management strategies in place. Where strategies are available their implementation has been difficult due to lack of resources and stakeholder involvement. It is now necessary to have multi stakeholder involvement every stage of the waste management cycle. Clearly the current methods of SWM are inadequate to meet with the changing scenario, calling for an integrated approach.

Integrated Solid Waste management is defined as a *“strategic approach to sustainable management of solid waste covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner with an emphasis on maximizing resource use efficiency”*.

The management of Solid Waste should essentially follow the following hierarchy of 3R approaches.

- **Reducing** waste generation at source by applying waste management principles to all phases of consumption and production to reduce the volume and toxicity of waste streams.
- Environmentally sustainable **Reuse** and **Recycling** techniques to reduce resources going to final disposal.



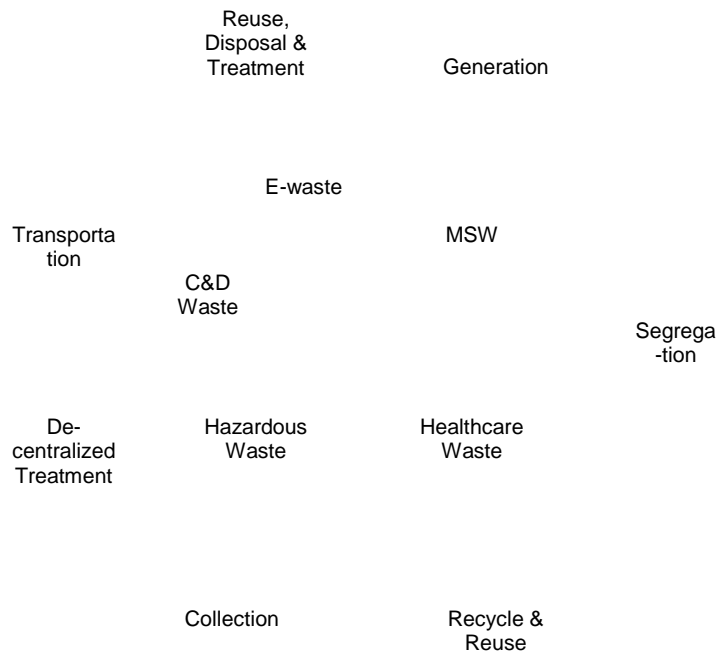


Figure 1.1: Integrated Solid Waste Management Concept

ISWM Plans are ideally holistic and applicable to all waste types. The plan will take into consideration concerns and views of all stakeholders and empower them by bestowing ownership of the project. In addition to this an ISWM Plan will maximize the opportunity to recover resources from all stages of the solid waste lifecycle by integrating and improving existing technical, financial, institutional and policy frameworks.

The ISWM Plan will be based on four elements of information which would have to be completed in advance to facilitate the plan. These information sources are depicted in the figure given below (Figure 1.2).

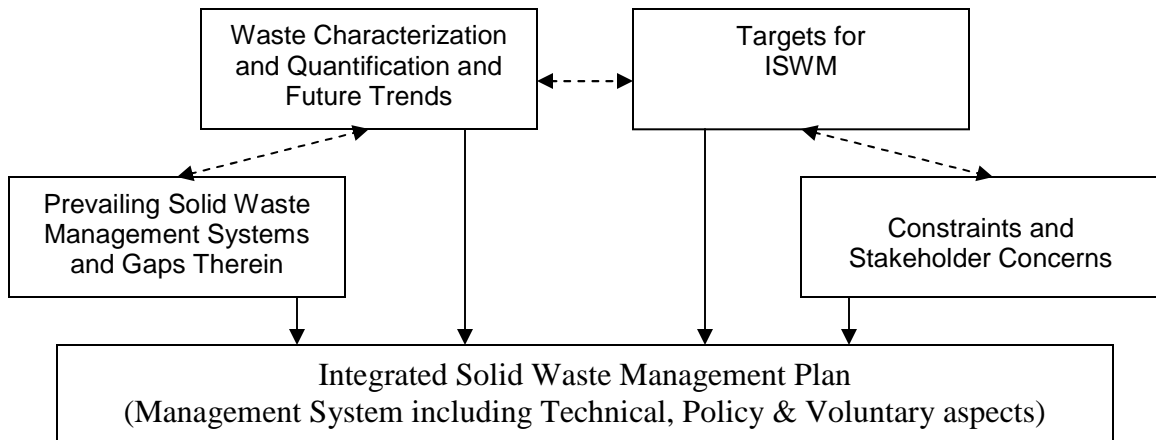


Figure 1.2: Information required for preparation of ISWM Plan

1.4 ISWM Plan for Matale

The ISWM Plan developed for Matale MC is based on strategic action planning which focuses on sustainable solid waste management. The key aspect of the plan is that it integrates the views and issues expressed by stakeholders through a participatory approach.



Figure 1.3: Process of Preparing ISWM Plan for Matale

Figure 1.3 illustrates the plan development process with the participation of relevant stakeholders at each stage. The data collection and situation analysis were conducted to identify gaps which in turn would be used in developing an ISWM Plan. Once completed and implemented the ISWM Plan will have to be monitored and reviewed against the key performance indicators. While the ISWM Plan is the result of these four separate activities the sustainability of the plan will depend on it being a continuous cyclic process. The effective implementation of the ISWM Plan will change the role of stakeholders by distributing the responsibilities amongst all. This will ensure a positive change in stakeholder participation and concerns.

Similarly the targets set by the MMC will affect the ISWM Plan by streamlining its activities to achieve these targets. However after implementation there could be changes in the targets on the long term as some targets may not be achievable within the given time frames.

The strategic action plan development process looks at all the stages of waste management from generation to final disposal and strategies are developed to cover policy, technological and voluntary actions needed at each of these stages. The barriers and constraints identified through the situation analysis and stakeholder participation (Technical, Economic, Social, Policy and Institutional) have been addressed in developing these strategic actions.

The plan will also conduct a sensitivity analysis through which positive/negative impacts that could result from these changes are highlighted for the MMC to decide the most appropriate course of action.

The overall objective of the plan will be to provide the MMC with a blueprint of diverse approaches which can be used in collaboration or individually in order to manage the Solid Waste Generated in Matale.

1.5 Organization of the Report

Chapter 1 of the report discusses the preparation of the Integrated Solid Waste Management plan and its importance to Matale. It details the scope of the project as well as the preparation process followed. **Chapter 2** summarizes the results of the waste characterisation study carried out under the waste inventory preparation phase of the project while **Chapter 3** gives a summary of the Situation Analysis carried out. **Chapter 4** of this report gives the Vision, Mission and Targets set by the MMC for the ISWM Plan. The Stakeholder concerns identified in the First Stakeholder Workshop are recapped in **Chapter 5** of this report. **Chapter 6** sets the Framework on which the Waste Management Action plan is prepared. It sets out the Vision, Mission and Goals of the plan. It also elucidates the relationship between these goals and the Targets set by the MMC (Chapter 4). It then goes on to highlight the Policy, Voluntary and Technological Measures required for the implementation of the plan. The major schemes developed under the ISWM Plan (under five main themes) have been discussed in **Chapter 7** of this report. These schemes have been linked to the goals and targets set in the previous chapter. The chapter also includes a detailed description of each scheme including the expected outcomes, the lead and supportive agencies as well as the financial requirement and time frame. **Chapter 8** is an assessment of various Solid Waste Management technologies available for each phase of the SWM cycle. **Chapter 9** describes the special projects (Pilot and sub projects) identified in the plan. Each project has been given a brief description including the budgetary and time allocations required. The methodology developed to communicate the ISWM Plan and its various components to relevant stakeholders is revealed in **Chapter 10** of this report. **Chapter 11** of the report outlines the Resource & Institutional Considerations of Implementing ISWM Plan. The chapter also gives the total budgetary requirement for the 31 schemes proposed by the plan. Each scheme and project of ISWM plan needs to be monitored after implementation to ensure that the goals and targets of the plan are met. **Chapter 12** highlights the Key Performance Indicators which have been developed to carry out the monitoring of the plan. **Chapter 13** gives the Implementation strategy.

Chapter 2: Base Line Information

2.1 Waste Inventory

This section describes the results of the waste characterisation study carried out under the waste inventory preparation phase of the project. The main waste streams identified under this study included residential waste, commercial and institutional waste, healthcare waste, industrial waste and construction and demolition waste.

2.1.1 Solid Waste Disposed within the Matale Municipality

2.1.1.1 Residential Waste

According to Table 2.1 there are considerable variations in the quantity of waste generated as well as the type of waste disposed among the three income levels. While the **total residential waste disposal is estimated to be around 17.7 tons/day** nearly 81% (14.3 tons) of it is organic in nature. Most of the organic waste component is disposed by middle income residents amounting to nearly 9 tons/day. According to this study the total organic waste disposed by high income families is less than 13% of the total organic waste component.

The quantities of disposal of wastes such as paper, plastics, metals and glass are minute in comparison to the organic waste component. The total quantity of non-organic waste disposed by all three income levels amounts to only 3.4 tons/day which is less than 20% of the total waste disposal.

| Waste Component | Waste disposal (Tons/day) | | | Total |
|-----------------|---------------------------|---------------|--------------|---------------|
| | Low income | Middle income | High income | |
| Organic | 3.650 | 8.796 | 1.820 | 14.267 |
| Paper | 0.278 | 0.740 | 0.113 | 1.131 |
| Plastic (Soft) | 0.200 | 0.574 | 0.055 | 0.829 |
| Plastic (Hard) | 0.020 | 0.048 | 0.015 | 0.083 |
| Textile | 0.038 | 0.569 | 0.074 | 0.681 |
| Metals | 0.057 | 0.035 | 0.007 | 0.099 |
| Glass | 0.014 | 0.061 | 0.008 | 0.083 |
| Hazardous | 0.000 | 0.001 | 0.000 | 0.001 |
| Other | 0.174 | 0.349 | 0.003 | 0.525 |
| Total | 4.432 | 11.173 | 2.001 | 17.700 |

Table 2.1: Characteristics of Waste Disposed by Households

| Income Level | Low (Total Monthly Income < Rs. 15,000) | Middle (Total Monthly Income between Rs. 15,000 to Rs. 40,000) | High (Total Monthly Income > Rs. 40,000) |
|---|--|--|---|
| Percentage | 27.1% | 62.8% | 10.1% |
| Per capita waste disposal (kg/day) | 0.369 | 0.420 | 0.470 |

Table 2.2: Per Capita Residential Waste Disposal

Note: In addition to the monthly income level factors such as the number of family members employed or the nature of business engaged, and the status of residents and vehicle ownership were also taken into consideration in categorizing families.

In contradiction to the total waste disposal pattern, the above table shows that high income families have a higher per capita waste disposal rate. The total waste disposal is less as the percentage of high income earners is less in Matale. But their waste disposal per person is 0.47 kg/day. This would also mean that their waste generation is higher than the other waste generators.

2.1.1.2 Commercial and Institutional Waste

Around 2400 commercial and industrial units within the municipality limits contribute to the total waste disposed in Matale. Out of this number about 801 units (Table 2.4) are considered to be major waste generators. Based on observations made during the study, the remaining 1600 units dispose solid waste at an average rate of 0.65 kg/unit. Therefore the total waste disposed by these 1600 units was calculated to be around 1.05 tons/day.

In addition to these units several other sources of waste disposal were observed. Around 30 king coconut sellers (roadside cart vendors) were observed to be disposing about 225 kg of waste daily. One tractor load, which was assumed to be 1.5 tons, of fish and offal disposed at the landfill site everyday. Based on these facts, overall commercial and industrial waste disposal is around 6.84 tons/day (Refer table 2.3 for summery). The waste composition is given in table 2.5. Accordingly even in the case of commercial waste the non-organic material is less than 10% of the total waste disposed.

| Source of Solid Waste | Number | Quantity (tons/day) |
|---|-------------|---------------------|
| Major Waste Generators (Table 2.3) | 801 | 4.07 |
| Minor Waste Generators | 1600 | 1.05 |
| King Coconut Vendors | 30 | 0.225 |
| Fish and Meat Stalls (included in 1600) | 22 | 1.5 |
| Total Commercial Waste Disposal | 2431 | 6.84 |

Table 2.3: Summery of Commercial Waste Disposal

| | Unit | Garages | Tailor Shops | Saloons | Printers | Hotels & Restaurants | Bakeries | Groceries | Fruit & Vegetable stalls (cat.1) | Fruit & Vegetable stalls (cat.2) |
|-----------------------------|-------------|---------------|---------------|---------------|---------------|----------------------|---------------|----------------|----------------------------------|----------------------------------|
| Number within MMC | No. | 33 | 61 | 58 | 8 | 56 | 30 | 355 | 59 | 80 |
| Organic | kg | 0.802 | 0.133 | 0.723 | 0.388 | 6.600 | 0.673 | 1.601 | 24.524 | 10.694 |
| Paper | kg | 0.287 | 0.205 | 0.130 | 3.195 | 0.921 | 0.156 | 0.559 | 1.177 | 0.222 |
| Plastic (Soft) | kg | 0.123 | 0.008 | 0.014 | 0.072 | 0.787 | 0.063 | 0.265 | 0.203 | 0.050 |
| Plastic (Hard) | kg | 0.106 | 0.004 | 0.005 | - | 0.083 | - | - | 0.004 | 0.010 |
| Textile | kg | 0.203 | 0.714 | 0.184 | 0.084 | 0.010 | - | 0.060 | 0.002 | - |
| Metals | kg | 0.003 | - | 0.001 | - | 0.031 | - | - | - | - |
| Glass | kg | 0.075 | - | - | - | - | - | - | - | - |
| Hazardous | kg | 0.523 | - | - | 0.250 | - | - | - | - | - |
| Other | kg | 0.037 | - | - | - | 0.344 | - | - | 0.335 | 0.185 |
| Sub Total | kg | 2.159 | 1.064 | 1.057 | 3.989 | 8.776 | 0.892 | 2.485 | 26.245 | 11.161 |
| Total Waste Disposal | kg | 71.247 | 64.904 | 61.309 | 31.912 | 491.456 | 26.760 | 882.175 | 1548.455 | 892.880 |
| Total Waste Disposal | Tons | 0.070 | 0.065 | 0.061 | 0.032 | 0.491 | 0.027 | 0.882 | 1.55 | 0.892 |

Table 2.4: Average Daily Waste Disposal by Major Waste Generators

| Component | Amount (Ton/day) | Percentage |
|----------------|------------------|---------------|
| Organic | 5.793 | 84.7% |
| Paper | 0.604 | 8.8% |
| Plastic (Soft) | 0.233 | 3.4% |
| Plastic (Hard) | 0.017 | 0.2% |
| Textile | 0.133 | 1.9% |
| Metals | 0.003 | 0.0% |
| Glass | 0.004 | 0.1% |
| Hazardous | 0.031 | 0.5% |
| Other | 0.020 | 0.3% |
| Total | 6.838 | 100.0% |

Table 2.5: Composition of Commercial Waste

| Source | Per Capita Waste Disposal (kg/employee) |
|------------------|---|
| Tailor shops | 0.358 |
| Garages | 0.391 |
| Vegetable stalls | 3.867 |
| Groceries | 0.931 |
| Saloons | 0.250 |

Table 2.6: Per Capita Waste Disposal for Selected Commercial Establishments

Institutions and organizations within the Matala city area were grouped together with commercial establishments in the study. Accordingly the total waste disposal by institutes/organizations is around 0.74 tons/day. The waste composition is given in table 2.6 while table 2.7 gives the per capita waste disposal.

| | Average Daily Waste Disposal (kg/day.unit) | |
|-----------------------|---|------------------------------|
| | Government Offices | Private Educational Units |
| Number | 69 | 30 |
| Organic | 5.623 | 6.933 |
| Paper & CB | 2.140 | 1.267 |
| Plastic (soft) | 0.538 | 0.574 |
| Total | 8.301 | 5.649 |

Table 2.6: Average Daily Disposal of Intuitional Waste per Unit

| Business | Per Capita Waste Disposal | Units |
|---------------------------|---------------------------|-------------|
| Private Educational units | 0.015 | kg/student |
| Government Offices | 0.320 | kg/employee |

Table 2.7: Per Capita Waste Disposal by Institutions/Organizations

Data related to public schools and public places was obtained through a report prepared for a similar study carried out in 2002 by a JICA funded project (*The Study on Improvement of Solid Waste Management in Secondary Cities in Sri Lanka - JICA*) This data is shown in Table 2.8. (Estimated annual growth rate of 2% for solid waste generation by 2007). Only 10% of the total waste generated by schools and public places are disposed to the MMC waste collection system.

| Source | Waste Generation (tons /day) | | Remarks (2% annual growth of waste generation was assumed) |
|------------------|---------------------------------|---------------------|---|
| | 2002 (Jica report) | 2007 (Estimated) | |
| Schools | 1.81 | 2.00 | About 90% of the waste is disposed on site |
| Religious Places | 0.15 | 0.17 | Composition is not known |
| Public places | 0.45 | 0.50 | About 90% of the waste is composted |

Table 2.8: Estimated Waste Generation from Other Sources (Not Included in the Study)

Accordingly though 2.67 tons of waste is generated by these places only around 0.42 tons of waste is disposed to the MMC system.

Based on all the data gathered the total Municipal Solid Waste disposal rate was calculated to be around 26.5 tons/day. The sources of waste and the composition are further illustrated in table 2.9.

| Component | Daily waste disposals from different generators(Tons/day) | | | | |
|--|---|--------------|--------------|--------------------------------|---------------|
| | Residential | Commercial | Offices | Private Educational Institutes | Total |
| Organics | 14.267 | 5.793 | 0.388 | 0.208 | 20.656 |
| Paper/Cardboard | 1.131 | 0.604 | 0.148 | 0.038 | 1.921 |
| Plastic (Soft) | 0.829 | 0.233 | 0.037 | 0.017 | 1.116 |
| Plastic (Hard) | 0.083 | 0.017 | - | - | 0.1 |
| Textile | 0.681 | 0.133 | - | - | 0.814 |
| Metals | 0.099 | 0.003 | - | - | 0.102 |
| Glass | 0.083 | 0.004 | - | - | 0.087 |
| Hazardous | 0.001 | 0.031 | - | - | 0.032 |
| Others | 0.525 | 0.02 | - | - | 0.545 |
| Total | 17.699 | 6.838 | 0.573 | 0.263 | 25.373 |
| Estimated waste disposal from schools, religious places, and public places | | | | | 0.42 |
| General Waste from the Hospital | | | | | 0.7 |
| Total MSW disposal within the MMC | | | | | 26.493 |

Table 2.9: Estimated Total MSW Disposal from Major Sources

Note: The quantities indicated here are waste disposed and not the waste generated.

2.1.1.3 Industrial Waste

According to the study only three types of large industries could be identified in Matala MC area. These can be categorised as Wood based industries, Apparel Manufacturing Industries and a Food Industry. Table 2.10 shows the total quantities of waste disposed from these industries. Majority of industrial waste is generated by wood based industries in the form of sawdust and wood waste. In addition to this about 100 kg/day additional industrial waste is disposed by the other major industries located within the MMC and

collected by the MMC collection system. Therefore the waste disposed to MMC system can be considered as 0.1 ton/day.

| Industry | Daily Waste Disposal (Ton) | Remarks |
|--------------------------|----------------------------|---|
| Sawmills and carpentries | 3.00 | Wood wastes. Onsite disposal and recovery |
| Juraniza Fashion Garment | 0.045 | Mainly paper, cardboard and polythene. Collected by the MMC |
| Diana Chocolate Company | 0.050 | Mainly paper, cardboard and polythene. Collected by the MMC |
| Winter Knitting Garment | 0.005 | Mainly polythene. Collected by the MMC |

Table 2.10: Daily Industrial Waste Disposal

2.1.1.4 Healthcare Waste

The government hospital is the largest healthcare facility within the MMC and the biggest source of healthcare (biomedical) waste. As shown in table 2.11 a, around 0.044 tons of hazardous healthcare waste (inclusive of annually disposed waste) is generated daily in addition to 1.218 tons of non hazardous waste.

Even though a segregation scheme is in place at the hospital some of the general waste (mainly food waste disposed at wards) was found to be contaminated by hazardous material such as used plasters and cotton wool etc. The study showed that the hospital was unaware of the quantity of used textiles such as linen disposed.

Out of the total waste generated at the hospital (1.262 tons) only around 56% amounting to 0.7 tons is disposed to the MMC system on a daily basis. The rest of the waste is disposed by the hospital according to the methods specified in tables 2.11 a and b.

In addition to this amount around 30 private healthcare units dispose 0.3 kg/unit of healthcare waste, resulting in approximately 9 kg of waste daily. Some of this waste ends up at the landfill site while some are burned or buried.

In total around 0.06 tons (0.053 tons of waste from government hospital and 0.004 tons of waste from other healthcare units) of hazardous healthcare waste is generated within the Matale Municipality area each day.

| Waste | Unit | Amount | Disposal method |
|-----------------------------------|---------------|-------------|--------------------------------|
| Hazardous & Infectious | | | |
| <u>Daily Disposal</u> | | | |
| Cotton wool, dressing etc., | kg/day | 35 | Daily burning |
| Syringes | kg/day | 2 | Weekly burning |
| Placentas | kg/day | 5 | Flushed to an underground tank |
| Tissues | kg/day | 2 | Buried daily |
| Total | kg/day | 44 | |
| <u>Annual Disposal</u> | | | |
| Expired Capsules | kg | 45 | Buried |
| Expired Vials | kg | 1350 | Buried |
| Unusable syringes | kg | 23 | Buried |
| Total | kg | 1418 | |

Table 2.11 a: Hazardous Waste Generation and Disposal at Government Hospital

| Waste | Unit | Amount | Disposal method |
|------------------------------|---------------|-------------|--|
| Non hazardous | | | |
| <u>Daily Disposal</u> | | | |
| Plastic containers | kg/day | 15 | Recycled |
| Paper | kg/day | 3 | Municipal council SWM system |
| Food waste | kg/day | 700 | Municipal council SWM system. Some of it is contaminated |
| Used textile | | Not known | Burning |
| Yard waste | kg/day | 500 | Burning |
| Total | kg/day | 1218 | |

Table 2.11 b: Waste Generation and Disposal at Government Hospital

2.1.1.5 Construction and Demolition Waste

The total C&D waste disposed within the MMC area is estimated to be about 5 tons per day. However this figure can vary depending on construction going on in the area.

None of the construction waste is collected by the MMC.

2.1.2 Material Recovered Prior to Disposal

Table 2.12 indicates the quantities “recyclable material” recovered from the waste streams, while table 2.13 gives quantity of organic waste recovered. Therefore it is estimated that around 4.44 tons of waste is recovered through various mechanisms within the MMC area.

| | Material Recovery (tons/day) | | | | | |
|---|------------------------------|----------------|----------------|--------------|----------------|----------------|
| | Paper | Glass | Metal | Cardboard | Plastic (Hard) | Plastic (Soft) |
| MC Assisted | 0.100 | 0.075 | 0.050 | | 0.030 | 0.015 |
| Hospital recycling | | | | | 0.015 | |
| Private company collection | 0.015 | | | | 0.013 | |
| Middlemen <ul style="list-style-type: none"> • From sources • From scavengers | 0.070 | 0.435 0.030 | 0.452 0.030 | 0.365 | 0.356 0.200 | |
| Total | 0.185 | 0.540 | 0.522 | 0.365 | 0.414 | 0.015 |

Table 2.12: Estimated Recycling of Waste

| Organic Waste Recovery (tons/day) | |
|-----------------------------------|------------|
| Method | Quantity |
| Composting by an NGO | 1.00 |
| Household composting | 1.00 |
| Composting at public parks | 0.4 |
| Total | 2.4 |

Table 2.13: Composting of Organic Waste

2.1.3 Solid Waste Disposed Through Other Mechanisms

Not all the waste generated within the MMC area is collected or disposed off using the MMC service. Some of the Municipal Solid Waste is also not included in the MMC service. The following table (table 2.14) shows the houses and other sources that use their own disposal methods for generate Municipal waste. It must be noted here that almost 2000 households do not receive the waste collection service through the MMC. The total waste generated by these houses is estimated to be around 4 tons while houses that carry out their own waste disposal are estimated to produce around 1.4 tons of waste daily.

| Category | Number | Quantity (tons) | Remarks |
|---|--------|--------------------|---|
| Households not covered by the MMC waste collection service | 2000 | 4 | Assumed to produce 2.0 kg waste per unit. |
| Households within the MMC service area that do onsite dumping | 600 | 1.4 | Assumed to produce 2.3 kg waste per unit. |

Table 2.14: Other Solid Waste Disposal Mechanisms

In addition to this around 2.25 tons of waste generated at schools and public places are disposed off at the point of generation itself. The hospital disposes around 0.562 tons of Hazardous and Non-hazardous wastes at the premises.

Therefore the total quantity of waste thus disposed off amounts to around 8.2 tons of waste a day.

2.1.4 Waste Disposed off at MMC Landfill

About 70% of the residential units and most of the commercial, small industrial units, and other institutes use the MMC waste management system to dispose the wastes generated. According to the study the total waste disposed daily at the MMC landfill site is around 19.021 tons. Here too the majority of the waste is organic in nature while non-organic material account for less than 20%.

The estimated amount of waste coming to the dumping site and the observed values are given in table 2.15, together with possible reasons for error. The organic amount includes yard waste as well as about 0.35 tons of king coconut waste.

| Component | Daily waste disposal at the site (tons/day) | | Error (%) | Remarks |
|-----------------|---|---------------|-------------|--|
| | Observed | Estimated | | |
| Organics | 12.957 | 13.742 | -6.1% | A large fraction of "Others" in observed data contains organic food waste combined with soil |
| Paper/Cardboard | 1.572 | 1.487 | 5.4% | Due to soil and moisture in at dumpsite paper |
| Plastic (Hard) | 0.225 | 0.268 | -19.0% | Due to unaccounted scavenging |
| Plastic (Soft) | 1.265 | 0.796 | 37.1% | Due to soil in soft plastic at dumpsite |
| Carpet/Textile | 0.505 | 0.552 | -9.4% | Accuracy is satisfactory |
| Glass | 0.056 | 0.094 | -68.5% | Due to unaccounted scavenging |
| Metals | 0.055 | 0.086 | -55.6% | Due to unaccounted scavenging |
| Hazardous | 0.566 | 0.020 | 96.5% | Due to the hospital waste, which is covered under hazardous waste |
| Others | 1.820 | 0.404 | 77.8% | A large fraction of "Others" in observed data contains organic food waste combined with soil |
| Total | 19.021 | 17.448 | 8.2% | |

Table 2.15: Estimated and observed daily waste disposal at the dumping site

- Note:
1. Hazardous waste is mainly from the hospital and includes contaminated food waste.
 2. Others include waste passing through 5 mm sieve and mainly contain some organic matter and rubble

2.1.5 Total Waste Generation

Table 2.16 shows the total Solid Waste generation within the MMC while table 2.17 shows the Municipal Solid Waste Generation. A total of about 42500 residents live in the MMC and hence the per capita MSW generation is estimated to be 0.91 kg/day. Per capita Solid Waste generation include all residential, institutional, and commercial waste disposal and recycling (by definition MSW does not include industrial waste), while per capita residential waste includes only the amount of waste disposed by residential units.

| Source | Quantity | Unit |
|--|---------------|-------------|
| Disposal by residences and commercial/institutional establishments | 25.37 | tons |
| Generation by Schools, Religious Places, Public Places | 2.67 | tons |
| Generation by Industries | 3.1 | tons |
| Generation by Government Hospital | 1.26 | tons |
| Disposal by other Medical Facilities | 0.009 | tons |
| Construction Waste | 5 | tons |
| Material Recovered prior to Disposal | 4.44 | tons |
| Generation by household not receiving MMC services | 4 | tons |
| Generation by households using own disposal system | 1.4 | tons |
| Total Waste Generation | 47.249 | tons |

Table 2.16: Total Solid Waste Generated in the MMC Area

| Source | Quantity | Unit |
|--|--------------|-------------|
| Disposal by residences and commercial/institutional establishments | 25.37 | tons |
| Generation by Schools, Religious Places, Public Places | 2.67 | tons |
| Industrial Solid Waste | 0.1 | tons |
| Hospital Food Waste | 0.7 | tons |
| Material Recovered prior to Disposal | 4.44 | tons |
| Generation by household not receiving MMC services | 4 | tons |
| Generation by households using own disposal system | 1.4 | tons |
| Total Municipal Solid Waste Generation | 38.68 | tons |

Table 2.17: Total Municipal Solid Waste Generated in the MMC Area

While 38.7 tons of municipal solid waste is generated from the various sources within the MMC area only about 19 tons of waste is sent to the MMC landfill site. Another 4.4 tons of waste is recovered through various mechanisms. There is no clear understanding of how the remaining 23.4 tons of waste is disposed. However in the cases of households that do not receive the MMC service or do not use it around 5.4 tons of waste is buried, burnt or composted.

| Component | Quantity (tons/day) | | | |
|------------------|---------------------|-------------|--------------|------------------|
| | Generation | Recovery | Disposed | Sent to Landfill |
| Organics | 30.42 | 2.40 | 28 | 12.957 |
| Paper/Cardboard | 3.22 | 0.55 | 2.67 | 1.572 |
| Plastic (Soft) | 1.37 | 0.01 | 1.35 | 1.265 |
| Plastic (Hard) | 0.54 | 0.41 | 0.13 | 0.225 |
| Textile | 1.16 | - | 1.20 | 0.505 |
| Metals | 0.65 | 0.52 | 0.13 | 0.055 |
| Glass | 0.65 | 0.54 | 0.11 | 0.056 |
| Hazardous | 0.03 | - | 0.03 | 0.566 |
| Others | 0.7 | - | 0.07 | 1.82 |
| Total MSW | 38.74 | 4.43 | 33.69 | 19.021 |

Table 2.18: Estimated total daily MSW generation

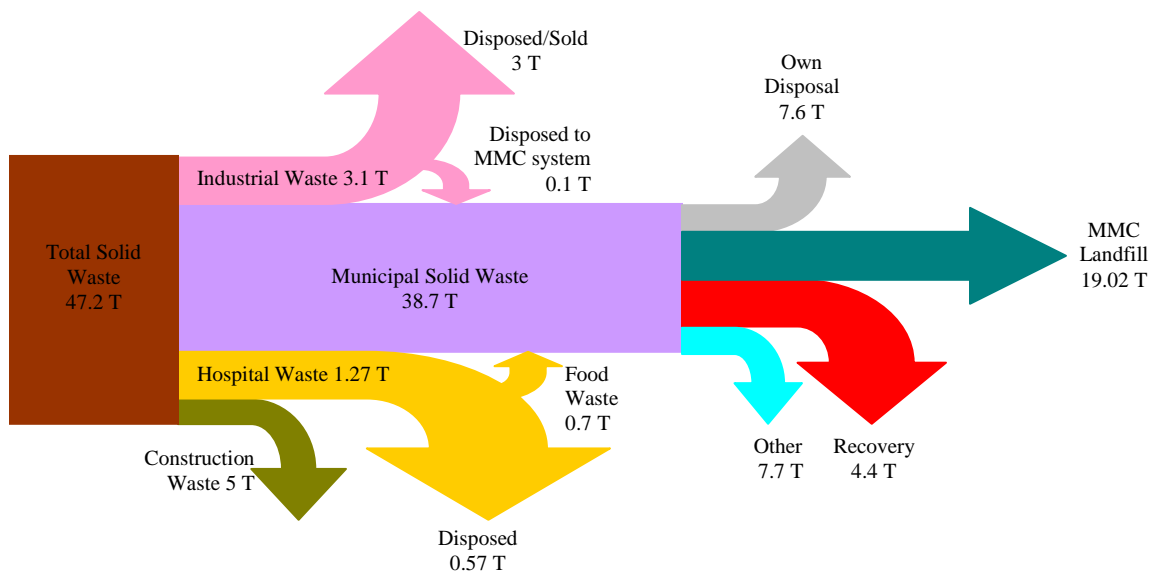


Figure 2.1: Total Waste Flow Within MMC

2.2 Characteristics of Waste

2.2.1 Moisture Content, Ash Content and Calorific Values of MSW

| Component | MC (Wet Basis) | Gross Calorific Value (MJ/kg dry matter) | Ash Content (% of dry matter) |
|----------------|----------------|--|-------------------------------|
| Organic | 60.6% | 17.50 | 42.8% |
| Plastic (Hard) | 31.1% | 44.30 | 27.3% |
| Plastic (Soft) | 75.2% | 36.90 | 16.7% |
| Paper | 41.5% | 14.17 | 6.2% |
| Textile | 37.3% | 15.27 | 12.6% |
| Yard waste | 60.7% | 17.32 | 36.1% |
| King coconut | 83.1% | 16.78 | 6.3% |

Table 2.19: Average Moisture Content and Calorific Values of Waste at Landfill

Note: For plastics and textiles moisture content includes soil and dirt associated with the materials.

| Component | Net calorific value MJ/kg (As- received basis) |
|----------------|--|
| Organic | 14.2 |
| Plastic (Hard) | 46.8 |
| Plastic (Soft) | 4.5 |
| Paper | 33.3 |
| Textile | 38.5 |
| Yard waste | 14.1 |
| King coconut | 1.0 |

Table 2.20: Net Calorific Values of Waste Components on “as received” Basis

A simple calculation indicates that the net calorific value of waste at the dumping site is 13.9 MJ/kg. Based on the analysis, availability of moisture free material at the dumping site is as given in table 2.21, while figure 2.2 depicts the dry basis percentages of material disposed at the site. The waste coming from the hospital was contaminated with the infectious waste and was considered as hazardous while the total weight was found to be 481 kg. A full tractor load of offal comes daily and the taking any

measurement proved to be impossible due to the nature of waste. A rough estimate of the load was taken to be about 1.5 tons and all of it was considered as organic waste.

| Component | Dry Material (kg/day) | Dry Material (Tons/day) |
|-------------------|-----------------------|-------------------------|
| Organics | 4051.2 | 4.05 |
| Paper/Cardboard | 919.5 | 0.92 |
| Plastic (Hard) | 103.9 | 0.10 |
| Plastic (Soft) | 313.7 | 0.31 |
| Carpet/Textile | 316.6 | 0.32 |
| Garden/Yard waste | 832.4 | 0.83 |
| King coconut | 92.8 | 0.09 |

Table 2.21: Average Dry Weight of Material Disposed at the Landfill

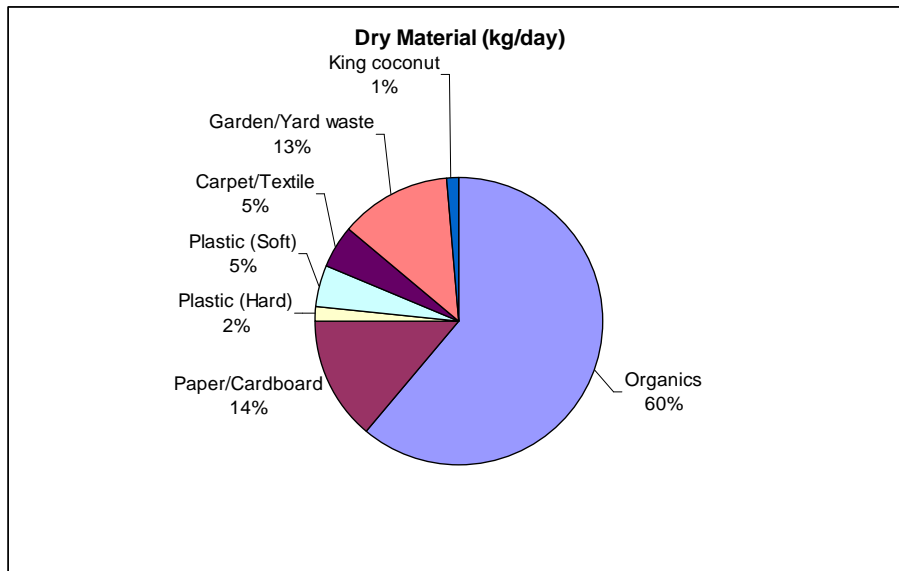


Figure 2.2: Dry basis percentages of materials dumped at the site daily

2.3 Projection of Solid Waste Generation from 2007 - 2025

2.3.1 Municipal Waste

The projection of solid waste generation in Matale municipality was carried out up to the year 2025. Many factors such as economical and population growth, consumption pattern, and local legislation were considered in doing so as they have a direct impact on the waste generation patterns.

A previous study conducted on MSW generation in Matale (2002) found the generation to be 29.4 tons while the current study suggests this figure to have risen to 38.68 tons. When looking at the pattern of Solid Waste Generation in Matale during the past five years the rate of increase has been 1.057 or 5 - 6%. This has been further illustrated in table 2.22.

| Year | Quantity (Tons) |
|------|-----------------|
| 2002 | 29.4 |
| 2003 | 31.1 |
| 2004 | 32.8 |
| 2005 | 34.7 |
| 2006 | 36.7 |
| 2007 | 38.7 |

Table 2.22: Municipal Solid Waste Generation Pattern from 2002 – 2007

Note: The above quantities were calculated based on a growth rate of 6 %

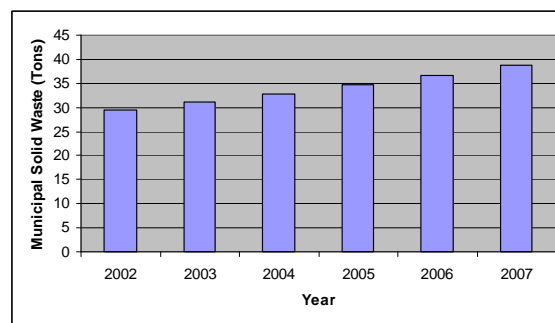


Figure 2.3: Municipal Solid Waste Generation for Past 6 Years

The following section describes the projected solid waste generation based on various factors.

2.3.1.1 Projection Based on Population and GDP growth.

According to the United State Environmental Protection Agency, generation of waste would grow at a rate between the rate of population growth and the growth rate of GDP. The average population growth rate in Matale is estimated to be around 1.5%, while the average GDP growth of Sri Lanka is about 6%. Based on this information, and taking into consideration the calculated growth rate for Solid Waste generation projections were made as per the table given below (table 2.22). The projected Municipal Solid Waste generations based on different growth rates are shown in figure 2.3

| Year | Municipal Solid Waste (Tons) | | | | |
|------|------------------------------|-------|-------|-------|--------|
| | 2% | 3% | 4% | 5% | 6% |
| 2007 | 38.74 | 38.74 | 38.74 | 38.74 | 38.74 |
| 2008 | 39.51 | 39.9 | 40.28 | 40.67 | 41.06 |
| 2009 | 40.3 | 41.09 | 41.89 | 42.70 | 43.52 |
| 2010 | 41.1 | 42.32 | 43.56 | 44.83 | 46.13 |
| 2011 | 41.92 | 43.58 | 45.3 | 47.07 | 48.89 |
| 2012 | 42.75 | 44.88 | 47.11 | 49.89 | 51.82 |
| 2013 | 43.6 | 46.22 | 48.99 | 52.38 | 54.92 |
| 2014 | 44.47 | 47.6 | 50.94 | 54.99 | 61.50 |
| 2015 | 45.35 | 49.02 | 52.97 | 57.73 | 65.19 |
| 2016 | 46.25 | 50.49 | 55.08 | 60.61 | 69.10 |
| 2017 | 47.17 | 52 | 57.28 | 63.64 | 73.24 |
| 2018 | 48.11 | 53.56 | 59.57 | 66.62 | 77.63 |
| 2019 | 49.07 | 55.16 | 61.95 | 69.96 | 82.28 |
| 2020 | 50.05 | 56.81 | 64.42 | 73.45 | 87.21 |
| 2021 | 51.05 | 58.51 | 66.99 | 77.12 | 92.44 |
| 2022 | 52.07 | 60.26 | 69.66 | 80.97 | 97.98 |
| 2023 | 53.11 | 62.06 | 72.44 | 85.01 | 103.85 |
| 2024 | 54.17 | 63.92 | 75.33 | 89.26 | 110.08 |
| 2025 | 55.25 | 65.83 | 78.34 | 93.72 | 116.68 |

Table 2.23: Projection of Municipal Solid Waste Generation (2007 – 2025)

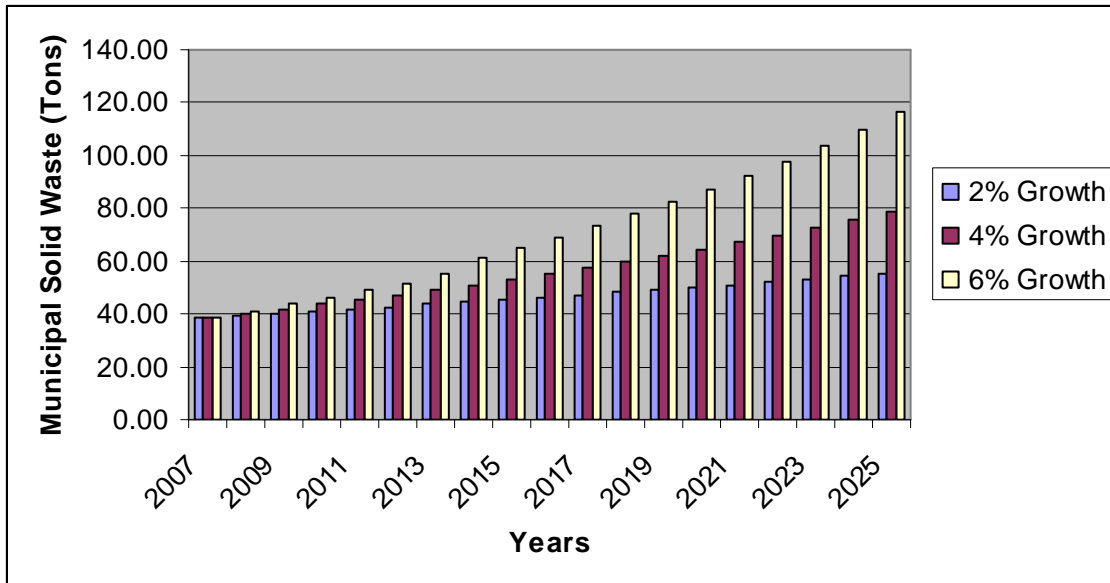


Figure 2.4: Projected Municipal Solid Waste Generation Based on Different Growth Rates

2.3.1.2 Effect of Proposed Expansion of the Boundaries of MMC

The area under the authority of the Matale Municipal Council is to be expanded by year 2009. According to this plan an additional 865 families amounting to approximately 2300 residents will be included into the existing number. Based on the values given in table 2.2 the per capita waste generation can be calculated as 0.42 kg/person per day. Therefore a quantity of 0.96 Tons of Municipal Solid Waste will be added to the existing amount. However as the areas to be incorporated to the MMC are mainly residential, the increase in the generation of industrial and commercial waste can be overlooked.

The projected total MSW generation, with the changes in physical boundaries of the MMC, is given in table 2.24.

| Year | Municipal Solid Waste (Tons) | | | | |
|------|------------------------------|-------|-------|-------|--------|
| | 2% | 3% | 4% | 5% | 6% |
| 2007 | 38.74 | 38.74 | 38.74 | 38.74 | 38.74 |
| 2008 | 39.51 | 39.90 | 40.28 | 40.67 | 41.06 |
| 2009 | 41.28 | 42.08 | 42.88 | 43.71 | 44.54 |
| 2010 | 42.10 | 43.34 | 44.59 | 45.89 | 47.21 |
| 2011 | 42.94 | 44.64 | 46.37 | 48.18 | 50.04 |
| 2012 | 43.79 | 45.97 | 48.22 | 50.58 | 53.04 |
| 2013 | 44.66 | 47.34 | 50.14 | 53.1 | 56.22 |
| 2014 | 45.55 | 48.76 | 52.14 | 55.75 | 59.59 |
| 2015 | 46.46 | 50.22 | 54.22 | 58.53 | 63.16 |
| 2016 | 47.38 | 51.72 | 56.38 | 61.45 | 70.72 |
| 2017 | 48.32 | 53.27 | 58.63 | 64.52 | 74.96 |
| 2018 | 49.28 | 54.86 | 60.97 | 67.74 | 79.45 |
| 2019 | 50.26 | 56.50 | 63.40 | 71.12 | 84.21 |
| 2020 | 51.26 | 58.19 | 65.93 | 74.67 | 89.26 |
| 2021 | 52.28 | 59.93 | 68.56 | 78.4 | 94.61 |
| 2022 | 53.32 | 61.72 | 71.30 | 82.32 | 100.28 |
| 2023 | 54.38 | 63.57 | 74.15 | 86.43 | 106.29 |
| 2024 | 55.46 | 65.47 | 77.11 | 90.75 | 112.66 |
| 2025 | 56.56 | 67.43 | 80.19 | 95.28 | 119.41 |

Table 2.24: Projected Municipal Solid Waste Generation Following Expansion

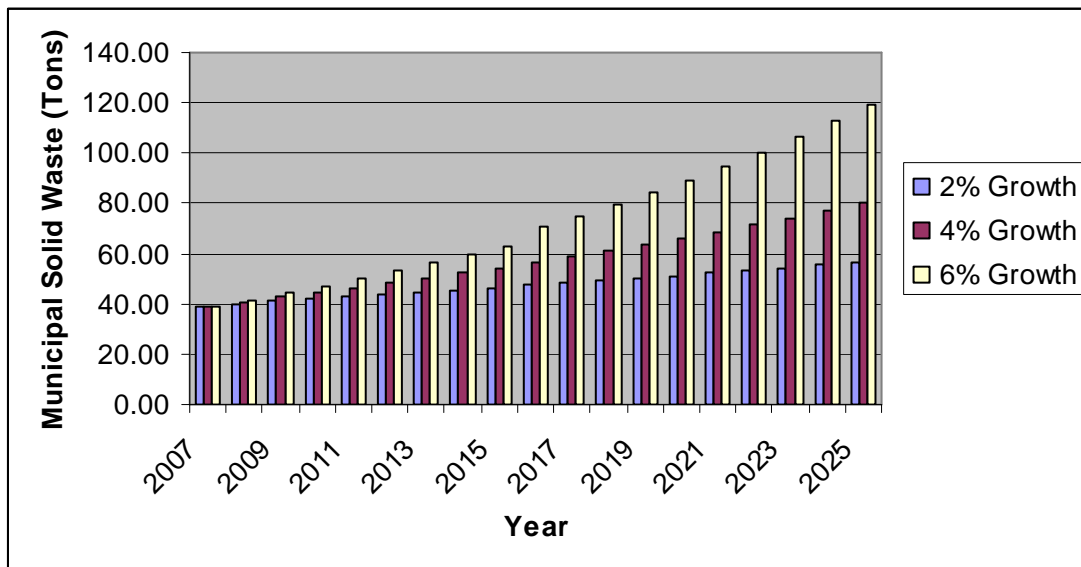


Figure 2.5: Projected MSW Generation Based on Planned Expansion of MMC Area

2.3.2 Industrial Waste

Projection of industrial waste is not possible because of the unavailability of historical data. In addition, a definite rate cannot be attached to industrial sector growth in Matale area- as there has been only a very few small scale industries established. Some of the possible industries that can set up in Matale would be mainly agro-based processing industries, apparel industries and timber based industries. However, this is only speculation as changes of policy in local or national level and economic growth can change the scenario.

2.3.3 Healthcare Waste

Healthcare waste projections were made by attaching a fixed growth rate. Figure 2.6 shows the projection for different growth rates of waste generation. The expansion of boundaries will as limited impact on healthcare waste generation, as the residents live in outskirts of the municipality obtains the services of healthcare units within the MMC.

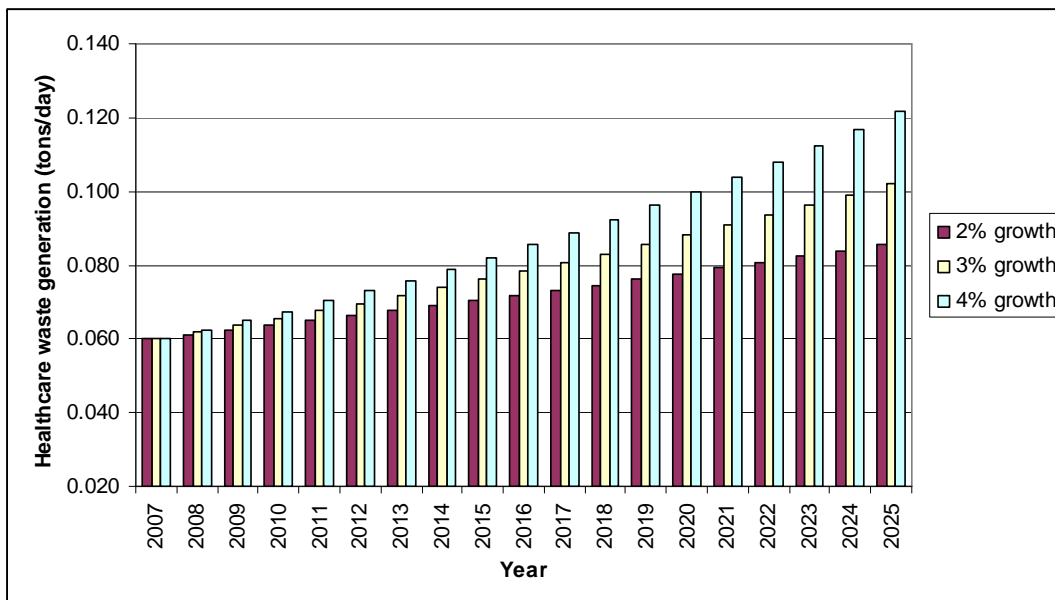


Figure 2.6: Projected Healthcare Waste Generation

Chapter 3: Analysis of Existing Solid Waste Management System

3.1 Legal Framework

The regulatory framework related to Solid Waste Management in Sri Lanka can be distinguished at National, Provincial and Local levels. The overarching legal framework for the management of MSW is the National Environmental Act (No. 47) passed in 1980.

On analysis of the framework several important Laws/Acts, Regulations/Standards and Technical Guidelines can be identified in relation to the management of Solid Waste. These have been listed below.

3.1.1 Policies at National Level

Two important policies can be identified influence the Solid Waste Management systems. The first is the **National Solid Waste Management Policy** developed to ensure environmental accountability and social responsibility of all waste generators, waste managers and service providers. It specifies the active involvement of all individuals and institutions toward integrated solid waste management. The policy also stresses on maximizing resource recovery through the proper management of Municipal Solid Waste.

The second policy applicable to ISWM is the **National Policy and Strategy for Cleaner Production** which pronounces that Cleaner Production Principles should be applied to improve efficiency of natural resource usage while maintaining and improving environmental quality. This policy is important as it specifies that waste generation should be reduced at source thereby assisting in reducing the amount of solid waste which would have to be managed by a Municipality.

Both policies are supported by strategies and action plans covering areas of Waste Reduction, Recycling and Reuse (CP policy) and Solid Waste management methodologies, capacity building, research and development, institutional strengthening, developing financial mechanisms and strengthening the legal mechanisms (Solid Waste Management Policy).

3.1.2 Laws and Acts at National Level

3.1.2.1 National Environmental Act (Act No.: 47 of 1980)

This act has wide objectives and a general mandate to protect and manage the environment. An amendment to the original act made in 1988 (act no. 56) has broadened the objectives of the Central Environmental Authority (CEA) giving it the mandate to control of the quality of the environment, prevent pollution and enhance the environment.

According to this act any person or institution which discharges, deposits or emits waste into the environment should obtain an Environment Protection Licence (EPL) from the CEA. The licence ensures all discharges are in conformity with pollution control standards stipulated in the licence. The act also makes it mandatory to require persons proposing to implement development projects in Sri Lanka to submit such proposals to an Initial Environment Evaluation (IEE) or an Environment Impact Assessment (EIA).

Therefore under the NEA any project(s) developed through ISWM Plan for the Matale Municipal Council will require an IEE or an EIA (i.e: projects such as Composting Plants, Biogas Plants and Sanitary Landfill sites etc.).

Another relevant section of the NEA, **(Section 23 K - 2)**, states that burning of solid waste without proper authorisation is prohibited. This will be an important clause in finding alternative solutions to the current practice of burning MSW.

3.1.2.2 Other Laws and Acts

(A) Food Act (*Act No.26 of 1980 – regulations under section 32 – No. 560/13, 2nd June 1989*)

(B) Code of Criminal Procedure (*Act No. 15 of 1979 - public nuisances*)

(C) Public Nuisance Ordinance (*Ordinance No.: 15 of 1862*)

(D) Municipal Council Ordinance (*Chapter 252, No.: 16 of 194*)

This is a vital ordinance as it stipulates the responsibility of a Municipal Council to ensure that streets are kept clean and free of curb side refuse. It also states that An MC is responsible for collecting waste disposed from residences and ensuring that this waste is disposed off in a proper manner. Under this law the municipality is required to collect waste from all residents living within MMC limits. It is therefore vital that the ISWM Plan include a comprehensive waste collection plan to include those households that do not receive waste collection services.

Furthermore the municipality will need to have proper infrastructure in place to dispose off solid waste in a manner that will not give rise to nuisance. Therefore constructing a properly designed landfill site will be mandatory under the IWSM Plan.

This ordinance further states that any solid waste collected by the Municipality is the property of the Municipality and and as such can be sold or disposed off as seen fit by the MC. Accordingly any money arising from such an act can be added to the Municipal Fund.

(H) Urban Development Authority Act

No.41 of 1978, Regulation No. 392/9, 10th of March 1986.

The act clearly sets down that Solid Waste generated by any residences, commercial establishments, industries etc. should be collected and disposed off in a manner that will not cause harm to the health of the people living or working therein. This act again will have a bearing on the efficient collection of solid waste from all sources within the MMC limits.

(I) By-laws on Solid Waste Management in Municipal Councils (pending parliamentary approval)

A new set of by-laws have been formulated for the management of solid waste in Municipal Council areas. It covers waste generated from several sources within a municipality including Households, Commercial establishments, Industries, Market, Street Vendors, Construction, Hospitals, Public Places and any others.

However the by-laws are not in effect as the final draft is still awaiting cabinet approval.

(J) Hazardous Waste Management Regulations

Gazette Notification No.: 924/13 of 23/05/0

The Protection and Quality Regulations under the NEA have been amended to include the storage, collection, transportation, recovery recycling or disposal of waste considered to be dangerous to human health and the environment. Accordingly waste having hazardous components as constituents and hazardous waste streams are listed under schedule 01 of the regulation. It specifies that special precautions and licences and approvals have to be obtained from the Central Environment Authority for handling and disposal of all hazardous wastes.

However a major drawback of this regulation is that it does not include healthcare waste/biomedical waste. Therefore the management and disposal of this waste maybe carried out by the generators themselves.

In the case of the ISWM Plan due consideration will have to be given to the management of hazardous waste especially in the case of household and commercial establishments. Also the ISWM Plan will be required address the gap existing in the exclusion of healthcare waste from hazardous waste.

(K) Regulations on Release of Waste Water to Environment

Gazette Notification No.: 595/16

Under this regulation no person or regulation can discharge waste waters to the environment as per the standards for discharge of effluents given in Schedule 01. Schedule 01 contains six different tolerance limits for the discharge of waste waters from different industry sectors and different discharge points.

The leachate from the landfill site of the MMC should abide by the general standards for discharge of effluents into inland surface waters. Therefore the ISWM Plan will have to include a method by which the leachate can be removed, treated and disposed off in a manner more conducive to the environment.

(L) National Environmental Regulations of 1994 on Ambient Air Quality

Amendment under Section 32 (2) of NEA 47 of 1980

Though regulations specifies permissible ambient air quality standards under Schedule 01 no direct refernce is made to impacts caused by Municpal Solid Waste.

(M) National Environmental Regulations for Mobile Air Quality (Air Emission, Fuel and Vehicle Importation Standards)

Extra-ordinary Gazette Notification 1137/35 on Regulation No. 01 of 2000

The Ministry of Environment has set out Air emission standards for all land vehicles operating within the country (stipulated in Schedule 01)

No user of a Motor vehicle is permitted to discharge emissions exceeding the limits set out in the standard. The vehicles used by MMC for collection and transportation of waste will have to meet the requirements set under the above regulation.

(N) National Environmental Noise Control Regulations

Gazette Notification No.: 924/12

(O) Regulation on Prohibition of Manufacture of Polythene or Any Product of 20 micron or below thickness

Gazette Notification No.: 1466/5 of 10/10/2006

Under this Order manufacture, sale and use of all thin plastic films which are 20 micron or below in thickness is prohibited.

The thin plastic material listed under the regulation include polyethylene, polypropylene, polystyrene, polyvinylchloride, polyethylene chlorine terephthalate or any other similar raw material used for the purpose of carrying, packing, wrapping or packaging. Therefore the use of such polythene and disposal into the Municipal disposal system should be banned.

(P) Sri Lanka Standard for Compost From Municipal Solid Waste and Agricultural Waste

SLSI 1246 : 2003

This standard specifies the National Requirements for compost produced using Municipal Solid Waste and Agricultural waste. Its intention is to promote the composting of solid waste arising from Municipal Councils and agricultural practices with minimum impacts on the environment. It also specifies the nutrient requirement as well as the physical properties the compost should show. In addition to this the standard states that the compost should not contain any materials hazardous to plant, animal or human health.

Any composting plant proposed under the ISWM Plan will therefore have to meet with the requirements of this standard.

3.1.3 Provincial and Local Levels

All National level Laws, Regulations, Ordinances, Policies and Guidelines relevant to Solid Waste Management are applicable at provincial and local level under the 13th amendment to the constitution and subsequent provisions.

In addition to this the Part XI (Laws relating to scavenging) of the Matale Municipal By-Laws are also applicable at local level. Part XI is stated below.

1. Upon the establishment of a scavenging service for the whole or any specified part of the council area, the occupier of any premises situated within an area for which such service has been established shall cause all ashes, sweepings and other refuse from his premises to be deposited in covered metal dust-bin, the height of which is not less than sixty one (61) cm and the diameter of which is not less than thirty six (36) cm at the bottom and forty six (46) cm at the top.

2. The occupier of any premises referred to in by-law 1 shall -:
 - (a). daily between such hours as the commissioner may from time to time notify by beat of tom tom or otherwise cause the bin referred to in by-law 1 to be placed by the edge of the road outside such premises but so as to cause no obstruction to traffic on the road, and
 - (b). cause the bin to be removed within half an hour of the emptying of the bin by the scavenging labourers of the council.
3. No person shall place on any road any bin referred to in by-law in 1 except between such hours as are referred to in by-law 2.
4. The occupier of any premises served by the scavenging service, other than an occupier who is exempted by the council on the ground of poverty, shall pay monthly to the council a scavenging fee at such rate as may be prescribed in that behalf of the council.
5. No person shall collect or remove dust, ashes, rubbish, refuse or filth from any street or public place within the council area, unless he is authorized to do so by the commissioner.
6. Every contravention of by-law 1 or by by-law 2 or by-law 5 shall be punishable within a fine not exceeding two hundred and fifty rupees.

3.1.4 Technical Guidelines

In addition to the laws, regulations and standards there are several **technical guidelines** prepared by the Central Environmental Authority on the management of several waste types given below.

Solid Waste Management

Used Lead Acid Batteries

Used Tyres

The technical guidelines set by the World Health Organization are used for the internal management of Healthcare wastes within hospitals in the absence of a National Law or Regulation.

3.2 Institutional Framework

There are several institutions and organizations involved in the Solid Waste Management process at Matale. They are at National Level, Provincial Level and Local Level and can be both regulators and service providers. The links between the institutions and organizations have been illustrated in the figure given below.

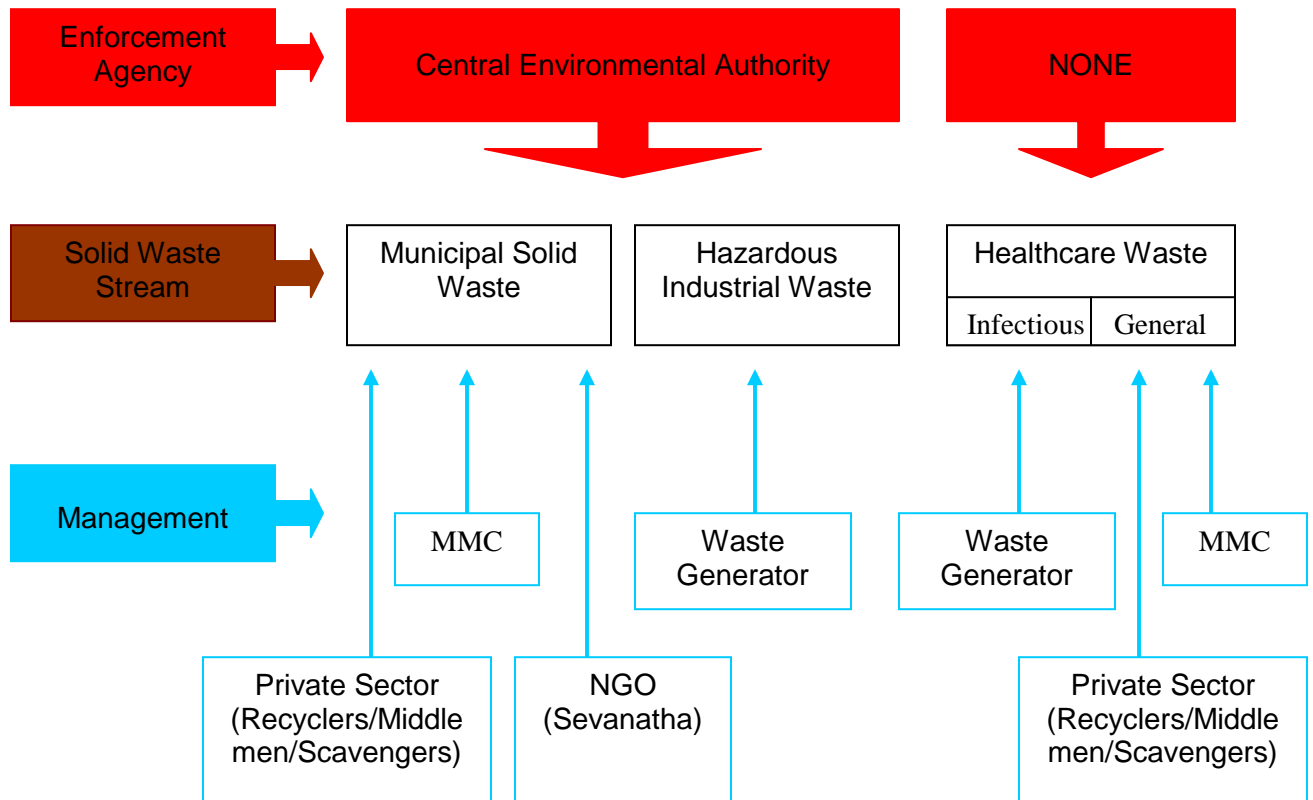


Figure 3.1: Institutions and Agencies Involved in Solid Waste Management in Matale MC

3.2.1 Roles and Responsibilities of Relevant Authorities, Institutions and Organizations

3.2.1.1 National Level

Ministry of Environment and Natural Resources

The development of the National Policy Strategy and Action Plans

Allocation of funds for Solid Waste Management through the National Budget

Providing technical expertise on Solid Waste Management

Ministry of Provincial Councils and Local Government

Providing Financial, Material and Technical assistance to Local Authorities

Coordinating with donors and national and international experts on Solid Waste Management

Creating synergy on solid waste management among neighbouring local authorities

Recognizing and rewarding best practices on Solid Waste Management by Local Authorities

Ministry of Urban Development

Developing zonal and town plans

Ministry of Health

Preparation and dissemination of Health Waste Management guidelines

Providing funding for waste management at Government Hospitals

Providing international and national technical expertise for Healthcare Waste Management

Central Environmental Authority

Developing laws and regulations related to environment

Enforcement of Environmental Regulatory framework

Urban Development Authority

Preparing guidelines on zonal planning

Project implementation

National Solid Waste Management Support Centre

The Ministry of Provincial Councils and Local Government established this centre to promote the following three strategies in line with the National Solid Waste Management strategy.

- 1) Waste Minimization
- 2) Maximize Resource Recovery through source segregation, home and centralized composting and strengthening capacity of the society
- 3) Setting up Sanitary Landfills

Several manuals and technical guidelines have been developed by this centre for the benefit of local authorities in order to facilitate the proper management of Solid Waste. The centre also acts as a facilitator in finding technical expertise and financial support required for setting up integrated solid waste management system.

This institution will be an important stakeholder in developing an ISWM Plan for Matale as it has carried out several similar projects around the country.

3.2.1.2 Provincial Level

Provincial Council of Central Province

Development of annual work plans for the central province

Allocation of budget for waste management at local level

3.2.1.3 Local Level

Matale Municipal Council

According to the National Environment Act and the Municipal By-laws the MMC is directly responsible for the management of Municipal Solid Waste within the MMC limits. This includes the collection, transportation, treatment and final disposal of municipal solid waste (excluding hazardous waste).

In order to do so the MMC receives financial resources through the national local government budgets. In addition to this the MMC receives funds through Bilateral and Multilateral Donors. It is the responsibility of the MMC to ensure that the funds received are properly managed and allocated for efficient solid waste management.

The MMC has a well defined organizational structure (Figure 3.2) in place to carry out the necessary activities. A separate Public health department has been set up under the Medical Officer Health (MOH) with four Public Health Inspectors including the Chief PHI. Each of the municipal wards is looked after by a Community Development Officer who in turn is responsible for the health and community aspects of the solid waste management system.

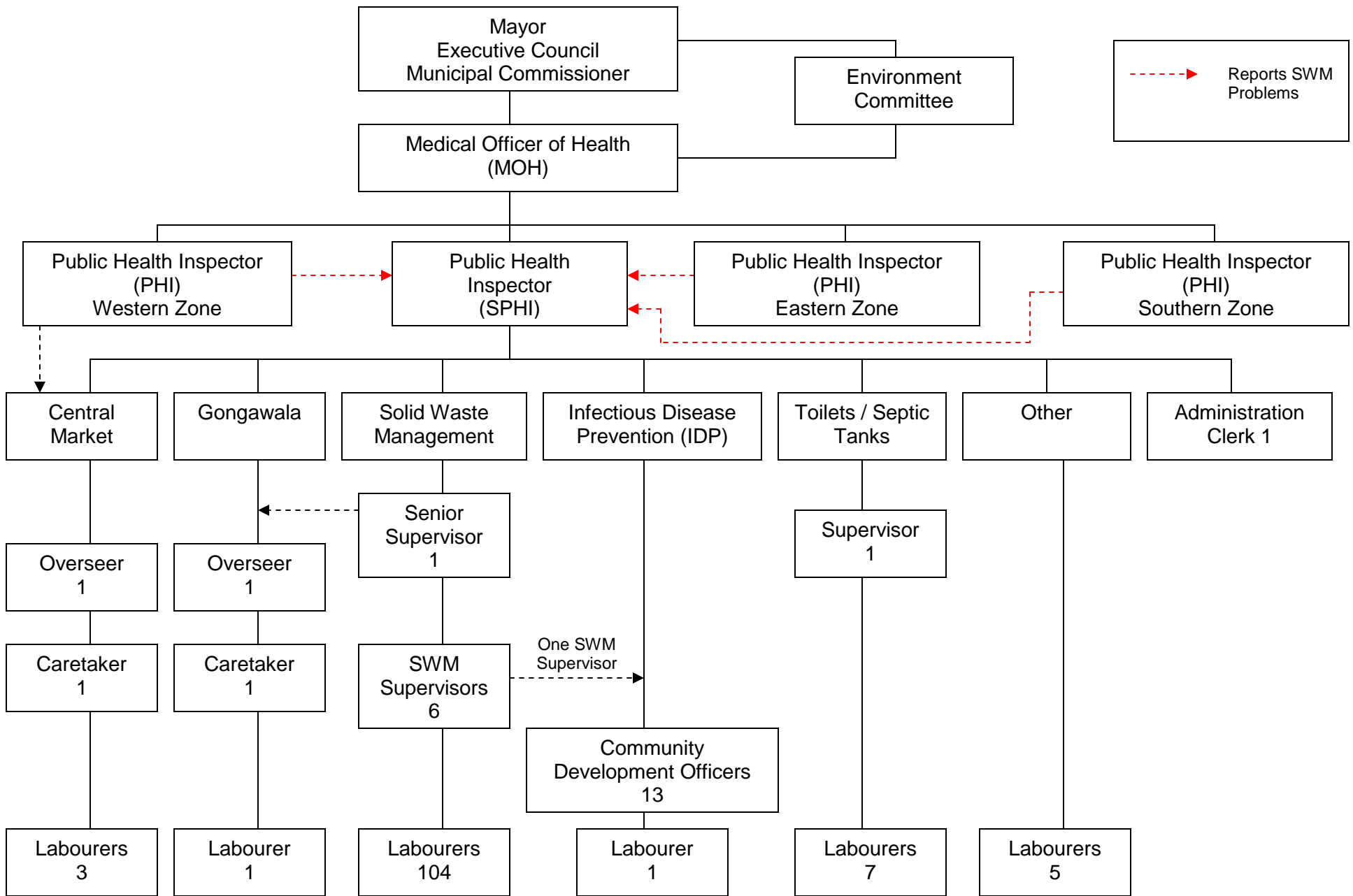


Fig 3.2: Solid Waste Management Organizational Structure at MMC

Matale Base Hospital

Responsible for managing all healthcare/biomedical waste generated by the hospital

Treating and neutralizing all infectious waste prior to final disposal

Police Department

Enforcement of laws and regulations at local level in association with the MMC

Taking legal action against persons breaching laws on the request of the MMC.

Divisional Secretariat

Responsible for registration of all businesses (including recyclers and middlemen) and other private sector providers of solid waste management services

NGOs – Sevanatha (Only NGO active in MMC)

Mobilizing the community for better participation in solid waste management activities.

Community empowerment through conducting training and awareness programmes

Operating the centralized composting plant using the Municipal Solid Waste.

Donor Organizations

Providing technical, financial and material assistance to MMC on special projects.

Capacity building of all stakeholders of Solid Waste Management

Private Sector Organizations

Investment and active participation in recycling based projects.

3.3 Financial Mechanism

The expenditure incurred for the management of solid waste has caused a heavy drain on the budget of the MMC. Therefore securing the necessary funds and careful management of available funds is a vital issue for the implementation of an effective solid waste management system. Due to existing regulations and economic situation the residents of Matale Municipal Council are not prepared to meet the cost of waste management. However, they are prepared to pay for specialized services related to environment. Therefore any Solid Waste Management plan developed for Matale should include a sound financial management strategy. The plan would have to focus on acquiring funds for development of infrastructure and purchasing of capital equipment and also the regular maintenance and upkeep of them. It also should address how to meet recurring costs for effective management of solid waste.

The current situation regarding the income and expenditure for solid waste management is analyzed in the following chapter with the objective of identifying existing gaps.

3.3.1 Total Income Generation for the Matale Municipal Council

Table 3.1 gives the total income of the municipal council for the years 2005 to 2007. According to the financial information provided by the MMC it is clear that the total income generation by the MMC has increased in the past three years. While the subsidy provided by the National Government has decreased over the years allocation from the Local Government and MC budgets have steadily increased from 2005 – 2007.

Almost all major financial contributions for development activities undertaken in the MMC area were covered by the Subsidiary provided through the Local Government and the MC budget.

| Matale Municipal Council- Total Fund Statement (LKR) | | | |
|---|--------------------|--------------------|--------------------|
| Year | 2005 | 2006 | 2007 |
| Subsidy from National Govt. | 4,527,042 | 1,096,622 | 1,832,209 |
| Subsidy from Local Govt. | 5,240,221 | 14,017,271 | 16,211,366 |
| Allocation From M.C. Budget | 96,523,500 | 100,261,900 | 165,010,550 |
| Donations/donor funding | 494,208 | 0 | 0 |
| Income through Services offered | 6,629,085 | 6,927,675 | 8,975,000 |
| Total | 113,414,056 | 122,303,468 | 192,029,125 |

Table 3.1: Total income for Matale Municipal Council (2005 – 2007)

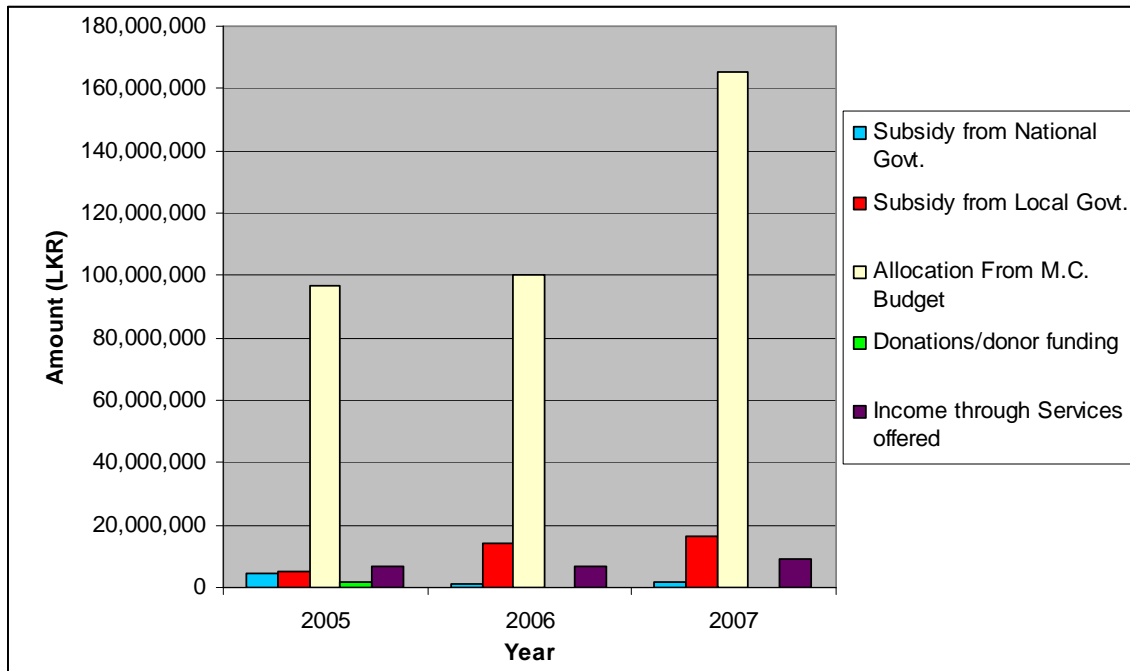


Figure 3.3: Comparison of Funding Received by MMC from 2005 - 2007

3.3.2 Income Generation through Environmental Services Offered

The revenue generated through the services offered by the MMC to the public is only around 5% - 6% of the total income. The income from environmental services amounts to around 34% of the revenue generated through the total services offered. Moreover the revenue from environmental services amount to only 2% of the total income generated.

| Environmental Service Offered | Income from Service offered (LKR) | | |
|-------------------------------|-----------------------------------|------------------|------------------|
| | 2005 | 2006 | 2007 |
| Gully Sucker | 688,774 | 733,133 | 923,873 |
| Cremations | 1,294,000 | 926,000 | 1,496,000 |
| Burials | 62,250 | 113,425 | 100,270 |
| Monuments | 180,000 | 230,000 | 290,000 |
| Meat transport | 163,573 | 189,184 | 281,037 |
| Total | 2,388,597 | 2,191,742 | 3,091,180 |

Table 3.2: Income from the Environmental Services offered

In further analyzing the Environmental Services Offered by the MMC it becomes clear that Solid Waste Management within the MMC area is not included. The current practice is that a fee for solid waste management is included in the "Municipal Rates" (Taxes).

Table 3.2 shows the separate income categories coming under the environmental services offered and the individual revenues generated. The solid waste management costs are therefore covered by the money which could have been allocated for Development Projects in the MMC.

3.3.3 Total Expenditure for Solid Waste Management by the Matale Municipal Council

| Stage | Cost item | Annual Expenditure Breakdown (LKR) | | |
|--------------------------|------------------|------------------------------------|-------------------|-------------------|
| | | 2005 | 2006 | 2007 |
| Collection | Labour | 5,900,000 | 7,675,000 | 7,776,000 |
| | Equipment | 150,000 | 200,000 | 250,000 |
| | Other | 95,000 | 100,000 | 115,000 |
| | Sub Total | 6,145,000 | 7,975,000 | 8,141,000 |
| Transport | Labour | 2,200,000 | 2,700,000 | 2,800,000 |
| | Vehicle hire | 1,420,047 | 1,883,987 | 2,172,696 |
| | Fuel | 517,450 | 2,877,423 | 1,950,000 |
| | other | 4,000 | 6,500 | 7,500 |
| | Sub Total | 4,141,497 | 7,467,910 | 6,930,196 |
| Recycling | Sorting Centre | 8,919 | 9,651 | 11,907 |
| | Labour | 38,750 | 39,500 | 22,600 |
| | Other | 1,405 | - | - |
| | Sub Total | 49,074 | 49,151 | 34,507 |
| Disposal | Labour | 400,000 | 540,000 | 550,000 |
| | Equipment | 22,500 | 25,000 | 32,000 |
| | Site rental | - | 350,000 | 250,000 |
| | Other | 236,834 | - | - |
| | Sub Total | 659,334 | 915,000 | 832,000 |
| Miscellaneous | Labour | 350,000 | 265,000 | 300,000 |
| | Equipment | 125,000 | 45,000 | 42,000 |
| | Fuel | 125,000 | 28,000 | 25,000 |
| | Other | 4,500 | 2,000 | 3,500 |
| | Sub Total | 604,500 | 340,000 | 370,500 |
| Total Expenditure | | 11,599,405 | 16,747,061 | 16,308,203 |

Table 3.3: Breakdown of Expenditure for Solid Waste Management

Table 3.3 shows the breakdown of the total expenditure incurred by the municipal council of Matale for Solid Waste Management during the last three years. According to this information it is obvious that the cost of solid waste

management has increased from rupees 11.5 Million to rupees 16.7 Million in 2006 which is an increase of nearly 45%.

| Year | Breakdown in Expenditure per Cost Item (LKR) | | |
|----------------|--|-------------------|-------------------|
| | 2005 | 2006 | 2007 |
| Labour | 8,888,750 | 11,219,500 | 11,448,600 |
| Equipment | 1,717,547 | 2,153,987 | 2,496,696 |
| Site | 8,919 | 359,651 | 261,907 |
| Fuel | 642,450 | 2,905,423 | 1,975,000 |
| Other Expenses | 341,739 | 108,500 | 126,000 |
| Total | 11,599,405 | 16,747,061 | 16,308,203 |

Table 3.4: Summary of Expenditure for Solid Waste Management

As seen in the table above each of the cost items contributing to the total expenditure has increased over the last three years with the exception of the other expenses. The most prominent increases were in the labour costs and the fuel costs.

The reason for this increase can be accounted to the increase in salaries and the fuel prices which took place in 2006 and 2007. The expenditure breakdown is further illustrated in the graphs given below.

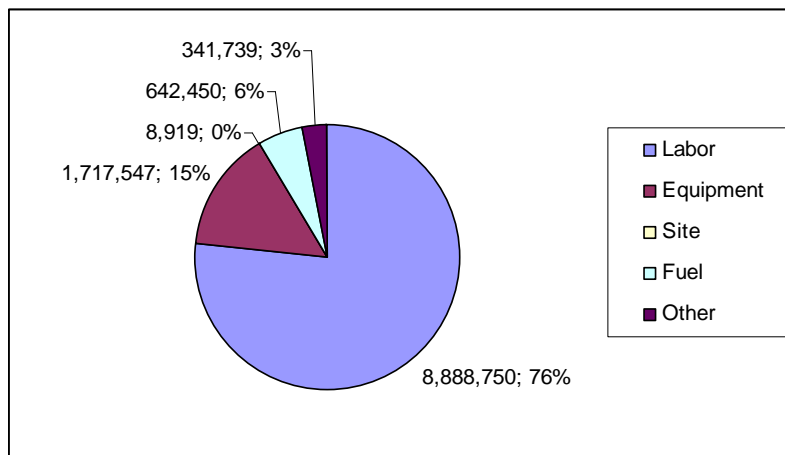


Figure 3.4: Breakdown of Expenditure for 2005

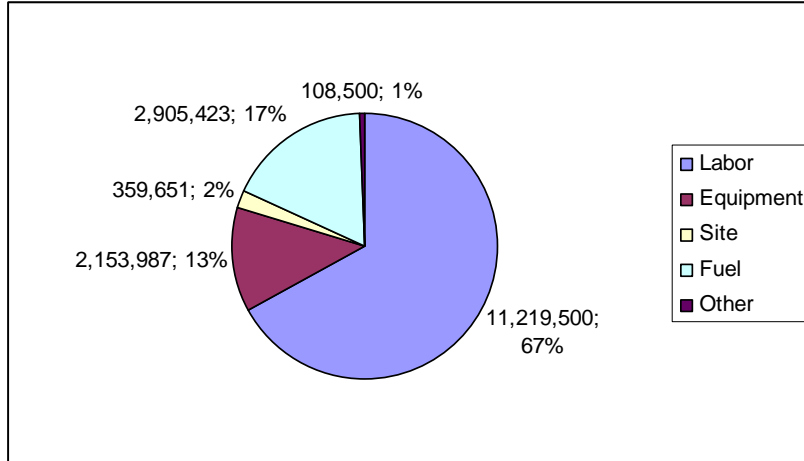


Figure 3.5: Breakdown of Expenditure for 2006

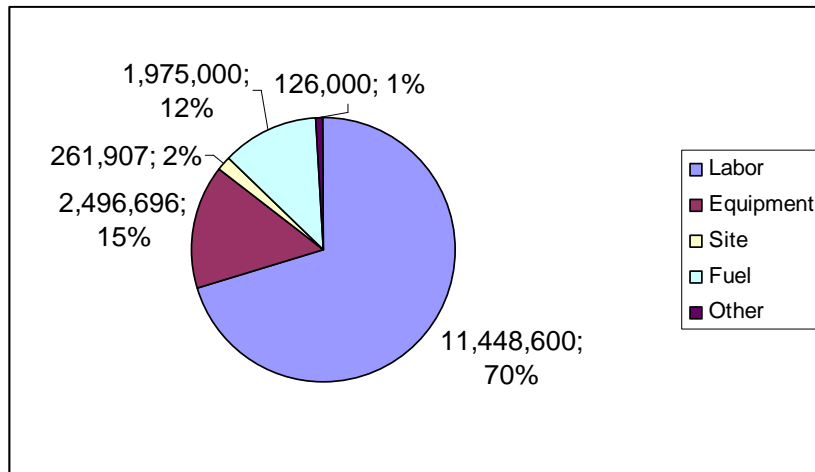


Figure 3.6: Breakdown of Expenditure for 2007

| Year | Breakdown in Expenditure Stage-wise (LKR) | | |
|---------------|---|-----------|-----------|
| | 2005 | 2006 | 2007 |
| Collection | 6,145,000 | 7,975,000 | 8,141,000 |
| Transport | 4,141,497 | 7,467,910 | 6,930,196 |
| Recycling | 49,074 | 49,151 | 34,507 |
| Disposal | 659,334 | 915,000 | 832,000 |
| Miscellaneous | 604,500 | 340,000 | 370,500 |

Table 3.5: Expenditure for Solid Waste Management based on Stages

As depicted in the table above the highest cost is incurred for the Collection and Transport of Solid Waste. When comparing this data with Table 2.4 it is evident that the labour charges, equipment costs and fuel charges related to the collection and transportation of solid waste places the biggest burden on the MMC financial resources.

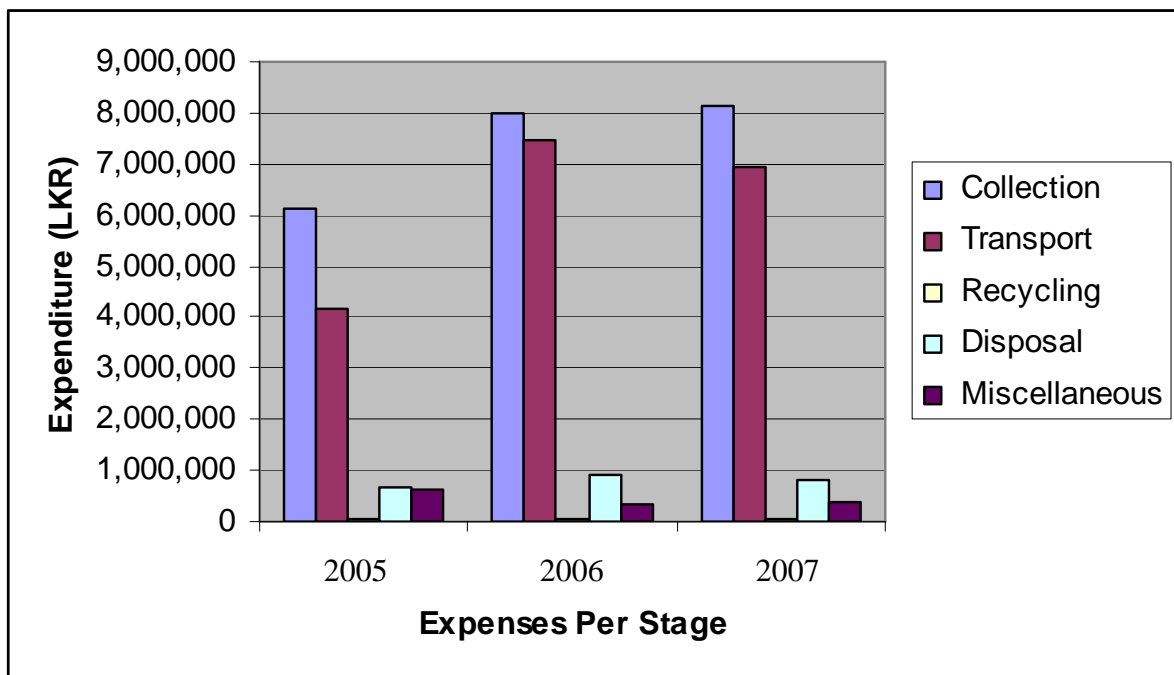


Figure 3.7: Expenditure per Stage per Year

The above table shows that while the collection cost has risen continuously over the period 2005 – 2007 the cost of transportation after the increase in 2006 was reduced in 2007. Comparatively the cost of recycling and disposal has been insignificant.

3.3.4 Summary of Financial Situation of Solid Waste Management at MMC

The above tables and graphs indicate that the highest expenditure of solid waste management is on labour. The labour cost of waste management in MMC has risen from rupees 8.89 Million in 2005 to rupees 11.45 million in 2007. In addition to this the cost of fuel and equipment too has increased over time. The cost of fuel after rising drastically in 2006 has come down by 2007. The cost of hiring equipment has also shown a considerable increase.

The highest costs incurred by the MMC under Solid Waste Management can be attributed to the collection and transport stages. The collection cost increased from rupees 6 Million in 2005 to rupees 8 Million in 2007. In the meantime the cost of transporting waste rose from rupees 4 Million in 2005 to rupees 7.5 Million in 2006. However it is interesting to note that the MMC has reduced the cost of transport in 2007. This could be credited to the fact that the fuel costs were reduced in 2007.

The total cost of Solid Waste Management increased from rupees 11.6 Million in 2005 to rupees 16.3 Million in 2007. However income from Environmental Services to MMC was only around rupees 3 Million in 2007 (refer table 2.2). Therefore MMC was able to recover only 18% of its total expenditure for Solid Waste Management in through the income from environmental services (2007). The remaining rupees 13.3 Million expenditure had been borne by the MMC from the funds they have for the other development work in the municipal area.

| Year | 2005 | 2006 | 2007 |
|---|-------------|-------------|-------------|
| Total funds received by the MMC (LKR) | 113,414,056 | 122,303,468 | 192,029,125 |
| Income from Environmental Services (LKR) | 2,388,597 | 2,191,742 | 3,091,180 |
| Total Expenditure on Solid waste Management (LKR) | 11,599,405 | 16,747,061 | 16,308,203 |
| Income from Environmental Services as Percentage of Expenditure (%) | 20.5 | 13 | 19 |
| Expenditure as a percentage of Total Funds Received (%) | 10.2 | 13.7 | 8.4 |

Table 3.6: Summary of Income and Expenditure for 2005, 2006, 2007

| | Units | 2005 | 2006 | 2007 |
|-----------------------------|-------|------------|------------|------------|
| Total Cost | LKR | 11,599,405 | 16,747,061 | 16,308,203 |
| Total Population | No. | 41,250 | 41,875 | 42,500 |
| Total Annual Waste Disposed | Tons | 12,700 | 13,400 | 14,125 |
| Expenditure Per Capita | LKR | 281.2 | 400 | 383.7 |
| Expenditure Per Ton | LKR | 913 | 1,249 | 1,154 |

Table 3.7: Expenditure on Solid Waste Management per Capita and per Ton

Note: The figures for 2005 and 2006 are based on calculations made from data available for 2007

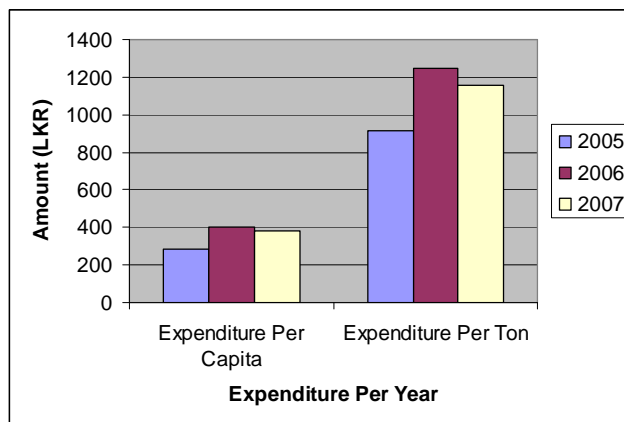


Figure 3.8: Yearly Comparison of Expenditure per Capita and per Ton

3.4 Technology Used

The waste management technology used by the Matale Municipal Council and by other institutions and organizations are often primitive in nature. There are currently very few identifiable environmentally sound technologies being used at any point of the Solid Waste Management life cycle. Those which are used are inadequate to meet the full extent of the solid waste generated at Municipal Level.

In addition to this no planned systems have been developed for the management of Hazardous waste. Usually any hazardous waste being generated is not collected by the MMC. Therefore the actual management methods are ambiguous. Another result of this is that the disposal of such waste is usually the responsibility of the generator (eg: Base Hospital) and usually the waste is disposed off with little consideration to the impact on the environment and the people in Matale.

The following chapter discusses the different technologies being used within the MMC at each phase of the waste management cycle including technologies and practices that are used by waste generators that do not use the MC system.

3.4.1 Primary Collection and Transport

3.4.1.1 MC Assisted Collection of Municipal Solid Waste:

The bulk of the MSW generated within the Matale city area is collected via the waste collection system operated by the MMC. Around 70% of the residences, commercial establishments and industries use this disposal system.

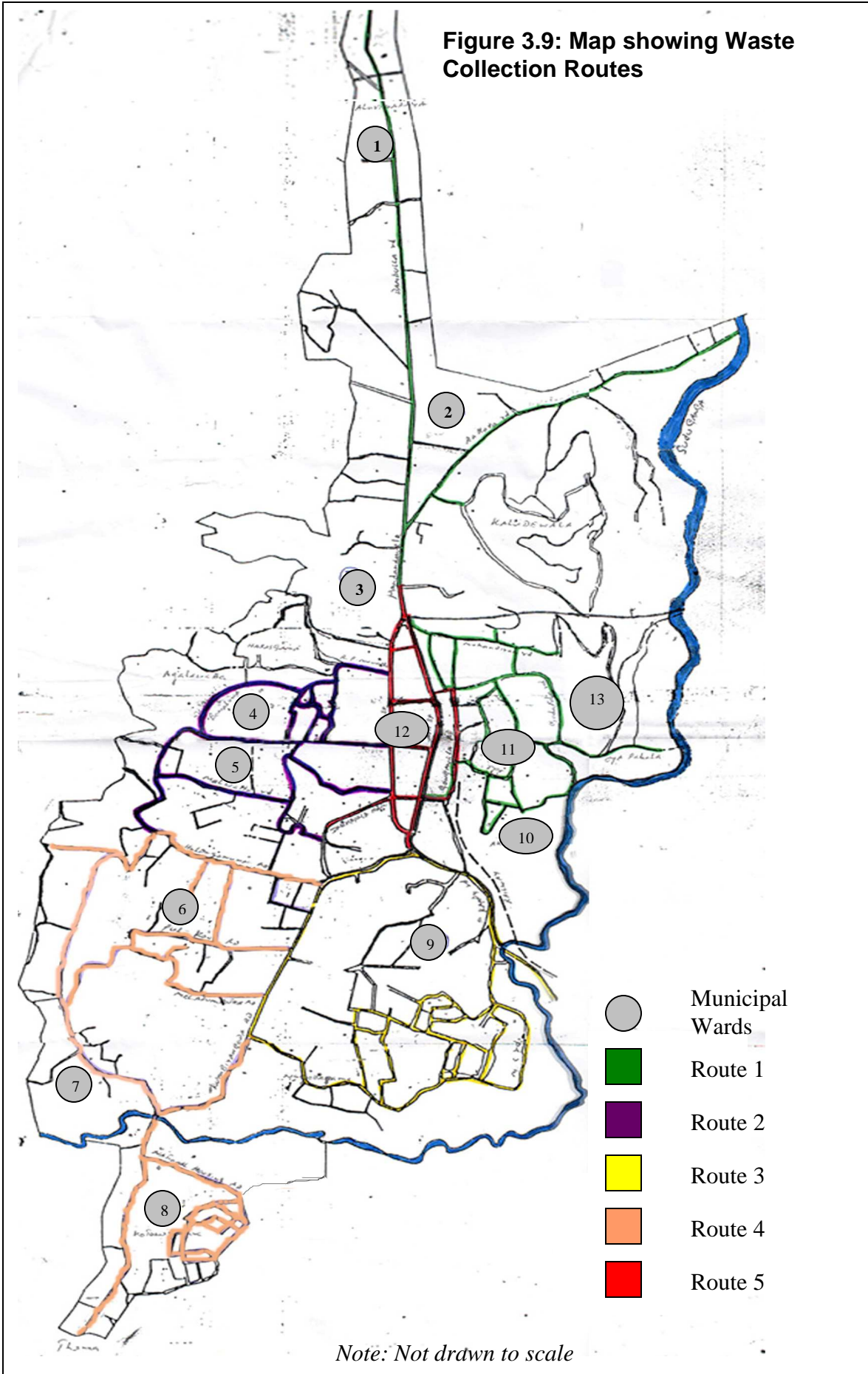
The Matale Municipal Council area has been subdivided into 13 Council Wards and the waste collection system has been designed in a manner to cover all the wards. The solid waste collection routes can be distinguished as follows.

| Route | Areas/Road Covered | Collection Frequency |
|--|--|----------------------------|
| Route 1 | Station Road, Gongawela Road, Dole Road, Dolewatta, Akkaramale, Hussein Avenue, Oya pahala, Tharalanda, Godapol Road, Muhandiram Road, Mandandawela, Aluviharaya | Daily |
| | Rattota Road | Once in Two Days |
| Route 2 | Malwatta Road, Vihara Road, Bomaluwa Road, Agalawatta, Richard Pamunuwa Road and By-roads in that area | Daily |
| | Harasgama | Once in Two Days |
| Route 3 | Kandy Road, M.C. Road, by-roads in M.C. Road area, Nagolla Road | Daily |
| | Nagollagama | Once in Two Days |
| Route 4 (Old Bell Collection Route) | Hulangamuwa Road, Dodandeniya, Kumbiyangoda, Thenna, Kotuwegedara, and National Housing Scheme | Monday Wednesday Friday |
| Route 5 Night Scavenging | Dharmapala Mawatha, Main Street, Kings Street, All Cross Streets and Gongawela. | Daily |
| Rout 5 Poultry & fish Waste Collection | Kings St, Mandandawela, Main St, Godapola Road, Gongawela Road, and Kandy Rd. | Daily |

Table 3.8: Collection Routes and Frequency

Note: These routes are illustrated in Figure 3.9

Figure 3.9: Map showing Waste Collection Routes



Residences and commercial establishments situated in the Gongawala ward (including the Market place at MC road) separate their organic waste component to be given to “Sevanatha (NGO) for composting. This includes around 1200 establishments that do not use the MMC collection system.

In addition to the Mobile collection system there are several stationary collection bins, trailers and hand carts positioned around the MMC area to facilitate solid waste collection. A large concrete bin which was constructed to collect solid waste is not being used by the public. What was most evident was that the waste was being deposited along the road sides. This practice is prevalent in the main commercial area which is situated between King Street and Trincomalee Street. In many cases the solid waste is directly onto the road side though in some cases plastic/polythene bags may be used.

As a practice the waste collectors sweep and collect street side waste into larger heaps (“sweepings”) to be collected by the tractors which follow. The only intermediate collection points that exist are open dumps where waste collected by handcarts and other methods are brought together to facilitate loading into larger vehicles. One such intermediate dump is available close to the Market place where the wastes collected by the 10 handcarts are brought together for collection by a 4 wheel tractor trailer. This practice has led to the presence of scattered garbage around the city limits which are often disturbed by animals (dogs, cows, goats etc.) causing poor sanitary conditions.

Waste Collection, Transportation and Handling are carried out by the use of a variety of vehicles. The vehicle fleet details are highlighted in table 3.9.

| Vehicle | Reg. No. | Make | Year | Purchase Status | Unit Price (LKR) | Lifetime (years) | Capacity (m ³) |
|-------------------------------|--------------------|---------------|------|-----------------|------------------|----------------------|----------------------------|
| 4-Wheel Tractor (no.1) | 37-9103 | MF 240 | 1991 | Brand new | 600,000/= | 8 | |
| 4-Wheel Tractor (no.2) | 49-9957 | MF 240 | 1998 | Brand new | 865,000/= | 8 | |
| 4-Wheel Tractor (no.3) | HK 9297 | John Deer | 2001 | Brand new | 700,000/= | 8 | |
| 4-Wheel Tractor (no.4) | HK 9303 | John Deer | 2001 | Brand new | 700,000/= | 8 | |
| Trailers (2 Nos.) | HK 7695 HK 7690 | John Deer | 2001 | Brand new | 46000/= | 5 -10 | 6.60 |
| Fully Covered Trailers (JICA) | Not Available | | 1998 | | 215,000/= | 8 | |
| Trash Compactor 1 | 227-6727 | UD Nissan | 1999 | Used | 800,000/= | 3-6 | 7.50 |
| Trash Compactor 2 | GI-1602 | | 2000 | Used | 450,000/= | Not in Working Order | 3.7 |
| Dumper | JN 2796 | TATA | 2003 | Brand new | 2,100,000/= | 8 | 10 |
| Hand carts (10 Nos.) | Not available | Not available | | Brand New | 15,000/= | 4 | 0.40 |
| Gully Sucker | 42-7553 | ISUZU | 1991 | Brand New | 2,000,000/= | 8 | 7 |

Table 3.9: Vehicle and Other Equipment Used for Waste Collection, Transportation and Handling

Note: Compactor No. 2 is currently not in use due to breakdown

A Bell collection system was initiated in the areas covering Hulangamuwa Road, Dodandeniya, Kumbiyangoda, Thenna, Kotuwegedara, and the National Housing

Scheme in 2003 with the assistance of the JICA project. The collection routes are still in place though no bells are being used as they are not in working order.

3.4.2 Treatment

3.4.2.1 Sorting Centres

Two sorting centres are in operation at MC road and Dole road where a certain portion of the recyclable material such as plastics, paper and metal are sorted out. They serve as resource recovery stations and the sorted out material are sold to recyclers outside of Matale.

The sorting centres were initiated by the MMC under the Sustainable City Programme. Residents in the relevant areas are required to separate their waste into recyclable and non-recyclable waste streams to be collected by the MMC waste collectors separately. The recyclable waste is then taken to the centres where they are sorted and stored until sold to recyclers.

3.4.2.2 Scavenging

There is an informal scavenging system operating within the MMC which provides the basis for the recovery of a considerable portion of the valuable resources. The scavenging operations can be distinguished in three levels. The first level of scavenging is carried out by the MMC waste collecting employees who remove the valuable material such as metals, cardboard and plastics from the waste stream during the collection process itself. The second level of scavenging occurs at the land fill site where once the waste is dumped people living in the vicinity sort out the remaining valuable resources from the waste stream.

In addition to this there is a traditional system of individual waste collectors going door to door collecting plastic, paper metal, glass and other marketable resources. These collectors are generally known as “Botal Pattara Karaya” (collector of bottles and paper).

The material collected through scavenging is either directly sold to recyclers outside Matale District or to middle men operating in the city as there are no recyclers or recycling industries within the Matale district (accepting the NGO operated composting plant).

3.4.3 Final Disposal

3.4.3.1 Municipal Land Fill

The final disposal system used by the Matale Municipal Council is the open Landfill. Though the term land filling is used by the MMC it is not an engineered sanitary landfill.

The landfill site is situated in Wariyapola Watte which is outside the Matale Municipal Council boundary (Ukuwela Pradeshiya Sabha). The total land area available to the MMC for its waste dumping activities is around 2.5 acres. The MMC is facing difficulties with the landfill as it is leased from a private party at the rate of Rs. 25,000 per month. The MMC does not have its own land for this purpose. The lease period is now expired and an extension of three months has been granted.

The system of waste disposal at the landfill is a mix between the sandwich system and the cell system. The solid waste collected by the tractors are brought to the MMC landfill and dumped at a suitable location. This waste is then covered with soil. However the solid waste is not levelled out before being covered by the soil as it should be done in the case of sandwich systems. The study conducted

for the preparation of the waste inventory found that on average around 10 – 12 tractor loads of Municipal Solid Waste is dumped at the landfill site daily.

The landfill site is situated along the bank of the river 'Sudu Ganga' which is a major fresh water source in the Matale District. On rainy days the landfill site becomes muddy and unstable. The solid waste even though covered by a layer of soil is penetrated by rain water and leachate is generated. Even on dry days this leachate can be seen collected in a small ravine between the dumping areas. This leachate is neither collected nor blocked from entering the water way. The water quality downstream of the landfill site has degraded due to pollution by this leachate.

The landfill site is also a feeding ground to birds, cows dogs and other animals. The buried waste is pulled or dug out of the ground causing poor sanitary conditions at the site. The situation at the landfill site is further aggravated during rain when the top soil is washed off and the waste and mud is exposed causing bad odour.

3.4.3.2 Open Burning

Several waste generator including the hospital use open burning as a method for disposal of solid waste. In the case of the Base hospital infectious wastes such as cotton wool and dressings as well as glass vials are burnt onsite. However the hospital is currently in the process of constructing an incinerator for the treatment of infectious wastes, glass ware and sharps before final disposal through burial.

The MMC also uses open burning at the landfill site as a means of reducing the waste volume and increasing the space available for dumping. This usually happens during the dry season.

Furthermore households that are either not serviced by the MMC collection system or prefer not to use this collection system burn their solid waste on site.

Open burning cannot be condoned as an acceptable method for solid waste disposal and the very use of this method can be identified as a major gap in the overall solid waste management system in Matale.

3.4.4 Recycling and Resource Recovery

3.4.4.1 Central Composting Plant Operated by NGO “Sevenatha”

| | |
|---------------------------|---|
| Design Capacity | : 2 Tons/day |
| Actual Quantity Processed | : Approx. 1 Ton/day |
| Human Resources | : 2 Officers 6 Labourers |
| Collection Vehicles | : 1 Two-wheel Tractor 4 Handcarts |
| Other Machinery | : 1 Chopper 1 Polythene sealer |
| Waste Received from | : Around 1200 Residences and Commercial Establishments (including Market Place) within the Gongawala Ward |

The composting unit is situated on a 40 perch land area on the Dole road (Gongawala Ward). Though the design of the plant allows for processing around 2 tons of organic wastes at the moment it operates only at half its capacity. The compost produced at this plant is sold at a price of Rs. 20 per kilogram. The main buyers include road construction companies (horticultural purposes), farmers and other horticulture businesses in the area.

3.4.4.2 Home Composting

Around 500 households have established source separation where the organic component is separated from other waste streams and composted onsite. Several different composting methods including the Barrel System, Pit System and the Bio Composting System “jeeva kotuwa” are used at household level. Around 475 cement type composting barrels and 350 metal type barrels have been provided to houses in the Matale MC area. Out of these barrels the metal type ones which were provided by the World Health Organization under the “Healthy City Programme” are unusable due to corrosion. The cement type barrels were handed over to the public under two separate projects. Of the 475 barrels 275 were given through the Central Environment Authority while 200 numbers were given by the MMC under the “Green City” project. These barrels are currently in use.

In addition to the residential composting several institutions and commercial establishments also have composting systems in place. The V T Nanayakkara Park and several other public places also use the Bio Composting Systems known as the “jeeva kotuwa” for composting organic waste. There are around 100 Bio composting units in the MMC area.

3.4.4.3 Recycling

The recycling of material within MMC area is limited as there are no recycling industries present. Any material collected for recycling is either sold to middle men operating in the MMC area or to recyclers outside of the Matale district.

3.5 Gaps, Barriers and Constraints

3.5.1 Regulatory Frame Work

- No regulations or standards have been developed to address the following areas of Municipal Solid Waste Management
 - Segregation of waste
 - Primary Storage
 - Intermediary Transfer Stations
 - Treatment of Solid Waste
 - Design Construction and Operation of Recycling Plants
 - Design Construction and Operation of Sanitary Landfills
 - Health care waste
 - Electronic Waste
 - Construction and Demolition waste

- In certain instances though regulations exist on controlling emissions and discharges to maintain the final quality of environment, the activities leading to the emission/discharge are neither addressed nor prohibited.

Eg: The ambient air quality standards have been stipulated by the **National Environmental Regulations of 1994 on Ambient Air Quality** (*Amendment under Section 32 (2) of NEA 47 of 1980*) the open burning of solid waste is not addressed.

- The acts and regulations already existing are not effectively enforced due to the lack of human resources. The human resources available do not have the right capacity to carry out the enforcement work. This has been further worsened by the fact that the necessary infrastructure and finances are unavailable.

- Though the standards and technical guidelines prepared are comprehensive they are available only for a few waste streams.
- No laws or regulations are in place nationally to ensure that the guidelines prepared for Management of Municipal Solid Waste is adhered to by the relevant authorities/institutions.
- No effective economic instruments (positive or negative) are available in Sri Lanka to support the enforcement of laws and regulations. This is a major gap identified in the case of the entire regulatory system throughout the lifecycle, from generation to disposal of solid waste. Where there are changes in the form of fines and levies the amount is usually too small to make any real impact on the polluter.

3.5.2 Institutional Framework

- There is a lack of coordination among the institutions/authorities responsible for the enforcement of the laws and regulations causing ambiguity and confusion.
- The ownership of roadways is under the Road Development Authority while the ownership of Drains is under the Municipal Council. Therefore issues arise maintaining and cleaning of these areas.
- In addition to this there is a lack of political commitment to implement the action plans as well as ensuring enforcement of regulations.
- The management of Healthcare wastes such as infections wastes as well as Hazardous industrial waste is carried out by the generators themselves. Therefore there is no method to ensure that the waste is handled and disposed off in an environmentally sound manner.

3.5.3 Financial Mechanism

- The MMC does not receive any direct income from Solid Waste Management. The income received through environmental services is mostly from indirect services offered to residents. As of now this income is inadequate to cover the total cost of Solid Waste Management.
- The MMC has to bear remaining cost of solid waste management from the funds received for city development work or from the revenue taxes received from the residents. This results in a shortfall of funds for other development activities.
- MMC does not have adequate funds for capital equipment purchases. The non availability of appropriate capital equipment severely hinders the effectiveness and efficiency of solid waste management. The MMC has opted for hiring or leasing capital equipment from external parties to perform the necessary tasks which in turn has caused a heavy drain of funds. In addition to this lack of funds for the purchase of spare parts and other components has caused delays in repair and maintenance work of broken down capital equipment causing further inefficiencies.
- The non availability of funds forces the MMC to look for donors assistance especially in procuring required capital equipment, meeting the cost of other infrastructure related to waste management and starting special projects on solid waste management.
- Since the existing Solid Waste Management system does not include an effective segregation stage most of the recyclable solid waste is disposed off at the landfill site. Therefore the MMC unwittingly loses a potential income from the sale such recyclable waste. On the other hand this non degradable waste causes the landfill to fill up soon and extra land space is

required. Finding a new landfill site is also an added expense to the already burdened MMC.

- The quantity of degradable solid waste could be converted to compost and this could help the MMC to earn about Rs. 1.8 million per annum as extra revenue. (This figure was estimated based on a minimum price of Rs. 2,500 per Ton of compost sold).
- The non availability of a proper landfill is a serious issue and the existing dump site causes numerous health and social problems. The contract for the existing dump site will expire by March 2007 and the MMC will have to reinvest on a new landfill site. This again will mean that further funds will have to be used up to procure or hire such a site.
- The MMC will require an Engineered Sanitary Landfill which will amount in excess of LKR 100 million.

3.5.4 Technology

3.5.4.1 Collection

- Around 2000 residences within the MMC area are not serviced through the MMC waste collection system. The Gangaboda area within Kaludewala (Ward 13) is totally excluded from the MMC collection system while waste removal in other areas within Kaluadewala takes place only once a week. In addition to this a by-lane off the MC road is also excluded from the MC collection route.
- The MMC faces a shortage of collection vehicles and employees which leads to the above short comings. Another issue identified by this study is that the bells used for “bell collection” are not in working order.

- The mechanical status of the waste collecting equipment and vehicles is poor leading to frequent breakdowns. This indicates that the maintenance of such equipment is not carried out in the proper manner reducing the total capacity for collection.
 - Eg: The two compactors used for waste collection were off road due to breakdowns for a considerable time period. Though one has now been fixed the second has still not been repaired.
- The hand tools used in the collection process such as shovels, ekel brooms and hoes are not in good condition. Employees use inappropriate and often improvised collection methods in the absence of proper equipment. The manual handling of waste is high and this can lead to safety hazards. In the absence of cane baskets for manual transfer of solid waste employees were seen to be using polyurethane sacks.
- The capacity of MMC employees to carry out the waste collection and disposal in a hygienic and environmentally sound manner is not given adequate attention.
- The employees have been issued with some personal protective equipment (PPEs) such as gloves and boots. The employees stated that the PPEs are issued once a year and are not replaced in between even if damaged or unusable.
- The use of PPEs was not evident during the collection process. Even where gloves were used the quality and type of gloves were not suitable for handling solid waste. Gloves provided to the employees are made of fabric. In addition to this no boots were worn during the waste collection process.

- Lack of appropriately designed intermediate transfer stations.
- The public waste collection bins are poorly designed and prove difficult to empty. Furthermore only one bin is placed at one spot promoting commingled waste disposal.
- A major gap effecting waste collection is the lack of public participation. Waste is generally disposed anywhere at anytime with no consideration to the surroundings. There seems to be very little awareness among the general public on the proper procedures for waste disposal.

3.5.4.2 Treatment

- The sorting centres operated by the MMC are very basic in nature and the sorting is carried out manually. Therefore the effectiveness and efficiency of the sorting operation is low.
- The scavenging operations are not streamlined and therefore prove to be haphazard in nature. Most times the scavengers are afraid that what they do is illegal and do the sorting of waste in a secretive manner. Developing this already established and spread out waste sorting system has therefore proven difficult.

3.5.4.3 Final Disposal

- The land filling system used is open dumping where a thin layer of soil is put over the waste. This is often inadequate to keep the waste covered and out of reach of animals.

- The MMC does not own its own waste disposal site. Due to this the MMC is in a situation of uncertainty. At the moment the current landfill site will only be available for three months.
- As the land fill is not engineered it causes many impacts on the surrounding environment. The study found that leachate collected from the solid waste flows into the adjoining river (Sudu Ganga) and the measures taken by the MMC to mitigate this problem has proven inadequate. The method used is to grow trees between the dumpsite and the water body which has not taken into account that the leachate can percolate through the layers of soil into the water table and the river.
- Odour arising from the land fill site is a nuisance to the residents living in close proximity to the area.
- The site has also become a breeding ground for flies, mosquitoes and rodents as it is open to the environment.
- The disposal system has had clearly distinguishable impact on the surrounding ecosystem. Several trees in the vicinity of the land fill were noted to be dying.

3.5.4.4 Recycling and Resource Recovery

- Though a centralized composting plant has been constructed it is unable to operate at full capacity. The major reason for this is that the market for the final product is not established within the Matale District.
- The waste exchange system that exists within the MMC area is informal in nature and not coordinated to include all marketable wastes. It is based on

individual contacts and does not include all types of waste. As a result of this part of the recyclable/reusable material is lost at the landfill site.

- There are no recyclers in the Matale district and therefore price of the recyclable material is often decided by middlemen. The price received for recyclable material is a factor affecting the level of material collected for recycling within the MMC.
- Since commingled waste disposal is prevalent and the segregation at source is not a statutory requirement the recyclable material are usually unclean. This results in such material having to market value and ending up at the Landfill.
- Since recycling technology is usually expensive and complex investment into micro level recycling businesses have not occurred.

Chapter 4: Targets Set for Matale MC

4.1 Vision for Matale Municipal Council

“A Clean and Green City”

4.2. Mission of Matale Municipal Council

“In this Historic city of Matale whilst paying due attention to the social, economic, and welfare needs of its resident population and visitors to the city. We are fully committed to accomplish an maintain at the highest level of efficiency our health services, roads welfare facilities and all utility services within as environmental friendly atmosphere”

4.3 Target Setting for Matale MMC:

4.3.1 Qualitative Targets

- GENERATION: Reduce volume of per capita waste generated
- GENERATION: Segregation of all waste streams at source prior to collection
- COLLECTION: Provide waste management services to all within the municipal area
- COLLECTION: Improve the efficiency of the waste collection system
- RESOURCE RECOVERY: All waste streams sorted and material/resources recovered from waste streams using the reuse and recycle techniques
- BIOLOGICAL TREATMENT: All organic wastes to be composted and where ever possible used for biogas generation
- FINAL DISPOSAL: Convert landfill sites into engineered sanitary type landfills

- FINAL DISPOSAL: Reduce waste sent for landfill site with final objective of zero waste
- INDUSTRIAL WASTE: Apply 3R concepts to all industrial wastes
- HAZARDOUS WASTE: All hazardous wastes to be segregated, treated and disposed safely
- AWARENESS AND TRAINING: All residents to be given thorough awareness and training
- COMMUNITY PARTICIPATION: Streamline and increase community participation in waste management practices

4.3.2 Quantitative Targets

(A) Short Term Targets (2008-2012)

- 15% reduction in waste generation at all sources
- 50% of the waste to be segregated at source
- Provide waste management services to 50% of the community that is not being served
- Four biogas and compost stations to be built to process 40% of the organic wastes
- 50% of the recyclable waste (including construction waste) to be transferred through waste exchange
- 50% of the recyclable waste (including industrial waste) to be converted to value added material through small industries
- 100% of the hazardous wastes to be segregated at source and sent for safe treatment and final disposal
- 100% of the community to be given awareness on proper solid waste management
- 10% of the community to be actively participating in solid waste management program
- Find adequate and suitable landfill site for waste disposal

(B) Long Term Targets (2013-2025)

- 30% reduction in waste generation at all sources
- 100% of the waste to be segregated at source
- Waste management services to be provided to entire community of the MMC
- 75% of the organic waste to be processed and treated using most appropriate technologies
- 75% of the recyclable waste to be converted to value added material through industries
- 20% of the community to be actively participating in solid waste management program
- Develop a fully engineered sanitary landfill for disposal of hazardous and residual wastes

Note: Other short term targets will continue to be applied in the longer term

Chapter 5: Stakeholder Concerns

The Stake Holder Consultation Workshop to identify Issues of Concern was held on the 11th and 12th of February 2008 at the Clover Grange Hotel in Matale. This event was organized by the Matale Municipal Council and attended by His Lordship the Mayor of Matale, Deputy Mayor, Council Members and the Municipal Commissioner. In addition to the officials of the MMC, the event was also graced by Mr. Surya Prakash Chandak, Deputy Director of UNEP-IETC Japan. The workshop was conducted by officers of the National Cleaner Production Centre in Sri Lanka.

The issues of concern highlighted by the stakeholders were further analysed to identify the gaps and constraints of the current system and practices which would have to be addressed in the ISWM Plan. These gaps and barriers were identified for each component of the solid waste management system. (Refer report on Stakeholder Consultation Workshop).

5.1 Framework Developed for Waste Management Actions

The ISWM Plan will not be able to address all issues raised by stakeholders. Therefore it is necessary that the issues listed in the Report on the Stakeholder Concerns workshop be prioritized and the most relevant issues be chosen. The most important factor considered in doing so are the targets set by the MMC. These targets will have to be met by resolving the issues identified. Therefore due consideration was given to those issues that have direct bearing on the overall achievement of quantitative targets. Here the short term targets were given priority over the long term targets.

The following weightage was decided on for the purpose of prioritizing the issues.

- 0 - No Impact on relevant Target
- 3 - Medium Impact on relevant Target
- 5 - High Impact on relevant Target

According to this scoring system all issues scoring 15 points or above for both target groups will be taken as high priority issues while issues that score 10 points or above for any one of the target groups will be considered as medium priority issues when. These issues have been listed below.

| Component | Gaps | Constraints | Scoring (Shot Term Targets) | | | | | | | | | Total | Scoring (Long Term Targets) | | | | | | | Total |
|---------------------------|--|--|--------------------------------|----|----|----|----|----|----|----|----|-------|--------------------------------|----|----|----|----|----|----|-------|
| | | | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | T9 | | t1 | t2 | t3 | t4 | t5 | t6 | t7 | |
| Source Segregation | 1 Waste Segregation is not carried out at source due to lack of bins/bags. | <ul style="list-style-type: none"> There are no financial mechanisms available to provide segregation bins/bags to residents. The residents expect the segregation bins to be provided to them free of cost or at a very low price. | 5 | 5 | 0 | 3 | 3 | 3 | 5 | 0 | 3 | 27 | 5 | 5 | 0 | 3 | 5 | 3 | 3 | 24 |
| | 2 The current waste management system does not include a fee to be paid by the community for waste disposal. | <ul style="list-style-type: none"> The residents expect the MMC to make incentives to people who segregate waste at source. The residents are not ready to segregate waste if no financial benefit is received in doing so. | 3 | 5 | 3 | 0 | 0 | 0 | 3 | 0 | 0 | 14 | 3 | 5 | 3 | 0 | 0 | 5 | 0 | 16 |
| | 3 Majority of residents in the Matale MC area do not accept responsibility for segregating solid waste at source. | <ul style="list-style-type: none"> People do not understand the true value of waste. Many households did not have enough space to accommodate segregation bins. Certain residents are not ready to store waste for more than one day. | 3 | 5 | 0 | 0 | 3 | 3 | 3 | 5 | 3 | 25 | 5 | 5 | 0 | 3 | 3 | 5 | 3 | 24 |
| | 4 The solid waste separated at source is mixed during collection and transportation. This acts as a de-motivating factor on the community. | <ul style="list-style-type: none"> The MMC does not have the equipment or vehicles required to collect and transport the separated solid waste streams. The skills of the sanitation workers on handling separated waste streams are poor. Therefore the waste is usually mixed during collection. | 0 | 5 | 0 | 5 | 5 | 5 | 3 | 0 | 0 | 23 | 0 | 5 | 0 | 5 | 5 | 3 | 3 | 21 |
| | 5 Low awareness among general public. | <ul style="list-style-type: none"> Very few awareness campaigns have been held targeting the general public. The community does not have ready access to information on Solid Waste Management or Environment. Therefore no continuous information dissemination takes place. The environmental centre constructed under a JICA funded project is not in operation as this building is being used for a different use. The language barrier is a major factor in the case of Matale. Some people may not understand if material is prepared only in Sinhala. | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 20 | 5 | 5 | 0 | 0 | 0 | 5 | 0 | 15 |
| | 6 MMC officers working in the Health Department do not have the necessary technical expertise to provide | <ul style="list-style-type: none"> Proper training and retraining of MMC employees is not carried out. Often training is provided to the wrong people. | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 5 | 3 | 17 | 3 | 3 | 3 | 0 | 0 | 3 | 0 | 12 |

| | | | | | | | | | | | | | | | | | | | | |
|-------------------|---|--|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|----|
| | advice to the community. | | | | | | | | | | | | | | | | | | | |
| | 7 The two centralized segregation plants operated by the MMC are unable to cope with the total solid waste generated in Matale. | <ul style="list-style-type: none"> • There isn't sufficient number of central segregation points within the Matale MC area. • The existing segregation points are small in capacity and are run manually. Therefore efficiency of these plants is low. • The centres are situated in a way that they can cater only to certain areas within the MMC. • Many residents are opposed to setting up centralized segregation plants as they feel such plants are not operated properly and will only be waste dumpsites. They do not want waste stored in their neighbourhood | 3 | 3 | 0 | 5 | 5 | 5 | 3 | 0 | 0 | 24 | 3 | 3 | 0 | 3 | 5 | 3 | 3 | 17 |
| | 8 Community participation is inconsistent | <ul style="list-style-type: none"> • Not all members of the community participate in MMC initiated community driven activities as they are not in good terms with the MMC. • Many of the high income residents do not participate in community based activities. | 5 | 5 | 3 | 3 | 3 | 0 | 3 | 5 | 5 | 32 | 5 | 5 | 3 | 3 | 3 | 5 | 3 | 27 |
| | 9 No treatment or disposal systems for hazardous wastes. | <ul style="list-style-type: none"> • The segregated hazardous waste disposal will become a burden to the residents. Residents are unwilling to separate hazardous wastes such as outdated medicines, fluorescent bulbs etc. from the general waste unless a disposal option is given to them | 5 | 5 | 0 | 3 | 0 | 0 | 5 | 0 | 0 | 18 | 5 | 5 | 0 | 3 | 0 | 0 | 3 | 16 |
| | 10 The current waste separation and recovery is carried out through an informal scavenging system which is not well developed or spread out to cover all recyclable wastes. | <ul style="list-style-type: none"> • Scavengers are usually sanitation workers of MMC or residents living close to the landfill site. They operate in secret thinking that scavenging is illegal. • Not all recyclable material is scavenged. | 0 | 3 | 0 | 0 | 5 | 5 | 0 | 0 | 3 | 16 | 0 | 3 | 0 | 0 | 5 | 0 | 0 | 8 |
| | 11 The value of waste collected through scavenging is lower than the market value. | <ul style="list-style-type: none"> • The waste segregated through scavenging is unclean as they are often mixed with food waste and other contaminants. No cleaning of waste is carried out by the scavengers and therefore the value of the waste is lessened. | 0 | 3 | 0 | 5 | 5 | 0 | 0 | 0 | 3 | 16 | 0 | 3 | 0 | 0 | 5 | 3 | 3 | 14 |
| Collection | 1The waste collection frequency and timing is considered to be unsatisfactory by the community | <ul style="list-style-type: none"> • The MMC does not have adequate waste collection equipment or vehicles. • MMC does not have adequate capital to purchase new equipment. • The number of sanitation workers (labourers) is not enough to meet the growing waste disposal quantity in Matale. The number of workers has not risen in relation to the growth in population, economy or waste generation. • The drain system in Matale needs to be | 5 | 3 | 5 | 0 | 0 | 0 | 3 | 3 | 5 | 24 | 5 | 3 | 5 | 0 | 0 | 3 | 3 | 19 |

| | | | | | | | | | | | | | | | | | | | | |
|--|--|---|---|---|---|---|---|---|---|---|----|----|---|---|---|---|---|---|----|----|
| | | <p>cleaned very often due to waste being disposed into drains. This is a heavy drain on the sanitation department and results in waste collection not being done properly.</p> <ul style="list-style-type: none"> • The existing Provincial council system does not allow for increase in the cadre of sanitation employees at MC level. • There is a high absentee level among sanitation workers as many are engaged in other employment. This is a result of the low income of such workers that drive them to do other work to earn more. | | | | | | | | | | | | | | | | | | |
| | 2 The technical condition of collection vehicles and equipment is poor | <ul style="list-style-type: none"> • The equipment and vehicles procured by or donated to the MMC are usually used ones. These equipments therefore have a lower lifetime. • The maintenance of collection equipment and vehicles is not carried out in a regular manner. There are also issues in finding the right spare parts for the vehicles. | 3 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 8 | 3 | 0 | 5 | 0 | 0 | 0 | 3 | | |
| | 3 The health of Sanitation Workers is impacted negatively | <ul style="list-style-type: none"> • The MMC does not have funds to replenish PPEs to employees if they are damaged. • The procurement procedure for PPEs does not look into the quality of the equipment. Often the PPEs are chosen based on the price. • The employees do not use the supplied PPEs as they feel these to be uncomfortable or useless. • The PPEs provided are not suitable for handling solid waste. • No regular medical check ups are conducted for sanitation workers. | 3 | 0 | 5 | 3 | 0 | 3 | 0 | 3 | 17 | 3 | 0 | 5 | 3 | 3 | 0 | 0 | 14 | |
| | 4 Waste collection is inefficient and does not cover the entire MMC area | <ul style="list-style-type: none"> • The community disposes its waste anywhere and anytime with little consideration on the environment. Therefore people tend to dispose off their waste by roadsides after the MMC collection is complete. • MMC cannot cover all areas within its limits due to lack of equipment and staff. • The sanitation workers do not have required hand tools to collect curb side waste and have to use makeshift tools. • Some of the roads and areas in the MMC area are inaccessible by the collection vehicles. • During rainy days the disposal site becomes inaccessible and the collection is stopped • MMC does not have facilities to dispose off construction waste, hazardous waste and yard | 5 | 3 | 5 | 3 | 3 | 3 | 5 | 0 | 3 | 29 | 2 | 3 | 5 | 3 | 3 | 5 | 0 | 21 |

| | | | | | | | | | | | | | | | | | | | | | |
|-----------------------|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|----|---|
| | | <p>waste. Therefore these streams are not collected.</p> <ul style="list-style-type: none"> Some resident are unwilling to allow sanitation worker to enter their compound to collect waste for security reasons. Therefore this waste is left by the roadside where stray animals break open the bags and pull out the waste. | | | | | | | | | | | | | | | | | | | |
| | 5 No properly designed central solid waste collection points | <ul style="list-style-type: none"> The two central collection points are open trailers where waste collected is exposed. There aren't adequate numbers of central collection points around the Matale city to help in waste collection. People in MMC area do not use central disposal points and curb side bins and the waste is usually thrown directly onto the roadsides. | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 6 |
| Transportation | 1 MMC does not possess adequate number of transportation vehicles | <ul style="list-style-type: none"> The number of transportation vehicles is not enough to meet the current waste disposal in Matale. MMC does not have adequate funds to procure new vehicles and usually hire vehicles as needed. Some of the collection vehicles are in very poor condition as they are not maintained properly. This leads to frequent breakdowns. Repairs take long as spare parts are unavailable and this has further reduced the fleet. | 3 | 3 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 14 | 3 | 3 | 5 | 0 | 0 | 0 | 3 | 14 | |
| | 2 Use of unsuitable vehicles for waste transportation | <ul style="list-style-type: none"> Some of the vehicles donated to the MMC are unsuited to the terrain in Matale. Therefore these vehicles cannot go into all areas within the MMC limits. The waste transportation tractors cannot get to the landfill site during rainy days as the road way becomes muddy and slippery. This affects the collection routine. The waste transportation is carried out in open tractor trailers. Therefore the waste spills onto the roads during transportation. | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 10 | |
| Treatment | 1 Waste streams are not treated prior to final disposal | <ul style="list-style-type: none"> MMC is unable to invest in waste treatment plants such as incinerators as the cost of constructing and operating such plant is expensive. MMC is unaware of the treatment technologies available or to decide on which technology is most suited to Matale. The technical officers of MMC have had little or no exposure to environmental technologies | 0 | 5 | 3 | 0 | 0 | 0 | 5 | 3 | 0 | 16 | 0 | 5 | 3 | 3 | 0 | 0 | 5 | 16 | |

| | | | | | | | | | | | | | | | | | | | | |
|-----------------------|---|--|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|----|
| | | <p>and are unaware of the importance of treating waste before disposal.</p> <ul style="list-style-type: none"> The government hospital does not have an incinerator designed for treating infectious and hazardous waste. | | | | | | | | | | | | | | | | | | |
| | 2 The final disposal of hazardous waste generated by industries, commercial establishments and residences is the responsibility of the generator and is not carried out in a proper manner. | <ul style="list-style-type: none"> Existing environmental regulations are not stringently applied to ensure hazardous wastes are treated before disposal. The relevant infrastructure is not available in Matale to assist in waste treatment. The hazardous waste is directly disposed to the environment without proper treatment or with inadequate treatment | 3 | 5 | 3 | 0 | 0 | 0 | 5 | 0 | 0 | 16 | 3 | 5 | 3 | 0 | 0 | 0 | 5 | 16 |
| | 3 There is very little awareness at community level as to the importance of waste treatment prior to disposal | <ul style="list-style-type: none"> There isn't a dedicated information dissemination system within the Matale MC area. Treatment procedures are often looked at in a negative manner as causing negative environmental impacts as opposed to reducing such impacts. The communication level between MMC and the community is low. Often the community has a poor esteem and very little trust on the MMC. This can be a barrier in convincing the community on setting up waste treatment plants. | 0 | 0 | 3 | 3 | 3 | 3 | 5 | 5 | 5 | 27 | 0 | 0 | 3 | 3 | 3 | 5 | 5 | 19 |
| Final Disposal | 1 Lack of a properly designed engineered landfill site | <ul style="list-style-type: none"> The capital cost of setting up an engineered landfill will be beyond the MMC limits. The community is not ready to pay an extra fee for disposing waste to a landfill. MMC does not own its own land area within the MMC limits which would be suitable for constructing a landfill. If a land outside the MC limits is used to build a sanitary landfill the residents of these areas will be opposed as they receive no benefits from it. | 3 | 3 | 3 | 3 | 0 | 0 | 5 | 0 | 0 | 17 | 3 | 3 | 3 | 3 | 0 | 0 | 5 | 17 |
| | 2 The existing disposal site does not belong to the MMC | <ul style="list-style-type: none"> Currently the MMC spends around Rs. 300,000 per annum as rental fee for the land used as the landfill site. The landfill site which was being used by the MMC was leased from a private party. This lease will expire in March 2008 after which finding a new land for the disposal will be a problem. | 0 | 0 | 3 | 0 | 0 | 0 | 5 | 0 | 3 | 11 | 0 | 0 | 3 | 0 | 0 | 3 | 5 | 11 |
| | 3 The disposal method used is inadequate | <ul style="list-style-type: none"> The current disposal system used is the "cell method". However as the soil layer placed | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 0 | 0 | 10 | 0 | 0 | 5 | 0 | 0 | 0 | 5 | 10 |

| | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|----|
| | | <p>middle men operating from the Matale area and that setting up direct recycling industries can lead to such small enterprises going out of business.</p> <ul style="list-style-type: none"> • Only middlemen operate from Matale town to collect waste material and sell them to recyclers outside Matale • The prices of recyclable material are controlled by the middlemen and are maintained at less than market values. | | | | | | | | | | | | | | | | | | |
| | 2 Lack of Community support for setting up recycling plants | <ul style="list-style-type: none"> • People are not willing to recycle their waste because middle men maintain the prices at less than market value. • People do not feel it is their responsibility to recycle their waste. The usually accepted practice is to directly dispose off to the environment. • The community in general does not trust that recycling plants will be operated in a proper manner and feel that they can pollute the environment | 5 | 5 | 0 | 5 | 5 | 5 | 0 | 3 | 3 | 31 | 5 | 5 | 0 | 5 | 5 | 3 | 0 | 23 |
| | 3 People are unaware of the value of waste and therefore the importance of recycling waste. | <ul style="list-style-type: none"> • The price of products made of virgin raw material is cheaper than products made of recycled material. There is no price control on goods made from virgin material. • Lack of public awareness on the importance of recycling waste streams. • People in Sri Lanka are not keen to buy products made from recycled waste. The general feeling is that such products will be of low grade. • There are no laws and regulations in Sri Lanka to support recycling of material such as plastics, paper and glass mandatory | 5 | 5 | 0 | 0 | 5 | 5 | 0 | 5 | 5 | 30 | 5 | 5 | 0 | 5 | 5 | 5 | 3 | 28 |
| | 4 Organic waste is not recycled fully and more than 70% ends up at the landfill site. | <ul style="list-style-type: none"> • In the case of home composting many people are not properly aware of how to choose the right composting technique or the equipment. • The compost produced by the central composting plant is not monitored on a regular basis to ensure that it meets with the National standards. Therefore people are not willing to buy this product. • There aren't any biogas plants in Matale • People usually feel that the quality of compost is not as high as chemical fertilizers. • The practice of adding outdated medicines into the composting bins in homes results in the compost being hazardous in nature. • There aren't sufficient investors to set up | 3 | 5 | 0 | 5 | 0 | 0 | 0 | 0 | 5 | 18 | 5 | 5 | 0 | 5 | 0 | 5 | 3 | 23 |

| | | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|----|
| | | composting plants | | | | | | | | | | | | | | | | | | |
| | 5 Biogas production is not used as a method to recycle organic waste. | <ul style="list-style-type: none"> • Lack of exposure to existing technologies. • The quality of the municipal organic waste may not be suitable for production of biogas. • The efficiency of a biogas plant that runs on municipal solid waste is considered to be low. • There are no operating procedures and standards developed to ensure that the biogas plants are operated efficiently. • The community may be unwilling to use biogas prepared from waste for cooking as they would consider it unhygienic. • There are no investors to set up biogas plants as they are not considered to be financially sustainable businesses. | 3 | 3 | 0 | 5 | 0 | 0 | 0 | 5 | 3 | 19 | 3 | 3 | 0 | 5 | 0 | 3 | 3 | 17 |

5.2 High Priority Issues

5.2.1 Segregation at Source

The foremost issue identified under this phase is that segregation of solid waste prior to disposal is not a customary within the MMC. Several financial, technical and social constraints were identified during cause analysis and these are listed below.

Financial

- There are no financial mechanisms available to provide segregation bins/bags to residents.
- Majority of the residents are unable to procure bins/bags as they can be costly and therefore expect such equipment to be provided free of cost or at a very low price.

Technical

- The MMC does not have the equipment or vehicles required to collect and transport the separated solid waste streams. Therefore even after waste streams are segregated they are mixed up during collection and transportation.
- The skills of the sanitation workers on handling separated waste streams are poor. Therefore the waste is usually mixed during collection.
- Several waste streams are not collected by the MMC. This includes hazardous waste such as outdated medicines, fluorescent bulbs etc. Since no alternative disposal system is available for residents to use many are unwilling to separate hazardous wastes from the general waste.
- The community does not have ready access to information on Solid Waste Management or Environment. Therefore no continuous information dissemination takes place.
- The environmental centre constructed under a JICA funded project is not in operation as this building is being used for a different use.

- The language barrier is a major factor in the case of Matale. Some people may not understand if material is prepared only in Sinhala
- Very few awareness campaigns have been held targeting the general public.

These issues will need to be immediately addressed by the ISWM Plan as reducing waste being disposed to the MMC collection system will be beneficial to both the MMC as well as the residents in Matale.

The two centralized segregation plants were identified as an alternative to source segregation. However these plants were considered to be inadequate and unable to cope with the total solid waste generated in Matale.

- The existing segregation points are small in capacity and are run manually. Therefore efficiency of these plants is low.
- The centres are situated in a way that they can cater only to certain areas within the MMC.

Social

- People do not understand the true value of waste.
- People do not feel it is their responsibility to participate in Solid Waste Management through source segregation.
- Many households are small and do not have adequate space to accommodate segregation bins.
- Certain resident are not ready to store waste for more than one day.
- Not all members of the community participate in MMC initiated community driven activities as they are not in good terms with the MMC. This is especially true in the case of high income residents.

An important aspect to consider if centralized segregation plants are to be recommended by the ISWM Plan is that many residents are opposed to them due to the presumption that they will only be waste dumpsites. Another factor is

that residents are uncomfortable with waste being “stored” in their neighbourhood. These social factors will need to be addressed by the plan.

5.2.2 Collection

Though several issues were identified under this topic they all result from the fact that the existing collection system is inefficient and unable to provide services to the entire MMC area. There is also a lack of trust on the MMC by the resident in the area. These factors contribute to make matters worse in regards to waste collection. The following constraints have been identified to be addressed by the ISWM Plan.

Financial

- MMC does not have adequate capital to purchase new collection equipment, hand tools or PPEs.
- MMC does not have the finances to increase the number of sanitation workers or to increase the wages of the workers to reduce absenteeism.

Technical

- The MMC does not have adequate waste collection equipment or vehicles. Therefore MMC cannot collect waste from all areas within its borders.
- The number of sanitation workers (labourers) is not enough to meet the growing waste disposal quantity in Matale. (The number of workers has not risen in relation to the growth in population, economy or waste generation.)
- The existing Provincial council system does not allow for increase in the cadre of sanitation employees at MC level.
- The drain system in Matale needs to be cleaned very often due to waste being disposed into drains. This is a heavy drain on the sanitation department and results in waste collection not being done properly.
- The sanitation workers do not have required hand tools to collect curb side waste.

- Some of the roads and areas in the MMC area are inaccessible to the collection vehicles.
- During rainy days waste collection in MMC area is stopped as the disposal site becomes inaccessible to the vehicles.
- MMC does not have facilities to dispose off construction waste, hazardous waste and yard waste. Therefore these streams are not collected.

Social

- There is a high absentee level among sanitation workers as many are engaged in other employment in addition to working at the MMC. This is a result of the low income of such workers that drive them to do other jobs to earn more.
- The community disposes its waste anywhere and anytime with little consideration on the environment. A major problem faced by the MMC is that people dispose off their waste by roadsides after the MMC collection is complete.
- Some resident are unwilling to allow sanitation worker to enter their compound to collect waste for security reasons. Therefore this waste is left by the roadside where stray animals break open the bags and pull out the waste.

5.2.3 Transportation

None of the issues related to transportation of waste are considered as high priority.

5.2.4 Treatment

None of the waste streams are subjected to appropriate treatment prior to final disposal. This is a major problem especially in the case of hazardous wastes generated at households and medical institutions. In many cases this waste is disposed directly into the MMC collection system and disposed off at the landfill

site. This is a major issue to be addressed by the ISWM Plan as the impact on the environment and health of the people in Matale area are directly impacted due to this practice.

In addition to the environmental and health impacts this also leads to people being unwilling to separate out their hazardous waste streams at the source. Many residents felt that separated hazardous wastes will become a burden to them as no alternative treatment and disposal methods were available.

The following issues are important to be considered by the plan when developing treatment systems/plants.

Financial

- MMC is unable to invest in waste treatment plants such as incinerators as the cost of constructing and operating such plant is expensive.

Technical

- MMC is unaware of the treatment technologies available or to decide on which technology is most suited to Matale.
- The technical officers of MMC have had little or no exposure to environmental technologies and are unaware of the importance of treating waste before disposal.
- There isn't a dedicated information dissemination system within the Matale MC area and the result of this matter is that the community is not aware of the importance of treating wastes especially hazardous wastes prior to disposal.
- The government hospital does not have an incinerator appropriately designed for treating infectious and hazardous waste.
- The relevant infrastructure is not available to assist in waste treatment.
- Existing environmental regulations are not stringently applied to ensure hazardous wastes are treated before disposal.

Social

- Treatment procedures are often looked at in a negative manner as causing negative environmental impacts as opposed to reducing such impacts.
- The communication level between MMC and the community is low. Often the community has a poor esteem and very little trust on the MMC. This can be a barrier in convincing the community on setting up waste treatment plants.

5.2.5 Final Disposal

The MMC disposes off all municipal solid waste on a land that is leased from a private party. This lease will expire in March 2008 and the MMC is having trouble locating a new land area suitable for this purpose. Currently the MMC spends around Rs. 300,000 per annum as rental fee for the land used as the landfill site. Though the MMC feels the need to develop an engineered sanitary landfill several issues have made this difficult.

Financial

- The capital cost of setting up an engineered landfill will be beyond the MMC limits.
- The community is not ready to pay an extra fee for disposing waste to a landfill.

Technical

- MMC does not own its own land area within the MMC limits which would be suitable for constructing a landfill.
- Existing environmental regulations are not stringently applied to ensure hazardous wastes are treated before disposal.
- Final disposal of hazardous waste generated by industries, commercial establishments and residences is the responsibility of the generator and is not carried out in a proper manner.

Social

- If a land outside the MC limits is used to build a sanitary landfill the residents of these areas will be opposed as they receive no benefits from it.

5.2.6 Recycling and Resource Recovery

Though most of the valuable material from the waste streams such as metals, glass and plastics are collected by scavengers and door-to-door collectors these materials are not sold directly to recyclers. There is a noticeable lack of recycling industries in the Matale area. The following issues were identified as important to be addressed by the plan.

The first issues identified are in regards to the recyclable or non-organic material.

Financial

- Funding required to set up small scale recycling plants is not available.
- No investors currently available to invest in businesses related to recycling. One major drawback identified here is that sufficient raw material would not be continuously available from waste generated within the MMC area.
- Only middlemen operate from Matale town to collect waste material and sell them to recyclers outside Matale. Therefore they control the prices paid for recyclable material.

Technical

- There is no access to information on recycling technologies in Matale. Many people feel that such technologies are too complex and expensive to be set up as small scale industries.
- The waste generated was not clean enough to be recycled. In such a case recyclers will not want to buy this waste.

- If the waste sent for recycling is unclean this will require cleaning processes. The resulting waste water can be damaging to the environment if not collected and treated properly.
- The price of products made of virgin raw material is cheaper than products made of recycled material. There is no price control on goods made from virgin material.
- Lack of public awareness on the importance of recycling waste streams.
- People in Sri Lanka are not keen to buy products made from recycled waste. The general feeling is that such products will be of low grade.
- There are no laws and regulations in Sri Lanka to support recycling of material such as plastics, paper and glass mandatory

Social

- Several middle men operate from the Matale area. Setting up direct recycling industries can lead to such small enterprises going out of business.
- The prices of recyclable material are controlled by the middlemen and are maintained at less than market values.
- People are not willing to recycle their waste because middle men maintain the prices at less than market value.
- People do not feel it is their responsibility to recycle their waste. The usually accepted practice is to directly dispose off to the environment.
- The community in general does not trust that recycling plants will be operated in a proper manner and feel that they can pollute the environment

The following issues were identified for organic waste material. Most of the organic waste is not recycled and more than 70% ends up at the landfill site.

Financial

- There are no investors to set up composting plants or biogas plants in the MMC area as industries/businesses because these operations are not considered to be financially sustainable businesses.

Technical

- In the case of home composting many people are not properly aware of how to choose the right composting technique or the equipment.
- The compost produced by the central composting plant is not monitored on a regular basis to ensure that it meets with the National standards. Therefore people are not willing to buy this product.
- The practice of adding outdated medicines into the composting bins in homes results in the compost being hazardous in nature.
- There aren't any biogas plants in Matale
- Lack of exposure to existing biogas production technologies.
- The quality of the municipal organic waste may not be suitable for production of biogas. Many stakeholders felt that the efficiency of a biogas plant run on municipal solid waste would be low.
- There are no operating procedures and standards developed to ensure that the bio gas plants are operated efficiently.

Social

- The community may be unwilling to use biogas prepared from waste for cooking as they would consider it unhygienic.
- People usually feel that the quality of compost is not as high as chemical fertilizers.

5.3 Medium Priority Issues

5.3.1 Source Segregation

Financial

- The current waste management system does not include a fee to be paid by the community for waste disposal.

Technical

- MMC officers working in the Health Department do not have the necessary technical expertise to provide advice to the community. Proper training and retraining of MMC employees is not carried out. Often training is provided to the wrong people
- The current waste separation and recovery is carried out through an informal scavenging system which is not well developed or spread out to cover all recyclable wastes.
- The waste segregated through scavenging is unclean as they are often mixed with food waste and other contaminants. No cleaning of waste is carried out by the scavengers and therefore the value of the waste is lessened.

Social

- The residents are not ready to segregate waste if no financial benefit is received in doing so.

5.3.2 Collection

Financial

- The MMC does not have funds to replenish PPEs to employees if they are damaged.

Technical

- The sanitation workers do not use adequate personal protective equipment (PPEs).
- The procurement procedure for PPEs does not look into the quality of the equipment. Often the PPEs are chosen based on the price.
- The employees do not use the supplied PPEs as they feel these to be uncomfortable or useless.
- The PPEs provided are not suitable for handling solid waste.

Social

- No regular medical check ups are conducted for sanitation workers.

5.3.3 Transportation

Financial

- MMC does not have adequate funds to procure new vehicles and usually hire vehicles as needed.

Technical

- The number of transportation vehicles is not enough to meet the current waste disposal in Matale.
- Some of the collection vehicles are in very poor condition as they are not maintained properly. This leads to frequent breakdowns.
- Repairs take long as spare parts are unavailable and this has further reduced the fleet.
- Some of the vehicles donated to the MMC are unsuited to the terrain in Matale. Therefore these vehicles cannot go into all areas within the MMC limits.
- The waste transportation tractors cannot get to the landfill site during rainy days as the road way becomes muddy and slippery. This affects the collection routine.
- The waste transportation is carried out in open tractor trailers. Therefore the waste spills onto the roads during transportation.

5.3.4 Final Disposal

Financial

- Currently the MMC spends around Rs. 300,000 per annum as rental fee for the land used as the landfill site.

Technical

- The existing disposal site does not belong to the MMC. The landfill site which was being used by the MMC was leased from a private party. This lease will expire in March 2008 after which finding a new land for the disposal will be a problem.
- The current disposal system used is the “cell method”. However as the soil layer placed over the waste was not thick enough animals can easily dig through it and pull out the garbage.
- The incorrect disposal is the result of lack of training provided to the sanitation workers.

Social/Environmental

- Odour arising from the landfill site is an issue to the residents in the neighbouring areas.
- The landfill also acts as a breeding ground to flies, mosquitoes, rats and other disease carrying animals.
- The waste disposed at this site includes hazardous material as well as sharp objects. Therefore the employees and scavengers alike are exposed to adverse health impacts.
- The leachate released from the landfill site was not collected or treated and was entering the river adjacent to the landfill area.

Chapter 6: Framework for Waste Management Action Plan

6.1 Overall Approach

The development of the action plan for Solid Waste Management in Matale followed the strategic planning process taking into consideration the current situation and the gaps therein as well as issues of concern expressed by stakeholders. Prior to developing the action plan the Vision, Mission, Goals and Targets of the plan were defined so as to develop actions/schemes which will ultimately lead to the achievement of these.

The following salient features of the current solid waste management situation were also considered in developing the Vision, Mission, Goals and Targets.

- The volume of waste generated and disposed within the MMC is on the increase.
- The MMC does not possess a land suited for a Landfill site within its limits and depends on rented/leased lands outside its boundary for waste disposal.
- Decentralized approaches will have to be given priority centralized approaches in the case of Matale due to lack of space.
- While the MMC often operates with inadequate infrastructure and equipment in the management of solid waste there are also shortcomings in the utilization or allocation of available resources.
- The capacity of the employees of MMC needs to be further enhanced to improve the efficiency of collection, transportation and disposal.
- The MMC clearly lacks funding essential for better management of its solid waste.
- The current approach to Solid Waste Management is reactive and ad-hoc in nature and lacks long term planning.

The vision and mission statements for the ISWM Plan were set down to align with the existing MMC vision and mission statements. It is important that the ISWM Plan should ultimately contribute to achieving the overall aspirations of the MMC. The vision,

Mission, Goals and Targets were developed in consultation with the MMC and other relevant stakeholders.

The goals set by the ISWM Plan will have to directly contribute to the mission of the plan which in turn would have to lead towards achieving the vision. The strategic planning process followed the path depicted below.

Vision -----Mission-----Goals-----Targets-----Themes-----Schemes

Each scheme included the resource requirement, responsibility allocation, institutional mechanism, required capacity building and finally the outcomes expected. In addition to this each task was analysed as to the positive and/or negative impacts it can have on the society and the environment after implementation.

6.2 Vision

The vision of the Matale Municipal Council (Refer Chapter 4, Section 4.1) was taken as the vision of the ISWM Plan as the plan ultimately visualizes the achievement of a cleaner and greener Matale by reducing waste generation and disposal.

The Vision Statement for the ISWM Plan for Matale is:

“A Clean and Green City”

6.3 Mission

The mission statement of the ISWM Plan is an extension of the Matale Municipal Council Mission Statement which is as follows:

“In this Historic city of Matale whilst paying due attention to the social, economic, and welfare needs of its resident population and visitors to the city. We are fully committed to accomplish an maintain at the highest level of efficiency our health services, roads welfare facilities and all utility services within as environmental friendly atmosphere”

Since Solid Waste Management comes under “Health Services” the mission statement for the plan had to be elaborated further giving clear and distinguishable description of what the health services (Solid Waste Management Division) had to do in order to fulfil the vision.

The Mission statement for the ISWM Plan is;

“Provide efficient and effective Solid Waste Management services to all using environmentally sound technologies in a proactive and socially & environmentally responsible manner. Endeavour to integrate the 3R concepts of waste management and develop the capacity of all stakeholders to contribute positively towards sustainable solid waste management”.

6.4 Goals of the ISWM Plan

Goal 1: Eliminate risks to the sensitive ecological systems in Matale.

This goal focuses on reducing risks caused during all phases of the solid waste life cycle. The environment of Matale needs to be safeguarded against the ever increasing volumes of waste being generated. This can be achieved by reducing waste generation at source, by introducing source segregation and diverting the

separated waste streams to be recycled and reused, for recovery of resources or for appropriate treatment and disposal.

Goal 2: Provide Waste Management services to all citizens in Matale Municipal council and eliminate risks to human health resulting from mismanagement of Solid Waste.

This goal focuses on ensuring that all citizens living and working within the MMC limits will receive the solid waste management services of MMC. Indirectly this goal aims at reducing the environmental impacts caused by the ad-hoc waste disposal methods followed by these residents.

Goal 3: Reduce loss of valuable resources by recovering prior to final disposal.

Currently many valuable materials end up in the landfill as there is no streamlined system for resource recovery. This goal aims at maximizing the recovery of material and thereby reduces the volume of waste disposed off at the landfill.

Goal 4: Comply with National, Provincial and Local environmental regulatory requirements.

The MMC currently faces difficulties in meeting with solid waste management related environmental regulations at National and Provincial levels. This goal focuses on ensuring that the ISWM Plan will assist the MMC and other major waste generators to meet the regulatory requirements of the country, especially in the case Hazardous wastes.

Goal 5: Build capacity of relevant employees of the MMC and all other stakeholders to achieve sustainable Solid Waste Management.

The internal capacity in terms of Human Resources needs to be enhanced at the MMC to be able to meet with the expectations of the ISWM Plan. This will include the skills development as well as basic infrastructure development for the MMC to

be able to manage the solid waste in a more efficient and sustained manner. It also looks at strengthening the relationship between the MMC and the citizens of Matale.

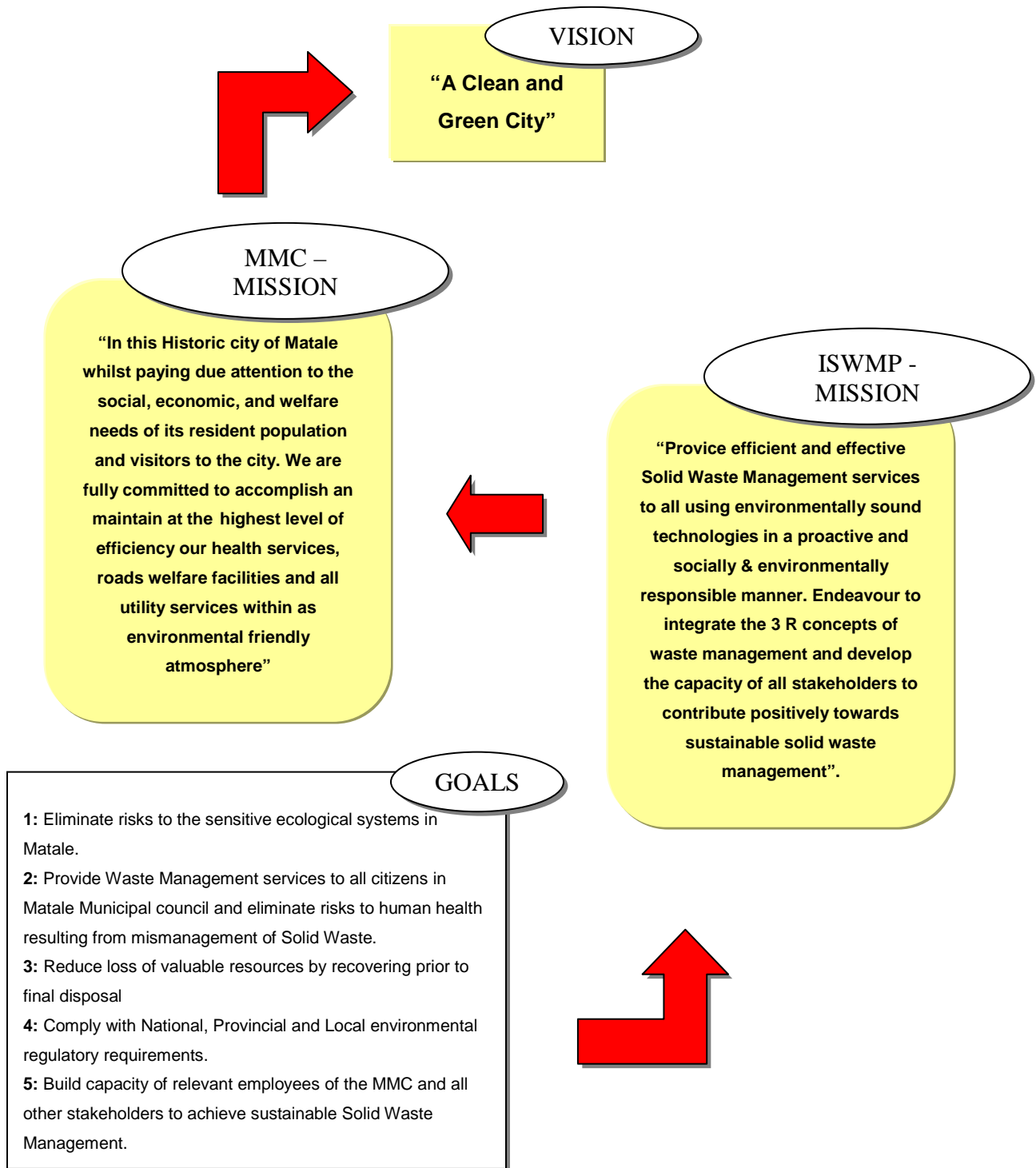


Figure 6.1: Vision, Mission and Goals for ISWM Plan – Matale MC

6.4.1 Relationship between Goals and Targets of ISWM Plan

Table 6.1: Relationship between Goals and Targets of ISWM Plan

| | Qualitative Targets | Quantitative Targets | |
|---|--|--|--|
| | | Short Term (2008 – 2012) | Long Term (2013 – 2025) |
| Goal 1 Eliminate risks to the sensitive ecological systems in Matale. | 1 Convert landfill sites into engineered sanitary type landfills | Find adequate and suitable landfill site for waste disposal | Develop a fully engineered sanitary landfill for disposal of hazardous and residual wastes |
| Goal 2 Provide Waste Management services to all citizens in Matale Municipal council and eliminate risks to human health resulting from mismanagement of Solid Waste. | 2 Segregation of all waste streams at source prior to collection 3 Provide waste management services to all in the MMC area 4 Improve the efficiency of the waste collection system | 50% of the waste to be segregated at source Provide waste management services to 50% of the community that is not being served | 100% of the waste to be segregated at source Waste management services to be provided to entire community of the MMC |
| Goal 3 Reduce loss of valuable resources by recovering prior to final disposal | 5 Reduce waste sent for landfill site with final objective of zero waste 6 All waste streams sorted and material/resources recovered from waste streams using the reuse and recycle techniques 7 All organic wastes to be composted and where ever possible used for biogas generation 8 Apply 3R concepts to all industrial wastes | Four biogas and compost stations to be built to process 40% of the organic wastes 50% of the recyclable waste (including construction waste) to be transferred through waste exchange 50% of the recyclable waste (including industrial waste) to converted to value added material through small industries | 75% of the organic waste to be processed and treated using most appropriate technologies 75% of the recyclable waste to be converted to value added material through industries |

| | | | |
|--|---|--|--|
| <p>Goal 4 Comply with National, Provincial and Local environmental regulatory requirements.</p> | <p>9 Reduce volume of per capita waste generated</p> <p>10 All hazardous wastes to be segregated, treated and disposed safely</p> | <p>15% reduction in waste generation at all sources</p> | <p>30% reduction in waste generation at all sources</p> |
| <p>Goal 5 Build capacity of relevant employees of the MMC and all other stakeholders to achieve sustainable Solid Waste Management.</p> | <p>11 Streamline and increase community participation in waste management practices</p> <p>12 All residents to be given thorough awareness and training</p> | <p>100% of the community to be given awareness on proper solid waste management</p> <p>10% of the community to be actively participating in solid waste management program</p> | <p>20% of the community to be actively participating in solid waste management program</p> |

6.5 Strategic Action Plan (Policy, Voluntary and Technological Measures)

The integrated waste management plan for Matale will encompass all stages of the waste management process from waste generation at source to final disposal. The activities under this frame work cover all stages and development of improvement measures to make the integrated waste management effective.

The goals, objectives and the targets of MMC together with the concerns of the stakeholders will define the final desired state while the waste inventory and situation analysis led to identification of gaps. Therefore strategies are developed to fill the gaps to reach the desired state of solid waste management in Matale.

Three types of strategies are developed to address these gaps, namely policy changes, technological action and voluntary action.

The policy changes includes the strengthening of the existing laws and regulations on solid waste management , enacting and enforcing new regulations where necessary and develop market based economic tools to motivate community to good practice and as a deterrent from harmful practices.

The voluntary actions include awareness, training and capacity building of different stake holder groups to synergize the actions of different segments of the community for effective solid waste management. Any projects started by schools and CBOs are also considered as voluntary measures

The technological measures include the broadening the infrastructure and designing and procurement of new equipment. Setting up of new recycling and treatment plants too are under technological measures. Similarly substitution of products and materials, change of packaging, research work carried out by universities and other research institutes for new techniques or improvement of existing methodologies too fall under technological measures.

6.5.1 Strategies for Waste Reduction

The ISWM plan for Matale commences with reduction of waste generation at source. This indicates that the quantity of waste to be disposed will become less and therefore the pressure on the other stages of the waste management cycle becomes less. The reduction at the point of generation focuses on prevention, reduction and reuse of the materials ending up as waste. This strategy will bring financial savings to the generators and at the same time reduce the volume to be handled by the MMC.

This could be achieved by making suitable policy changes including enacting & enforcing regulations and economic tools, voluntary actions and technological actions.

6.5.1.1 Policy Changes and Economic Tools

- The policy changes should include suppliers' liability for all durable products and products containing hazardous materials.
- Enforcing the existing regulations on plastic thin films
- Subsidies for environmental friendly purchases

6.5.1.2 Voluntary Actions

Voluntary actions through awareness, training, communication and capacity building could provide the necessary platform to bring down the generation of waste at household levels as well as at commercial and industrial level. In addition the voluntary measures could be useful for providing the transition to implement policy changes.

- Pay back system for all empty cans & bottles and also for other old household capital goods such as electronic items and furniture by commercial houses
- Take back packaging of consumer goods as well as old household capital items and provide a discount for the new purchases.

6.5.1.3 Technological Options

- Introduction to bio degradable packing materials
- Establishment of recycling stations

6.5.2 Strategies for Source Separation

The changes to the current entire solid waste management approach starts from the separation of different wastes at the point of generation. Therefore this stage should be properly addressed with correct and effective policy measures, voluntary actions and technological changes.

6.5.2.1 Policy Changes and Economic Tools

- Regulations banning mixing of hazardous waste with other wastes
- Enact Regulation to separate different wastes at source level and fines for not adhering to the practice.
- Economic incentives to families who does the source segregation

6.5.2.2 Voluntary Actions

- Establishment of a monitoring system by citizens committees to ensure source separation
- Awareness raising through CBOs
- Regular meetings with religious places, schools and commercial organizations on source segregation

6.5.2.3 Technological Options

- Free bags for separation of different wastes for households
- Bins/bags at a subsidized rate for commercial institutes

- Container/Bin for separation of hazardous wastes

6.5.3 Strategies for Collection & Transport

The major cost of the existing solid waste management is spent on collection and transport. Though it represents the high cost stage many segments of the community are dissatisfied with the service while about 20% of the population does not receive the solid waste collection service of MMC. Therefore proper care must be taken to address the issues of this stage by effective policy measure, voluntary actions and technological interventions.

6.5.3.1 Policy Changes and Economic Tools

- Stipulate times for disposal of waste at households and other places
- Early morning & late evening collection system
- Fines for those who dispose waste after the given time slots
- National Standards for vehicles collecting wastes
- Fines for illegal dumping of wastes at roadside
- National regulations for safety, and maintenance of collection vehicles including noise and air emissions, leakages and cleanliness of collection vehicles
- Licensing system for all rag pickers/scavengers who collect wastes from households and other places

6.5.3.2 Voluntary Actions

- Voluntary groups to monitor and advice on punctuality in putting wastes at proper places at correct times in a proper manner for collection
- Create respect for sanitary workers and scavengers to motivate them for effective services
- Provide feed back to MMC by the citizens groups on the effectiveness of the collection system

6.5.3.3 Technological Options

- Provide PPE for all sanitary workers and regular inspections on usage
- Use appropriate vehicles for collection without leaks and properly covered
- Use of a compartmentalized vehicle for collection of segregated wastes
- Regular cleaning, servicing and maintenance of the waste collection & transporting vehicles
- Establish eco Kiosks at selected locations to collect segregated wastes

6.5.4 Strategies for Transfer Stations /Sorting Centres

The proposed transfer stations and sorting centres are to facilitate the segregation of wastes by MMC/scavengers/other micro industrialists for recovery of useful resources. This will prevent any organic and non organic wastes ending up in the land fill site but these recoverable wastes will be directed to recycling stations or treatment plants.

6.5.4.1 Policy Changes and Economic Tools

- Transfer stations/sorting centres to handle only specified wastes
- Hazardous wastes should not be allowed at transfer stations/sorting centres
- Have separate areas for e-wastes, plastics and paper in sorting centres
- dedicated transfer stations for meat/fish wastes as well as hazardous wastes before safe disposal
- All transfer stations/sorting centres to be operated according to national environmental regulations in force.

6.5.4.2 Voluntary Actions

- CBO to handle transfer stations/Sorting centres
- Awareness raising and environmental education to communities and special groups such as school children at these centres

- Cleanliness, safety and health to be given highest priority

6.5.4.3 Technological Options

- Equip at transfer stations/sorting centres with cleaning facilities for workers
- Transfer stations to be have proper layout plan
- Regular transferring of these wastes to other stations such as exchange centre/recycling plants/ disposal

6.5.5 Strategies for Biological & Thermal Treatment

Since the major portion of the waste is organic it is important that we have sufficient treatment facilities in operation to treat the wastes. The treatment technologies selected in the case of Matale is limited to biological (bio gas & composting) and thermal (incineration) due to nature and volume of waste. Suitable policy measures, voluntary actions and technological interventions are important to try out these treatment facilities successfully as these treatment plant will become the major solution to organic wastes to get rid of a large landfill site.

6.5.5.1 Policy Changes and Economic Tools

- Supportive policy frame work to encourage use of digestors for producing bio gas from organic wastes
- Approved standard designs to be made available to public who wants to construct own bio gas plants at household level
- Environmental standards and safety standards to be stipulated for bio gas plant/compost plants/incinerators
- Hazardous waste should not be allowed at the treatment plants
- Minimum capacities and Operational standards/guidelines to be established for incinerators

6.5.5.2 Voluntary Actions

- Citizens groups to promote use of bio gas and compost made from wastes
- Awareness raising for possibility of making bio gas and composting at household/organization level
- Develop a Marketing mechanism for selling of enriched compost fertilizer

6.5.5.3 Technological Options

- Develop a model Bio gas/compost plant for others to learn
- Develop a bio gas portable storage container/cylinder for transport by households from bio gas generating station
- Establish a knowledge centre to promote technologies to communities on treatment of wastes for recovery of energy/fertilizer
- Set up one incinerator for treatment of hazardous wastes

6.5.6 Strategies for Reuse, Recycling and Resource Recovery

The major thrust in the ISWM plan will be to recover as much as wastes possible from the wastes generated. Therefore a very high priority will be given to the reuse/recycling and recovery of resources from wastes.

6.5.6.1 Policy Changes and Economic Tools

- Supportive policy framework to encourage people to use recycled materials and products
- Economic Incentives to investors for establishing recycling plants for recovery of resources
- Concessions to households, commercial institutes and industries for using of recycled materials
- Curricula changes in educational system to include natural resource conservation

- Develop guidelines and standards for recycled materials and products

6.5.6.2 Voluntary Actions

- Awareness among community on economic and environmental benefits of reusing and recycling of materials
- Initiatives at School levels to educate and encourage students to become champions in reusing and recycling
- Training of potential small scale industrialists on starting up recycling of wastes

6.5.6.3 Technological Options

- Set up a model recycling plant for each type of recoverable waste

6.5.7 Strategies for Final Disposal

Over the next few years it is expected that the residual wastes disposed at the final landfill site will be reduced with the proper implementation of reduce, reuse and recycling strategies. MMC does not have a engineered sanitary land fill site but they dispose the wastes in a dump site. The wastes are deposited using a cell structure and covered with soil but the leachate is neither controlled nor treated and seen flowing to the close by river. However, MMC is now looking for acquiring a new land for a land fill site. When the new land is acquired following policy measure should be taken into consideration.

6.5.7.1 Policy Changes and Economic Tools

- The landfill should be designed according to the national guidelines for engineered sanitary land fill sites.

- Environmental and safety regulations for landfill sites should be adhered to as per the Environmental protection license. Noise, odour, and emissions should be according to the environmental regulations
- No hazardous wastes or contaminated waste should be permitted at the landfill site.
- Any clinical wastes or hazardous wastes should be treated to make them inactive prior to disposal at the land fill site.
- Sewage, treatment plant sludge or semi processed sludge should not be deposited at the land fill site.
- Any personnel working at land fill site should be provided with a license/permit and no persons should be allowed to engage in the land fill site without the permit.

6.5.7.2 Voluntary Actions

- Any scavengers sorting waste at the land fill site should be trained on safety and sanitary issues and certified.
- Any scavengers working at the land fill site should be wearing personal protective equipment.

6.5.7.3 Technological Options

- The design of the land fill should include mechanisms to treat leachate before discharge to the river.
- The themes and schemes discussed later are based on the policy measures, voluntary actions and technological measures proposed in this chapter.

Chapter 7: Schemes Developed for the ISWMP

7.1 Introduction

The major schemes identified under the ISWM Plan were based on the goals and targets set under section 6.4.1. These schemes will provide the support mechanism through which the ISWM plan will be implemented. Each scheme in turn will fall under a broader category or “theme”. Five themes were identified in this process and are given below.

- **Capacity Building and Communicating ISWM Plan**
- **Establishing Partnerships through Institutional Building and Community Empowerment**
- **Infrastructure Development**
- **Source Reduction through CP/3R and Resource Recovery**
- **Policy Based Changes**

The following table lists the schemes with the relevant Goals and Targets which they will ultimately contribute to achieving.

Table 7.1: Link between Themes, Schemes Goals and Targets

| Theme | Scheme | Goals | Qualitative Targets |
|---|--|---|--|
| T1 - Capacity Building and Communicating ISWM Plan | S1 Developing Information Sharing Systems | G 5 - Build capacity of relevant employees of the MMC and all other stakeholders to achieve sustainable Solid Waste Management. | QT 12 - All residents to be given thorough awareness and training |
| | S2 Establishing Links with Existing Waste Exchange Programmes | | QT 6 - All waste streams sorted and material / resources recovered from waste streams using the reuse and recycle techniques |
| | S3 Developing Publicity Material in Sinhala and Tamil | | QT 12 - All residents to be given thorough awareness and training |
| | S4 Developing Awareness and Training Packages | | QT 12 - All residents to be given thorough awareness and training |
| | S5 Conducting Awareness Programmes to all Stakeholders | | QT 12 - All residents to be given thorough awareness and training |
| | S6 Conducting Training Programmes to key stakeholders | | QT 12 - All residents to be given thorough awareness and training |
| T2 - Establishing Partnerships through Institutional Building and Community Empowerment | S7 Setting up Children's' Societies at each Municipality ward | G 5 - Build capacity of relevant employees of the MMC and all other stakeholders to achieve sustainable Solid Waste Management. | QT 11 - Streamline and increase community participation in waste management practices |
| | S8 Establishing Waste Minimization Cells in each Municipality ward | | QT 11 - Streamline and increase community participation in waste management practices |
| | S9 Establishment of Waste Exchange Centre | | QT 11 - Streamline and increase community participation in waste |

| | | | |
|---------------------------------|---|---|---|
| | | | management practices |
| | S10 Promoting Private Sector Participation in recycling based industries | | QT 11 - Streamline and increase community participation in waste management practices |
| | S11 Strengthening Community Based Organizations | | QT 11 - Streamline and increase community participation in waste management practices |
| | S12 Develop programmes to enhance living and working conditions of Sanitation Workers | | QT 11 - Streamline and increase community participation in waste management practices |
| T3 - Infrastructure Development | S13 Provide segregation bins to residents of identified streets for promotion of source segregation | G 2 - Provide Waste Management services to all citizens in Matala Municipal council and eliminate risks to human health resulting from mismanagement of Solid Waste | QT 2 - Segregation of all waste streams at source prior to collection |
| | S14 Reintroduce bell collection system for house to house collection | | QT 4 - Improve the efficiency of the waste collection system |
| | S15 Restore the Environmental Education centre and provide necessary equipment to enhance its role. | | QT 3 - Provide waste management services to all in the MMC area |
| | S16 Setting up Eco-Kiosks | | QT 4 - Improve the efficiency of the waste collection system |
| | S17 Setting up intermediate collection point for E-Waste | | QT 4 - Improve the efficiency of the waste collection system |
| | S18 Setting up Intermediate Collection and Transfer Stations for Municipal | | QT 4 - Improve the efficiency of the waste collection system |

| | | | |
|--|---|---|--|
| | Waste | | |
| | S19 Establishing a Central Collection and Exchange Point for Construction and Demolition Material | | QT 4 - Improve the efficiency of the waste collection system |
| | S20 Introduce compartmentalized trailers to transport separate waste streams | | QT 4 - Improve the efficiency of the waste collection system |
| | S21 Locate suitable land for construction of Sanitary Landfill | G1 - Eliminate risks to the sensitive ecological systems in Matale | QT 1 - Convert landfill sites into engineered sanitary type landfills |
| T4 - Source Reduction through Cleaner Production, 3R and Resource Recovery | S22 Conduct Cleaner Production demonstration project for wood based industries | G 3 - Reduce loss of valuable resources by recovering prior to final disposal | QT 5 - Reduce waste sent for landfill site with final objective of zero waste |
| | S23 Conduct Cleaner Production demonstration project for Hotels and restaurants | | QT 8 - Apply 3R concepts to all industrial wastes |
| | S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries | | QT 5 - Reduce waste sent for landfill site with final objective of zero waste |
| | S25 Develop project proposals for setting up decentralized composting plants | | QT 6 - All waste streams sorted and material / resources recovered from waste streams using the reuse and recycle techniques |
| | S26 Develop project proposal for setting up decentralized biogas | | QT 7 - All organic wastes to be composted and where ever possible used for biogas generation |
| | | | QT 7 - All organic wastes to be composted and where ever possible used |

| | | | |
|---------------------------|--|---|--|
| | plants | | for biogas generation |
| | S27 Preparation of the Project Idea Note (PIN) and Project Design Document (PDD) for proposed Biogas Plants as a CDM Project | | QT 9 - Reduce volume of per capita waste generated |
| T5 - Policy Based Changes | S28 Effecting Policy Changes at Local Government Level | G 4 - Comply with National, Provincial and Local environmental regulatory requirements. | QT 9 - Reduce volume of per capita waste generated |
| | S29 Lobbying for Approval of Municipal Council By-laws | | QT 9 - Reduce volume of per capita waste generated |
| | S30 Develop incentive system to promote source segregation | | QT 10 - All hazardous wastes to be segregated, treated and disposed safely |
| | S 31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste | | QT 10 - All hazardous wastes to be segregated, treated and disposed safely |

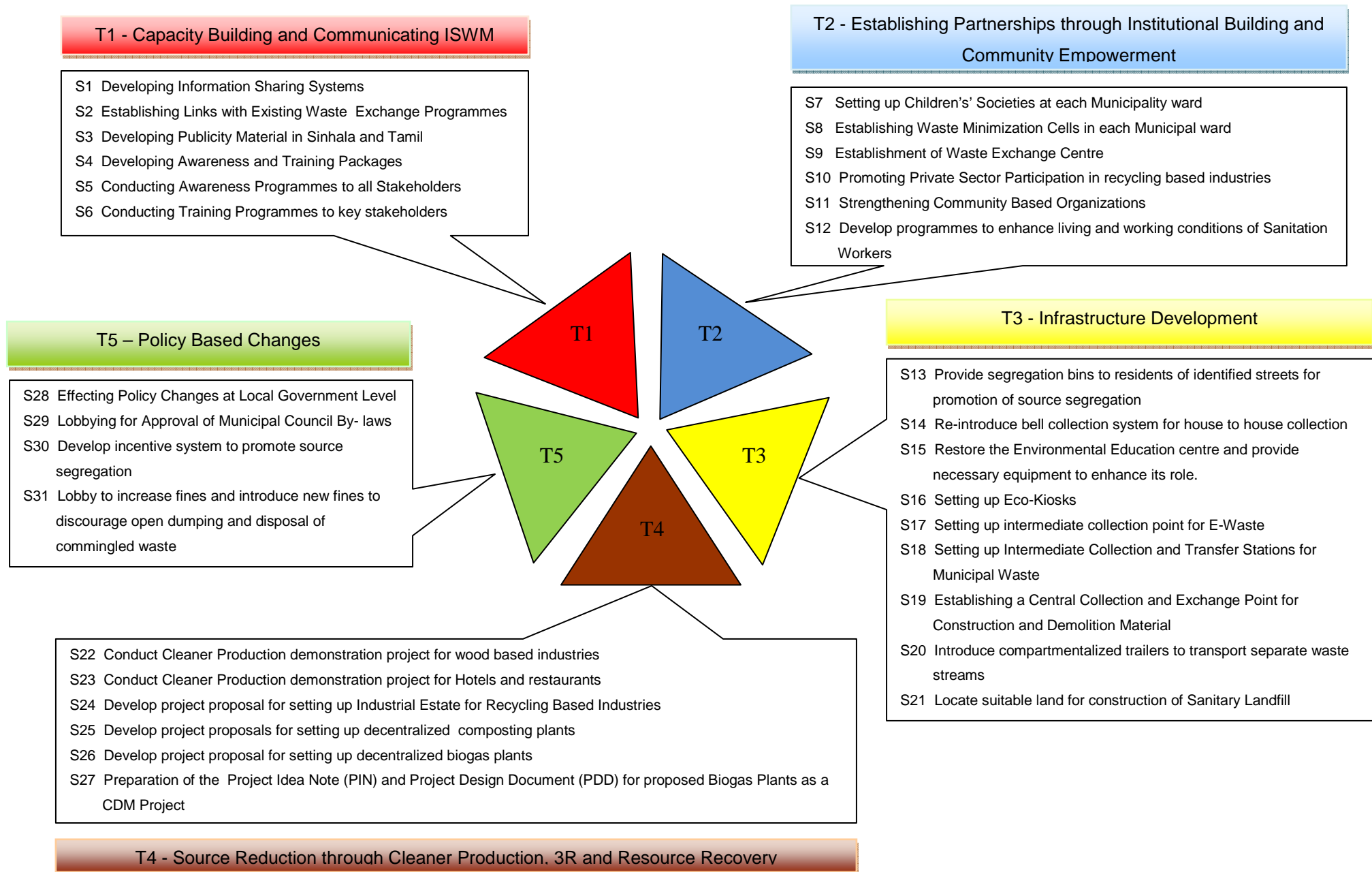


Figure 7.1: Schemes of the ISWM Plan

Table 7.2: Categorization of Schemes Based on Phases of Solid Waste Lifecycle

| Phase of the Solid Waste Lifecycle | Scheme | Type of Waste |
|---|--|--|
| Generation | S7 Setting up Children's' Societies at each Municipality ward | Municipal Solid Waste Hazardous Waste |
| | S8 Establishing Waste Minimization Cells in each Municipal Ward | Municipal Solid Waste Industrial Waste |
| | S13 Provide segregation bins to residents of identified streets for promotion of source segregation | Municipal Solid Waste |
| | S22 Conduct Cleaner Production demonstration project for wood based industries | Industrial Waste |
| | S23 Conduct Cleaner Production demonstration project for Hotels and restaurants | Municipal Solid Waste |
| | S27 Preparation of the Project Idea Note (PIN) and Project Design Document (PDD) for proposed Biogas Plants as a CDM Project | Municipal Solid Waste |
| Source Segregation | S7 Setting up Children's' Societies at each Municipality ward | Municipal Solid Waste |
| | S16 Setting up Eco-Kiosks | Municipal Solid Waste |
| | S30 Develop incentive system to promote source segregation | Municipal Solid Waste Hazardous Waste Healthcare Waste |
| | S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste | Municipal Solid Waste Hazardous Waste Healthcare Waste |
| Collection | S12 Develop programmes to enhance living and working conditions of Sanitation Workers | Municipal Solid Waste |
| | S14 Reintroduce bell collection system for house to house collection | Municipal Solid Waste |
| | S17 Setting up intermediate collection point for E-Waste | Electronic Waste |
| | S18 Setting up and intermediate Collection and Transfer Stations for Municipal Waste | Municipal Solid Waste |
| | S19 Establishing a Central Collection and Exchange Point for Construction and Demolition Material | C & D Waste |
| Transportation | S20 Introduce compartmentalized trailers to transport separate waste streams | Municipal Solid Waste |

| | | |
|---------------------------------|--|--|
| Treatment | S25 Develop project proposal for setting up decentralized composting plants | Municipal Solid Waste |
| | S26 Develop project proposal for setting up decentralized biogas plants | Municipal Solid Waste |
| Recycling and Resource Recovery | S2 Establishing Links with Existing Waste Exchange Programmes | Industrial Waste C & D Waste |
| | S9 Establishment of Waste Exchange Centre | Industrial Waste C & D Waste |
| | S10 Promoting Private Sector Participation in recycling based industries | Industrial Waste C & D Waste |
| | S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries | Industrial Waste C & D Waste |
| Disposal | S21 Locate suitable land for construction of Sanitary Landfill | Municipal Solid Waste Hazardous Waste |

In addition to the schemes given in the above table there are several schemes which are applicable to the entire lifecycle and to all waste streams. These are listed below:

- S1 Developing Information Sharing Systems
- S3 Developing Publicity Material in Sinhala and Tamil
- S4 Developing Awareness and Training Packages
- S5 Conducting Awareness Programmes to all Stakeholders
- S6 Conducting Training Programmes to key stakeholders
- S11 Strengthening Community Based Organizations
- S15 Restore the Environmental Education centre and provide necessary equipment to enhance its role.
- S28 Effecting Policy Changes at Local Government Level
- S29 Lobbying for Approval of Municipal Council By- laws

The schemes identified under the ISWM plan cover all stages of the solid waste lifecycle. Each scheme will contribute to enhance solid waste management at one or more of the phases of this cycle. Similarly the schemes are generally applicable to all types of waste streams though there are several instances where schemes are waste specific.

7.2 Detailed Description of Schemes under ISWM Plan

Scheme 1- Developing Information Sharing Systems

Introduction:

The effective implementation of the ISWM plan requires the support and commitment of all stakeholders concerned. It is essential that these stakeholders participate proactively and take over certain responsibilities and roles in the implementation process. Therefore each stakeholder group must be fully aware of the aspects of the ISWM plan and its various components. This can be achieved only if the plan is properly communicated to all stakeholders. Proper communication at the beginning to clearly define the responsibilities towards better waste management services and the subsequent communication of monitoring results and achievements while the implementation is in progress are important for realizing the final objectives of the ISWM plan. This will ensure that the entire plan development and implementation process is transparent.

Therefore all elements of the plan must be effectively and clearly communicated to relevant stakeholders. Since there are number of stakeholders with varied interests in the solid waste management the communication modes used will vary according to their nature, interest, education level and other specific criteria. The mode used for communication to each stakeholder group should facilitate two-way communication for information sharing to ensure suggestions; recommendations and other feed back reach the implementing agencies. Information dissemination will have to be conducted so as to outreach as many stakeholder groups as possible.

The communication of the ISWM Plan requires a well designed and far reaching information sharing system. The following scheme describes the system developed for Matale.

Purpose:

Prepare information sharing system to communicate proposed plans, their implementation, barriers, deficiencies & shortfalls and progress to all stakeholders.

Desired Outcomes:

- To make all citizens and other stake holders aware of the problems arising from current waste management practices in the city
- To communicate the proposed ISWM plan and its aspects to all stakeholders
- To have a system through which feed back on the ISWM Plan can be taken from stakeholders
- Enlist the participation of community groups in Solid Waste Management
- Strengthen the relationship between the municipality and other stakeholders

Nature of the Scheme: Capacity Building and Communicating Project

Agencies responsible:**Lead**

- Matale Municipal Council

Supporting

- Ministry of Provincial Councils and Local Government (MoPC&LG)
- National Solid Waste Management Support Centre (NSWMSC)
- National Cleaner Production Center (NCPC)
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- Agriculture Department

Location: Matale

Budget: LKR 800,000/- (USD 7,500 Approx)

Time Frame: 6 months

Description:

The information sharing strategy should address all stake holder groups with special attention to stake holder who contribute to the solid waste problem most. An effective information sharing strategy will enhance the transparency of the process and thereby improve voluntary participation of more citizens to make solid waste management efficient.

The activities preceding the development of the ISWM Plan highlighted that all stake holders either directly or indirectly have an effect on or are affected by solid waste management in Matale. Therefore it is important to identify and then carefully group different stakeholders before deciding on the mode/mean of communication with each group.

Several tiers of stakeholders were identified for this purpose and the quality and quantity of information to be provided to each will be different. In addition to this several activities have been identified under the ISWM Plan to dissemination information and create awareness among stakeholders in Matale. These activities will be used concurrently to achieve the level of commitment and community participation required for the successful implementation of the plan. (Refer Chapter 10 of this Report for Further details on Information and Communication Systems)

Implementation:

MMC should hire a consultant to help them prepare suitable information dissemination and communication system which would benefits all partners in the ISWM Plan. The first step in this regard would be identifying the stakeholder groups and the target groups within each stakeholder group. These stakeholders will include those who both directly and indirectly impact the SWM system.

The information needs include the various components of the ISWM plan (Waste Inventory, Situation analysis, Targets, Stakeholder Concerned), the proposed themes and schemes, progress of achievements, successes and lessons learned from failures etc. The information needs will also include information on new and appropriate solid waste

management technologies adopted or considered as well as health and safety issues related to solid wastes.

Following this a needs analysis must be carried out to identify the best method of conveyance based on the information stakeholders and their role in the ISWM Plan. The system may have several different methods of conveyance such as news letters, notices, posters, meetings, seminars etc (refer table 10.2 for details). Since Matale is a multi ethnic society all methods of information conveyance must be in Sinhala, Tamil and English.

Once these factors are decided upon, the next important issue is the frequency of information sharing such as daily, weekly, bi weekly, monthly etc. The information sharing system should include a method to obtain feedback from the stakeholders as well.

A basic needs analysis has been carried out in Chapter 10 of this report. It details out the specific target groups within the stakeholder groups and the different means of communication which would be best suited.

The information sharing should then be started using the system developed as early as possible and its effectiveness should be monitored regularly to ensure all stakeholders are properly communicated.

Performance Indicators:

- % of households cooperating with MMC
- % increase of community participation in SWM
- Number of complaints on non collection
- Number of citizen suggestions received for clean city
- Number of solid waste related complaints made to Provincial Environmental Committee

Measure of Success:

- Appropriate information communicated to all stakeholders

Benefits/Impacts:

- Community cooperation and participation in ISWM
- Reduced waste generation and disposal in Matale
- Improved image of MMC among stakeholders
- Improved communication between MMC and Community
- Reduced complaints against MMC
- Financial Benefits accrued to Matale Community

Barriers:

- Identification of proper information needs for stakeholders
- Obtaining feedback from community
- Difficulty in managing many systems for information dissemination
- Breakdown of information dissemination and communication systems over a period of time due to lack of resources

Links to Other ISWM Schemes of Matale:

- S2 Developing links with existing waste exchange programmes
- S3 Developing Publicity Material in Sinhala and Tamil
- S4 Developing Awareness and Training Packages
- S8 Establishing waste minimization cells in each municipal ward
- S10 Promoting Private sector participation in recycling based industries
- S11 Strengthening Community Based Organizations
- S15 Restore the Environmental Education centre and provide necessary equipment to enhance its role

Scheme 2 - Establishing Links with Existing Waste Exchange Programmes

Introduction:

Municipal solid waste management is considered to be ineffective and has become a huge public issue in Sri Lanka. Except in a few instances the local government authorities (LGAs) majority of the LGAs are unable to provide efficient and effective solid waste management services to their communities. There are many aspects in solid waste management which have lead to these issues. Among them are factors such as lack of finances, use of obsolete technologies, lack of information and the dissemination of information, lack of policies and strategies applied by the individual local government authorities.

The integrated solid waste management plan prepared for the Matale city addresses all types of waste and proposes methods of managing this waste throughout the entire lifecycle (i.e. Generation, Source segregation, Collection, Transportation, Treatment, Final Disposal, Recycling and Resource Recovery). The foundation of the plan is the 3R Principle (Reduce, Reuse, Recycle) where valuable resources are diverted away from the waste streams. The waste generated by one party can easily be used by another as a raw material in production. Such systems are known as waste exchanges. Currently there are two waste exchange programmes in existence in Sri Lanka. The ISWM Plan for proposes to set up a waste exchange platform for Matale to increase waste reuse and recycling. This scheme proposes to link the WEX prepared for Matale with existing networks and thereby allow easier access to the waste in Matale.

Purpose:

To network with existing waste exchange platforms to create a better market position for the wastes generated within Matale

Desired Outcomes:

- To link the information on waste available in Matale to waste users and recyclers nationally
- Effectively link to the waste exchange platforms in operation by other institutes

- Facilitate waste generators to exchange their reusable/recoverable waste with any user quickly.
- Increase the economic value of wastes by listing of it as a usable resource

Nature of the Scheme: Waste Exchange Programme

Agencies responsible:

Lead

Matale Municipal Council

Supporting

Industrial Technology Institute

SMED-SPX (Small & Medium Enterprise Developers - Subcontracting Partnership Exchange)

Matale Chamber of Commerce and Industry

NCPC

Location: Matale

Budget: Rs 50,000/-(USD 475 approx)

Time Frame: 12 months

Description:

Currently two WEX platforms are in operation in Sri Lanka. These have been created and operated by Industrial Technology Institute and the Small and Medium Enterprise Developers – Subcontracting Partnership Exchange Programme. Both are web based platforms and are used quite extensively in Sri Lanka. Many industrialists are familiar with the platforms as well as the institutions operating them.

The ISWM Plan proposes to set up a Waste Exchange Platform in Matale. However for this platform to be successful it would need to be linked to existing platforms which have a well developed client base. Therefore the web based WEX platform prepared for Matale can be linked to the ITI and SMED-SPX platforms.

The waste exchange platform of the Industrial Technology Institute (ITI) provides details of wastes available in registered companies and also companies/individuals searching for sorted waste streams with the description of the wastes and quantities. MMC can register in the ITI waste exchange to seek for buyers of the available waste streams. Similarly the details of available waste can be registered in the Sub Contracting & Partnership Exchange (SMED-SPX) of the Federation of Chambers of Commerce and Industry of Sri Lanka (FCCISL).

In addition to this there are a few material and by-product exchange centers operating in the country which provides information to buyers and users. These too can be linked with and thereby increase the visibility of the Matale WEX.

Implementation:

Matale requires the assistance of an external consultant to prepare a detailed project proposal for the establishment of a WEX. The consultant must carry out a detailed waste inventory (based on the inventory prepared under the ISWM Project) and carry out a survey to identify the available waste types and their sources (Refer Scheme 9 for further details).

Once the waste exchange platform for Matale is set up the database can be linked to the ITI and SMED SPX waste exchanges through registration. The database must be regularly updated so that the information is accurate which will encourage more prospective buyers to link directly with the waste suppliers/MMC or any other operator in Matale.

Performance Indicator:

- Volume of waste exchanged
- Quantity of waste recycled
- % of waste recycled
- % of waste recycled into value added products
- % increase in resource recovery
- % reduction of waste going to landfill site
- % income from environmental services against total expenditure

- % reduction in SWM expenditure due to resource recovery
- Total income generated from resource recovery
- % income generated

Measure of Success:

- Increased number of buyers from Matale and other parts of the country seek to exchange waste with industries/MMC.

Benefits/Impacts:

- Recyclable wastes get a better economic value
- Wastes going to landfill site is reduced
- Better returns to Matale community

Barriers:

- Lack of continuity of the existing waste exchanges
- Low number of visits to web pages by resource users
- Difficulty in gaining access to the Internet

Links to Other ISWM Schemes of Matale:

- S1 Developing information sharing systems
- S8 Establishing waste minimization cells in each municipal ward
- S9 Establishing waste exchange centre
- S10 Promoting private sector participation in recycling based industries
- S16 Setting up eco-kiosks
- S17 Setting up intermediate collection point for e-waste
- S18 Setting up intermediate collection and transfer stations for Municipal Waste
- S19 Establishing a central collection and exchange point for construction and demolition waste

Scheme 3 - Developing Publicity Material in Sinhala and Tamil

Introduction:

Since the vision of the ISWM plan is to make Matale a Clean and Green City and as the Mayor and the MMC officers are keen to develop Matale into a city without a landfill (dump site) it is essential that the plan focus on reducing the generation of waste at source. Therefore the ISWM Plan aims at reducing the generation and disposal of all types of waste and streamlining solid waste management through a variety of activities and schemes. In such a case the actual generators of waste (i.e.: Residents, Business people, Industrialists, Hospital staff etc.) will play a key role in the successful implementation of the plan.

The ISWM Plan will bring about many changes which may be looked upon as a nuisance by the community in Matale. This can be a major barrier to the successful implementation of the plan. Also taking into consideration the current level of mistrust between the MMC and the community it is difficult to expect total and unquestioned support from the community immediately. Therefore the MMC must prepare a set of simple and easy to understand publicity material which can be used to gain popular support for the plan. These materials will have to be prepared immediately and used extensively to ensure that the plan has adequate support from the community prior to implementation.

This material should be simple and easy to understand. This scheme describes the publicity material required for the project and details out how they can be used for the purpose of generating public support.

Desired Outcomes

- To develop publicity materials suitable to English speaking citizens
- To ensure that this material is simple and easy to follow to all stakeholders in Matale
- Enhanced public involvement in the implementation of ISWM plan
- Better relationship between MMC and its stakeholders

Nature of the Scheme:

Capacity building and communication project

Agencies responsible:**Lead**

- Matale Municipal Council

Supporting

- United Nations Environment Project (IETC)
- NCPC
- External Consultants hired by MMC
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- Agriculture Department

Location: Matale

Budget: Rs 1,000,000/- (USD 9,350 approx)

Time Frame: 6 months

Description:

Publicity materials for the communication of the ISWM Plan are as follows:

- Posters
- Banners
- Brochures
- Articles in News Papers
- Programmes over electronic media
- Video Films
- News Letters

Much of the information required to prepare the material will be available with UNEP and NCPC. Therefore the first step in preparing the material is to identify already available literature which can be directly used with a few modifications. As indicated earlier the material should be prepared in easy to follow simple language with as less technical words

used as possible. Therefore some of the available literature may need to be modified to suit Matale

All material prepared or already available in English must be translated to Sinhala and Tamil to make the material more accessible to the general public of Matale.

Once the material is prepared and translated they must be pre-tested among the general public to further improve them to be most suitable. The material will then have to be printed and made available to relevant stakeholders.

Implementation:

MMC will need to hire a consultant to prepare the necessary publicity material and to translate the material into Sinhala in Tamil. The reading and reference materials including guidelines on ISWM prepared by UNEP may be used as the seed material for developing the required literature for Matale.

Posters and Banners: These have to be designed and printed to be attractive and interesting. It is best to use figures and pictures rather than words to put the message across. Posters and banners can be used in public places, schools etc. as they are best suited to the General public and children. Therefore these should be prepared to be best suited to these audiences.

Brochures: These can have more detailed description of the Plan. Brochures should be prepared to introduce new concepts as well as elements of the ISWM Plan and various technologies and techniques being introduced under the ISWM Plan.

Articles in News Papers / Programmes on Television: Articles and programmes run through media can help to generate interest in the implementation of the plan as well as to keep the stakeholders informed of the progress of the schemes being implemented.

Video Films: Films can be prepared on various components of solid waste management such as source segregation, resource recovery and waste recycling, composting, biogas, incineration, landfilling etc. These films can give descriptions of how plants are operated as well as highlight success stories from other parts of the country/world. Films can give the message of the ISWM plans visually making them more attractive and interesting to the target audiences.

News Letter: The news letter will be a method of ongoing publicity to the project. It can be used to continuously provide information as well as updates on the implementation process and be a method of disseminating information to the stakeholders. News letters can carry more technical information for stakeholders who are directly involved in the setting up and operation schemes (i.e. resource recovery and waste recycling, composting, biogas, incineration, landfilling).

Poster, banners and brochures should be prepared prior to the implementation of schemes so that they can be distributed to stakeholders and used during awareness and training programmes. MMC must also develop a media circle for the ISWM Plan so that regular updates can be made across the print and electronic media continuously. Video films already available can be translated for the purpose of information dissemination by MMC. A detailed film can be prepared by MMC on the implementation of the ISWM Plan once some of the projects are underway.

Performance indicator:

- Number of awareness programs held
- % of households cooperating with MMC
- % increase of community participation in SWM

Measure of Success:

- Adequate publicity if given to the ISWM Plan and majority of the community is aware of the project and its components.

Benefits/Impacts:

- Better community participation in ISWM
- Transparency of the development and implementation process of the ISWM Plan
- Availability of material which can be used for awareness creation
- MMC can continue to create awareness and build capacity once the project period is over using the prepared material
- Availability of material to suite different stakeholders

Barriers:

- Difficulty in finding suitable information to prepare publicity material
- Difficulty of translating the materials to Sinhala and Tamil

Links to Other ISWM Schemes of Matale:

- S1 Developing Information Sharing Systems
- S4 Developing Awareness and Training Packages
- S5 Conducting Awareness Programmes to all Stakeholders
- S6 Conducting training programmes to key stakeholders

Scheme 4 - Developing Awareness and Training Packages

Introduction:

ISWM Plan is prepared to address all types of waste generated within MMC including Hazardous waste and construction waste. It also includes all phases of the solid waste management lifecycle such as source segregation, collection, transportation, treatment, disposal and recycling & recovery. Currently the MMC waste management system includes only the collection, transportation and disposal phases. Therefore technologies and techniques under the source segregation, treatment and recycling & recovery will be new and complicated systems for Matale.

As many of the waste streams are directly related to the community attitudinal changes in people will have to be developed gradually. The ISWM Plan proposes various innovative ideas and approaches which will cover more complex waste streams and technologies. Therefore stakeholders who will be directly involved in these areas as well as those who will impact waste generation and disposal will require capacity building in order to be able to cope with the ISWM Plan and the changes it will bring.

Solid waste management in Matale has its own problems due to specific nature of the local conditions. One major issue had been the lack of cooperation and participation by community in Matale. Many stakeholders do not have the capacity to efficiently contribute to solid waste management even though they are keen to do so. Others are not ware of the impacts solid waste can have on the environment or society. There have not been sufficient attempts to sensitize and educate the population in Matale on the issues of solid waste management in the past.

The best method of doing so is to create awareness among all stakeholders and build their capacity to ensure that they are able to contribute positively to solid waste management. Therefore suitable awareness and training material should be prepared to be used for this purpose. These materials should be simple and easy to understand while adhering to

national and international training methodologies. The following scheme describes the development of such awareness and training material.

Purpose:

Make all the stake holders aware of the ISWM plan and support the implementation through enhanced awareness and capacity

Desired Outcomes

- Appropriate Awareness and training packages available to trainers and MMC officers to organize and conduct training programs
- Special awareness package prepared on the regulatory framework related to environment in Sri Lanka
- Provide preset but uniform training materials to all participants
- Develop awareness materials and programs to suit all stake holder groups in Matale

Nature of the Scheme:

Capacity building and communication project

Agencies responsible

Lead

- MMC

Supporting

- NSWMSC
- NCPC
- External Consultants
- Matale Divisional Secretariat
- Agriculture Department

Location: Matale

Budget: LKR 500,000/- (USD 4675 Approx)

This amount includes cost of

Preparation and translation of awareness material
Printing of 5 sets of Awareness and training material
External Consultant's fee

And excludes the cost of

Conducting awareness and training programmes

Time Frame: 3 months

Description:

The awareness and training material prepared for Matale must cover both the planning and implementation phases of the ISWM Plan. The important topics identified are given below.

Planning Phase:

- Waste Characterization and Quantification
- Assessment of Solid Waste Management System
- Target Setting
- Stakeholder Concerns

Implementation Phase: These will be divided into two groups which are technical training topics and management training topics. They are highlighted below.

Technical Training

- Source Segregation
 - Major Waste Types
 - Segregation Methodology
 - Identifying Recyclable Plastic Waste
 - Good Housekeeping Systems
- Collection and Transportation
 - Developing Collection Schedules
 - Collection Vehicles and Equipment Operation and Maintenance
- Treatment Technologies

- Composting Plants
 - Operating and Maintenance of Composting Plants
 - Health & Safety aspects of Composting Plant Operators
- Biogas Plants
 - Operating and Maintenance of Biogas Plants
 - Health & Safety aspects of Biogas Plant Operators
- Incineration
 - Operating and Maintenance of Incinerators
 - Health & Safety aspects of Incinerator Operators
- Disposal Technologies
 - Operation and Maintenance of Engineered Sanitary Landfills
- 3 R Technologies
 - Reduction Techniques and Technologies
 - Cleaner Production & Waste Minimization
 - Reuse & Recycling
 - Plastic Recycling
 - Paper Recycling
 - Glass Recycling
 - C & D Reuse and Recycling
 - Health & Safety aspects of Recycle plant Operators
- Occupational Health & Safety

Management Training

- Financing and Accounting
- Community Participation
- Partnership Building
- Monitoring and Measurement
- Policy and Regulatory Framework
 - Environmental Legislation
 - Market Based Instruments

Majority of these awareness and training material will be prepared as presentations. (refer report on Awareness and Training Package). However several handbooks will also be prepared to impart further in-depth information on technologies such as composting and biogas. In addition to this a separate training package will be prepared on the management of Hazardous Waste as well as Healthcare waste. These too will be prepared as presentations.

Both awareness and training material will be prepared together as many of the modules will be similar. However they can be further modified or expanded to suite the audience and final use. An important feature of these materials is that they will be prepared in simple language with illustrations and figures to make them more understandable.

These materials will then be used by the MMC to create awareness and provide training among their stakeholders.

Implementation:

MMC will require the assistance of an external consultant(s) to prepare the packages described above. Several existing material developed by UNEP may be used as seed materials but they should be adapted to suit the local requirements and specific conditions of Matale.

Once prepared these awareness and training packages will be translated to Sinhala and Tamil and tested with the selected group stakeholder to comprehend their effectiveness. Based on the feed back received these materials will then be improved and disseminated to all stakeholders.

Performance Indicator:

- Number of awareness programs conducted
- % of community participated in awareness programs
- Number of trainers trained for future awareness programs
- Number of persons trained on recycling

- Number of persons in the community trained on sorting

Measure of Success:

- ISWM communicated to stakeholders and better community
- involvement in implementation of components and sub projects of the ISWM.

Benefits/Impacts:

- Trainers can use identical sets of documents to carry out awareness and training and thereby maintain the level of effectiveness
- Readily available reference material which can be used by stakeholders to improve their knowledge on ISWM
- Better participation of community in the waste management
- Better returns to community in Matale
- School children become better educated on environmental protection and resource use

Barriers:

- Lack of sufficient information for preparing some lessons of the packages
- Difficulty in finding suitable technical terminology in Sinhala and Tamil
- Lack of sufficient success stories in other LGAs

Links to Other ISWM Schemes of Matale:

- Developing Information Sharing Systems
- Developing Publicity Material in Sinhala and Tamil
- Conducting Awareness Programmes to all Stakeholders
- Conducting Training Programmes to key stakeholders

Scheme 5 - Conducting Awareness Programmes to all Stakeholders

Introduction:

Solid Waste management is often considered to be sole responsibility of local authorities in developing nations such as Sri Lanka. Similarly this has been the case in Matale where the MMC is burdened with the task of collecting, transporting and disposing of all solid waste. The community feels little responsibility towards waste management and is often reluctant to assist the MMC to carry out waste management in an efficient manner. The initial studies carried out to identify the existing solid waste management system and its gaps clearly pointed out that much of the existing problems were caused due to lack of support from the community. The ISWM Plan aims at reducing the generation and disposal of all types of waste and streamlining solid waste management through a variety of activities and schemes. This cannot be achieved without the support and cooperation of the waste generators (i.e.: Residents, Business people, Industrialists, Hospital staff etc.).

These waste generators must be made aware of the impact they have on Solid Waste as well as the waste management system and the environment in general. They must also be made fully aware of the different components and aspects which make up the ISWM Plan. In doing so MMC can ensure that these stakeholders take on a more positive role in the solid waste management situation in Matale.

The best method of doing so is to create awareness among all stakeholders to ensure that they are able to contribute positively to solid waste management. Proper awareness will guarantee that the implementation of the plan is sustained and that the stakeholders will be able to take over the project and its activities even after the main project team has moved out. Awareness raising must be a continuous process.

This scheme highlights the importance of conducting awareness programmes and details out an awareness campaign suitable to Matale.

Purpose:

Build Capacity of the stake holders to improve the city into a clean & green city

Desired Outcomes

- Ensure all the stake holder groups are properly sensitized about the importance of effective solid waste management
- All members of the community understand the elements of ISWM plan
- Community groups supporting the effective implementation of ISWM
- Increase the community participation in SWM
- Initiate waste management programs in schools

Nature of the Scheme:

Capacity Building and Communication Program

Agencies responsible:**Lead**

- MMC

Supporting

- NSWMSC
- NCPC
- Sevenatha (NGO)
- External Consultants / Trainers
- School teachers
- Children's societies
- Community Development Organizations (CDOs)
- Matale Divisional Secretariat
- Agriculture Department

Location: Each Municipal Ward in the Matale Municipal Council

Budget: LKR 1,000,000/- (USD 9350 approx)

This amount includes cost of

Payments to be made to resource persons
Venue charges for awareness programmes
Hiring of multimedia equipment
Organizing of awareness programmes (Logistics)
Organizational expenditure
External Consultants fee
Printing of handouts and reading material

and excludes the cost of

Preparation and printing awareness and training package

Time Frame: Continuously from the 1st Month

Description:

Awareness creation among stakeholders can be carried out by conducting Awareness programmes. These awareness programmes will vary from half day – one day programmes and usually cover general or more specific topics. These awareness programmes will differ according to the main theme under which they are conducted. Several types of awareness programmes are given below.

- Awareness Programme on the concept of integrated solid waste management, the ISWM Plan for Matale and the development process
- Awareness Programme on waste reduction through source segregation, composting, recycling and good house keeping systems
- Awareness Programmes on waste minimization and Cleaner Production
- Awareness programmes on Hazardous waste management

The programmes can be designed to suite different stakeholder groups. However it is essential that the major focus should be on the general public and school children. Awareness programmes held for the general public should be short and cover simple topics which can be understood by all. Programmes for school children can include more detailed

information though it is recommended that both cases the language used be simple so that the effectiveness of awareness creation is improved.

In addition to the topics given above the general awareness programmes must also inform the stakeholders of their role and responsibilities on the proposed ISWM and the negative effects of failing to fulfil them.

In addition to awareness programmes organized by the project several other initiatives can also be taken to further improve awareness. These include pocket meetings through which smaller groups of the community can be targeted to a better effect and using community leaders such as religious leaders to create awareness through their own mediums.

Implementation:

It is recommended that awareness programmes be conducted by a group of trained personnel selected by MMC who are residents of Matale. The group selected should include Public Health Inspectors, Community Development Assistants, Samurdhi Development Officers, technical officers of the MMC as well as personnel from other public and private institutions.

This group must initially undergo extensive training consultants competent in subjects related to ISWM who have wide knowledge and experience. This consultant will use the presentations of the awareness and training packages to carry out this task. This will be a training of trainer workshop. The selected group will also be given training on how to make presentations, answer questions and effectively interact with different stakeholder groups.

The MMC have to prepare a schedule of awareness programs taking into account the importance of the groups in ISWM, their availability, educational and social standing and other relevant factors in delivering the awareness programs. The effectiveness of the awareness programs will be high if they are delivered closer to the community at the wards, houses or at pre-selected premises such as chambers rather than gathering all to a central

place. Then trainers will use the schedules and work in batches to create awareness among groups of different stakeholders with appropriate awareness materials.

Awareness creation must be carried out regularly so as to ensure that the stakeholders are kept updated and that their enthusiasm for the plan is high.

Performance indicator:

- Number of awareness programs held
- % of community participated in awareness programs
- Number of trainers trained for future awareness programs

Measure of Success:

- Improved awareness and better participation of community in Solid waste management

Benefits/Impacts:

- A larger group of the Matale community becomes aware of the component of the ISWM plan and its schemes
- Stakeholders can be updated regularly on the ISWP plan and its aspects
- Improved relationship between the MMC and the community due to better communication
- More citizens take part in MMC activities

Barriers:

- Difficulty in getting stake holders to participate in awareness programmes
- Difficulty in Locating suitable resource personnel to carry out the awareness programmes
- Difficulty in Locating resource personnel to carry out awareness in Tamil
- Language of communication to stakeholders

Links to Other ISWM Schemes of Matale:

- S1 Developing Information Sharing Systems
- S3 Developing Publicity Material in Sinhala and Tamil
- S4 Developing Awareness and Training Packages
- S 6 Conducting Training Programmes to key stakeholders
- S7 Setting up children's societies at each municipal ward
- S8 Establishing Waste Minimization Cells in each Municipal ward
- S15 Restore environmental education centre and provide necessary equipment to enhance its role

Scheme 6 - Conducting Training Programmes to key stakeholders

Introduction:

ISWM Plan is prepared to address all types of waste generated within MMC including Hazardous waste and construction waste. It also includes all phases of the solid waste management lifecycle such as source segregation, collection, transportation, treatment, disposal and recycling & recovery. Currently the MMC waste management system includes only the collection, transportation and disposal phases. Therefore technologies and techniques under the source segregation, treatment and recycling & recovery will be new and complicated systems for Matale.

As the ISWM Plan proposes various innovative ideas and approaches which will cover more complex waste streams and technologies stakeholders who will be directly involved in these areas as well as those who will impact waste generation and disposal will require in depth training.

The level of training and the areas of training to be provided will depend on the stakeholder's involvement in the implementation process as well as their technical background and capabilities.

Taking into consideration all the above factors training and capacity building of relevant stakeholders will have to be given priority status within the plan. Therefore the ISWM plan must include a systematic plan to provide the necessary training to stakeholders. The following scheme discusses the training arrangement for the ISWM plan.

Purpose:

Build capacity among Matale stakeholders for effective solid waste management.

Desired Outcomes:

- Provide training to different stakeholders on each relevant aspect of ISWM
- Develop competencies in carrying out activities under ISWM

- Train a group of trainers on ISWM to continue with community education
- Effective implementation of schemes and special projects
- Improved participation of different segments of the community in ISWM

Nature of the Scheme:

Capacity building and communication program

Agencies responsible

Lead

- MMC

Supporting

- NSWMSC
- NCPC
- Sevenatha (NGO)
- Consultants / Trainers
- Schools
- Children's societies
- CDOs
- Matale Divisional Secretariat
- Agriculture Department
- Matale Chamber of Commerce and Industry

Location: Matale

Budget: LKR 1,000,000/- (USD 9350 approx)

This amount includes cost of

Payments to be made to resource persons

Venue charges for training programmes

Hiring of multimedia equipment

Organizing of awareness programmes (Logistics)

Organizational expenditure

External Consultants fee

Printing of handouts and reading material
and excludes the cost of
Preparation and printing awareness and training package

Time Frame: 12 months

Description:

The main goal of this scheme is to provide the training required to implement the ISWM Plan to the key stakeholders. Therefore the training programme will have to be conducted so as to include the stakeholders who have a direct impact on the phases of the Solid Waste lifecycle. However it will not be possible to conduct in-depth training programmes to all these stakeholders. Therefore several different training approaches will be used in combination to achieve best possible results. As in the previous case the methods and approaches to conducting the training will again vary depending on the education and social background of the stakeholders concerned.

It is obvious that different stakeholders require different knowledge, skills and training to carry out activities identified in the ISWM. Since all the stakeholders are engaged in varied day to day activities it is also important to re-train them at regular intervals.

The training and capacity building will have to cover both the planning and the implementation phase of the ISWM Plan. Therefore the following key topics will have to be included for capacity building (Refer report on Awareness and training package for further details)

Planning Phase:

- Waste Characterization and Quantification
- Assessment of Solid Waste Management System
- Target Setting
- Stakeholder Concerns

Implementation Phase: These will be divided into two groups which are technical training topics and management training topics. They are highlighted below.

Technical Training

- Source Segregation
 - Major Waste Types
 - Segregation Methodology
 - Identifying Recyclable Plastic Waste
 - Good Housekeeping Systems
- Collection and Transportation
 - Developing Collection Schedules
 - Collection Vehicles and Equipment Operation and Maintenance
- Treatment Technologies
 - Composting Plants
 - Operating and Maintenance of Composting Plants
 - Health & Safety aspects of Composting Plant Operators
 - Biogas Plants
 - Operating and Maintenance of Biogas Plants
 - Health & Safety aspects of Biogas Plant Operators
 - Incineration
 - Operating and Maintenance of Incinerators
 - Health & Safety aspects of Incinerator Operators
- Disposal Technologies
 - Operation and Maintenance of Engineered Sanitary Landfills
- 3 R Technologies
 - Reduction Techniques and Technologies
 - Cleaner Production & Waste Minimization
 - Reuse & Recycling
 - Plastic Recycling
 - Paper Recycling
 - Glass Recycling
 - C & D Reuse and Recycling

- Health & Safety aspects of Recycle plant Operators
- Occupational Health & Safety

Management Training

- Financing and Accounting
- Community Participation
- Partnership Building
- Monitoring and Measurement
- Policy and Regulatory Framework
 - Environmental Legislation
 - Market Based Instruments

Implementation:

As in the case of awareness creation, training too will have to be carried out continuously regularly. Therefore it is essential that a permanent group of stakeholders be developed as trainers in Matale. Therefore training programmes should be initiated with a training of trainers workshop designed to develop a group of local resource persons who can carry out the awareness and training activities needed for the ISWM Plan. This group will include officers at MMC, school teachers, community leaders, public sector officials (e.g. Divisional Secretariat, agriculture department), NGO personnel as well as officers of the Matale Chamber of Commerce and Industry. The selected group will be given further training on how to make presentations, answer questions, and effectively interact with different stakeholder groups so as to maximize the effectiveness of training.

These trainers will use the presentations of the awareness and training package prepared for the Plan in conducting the training programmes.

The MMC will need to prepare a schedule of training programs taking into account the importance of the groups in ISWM, their availability, educational and social standing and other relevant factors in delivering the training programs. The effectiveness of the training programs will be high if the participants of the community are active in the training and

unlike in the awareness these training programs have to be delivered at selected premises such as chambers, composting plant etc. The trainers will use the schedules to train groups of different stakeholders using appropriate training packages.

Performance Indicators:

- Number of persons in the community trained on sorting
- Number of scavengers collecting wastes for recycling trained
- Number of persons trained on recycling
- Number of trainers trained for future awareness programs

Measure of Success:

Higher community participation and the solid waste management becomes effective

Benefits/Impacts:

- Relevant stakeholders are able to contribute effectively to the ISWM Plan
- Stakeholders have necessary skills to carry out resource recovery and recycling
- A larger group of the Matale community trained on the schemes of ISWM
- Reduce the conflicts between the MMC and community on solid waste management
- More citizens take part in MMC activities

Barriers:

- Difficulty in getting stake holders to participate in training programmes
- Difficulty in locating suitable resource personnel to carry out the training programmes
- Difficulty in locating resource personnel to carry out training in Tamil
- Long term continuity of training can be hindered to non availability of trainers

Links to Other ISWM Schemes of Matale:

- S1 Developing Information Sharing Systems
- S3 Developing Publicity Material in Sinhala and Tamil
- S4 Developing Awareness and Training Packages

- S 6 Conducting Awareness Programmes to key stakeholders
- S7 Setting up children's societies at each municipal ward
- S8 Establishing Waste Minimization Cells in each Municipal ward
- S15 Restore environmental education centre and provide necessary equipment to enhance its role

Scheme 7 - Setting up Children's Societies at each Municipality Ward

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on 3R (reduce, reuse, and recycle) approach. Awareness raising and stakeholder participation are essentially required to achieve the targets set for waste reduction and waste diversion for reuse and recycle.

For household waste, the source reduction and source segregation is considered as a major challenge, as households do not segregate waste and it would required a lot of awareness raising and capacity building to bring the change in culture and attitudes about waste.

There are various activities proposed under this ISWM Plan to raise awareness and build local capacity at household level. One of these activities is to raise awareness of children and make them to participate in waste segregation at their homes. This could be achieved by forming children societies with a focus on environmental activities including waste management.

Though there are children's societies in some of the wards of the municipality they are neither directly nor indirectly engaged in activities related to solid waste management. This has to some extent aggravated the solid waste problem as the children do not take part in the protection of the city from dumped garbage.

Children can be a motivating force who can guide the adults in the society, their parents and other family members, to be more proactive in their approach towards solid wastes. As future citizens of Matale the children should be instilled with the responsibility of caring for the city. Through such societies, children can take over projects to reduce, segregate and recover wastes. This will improve their knowledge on solid wastes management, and benefit them as adults to be active partners in ISWM in Matale. The plan therefore includes strengthening and building capacity of existing societies to participate actively in the

implementation of the ISWM Plan and to set up new societies in wards that do not already have them.

Purpose:

Children societies are to be established to conduct various activities for children with an aim to raise awareness and to motivate them to participate in environmental activities including waste reduction and segregation at their homes and schools.

Desired Outcomes:

- Strengthening existing children’s societies and setting up new ones in wards that don’t already have societies.
- Mobilizing all children in MMC to be organized into societies within their wards
- Make use of children’s innovativeness and creativity to find new solutions to solid waste problems
- Active participation of children in solid waste management and keeping the city clean.
- Children to act as motivating force to convince community groups to proactively involve in solid waste management.

Nature of the Scheme:

Institutional building and community empowerment project

Agencies Responsible:

Lead

- MMC

Supporting

- Sevenatha
- CDOs
- Central Environmental Authority
- NCPC
- Matale Divisional Secretariat (Child Rights Promotion Officers)

Location: Each municipal ward in Matale

Budget: Rs 100,000/- (USD 950 Approx)

This amount includes cost of setting up societies and providing the awareness and training required and excludes the cost of infrastructure and equipment.

Time Frame: 12 months

Description:

The children's societies are to be formed under the primary schools and children from junior high schools are also encouraged to be members of these societies. The wards in the vicinity of each school will have their ward level societies at the school and each society will be guided by a teacher from that school. The community organizations and NGOs will also be encouraged to support these children societies and work jointly their activities.

MMC would provide seed money to schools to establish these societies and carry out the activities. At the school level, all the activities will be conducted jointly for all the ward level children societies, which are established at that school. These include segregation at school, brainstorming and games to raise awareness and walk through the wards to understand the level of waste generation and impact of source reduction and source segregation of waste.

These societies will conduct ward-level activities by making a pie chart of waste at household level and try to learn what type of waste could be reused and recycled. The games at ward level would be conducted to increase their interaction among themselves and among various households. Special waste-related days, such as waste-free days, could be promoted to motivate children that they may not generate waste at their level on those days.

Competitions among different ward-level and/or school-level societies could be conducted twice a year to include sports as well as the outcomes of waste reduction and waste

segregation during the last six months and awards may be given to the best wards and schools.

Implementation:

During the first month, MMC with the assistance from NGOs and NCPC would visit all the schools and meet the ward-level NGOs, if available, to inform them about establishment of Children Societies and solicit their support and help. In the second month, all the schools will provide the list of the wards, located within their vicinity and number of children from those wards. They would also provide the names of the voluntary teachers who would guide these children societies. In the third month, the children societies will be formed and first activity, basically games, will be conducted to let them provide an opportunity to know each other. The students from junior high school and participants from NGOs would be encouraged to joint this activity. From the fourth month, all the children societies will conduct school level activities including games and waste segregation. From the fifth month, ward-level activities will start. In the ninth month, a competition among ward-level societies at school will be held. In the 12th month, a competition among all the ward level organizations at central place will be held. From second year, these children societies are expected to work on their own with a minimum support from MMC.

Performance Indicator:

- % school programs started
- Number of school initiatives on SWM
- Number of school initiatives on resource recovery and pollution prevention

Measure of success:

- Wards and school with children societies produce less waste and segregate most of its waste in comparison to previous year from year 2.

Benefits/Impacts:

- Environmentally responsible community
- Enhances participation of future generations in Solid Waste Management

- Better community participation and improved relationship with MMC
- Reduction in waste generated and disposed
- Enhanced segregation at source
- Reduction in waste sent to landfill site
- The impacts would be future environmentally friendly society

Barriers:

- Inability to find donors to provide financial assistance to set up Children's societies
- Lack of support from schools in setting up children's societies
- Cost of the materials required for activities by children societies
- Other similar Experiences

Link to other ISWM Schemes of Matale:

- S3 Developing publicity material in Sinhala and Tamil
- S4 Developing awareness and training packages
- S5 Conducting awareness programmes to all stakeholders
- S8 Establishing waste minimization cell for each municipality ward
- S13 Provide segregation bins to residents of identified streets for promotion of source segregation

Scheme 8 - Establishing Waste Minimization Cells in each Municipal Ward

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation is essentially required, particularly for source reduction and source segregation of waste.

For household waste, the source reduction and source segregation is considered as a major challenge, as households do not segregate waste and it would required a lot of awareness-raising and capacity building to bring the change in culture and attitudes about waste.

There are various activities proposed under this ISWM Plan to raise awareness and build local capacity at household level. One of these activities is to establish waste minimization cell for each municipality ward in cooperation with community based organizations in each ward. The community based organizations in each ward can be strengthened and their participation can be improved in solid waste management by establishing waste minimization cells in each of the municipal wards.

The waste minimization cell will be facilitated through training to quantify and assess waste generated within their own ward and segregate them so that their economic values are increased. The housewives will be educated by members of the Waste Minimization Cell/CBO of each ward to reduce the cost of living through reduced waste and earn additional incomes by selling sorted wastes to recyclers or re-users.

A way to ensure success setting up and operating such cells is to give leadership of such cells to community leaders and other public figures that hold influence with the common people. This will also ensure that people are motivated and supportive of the cause. In addition to this a steering committee will be formed with representatives from each cell. This steering committee can then link up and communicate with the MMC regarding the

ISWM Plan. A mechanism will also be in place to ensure that information flow occurs both upstream and down stream.

Purpose:

Assist households and especially housewives to reduce the waste generation through intelligent purchasing and consumption and then by vigilant sorting of wastes prior to disposal.

Desired Outcomes:

Following outcomes are expected from this activity:

- Waste Minimization cells in all municipal wards
- Improved awareness on ISWM among community groups
- Reduce the solid waste generated at household level and ward level
- Improved accountability by each ward for waste generated within their wards
- Increase the community participation in solid waste management at Matale

Nature of the Scheme:

Institutional building and community empowerment project

Agencies Responsible

Lead:

- MMC

Supporting:

- Sevenatha
- CDOs
- Central Environmental Authority
- NCPC
- Divisional Secretariat
- Matale Chamber of Commerce and Industry
- Village Development Societies

Location: Each Municipal ward in Matale

Budget: Rs 100,000/- (USD 950 Approx)

This amount includes cost of setting up societies and providing the awareness and training required and excludes the cost of infrastructure and equipment.

Time Frame: 12 months

Description

The waste minimization cells are to be formed under the MMC with the offices responsible for each ward. The community organizations and NGOs will be encouraged to support these cells and their activities.

MMC would provide seed money to each ward office to establish these cells and carry out the activities. At the ward level, NGOs and community development organizations including women organizations will be engaged in raising awareness and building capacity in waste segregation and reuse and recycle.

Training and awareness raising materials in local languages will be developed and used to carry out aware programmes and pocket meetings regularly. Households will be encouraged to participate in these regular activities to learn more about the waste segregation and reuse and opportunities for waste recycling.

Implementation:

During the first month, MMC with the assistance from NGOs and NCPC would visit all the wards and meet the ward -level community development organizations to inform them about establishment of Waste Minimization Cells at ward offices and solicit their support and help. In the second month, all the ward offices will provide the list of members, who would be active partners/volunteers to carry out the activities including awareness raising campaigns and training. Following this, a training will be conducted for these partner/voluntary organizations and individuals. From the fourth month, all the ward offices will start awareness raising campaigns and training. In the 12th month, a competition among

all the wards will be held. From second year, these ward level cells are expected to work independently with a minimum support from MMC.

Performance Indicator:

- % increase of community participation in SWM
- Number of citizen suggestions received for clean city
- Number of applicants for Best Solid Waste Management award scheme
- % of households cooperating with MMC
- Number of awareness programs held
- Number of persons in the community trained on sorting
- % increase of community participation in SWM
- Number of persons trained on recycling
- % of community participated in awareness programs
- Number of trainers trained for future awareness programs

Measure of success:

Wards produce less waste and segregate most of its waste in comparison to previous year from year 2.

Benefits/Impacts:

- Environmentally responsible community
- Enhances participation of future generations in Solid Waste Management
- Better community participation and improved relationship with MMC
- Reduction in waste generated and disposed
- Enhanced segregation at source
- Reduction in waste sent to landfill site
- The impacts would be future environmentally friendly society

Barriers:

- Inability to find donors to provide financial assistance to set up Waste Minimization Cells
- Lack of support from CDOs in setting up cells
- Cost of the materials required for activities carried out by cells
- Other similar Experiences

Link to other ISWM Schemes of Matale:

- S3 Developing publicity material in Sinhala and Tamil
- S4 Developing awareness and training packages
- S5 Conducting awareness programmes to all stakeholders
- S7 Setting up children's societies at each municipality ward
- S13 Provide segregation bins to residents of identified streets for promotion of source segregation

Scheme 9 - Establishment of Waste Exchange Centre

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on the 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation is essentially required, particularly for source reduction and source segregation of waste.

To encourage the waste segregation for material and resource recovery, economic incentives would be required. These incentives could only be sustained if generated through market. Hence, a Waste Exchange centre (WEX) would be required to create a market-place for waste exchange, where sellers and buyers can trade the waste for economic incentives and mutual benefits.

This waste exchange platform would be ideal for organizations rather than individuals, as industries and recyclers can trade waste through it. This is based on a concept that waste of one organization is a resource for another. Currently the recoverable or reusable wastes are not being exchanged as resources in Matale due to non-availability of information for the potential sellers and buyers. Therefore it is intended to develop communication channels (ie: Electronic Interface/website, centre) to offer the available wastes and related information to those potential users/buyers.

The proposed waste exchange will only be an interface. It will not physically store the available resources at one place but will provide the information on wastes available for exchange, location (address), quantity and any other information required for a new user. The users can then directly communicate with the seller/disposer and make arrangements for exchange.

Through the scheme 1 (S1) under theme 1 the waste exchange will also be linked to the national waste exchanges already in operation and thereby the businessmen outside of Matale too can buy the materials offered through it.

Purpose:

To boost the trade of recyclable waste by providing information based on market-place to buyers and sellers.

Desired Outcomes:

- Establish an electronic interface (Website) to link waste generators and buyers/users of wastes
- Establish a mechanism through which people who do not have access to the internet can also link waste generators and buyers/users of wastes
- Listing of all recoverable wastes in the electronic interface
- Streamline the exchange of wastes through quick communication
- Increase the amount of waste recovered as usable resources
- Reduce the amount of wastes ending up in landfill

Nature of the Scheme

Virtual market-place

Agencies Responsible:**Lead:**

MMC

Supporting:

NSWMSC

ITI

NCPC

Matale Chamber of Commerce and Industry

Matale Divisional Secretariat

Matale Vidatha Centre

Location: Matale Municipality

Budget: Rs 200,000/- (USD 1875 approx)

This amount includes the cost of

- Conducting initial market study/survey and waste inventory preparation

- Preparation of the database

- Setting up of website

and excludes the cost of infrastructure and equipment such as computers.

Time Frame: 6 months

Description:

The waste exchange centre will be setup within the premises of Matale Municipality and will be operated by one person. The forms, to seek information on available recyclable waste from sellers and demand from buyers, will be printed. The buyers and sellers will submit their forms and the information will be fed into the computer-based waste exchange platform and on weekly basis a report will be published and displayed to inform buyers and sellers about the demand/supply and price quotes by buyers and sellers.

Implementation:

MMC is required to hire/assign a person to establish waste exchange centre. The initial step in the implementation process is to carry out a market study and to collect data regarding available waste for exchange through a survey. This data will then have to be compiled into a waste database. Concurrently a list of (inventory) prospective sellers and buyers will also be developed along with relevant information. All this information will have to be included in the WEX database. (Refer Project Proposal on Waste Exchange Centre for Matale for further details). The MMC will then have to buy/allocate a computer and set up office place with an employee to operate the waste exchange. Alternatively the WEX can be set up at the Matale Chamber of Commerce and Industry which has already developed links with industries in the region and have the necessary resources to set up a waste exchange.

The WEX will have two components the first of which will be the physical location from which prospective buyers and sellers who do not have access to the internet can visit and the second which will be the website with links to existing WEXs.

The information on the waste exchange must be updated regularly so as to ensure that the clients have access to accurate information. This can be achieved by having a procedure through which prospective buyers and sellers must register with the Matala WEX and provide regular updates on the available waste. The final phase of setting up the WEX will include the actual trading of waste.

For the first year, this project will be subsidized by MMC; however, based on the progress of the project and its popularity among entrepreneurs, a commission can be earned by MMC from the second year onward to support the costs of the project.

Performance Indicator:

- Volume of waste exchanged
- Quantity of waste recycled
- % of waste recycled
- % of waste recycled into value added products
- % increase in resource recovery
- % reduction of waste going to landfill site
- % income from environmental services against total expenditure
- % reduction in SWM expenditure due to resource recovery
- Total income generated from resource recovery
- % income generated

Measure of Success:

- Increased number of buyers from Matala and other parts of the country seek to exchange waste with industries/MMC.

Benefits/Impacts:

- Recyclable wastes get a better economic value
- Wastes going to landfill site is reduced
- Better returns to Matale community

Barriers:

- Delay in national and local policies to support the use of recyclable waste in place of virgin natural resources
- Lack of continuity of the existing waste exchanges
- Industries do not provide accurate information regarding the quality and quantity of was available
- Some hazardous waste could be included in the exchange process
- Low number of visits to web pages by resource users
- Difficulty in gaining access to the Internet

Links to Other ISWM Schemes of Matale:

- S1 Developing information sharing systems
- S8 Establishing waste minimization cells in each municipal ward
- S9 Establishing waste exchange centre
- S10 Promoting private sector participation in recycling based industries
- S16 Setting up eco-kiosks
- S17 Setting up intermediate collection point for e-waste
- S18 Setting up intermediate collection and transfer stations for Municipal Waste
- S19 Establishing a central collection and exchange point for construction and demolition waste

Scheme 10 - Promoting Private Sector Participation in recycling based industries

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on the 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation are essentially required, particularly for source reduction and source segregation of waste. Economic-incentive based motivation could work well to divert most of the waste for material/resource recovery.

Economic-incentives could be generated, if there is a market for recyclable waste and to create the demand for recyclable waste. Industries could play a vital role in this regard. Either new, dedicated industries based on recyclable waste could be established or the existing industries could be encouraged to replace some of their natural resources based inputs with recyclable waste.

The previous experience in solid waste management in the other parts of the country has shown that commercial based projects cannot be operated by public sector due to many reasons. Therefore the trend has been to develop public-private partnerships and encourage the participation of private sector in carrying out commercial projects in a sustainable manner.

Therefore several projects in the ISWM plan which depend on recovery of resources will be carried out on a market based approach to ensure its long term sustainability. However due to the small quantities involved it will not be possible to start large scale industries based on waste as the main raw material. This necessitates MMC to work with the local chamber of commerce and industry to gain the support of small investors to start a few small scale industries/businesses to add value to non organic recyclable wastes. It is important to give priority to industrialists and investors from within the Matale district when setting up such industries to ensure that the benefits reaped from them are enjoyed by the residents and business community of Matale.

This will further assist to build confidence between the business sector and the MMC and will lead to better cooperation for effective implementation of ISWM plan.

Purpose:

To promote private sector participation to establish recycling waste based industries

Desired Outcomes:

New businesses/SMEs started in Matale to carry out waste recycling

- Generate new employment opportunities within Matale
- Increase the amount of wastes recovered and ensure that benefits remain in Matale
- Give priority to private sector organizations in the Matale district in setting up and operating such industries (When ever possible)
- Active participation of private sector businesses in ISWM plan implementation

Nature of the Scheme:

Project to Establish partnerships and improve institutional building

Agencies Responsible:

Lead

- MMC

Supporting

- Matale Chamber of Commerce and Industry
- Local and National Business Associations
- Ministry of Industrial Development
- Industrial Development Board
- Matale Divisional Secretariat

Location: Matale

Budget: Rs 50,000/- (USD 475 approx)

Time Frame: 6 months

Description:

MMC with assistance from business organizations and national government would encourage setting up an eco-industrial estate for recycling based industries. These industries will essentially be private sector owned and operated. The recycling industries will recover materials and energy from waste to be utilized as an input in industrial production. (Refer project proposal on Eco-industrial Park).

The MMC together with other responsible agencies must develop a suitable incentive system to promote private sector participation in this endeavour. These incentives can be monetary or non-monetary in nature. For example the MMC can provide the land to set up such an industrial estate to the investors.

Based on the information gathered through the Waste quantification exercise the main recycling industries can be paper, plastic, construction and demolition waste, fish and offal waste from market place etc. Several new and innovative industries can be set up with private sector participation within Matale. The MMC must come to an agreement with the industries and investors that priority will be given to local human resources for employment and thereby ensure that the benefits of these industries are directly felt by the community. It is also recommended to find local investors so that the benefits from such a project remain within Matale and encourage more local investors and industries.

Implementation:

The MMC must hire/appoint an external consultant to prepare a project proposal to set up the eco-industrial estate for recycling based industries. The implementation of this scheme will be based on this proposal.

Performance Indicator

- Quantity of waste recycled
- % of waste recycled
- % of waste recycled into value added products

Measure of success:

Number of industries established and amount of recyclable waste diverted for these industries.

Benefits/Impacts:

- Add value to waste and thereby encourage stakeholders to reduce waste disposal
- Waste is diverted from landfill
- Reduce cost of solid waste management
- Reduce the use of virgin material in production and thereby reduce overconsumption of natural resources
- With the establishment of new industries, employment and economic activities will be generated enhancing the living conditions of the community
- Increased investment within Matale

Barriers:

- Lack of investors to set up new recycling based industries
- Lack of rapport between industrialists and the MMC
- Lack of space to set up industries within Matale Municipal Council area
- Lack of policies and strategies at national level to encourage industries to replace virgin resources with recyclable material
- Belief that products made from recycled material is low in quality

Link to other ISWM Schemes of Matale:

- S9 Establishment of waste exchange centre
- S13 Provide segregation bins to residents of identified streets for promotion of source segregation
- S16 Setting up Eco-kiosks
- S18 Setting up intermediate collection and transfer stations for Municipal Waste
- S19 Establishing a central collection and exchange point for construction and demolition material

- S20 Introduce compartmentalized trailers to transport waste streams
- S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries
- S30 Develop incentive system to promote source segregation

Scheme 11 - Strengthening Community Based Organizations

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation is essentially required, particularly for source reduction and source segregation of waste. One of the activities for achieving stakeholders' participation in ISWM is to strengthen community based organizations such as Community Development Organizations (CDOs).

CDOs are in existence in each of the municipality wards but their positive contribution to solid waste management is at a minimum level. If the CDOs are strengthened adequately they will be able to play a significant role in the implementation of the proposed ISWM plan. The community development organizations could become the promoters for reducing waste generation and waste segregation at source.

In addition to this CDOs will also play an important role as operators of proposed decentralized treatment plants such as composting and bio gas plants. Therefore the CDOs should be exposed to relevant technologies, basics of quality assurance, marketing and economics of production etc. By doing so, these organizations will be capable of efficiently operating these plants in an economical and environmentally safe manner. CDOs must also be able to look after the maintenance of these plants without external assistance in the long run.

It is also important that all CDOs be registered with the MMC or the Divisional Secretariat so that their activities, operations and participation in the implementation process can be closely monitored. Such a link will also help the CDOs to receive further assistance in their activities.

Purpose:

To get effective support of community based organization such as CDOs for smooth implementation of ISWM Plan including waste reduction and segregation, waste collection and waste reuse and recycling.

Desired Outcomes:

Improve the knowledge and capacity of community development organizations on solid waste management

- Make the CDOs capable of taking over some of the major activities of ISWM plan in future
- More households to become active members of the CDOs
- Improve community participation in ISWM plan implementation

Nature of the Scheme:

Project to establish partnerships and enhance institutional building and community empowerment

Agencies Responsible:**Lead**

- MMC

Supporting

- Provincial Council (Central Province)
- Matale Divisional Secretariat
- Sevenatha
- MoPC&LG
- NCPC.

Location: Matale municipality wards

Budget: Rs 100,000/- (USD 950 approx)

Time Frame: 12 months

Description:

Existing Community development organizations will be encouraged to take an active role in ISWM and the implementation of the plan. Their role could vary, based on the type of the activity. Some organizations will be focusing on awareness raising campaigns, some will act as service providers for door-to-door waste collection and segregation while others will be involved in the recycling waste and operating composting and biogas plants.

To improve the efficiency and effectiveness of these community based organizations, their capacity will be strengthened through training activities. Specific training packages will be developed in accordance with the roles and responsibilities, these organizations are willing to take.

These organizations will be registered and with strengthened capacity, they will be capable of performing well in an environmentally friendly manner.

Implementation:

During the first month, MMC will work with community based organizations to develop a matrix of roles and responsibilities of these organizations based on their interest in various activities under ISWM Plan. During the second month, based on need assessment survey, the training courses will be identified. During the next 3 months, training packages will be developed. The next 6 months will be spent on training to strengthen the capacity of community based organizations.

Performance Indicator:

- Number of persons in the community trained on sorting
- % increase of community participation in SWM
- Number of persons in the community trained on environmental pollution and resource conservation
- Number of citizen suggestions received for clean city

Measure of success:

Number of community based organisations and their members are involved in the activities under ISWM Plan after the training.

Benefits/Impacts:

- In the short-term, effective and efficient community based organizations are available to assist MMC in the implementation of ISWM
- The impact of capacity strengthening could be that these community based organizations can also contribute in other services such as water and wastewater, healthcare and education
- A well trained group of community development organizations ready to take over the implementation of various schemes proposed under the ISWM Plan

Barriers:

- Availability of appropriate resources including trainers for capacity strengthening of community based organizations

Link to other ISWM Schemes of Matale:

S3 Developing publicity material in Sinhala and Tamil

S4 Developing awareness and training packages

S5 Conducting awareness programmes to all stakeholders

S7 Setting up children societies at each municipality ward

S8 Setting up waste minimization cells in each Municipal ward

S9 Establishment of waste exchange centre

S13 Provide segregation bins to residents of identified streets for promotion of source segregation

S14 Re-introduce bell collection system for house to house collection

S15 Restore the environmental education centre and provide necessary equipment to enhance its role.

S16 Setting up Eco-kiosks

S29 Develop incentive system to promote source segregation

Scheme 12 - Develop programmes to enhancing living and working conditions of Sanitation Workers

Introduction

Integrated solid waste management (ISWM) plan for Matale city is based on 3R (reduce, reuse, and recycle) approach. To achieve the targets for 3R and proper waste collection, the living and working conditions of sanitary workers should be improved. This would help to increase their productivity and motivation for work.

The low social status and poor public recognition of sanitation workers is a problem faced by all local authorities in Sri Lanka. This situation is no different in the case of Matale. As a result of that the community groups do not pay much attention to the living conditions of these people and the workers themselves do not attempt to enhance their living conditions. This leads to sanitation workers paying minimum attention to health and safety of themselves or the community they serve.

Besides that the workers are not provided with or do not use provided PSEs when carrying out their tasks. This often exposes them to accidents and poor health conditions which in turn and increased absenteeism. Since their motivation is at a very low level they are often negligent.

The proposed ISWM plan identified that the motivation and effective involvement of sanitary workers is a key ingredient for effective implementation of the plan. The first step in doing so is to change the term associated to them (scavenger). The active participation of workers can be ensured by recognizing them as an equal member of community and a key partner in the solid waste management system. This could be achieved by developing their working conditions and living conditions. There is a need to provide counselling and health care services to the workers and their families in order to ensure that their lives are improved. The employees must also be given at least primary education to be able to read and write.

Purpose:

The purpose of this activity is to improve the living and working conditions of sanitary workers, which would enable these workers to live a good life and may contribute more effectively and efficiently towards the implementation of ISWM

Desired Outcomes:

Following outcomes are expected from this activity:

- Improve health and safety of sanitation workers and their families
- Reduce risks to sanitation workers as well as the public caused by unsafe handling of waste.
- Create an enhanced image and better recognition to sanitation workers by the public.
- Increase motivation among them and improve attendance.
- Improve social status as well as living conditions of sanitation workers
- Improve efficiency of solid waste management system at Matale.

Nature of the Scheme:

Institutional strengthening

Agencies Responsible:**Lead**

- Matale Municipal Committee (MMC)

Supporting

- Provincial Council (Central Province)
- Divisional Secretariat
- Sevenatha
- Ministry of Local Government
- Matale Hospital
- NCPC

Location: Matale

Budget: Rs 100,000/- (USD 950 approx)

Time Frame: 12 months

Description:

Based on the assessment of current conditions and challenges faced by sanitary workers, a comprehensive programme, including policies and physical support, would be developed. The policy would focus on the improvements in working conditions, including proper gear and medical care. The physical support would focus on the salary structure and partnership on material recovery for recycling.

Implementation:

During the first month, MMC will do the assessment of current challenges faced by sanitary workers. During second week, a comprehensive package would be developed. In the following 2 months, required approvals at local/national level would be sought and funds would be requested. From 5th month, the programme would be implemented.

Performance Indicator:

Approval of the comprehensive programme.

Measure of success:

Number of sanitary workers living a better life and working in improved environment after 6 months.

Benefits/Impacts:

In the short-term, the sanitary workers would be living a good life and their work efficiency and effectiveness would be improved. The impact would be their social status would be improved.

Barriers:

Availability of appropriate resources

Link to other ISWM Schemes of Matale:

S13 Provide segregation bins to residents of identified streets for promotion of source segregation

S14 Re-introduce bell collection system for house to house collection

S15 Restore the environmental education centre and provide necessary equipment to enhance its role.

Scheme 13 - Provide segregation bins to residents of identified streets for promotion of source segregation

Introduction:

Municipal solid waste management is considered to be ineffective and has become a huge public issue. Except in a few instances the local government authorities (LGAs) all over the country have failed to deliver a good service in the area of solid waste management. There are many aspects in solid waste management which hinders improvement. Among them are lack of finances, use of obsolete technologies, lack of information, lack of policies and strategies applied by the individual local government authorities and poor community participation.

Among all these limiting factors, the lack of community cooperation and participation plays a major role the existing solid waste management problems. One important factor in regards to this is that there is little or no waste segregation at source. Most of the residents dispose their wastes in commingled form and therefore the non-bio degradable wastes which have a market value ends up in the final land fill. This has also contributed largely to the fact that many of the recyclable material receive low prices in the market as they are often unclean and contaminate. This also applies to biodegradable waste which if properly segregated can be converted to value added products such as compost and biogas. However due to the prevalent waste disposal system many of these valuable wastes end up at the land fill and become an environmental issue to Matala.

To prevent this situation and to improve the quality of garbage for reuse and recycle it is important for MMC to encourage the residents to adopt waste segregation. Though several initiatives have already been made to introduce source segregation in Matala factors such as lack of finances, adequately trained personnel to carry out training and technical difficulties have confines these efforts to a small area within the MMC. This scheme proposes to initiate a pilot project within the MMC area to introduce source segregation by providing the necessary bins to residents of identified streets.

Purpose:

Facilitate a selected number of households to commence segregation and to divert their waste away from the final landfill site

Demonstrate to the residents that segregated wastes can provide economic returns to them when compared to commingled waste.

Desired Outcomes:

- Identify a pilot project area to issue bins for waste segregation
- Reduce commingled waste coming into landfill site
- Increase economic value of wastes
- Improve the community participation for solid waste management

Nature of the Scheme: Demonstration Project

Agencies Responsible:**Lead**

- MMC

Supporting

- NSWMSC
- CEA
- Sevenatha
- NCPC
- Matale Chamber of Commerce and Industry
- Funding Agencies
- External Consultants

Location: Matale (Selected wards or streets)

Budget: Rs 1,500,000/- (USD 14,000 approx)

This amount includes the cost of meeting the following requirements

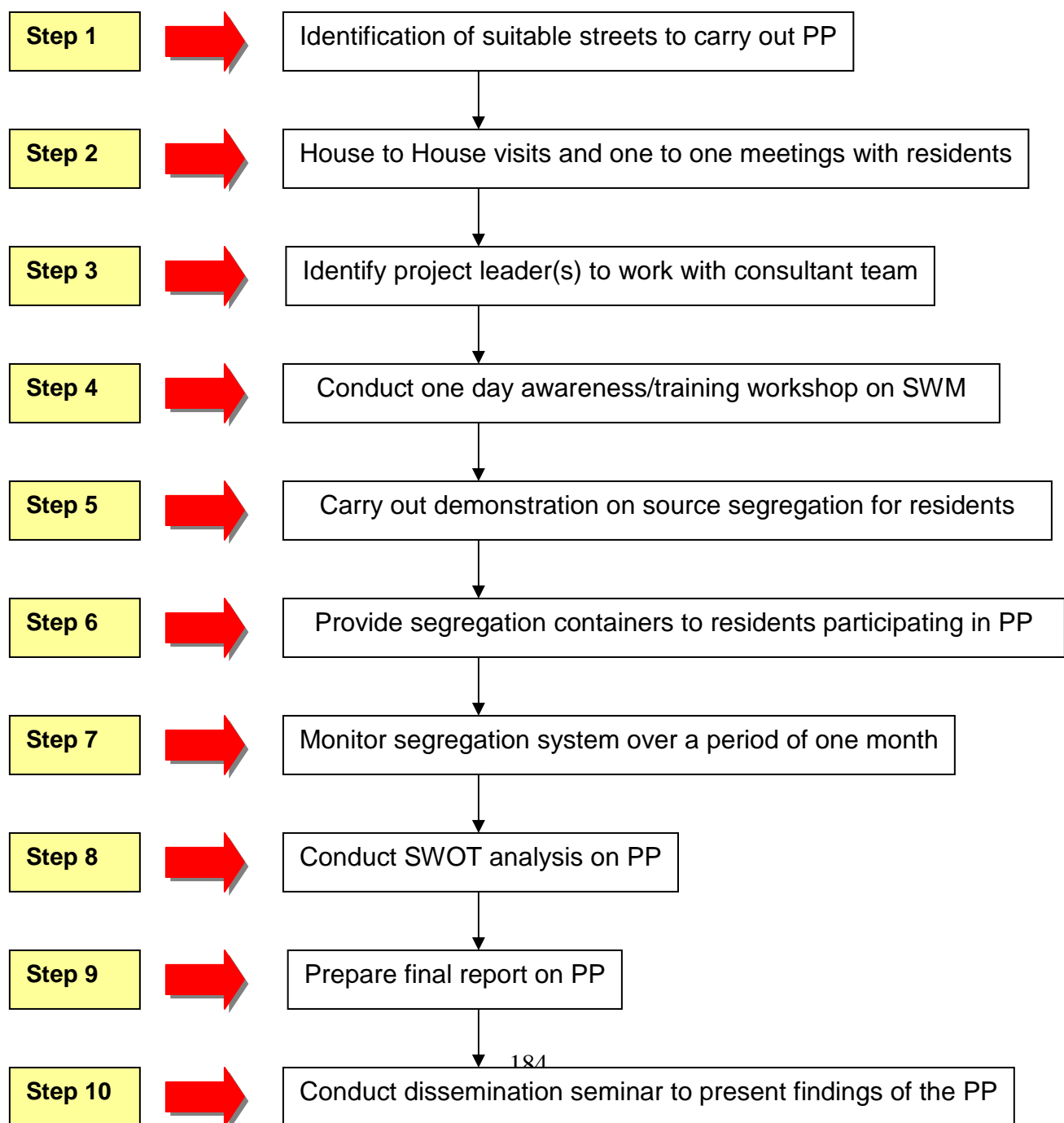
- Segregation bins and bags
- Awareness and training material (handouts, manuals, guidebooks)

- Trainers with the capacity to conduct theoretical and practical training
- External consultant to coordinate the project

Time Frame: 6 months

Description:

As depicted in the figure given below the Pilot Project on Source Segregation at Household Level will be carried out in 10 steps. Though the steps are shown in the figure as taking place one after the other some steps may be carried out simultaneously so as to complete the project within a short period of time.



Step 1: Identification of suitable streets to carry out PP1

The identification of the streets at which the project will be carried out is the initial and most important step in the process as the success of the entire project rests upon this decision. It is recommended that the streets/areas chosen for this purpose be based on the income level of the residents living in the area. Accordingly three areas/streets can be chosen to represent the three levels of income generation within the MMC. This will help in identifying how to design the source segregation system to suit the socio-economic situations of the residents in Matale.

Steps 2: House to House visits and one to one meetings with residents

Once the areas are decided on the team of consultants will conduct one-on-one meetings with residents in the chosen street/area to create awareness and inform the residents of the upcoming project. This will also be an ideal opportunity for the consultant team to gather information as to the space available at each house and the willingness of the residents to participate in source segregation. The team will also use this opportunity to identify persons who will act as leaders in carrying out the project which will be step 3 of the process.

Step 4: Conduct Two-day awareness/training workshop on SWM

The main objective of this two-day workshop will be to create awareness among the residents chosen for the pilot project on the importance of source segregation for the better management of solid waste in Matale. This activity can be coupled with step 5 which is to practically demonstrate to the participant how to identify different waste types and how to segregate the waste streams into designated bin/bags. This event can also provide the opportunity to residents who are already carrying out source segregation to share their experiences with the participants.

Step 6: Provide segregation containers to residents participating in PP1

The segregation bins or bags must be procured in advance and kept ready to be distributed to the participating residents. The segregation of waste will be carried out into in the simplest form with only categories, biodegradable, hazardous and non-biodegradable waste which will include paper, glass, plastics, metals etc. Therefore three types of

containers will have to be provided to each household. It is best to use durable yet inexpensive containers which can be replaced easily if damaged. Therefore the containers can be 10 Litre Plastic Barrels (non-biodegradable waste) and polythene bags for biodegradable waste and hazardous waste. The containers will have to either be labeled or color coded for the residents to recognize which waste material is contained in which bin/bag.

In addition to this the residents can be given necessary training to carry out home composting using kitchen waste and food waste to reduce the volume of biodegradable waste disposed to the MMC system.

Step 7: Monitor segregation system over a period of one month

The segregation system will have to be monitored closely for a period of 4 weeks with regular visits and meeting with the residents to identify any barriers or constraints faced by them. Regular communication with the residents during this period of time is essential so as to provide the necessary support and technical guidance.

Step 8: Conduct SWOT analysis of PP1

Based on the barriers, constraints and any complaints recorded during the project period as well as the success achieved by the residents as well as the consultant team a SWOT analysis will be carried out. The objective of the analysis will be to identify what improvements will need to be made when implementing source segregation at a larger scale and to understand how the barriers and constraints can be overcome. As step 10 of the process a final report will be prepared by the consultant team with inputs from the community leaders of the PP1. This report will include recommendations for implementing source segregation at a larger scale.

Step 10: Conduct dissemination seminar to present findings of the PP1

The findings of the PP1, and the report prepared on the project will be presented to the group of identified stakeholders including residents from areas that were not included in the project, potential donor organizations and MMC. This seminar will be held with the objective

of spreading the concept of source segregation and to motivate other stakeholders also to participate. In addition to this the seminar will be used to show possible donor agencies/organizations the importance of source segregation and how they can assist in the process by donating segregation bins/bags to the community to reduce the solid waste problems faced by Matale.

Implementation:

A decision should be made on the degree of segregation to start in streets. At the beginning it is easy to start with 4 container segregation with one composting bin for bio degradable wastes and three polyurethane bags for plastics, paper and other waste respectively. Providing the composting bins will reduce the collection rate considerably as most of the household biodegradables can be composted. Those materials which cannot be composted will have to be disposed off with the other wastes. Therefore this waste stream will have to be collected daily. The plastic and paper wastes once separated at source can be collected every week or fortnight.

When choosing the ward/streets to implement the project it is essential to keep in mind that the households can be reached by the MMC collection vehicles. Therefore areas where regular collection routes and easy access should be given priority over other areas. Bins/bags should be procured or manufactured and distributed to the households in the selected streets and the households to be educated properly on the scheme.

Regular supervision and continuous advice is required to ensure the households use the compost bins properly and the bio degradable wastes are not dumped elsewhere.

The collection system for paper and plastic should ideally be carried out with compartmentalized handcarts so that the waste is not mixed during collection. This waste will then have to be transferred to a suitable central transfer station where further segregation can be carried out by MMC or by scavengers

Performance Indicator:

- % households carrying out segregation
- % waste segregated per day
- Number of Households carrying out composting
- % of waste composted at household level
- Number of Households that do not compost organic waste though possessing compost barrels
- % reduction in waste taken to sanitary landfill
- Total cost of containers provided
- % of containers replaced within first year
- Cost of collection and transportation per household unit
- Number of households that segregate hazardous waste for safe treatment & disposal

Measure of success:

Households cooperate with the MMC to segregate waste and more households join segregation and request for segregation bins/bags

Benefits/Impacts:

- Clean and segregated wastes are collected from the households
- Improved market value for waste
- Reduced cost for collection and transportation of waste
- Households are able to initiate home gardening projects using compost
- Increased income generation through the sale of compost
- The wastes ending up landfill site is reduced
- MMC/Households receive economic benefits through segregated wastes

Barriers:

- Lack of funds to provide bins to all households
- Lack of space to segregate and store waste in some households

- Lack of cooperation of all households in the selected area
- Community unwilling to segregate waste if no monetary incentives are paid by the MMC for doing so
- Failure in regular collection of wastes due to break downs in the collection system
- Refusal of some households to pay even a minimal amount to purchase bins
- Use of freely distributed bins for purposes other than waste segregation

Link to other ISWM Schemes of Matale:

S14 Re-introduce bell collection system for house to house collection

S15 Restore the Environmental Education centre and provide necessary equipment to enhance its role.

S16 Setting up Eco-Kiosks

S17 Setting up intermediate collection point for E-Waste

S18 Setting up Intermediate Collection and Transfer Stations for Municipal Waste

S19 Establishing a Central Collection and Exchange Point for Construction and Demolition Material

S20 Introduce compartmentalized trailers to transport separate waste streams

S29 Develop incentive systems to promote source segregation

S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 14 - Re-introduce bell collection system for house to house collection

Introduction:

Municipal solid waste management is considered to be ineffective and has become a huge public issue. Except in a few instances the local government authorities (LGAs) all over the country have failed to deliver a good service in the area of solid waste management. There are many aspects in solid waste management which hinders improvement. Among them are lack of finances, use of obsolete technologies, lack of information, lack of policies and strategies applied by the individual local government authorities and poor community participation.

A major issue concerning the existing solid waste management system in Matale is that waste is not disposed to the MMC collection system and is dumped by roadsides and waterways. One factor contributing to this issue that residents are not aware when the collection vehicle reaches their street and therefore misses the collection vehicle. Therefore the households dispose their wastes at odd times of the day sometimes after the collection vehicle departs. This leads to non collected wastes on the streets and strewn all over.

Though MMC had initiated a bell collection system through a previous project (Funded by JICA) the bells used to signal the arrival of the collection vehicles is no longer in operating condition. Therefore MMC is again facing difficulties in waste collection. To overcome this issue the plan proposes that hand rung bells be attached to the collection vehicles which can be rung by the MMC waste collectors to indicate their presence.

This scheme proposes the reinstatement of the bell collection system to further enhance waste collection within the MMC area.

Purpose:

To synchronize the home disposal with MMC collection routine and to prevent non collected wastes remaining on streets.

Desired Outcomes:

- Improve communication to public on solid waste collection routine
- Increase the efficiency of collection system
- More organized and complete service provided to community
- Eliminate unplanned dumping of solid waste on streets/roads

Nature of the Scheme: Synchronized collection system

Agencies Responsible:**Lead**

- MMC

Supporting:

- NSWMSC
- CDOs
- NCPC
- Funding Agencies

Location: Matale (Selected Streets)

Budget: Rs 50,000/- (USD 475 approx)

Time Frame: 03 months

Description:

The lack of communication between the collection workers and community has been a major drawback for effective collection of waste generated at households and also from commercial houses. There are complains from the public that MMC collection is neither efficient nor scheduled. On the other hand sanitation workers complain that the households and commercial houses dispose wastes on the streets haphazardly after the collection is complete. To overcome this poor communication bell collection system was introduced in Matale. During this exercise the collection vehicle was fitted with a musical horn which was loud and clearly audible to households on the streets in advance before the vehicle

reached their premises. This system was very effective and the waste collection efficiency improved considerably.

Unfortunately this mechanism is not in used today as they are not in working condition. It is proposed to reactivate this system by providing a bell instead of a musical horn to each collection vehicle. The manually operated bell can be rung by the driver and people will know to bring their wastes to the vehicle instead of disposing them on the road.

Implementation:

Bell collection can be restarted in the same streets where this system was successfully operational previously. To do this the collection vehicles should be fitted with new bells or homing devices. Since electric bells break down frequently it is suggested to use mechanical bells or old type of horns. If MMC prefers they may use a musical horn and it should be heard by the households on the by lanes.

Also all the households in the selected streets should be notified about the restart of the bell collection systems by visiting them and educating them. The MMC should have meetings with the streets where bell collection will be restarted and find out the most suitable times and route to take and the comments of the households. The waste collection schedule should be prepared only with this consultation.

A formal opening with community participation can be organized to reintroduce the system.

Performance Indicators:

- % community served
- Number of complaints on non collection
- % of households not served by MMC system

Measure of success:

Households handover their wastes to the collection vehicles

Benefits/Impacts:

- No uncollected wastes remain on the streets
- Better community cooperation
- Regularized collection system

Barriers:

Lack of cooperation from sanitation staff

- Frequent break down of the bell

Link to other ISWM Schemes of Matale

- S16 Setting up Eco-Kiosks
- S18 Setting up Intermediate Collection and Transfer Stations for Municipal Waste
- S20 Introduce compartmentalized trailers to transport separate waste streams

Scheme 15 - Restore the Environmental Education centre and provide necessary equipment to enhance its role.

Introduction:

Municipal solid waste management is considered to be ineffective and has become an environmental and public issue in Sri Lanka. Except in a few instances the local government authorities (LGAs) all over the country has failed to deliver a good service in the area of solid waste management. There are many aspects in solid waste management which hinders improvement. Among them are lack of finances, use of obsolete technology, poor information dissemination and weak policies and strategies. Among these factors poor information dissemination plays an important role as it leads to many other issues such as poor public participation and support and unavailability of accurate information on waste which then cause many valuable resources to be disposed off without being reused or recycled. The community has all but lost confidence in LGAs due to insufficient sharing of information with them.

However in the case of the Integrates Solid Waste Management plan prepared for Matale community participation is an integral feature. Several schemes and projects have been outlined by the plan to create positive publicity on the Plan and its aspects as well as to disseminate information, provide awareness and training, receive feedback from stakeholders and to monitor the progress of ongoing projects. All the above activities require a dedicated place/centre where the work can be carried out. In other words Matale requires a focal point for the ISWM Plan.

An Environmental Education Centre (EEC) was set up by a Solid Waste Management Project initiated by JICA a few years ago with the sole purpose of having a centre dedicated to raising awareness on environmental issues in Matale. However over a period of time this centre has gone into misuse and the equipment provided to the centre is also non-functional. The ISWM Plan has identified the EEC as an ideal entity to act as the focal point for the ISWM Plan implementation and also act as communication and information

dissemination point which is accessible to all stakeholders. This scheme describes the restoration of the EEC and enhancement of its role within the context of the Plan.

Purpose:

Establish a focal point through which the activities and their progress monitoring can be carried out.

Desired Outcomes:

- Provide a permanent meeting place for all partners of waste management
- Develop the centre as a information clearing house and a training centre
- A place to set up the waste exchange centre
- A place for public to visit for information on solid waste management and learn progress on the on going projects
- Place for schools children to obtain ideas for school projects

Nature of the Scheme: Infrastructure development project

Agencies Responsible:

Lead

- MMC

Supporting

- Mo E&NR
- MoPC&LG
- NSWMSC
- NCPC
- UNEP
- Department of Agriculture
- Zonal Education Office
- Funding agencies

Location: Matala (Already available Site)

Budget: Rs 3,000,000/- (USD 28,037 approx)

This amount includes the cost of

Refurbishing and purchase of equipment

Setting up the environmental education reference library

and excludes the cost of

Setting up Waste exchange (cost will be borne under scheme 9)

Human Resource needed to operate the centre (Salaries etc.)

Purchase of vehicle for Mobile EEC

Time Frame: 06 months

Description

The existing centre must be updated and improved to include the following facilities

Reception Area/Information and Exhibition Room/Area

This room will act as the main entrance to the centre and a receptionist will be placed here to guide visitors to various sections of the centre. Leaflets, brochures and other publications created through the ISWM plan will be placed here for visitors to take. Banners and notice board will also be placed in this area where updates on the project and its various aspects will be put up for visitors to read. In addition to this a display cabinet can be used to display any products created from recycled material from Matale. These exhibits as well as posters and banners will have to be colorful and attractive and simple to comprehend so that any stakeholder/visitor can easily grasp their content.

Equipment required:

- Lounge Chairs (5)
- Reception Table (1)
- Reception Chair (1)
- Book racks (2)
- Display cupboard (1)
- Telephone (1)

If space is available the centre can also include a small area where models of composting units, biogas units, recycling units will be placed for visitors to see.

Training Room:

The centre will include a training room equipped with audiovisual equipment such as

- Overhead projector (1)
- Video deck (1)
- DVD Player (1)
- Audio equipment and podium (1)
- Microphones (2)
- Laptops (2)
- Screen (1)
- Table (1)
- Lecture theater chairs (35)
- Telephone with intercom facilities (1)

which can be used for training purposes. This room will be able to hold 30 persons and seating arrangements will be done accordingly. The training room will be suitable to carry out training programmes as well as meetings between various stakeholder groups.

Computer Room / Waste Exchange:

The computer room will be equipped in the following manner

- Computer table (2)
- Computer Chairs (2)
- Computers (2)
- UPS units (2)
- External CD Burner (1)
- Internet connection and networking between computers
- Telephone with intercom facilities (1)
- Filing cabinet (1)

One of the computers will be reserved for the Waste Exchange. A part of this room will be used as the waste exchange and prospective clients will be able to visit and contact the operator of the WEX directly to gain information.

Reference Library:

A collection of books and periodicals, information brochures, training packs, CDs and other publications both national and international will be available for reference to the general public. It is essential that the library house publications which are in local languages or translate the material into Sinhala and English for the benefit of local stakeholders. This library will also be open schools and university students who carry out projects regarding Solid Waste Management or Environment Management. The room will be equipped in the following manner;

- Library Table (2)
- Library Chairs (6)
- Book Racks (2)
- Photocopy Machine (1)
- Library Cupboards (2)
- CD racks (2)

Public Relations/Technical Support Cell:

A special cell must be set up within the building to interact with different stakeholders and provide the necessary technical assistance regarding the implementation of the Plan. This cell will also provide the opportunity for stakeholders to give their feed back on the various projects going on. The technical support should be available on technologies such as composting, biogas preparation, recycling activities etc. Another important function of the cell will be to carry out the monitoring activities regarding the implementation of the plan and provide weekly/monthly updates to key stakeholder organizations.

Mobile EEC:

This is a novel idea through which the EEC and some of its activities can be taken to public places, schools etc. This will also provide the opportunity for the MMC to approach and communicate with the floating population of the City. The vehicle most suited for this purpose is a van. The mobile EEC can also include a small information dissemination centre, a mobile screen and projector to show films and presentations in public areas. The

mobile EEC will be most useful during festival seasons when it can be parked in areas where the activities are going on and continue to disseminate information.

Implementation:

Since the building is already in place it can be used as the place for setting up the centre. Therefore the most important aspect in implementation process is finding the necessary resources to reinstate and equip the centre so that it is able to carry out the activities highlighted above. The MMC will need to hire a consultant to prepare a project proposal for the restoration of the centre highlighting all resources required including financial and human resources. The MMC will then need to approach funding agencies as well as local industries to accrue the financial requirement for the centre.

During the first two years the centre will require donor funding to meet all its expenses. Though initial funding for restoration can be collected through corporate partnerships and funding agencies the MMC must look at a long term plan to ensure that the centre is able to operate in a self sustainable manner. Therefore a fee system will have to be introduced even in a small way to build up a capital which can be used for operation expenditure and payment of salaries for the Staff.

The following activities can be provided at a cost to the stakeholders

- Registration Fee to use reference library
- Photocopying of publications at a minimal price for
- Registration fee to join waste exchange programme

Another means of generating income for the centre is to hire out the training room when not used for ISWM Plan implementation.

Human Resource Requirement

- Receptionist cum office assistant
- WEX Operator cum IT Assistant
- Librarian
- Administrative Officer/Trainer

The centre should be open six days a week during normal office hours of 09.00 am to 05.00 pm.

Performance Indicator:

- % increase of community participation in SWM
- Number of school initiatives on SWM
- Number of persons in the community trained on environmental pollution and resource conservation
- Number of citizen suggestions received for clean city

Measure of success: Use of the centre by community, school children and other stakeholders

Benefits/Impacts:

- A central focal point to oversee and coordinate the implementation of the ISWM Plan
- All environmental issues discussed at one place
- A knowledge centre for all stakeholders and especially for children
- New and innovative schemes and projects developed

Barriers:

- Difficulties in securing funds required
- Recruitment of a suitable person from Matale

Link to other ISWM Schemes of Matale:

- S1 Developing Information sharing systems
- S2 Establishing links with existing waste exchange programmes
- S3 Developing Publicity Material in Sinhala and Tamil
- S5 Conducting Awareness Programmes to all Stakeholders
- S6 Conducting Training Programmes to key stakeholders
- S7 Setting up Children's societies at each municipal ward
- S8 Establishing waste minimization cells in each municipal ward
- S10 Establishment of waste exchange centre

Scheme 16 - Setting up Eco-Kiosks

Introduction:

The collection of Solid waste is a high cost operation which causes a heavy drain on the financial resources available to the MMC. Even though the MMC spends around LKR 16,000,000/- annually for Solid Waste Management with the cost of collection and transport alone amounting to approximately LKR 14,000,000/- (Refer Chapter 11 for further details) the waste collection cannot be considered efficient or effective. Around 200 houses in Matale do not receive waste management services. Therefore much of the waste is disposed off to the environment causing great harm to the sensitive eco-system in Matale.

In addition to this the MMC collection system collects waste from residences, public places, religious institutes etc. in a commingled manner reducing its value for reuse and recycling. Therefore recyclable waste does not fetch a high price in the market. All these reasons have lead to the community being disappointed in the MMC collection services. In order to prevent this situation the Plan has identified that necessary infrastructure must be put in place to facilitate safe manner. Since the MMC is unable to add to its existing fleet of collection vehicles to be able to cope up with the increasing levels of Solid Waste an alternative must be found to improve the situation. Several alternatives have been provided through the plan such as Scheme 13 – to provide segregation bins to residents on identified streets for promotion of source segregation etc. In addition to this the plan also proposes to set up Eko-Kiosks in public places such as market place, bazaar, religious places and schools to allow the community to dispose off their segregated waste material.

Purpose:

Provide infrastructure to residents and general community gathering in public places to dispose their segregated wastes.

Desired Outcomes:

- Facilitate waste segregation by community groups, households and commercial houses

- Provide a transfer point for selected segregated waste streams at convenient locations
- Improve the value of segregated solid wastes by collecting separately
- Create an enhanced image to solid waste management system (ISWM)
- Prevent roadside disposal of recoverable waste material.

Nature of the Scheme: Infrastructure development project

Agencies Responsible

Lead

- MMC

Supporting

- “Pilisaru” Project (MoE&NR)
- MoPC&LG
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- Private Contractors
- NCPC

Budget: Rs 1,000,000/- (USD 9,350 approx)

This amount includes the cost of

Procuring the land

Construction of the building

Purchase of equipment

and excludes the

Labour cost

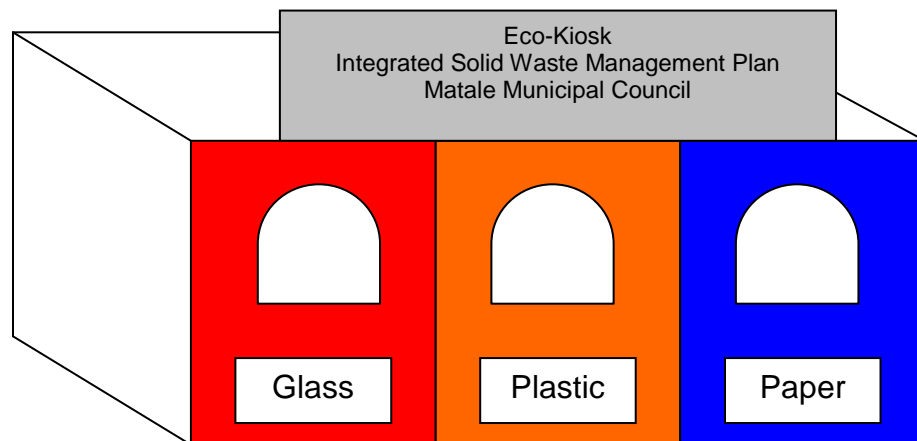
Operational costs such as electricity etc.

Time Frame: 12 months

Description:

The eco kiosks which are referred to as take back centres or buy back centres are intermediate collection points for segregated wastes. It is not advisable to set up eco kiosks at all the places and streets but establish them at selected locations where non-organic waste generation is high.

An eco-kiosk is generally a small building with three compartments and three opening allowing persons to dispose their waste through these openings. The three compartments can be painted the color (based on the National Segregation color code) with respect to the waste stream. The Following figure gives the basic outline for the proposed Eco-kiosk.



One of the biggest barriers which have caused several eco-kiosks set up in Sri Lanka to collapse is that people dump commingled waste around the kiosks area. Therefore the entire process breaks down. The reason behind this is that many Eco-kiosks open around 9 am and close by 5 pm. Therefore many people especially those who go to work are unable to dispose hand over their waste to the kiosk. This can be overcome by ensuring that the kiosk is open from 7 am till 6 pm.

It is also advisable to give small tokens of appreciation to children who bring segregated wastes to the kiosks as a motivation to others to segregate and deliver wastes to these collection points. A monetary incentive will also encourage further community participation in segregation. If the waste can be purchased at a nominal price, more people will bring in their recyclable material. In such a case this centre can be converted to a "Buy-

Back“Centre. Waste Material will have to be given valued and these values will be indicated on a notice board at the centre. The values can change according to the cleanliness of the material brought in.



The centre must also have enough land area to re-segregate waste that is handed in or bought. This can be carried out at the back of the eco-kiosk/buy-back centre. The following resource requirement has been identified for setting up an eco-kiosk.

Resource (Non-financial) requirement

Human resource: The human resource requirement for the plant can be identified as follows

- Office staff/Administration staff 1
- Scavengers (rag pickers) 3

Land Resource: 10 perches (due to limitation of space)

The land area should be concreted to avoid contamination of soil and underground water ways due to waste especially during rainy season.

Equipment and Machinery:

- Personal protective equipment
- Weighing Scale (50 Kg)
- Hand tools

Rotating screen
Baling machine
Computer

In addition to this the workers must be provided with necessary facilities such as office area, restrooms and toilets. They must also have a proper area for meals.

All employees at this plant will have to be inoculated against Tetanus, Hepatitis “A” “B” “C” and Typhoid

If the land area available for setting up eco-kiosks is limited the wastes collected can be transferred to a nearby sorting centre for further segregation. Therefore more number of kiosks can be set up within Matale.

Implementation:

MMC should first identify suitable places for positioning of the Eco-kiosks. This will provide information on how many are required for the city. Eco-kiosks can also be set up close to or immediately within religious places and schools too.

Since there are standard designs MMC can select a suitable design and get a set of fabrication drawings. MMC should find suitable manufacturers and obtained quotations. The most suitable quotation in terms of price, technical specification and other criteria should be selected and eco kiosks fabricated. It is advisable to give the fabrication of the kiosks to a person/company in Matale. This facilitates later maintenance.

MMC should select a few persons to stay in the kiosks at least during working hours but on all seven days. These persons may be from CDOs.

These eco kiosks can be handed over to CDOs for operation and the economic benefits could be shared between MMC and the partner CDOs.

Performance Indicators:

- Cost of collection and transportation per household unit / institution unit / commercial unit
- % households carrying out segregation
- % waste segregated per day
- % of Commercial establishments carrying out sorting
- % of waste recycled
- Total Waste Collected (per month)
- % of waste collected per transfer station
- Total waste transported
- % reduction of wastes disposed to landfill site
- Remaining year of sanitary landfill
- Total income generated from resource recovery

Measure of success:

- Segregated wastes are collected by eco kiosks in public Places
- Co-mingled wastes from public areas going to landfills will be reduced

Benefits/Impacts:

- All residents receive waste collection services
- Reduce environmental impacts caused by residents disposing waste on their own by open burning or dumping to water ways and roadways
- Maximize material recovery
- Reduced collection costs
- Improve waste segregation
- Generate employment opportunities
- Value addition to the recyclable wastes
- Scavengers maintain their income generation under safer and supervised conditions
- Ensure that recycling industries set up in Matala have access to a ready supply of raw material

Barriers:

- Resident dump of commingled wastes at the kiosks
- Eco-kiosks are misused as waste dump sites by residents from other LGAs
- Community mistrusts and dislikes central collection points as they perceive these places to be waste dumps
- Willingness of scavengers to work under formal supervised conditions
- Lack of adequate space to set up eco-kiosks point which is accessible to both small hand carts and large vehicles
- Lack of financial resources to set up a properly designed eco-kiosks
- Lack of commitment and cooperation from business community

Link to other ISWM Schemes of Matale:

- S9 Establishing waste exchange centre
- S10 Promoting Private Sector Participation in recycling based industries
- S11 Strengthening Community Based Organizations
- S17 Setting up intermediate collection point for E-waste
- S18 Setting up intermediate collection and transfer stations for municipal waste
- S19 Establishing a central collection and exchange point for construction and demolition waste
- S 20 Introduce compartmentalized trailers to transport separate waste streams
- S 12 Develop programmes to enhance living and working conditions of Sanitation workers
- S21 Locate suitable land for construction of Sanitary Landfill

Scheme 17 - Setting up intermediate collection point for E-Waste

Introduction:

In order to improve the solid waste management system in Matale city, UNEP, NCPC and the Matale Municipal Council developed an ISWM Plan which encompasses the principles of 3R (Reduce, Reuse, Recycle) to address all types of solid waste. The ISWM Plan is an active process which is made up of 31 schemes to streamline solid waste management, improve efficiency of the collection and disposal, divert valuable resources from the landfill site and add value to waste and generate environmental and economic benefits for the community. One of the most important factors in the development and implementation of the ISWM Plan is developing infrastructure without which the implementation of the plan will not be successful.

The ever increasing social dependence on electrical and electronic appliances has led to a new waste stream of E-waste coming into municipal landfills. Since most of the appliances have electronic parts which consist of heavy metals, toxic chemicals and other minerals which can be harmful to ecosystems and humans they are categorized as hazardous. Therefore E-waste can create serious problems if not managed properly and therefore should be dealt with utmost care. It is very important to collect all the e-wastes to one specific place so that they do not mix with other wastes and be disposed off after proper treatment procedures.

Though the amount of end of use electronic appliances disposed is very small in Matale it is advisable to be prepared for future inrush of such waste. This is most prudent as the increasing economic standards of people in Matale will lead to higher purchase capacity of such items and within the next 10-15 years. In addition to this a National Policy, Strategy and Action Plan is being prepared by the Ministry of Environment and Natural Resources to manage E-waste in Sri Lanka. This is being prepared in line with the Basel Convention. One key feature of this action plan is to set up a centralized collection point and recycling facility for E-waste generated in the country. Therefore though e-waste is still not a major

threat in Matale it is essential that the ISWM Plan be in line with the National Strategy and action plan.

The ISWM Plan therefore includes a scheme to set up an intermediate collection point for e-waste.

Purpose:

Establish a dedicated collection point for e-wastes where residents can handover their post consumer electrical and electronic wastes for treatment and disposal

Desired Outcomes:

- Create awareness on E-waste among community in Matale
- Prevent road side disposal of E-waste and hazardous substances getting into soil
- Create opportunities for recyclers to collect these E-wastes for value addition
- Mitigate all negative impacts caused by haphazard handling of E- wastes

Nature of the Scheme: Infrastructure Development Project

Agencies Responsible:

Lead

- MMC

Supporting

- E-waste Project - Ministry of Environment
- NSWMSC
- Matale Chamber of Commerce and Industry
- University of Peradeniya

NCPC

Location: Matale (At a selected site)

Budget: Rs 500,000/- (USD 4675 approx)

This amount includes the cost of

Purchase of land for E-waste collection site

Construction of the site

and excludes the costs of

Purchase of vehicle for transportation of e-waste

Operational costs such as transportation, electricity etc.

Human resources

Final Disposal mechanism

Time Frame: 6 months

Description:

The collection point for all categories of E-waste proposed to be set up in Matale will act as a drop off centre where residents and other members of the community can hand in their electronic waste. In addition to this the MMC can also collect e-waste from various sources and transport them to this site. Since the current levels of E-waste generation is extremely small this operation can be coupled with eco-kiosks/”buy-back” centres. It is also not feasible to set up a recycling plant for e-waste in Matale. Therefore the waste can be collected at this point and a preliminary segregation can take place. Once the waste is sorted into different materials they can be stored or directly transported to the National e-waste recycling centre.

The primary activities which can be carried out at this point are as follows

- Collection
- Transportation
- Unloading
- Sorting of waste
- Storage
- Transportation

Resource (Non-financial) requirement

Human resource: The human resource requirement for the plant can be identified as follows

Office staff/Administration staff 1

Supervisors 1

Scavengers (rag pickers) 3

Land Resource: 10 perches (due to limitation of space)

The land area should be concreted to avoid contamination of soil and underground water ways due to waste especially during rainy season.

Equipment and Machinery:

Personal protective equipment

Weighing Scale (50 Kg)

Hand tools

Baling machine

Computer

Collection and transportation vehicle

These E-wastes collected can either be given for and resource recovery or re-exported for recycling. The centre can collect and/or buy all E-waste including obsolete computers, televisions, fused fluorescent tubes, etc. Though the schemes are prepared on the premise that the centre will be operated by MMC, it can also can be operated by private sector through a partnership so that its sustainability is ensured.

Implementation:

The first step in the implementation process is to carry out a detailed study of the e-waste generation in Matale and surrounding suburbs. Therefore MMC will have to appoint an external consultant to carry out this activity.

E waste strategy at Matale should be in line with the national policy for e-wastes and therefore the priority categories identified nationally should be given first consideration.

Once the policy, strategy and action plan are finalized and documented the MMC should create awareness among stakeholders on the salient features of the policy. This will generate better understanding among the public on the need to manage E-waste in a more methodical manner. It is also essential that the management of E-waste be included in the awareness and training schedules.

The next step in the process is to identify the sources of e-waste in Matale and surrounding areas. This can be carried out as a survey or study in partnership with the University of Peradeniya. This survey should indicate What types of e-waste is available, the sources of generation, how much waste is produced, reused, exported and disposed of on a yearly basis and also identify how these wastes are disposed of.

Finally based on the survey results MMC should decide how large the collection point should be and accordingly find/identify a suitable location and make necessary requirements to construct the collection and storage centre. Alternatively this entire process can be handed over to a private company and the center can be established and operated as a public – private partnership. It is advisable for the MMC to link this project with similar project in the country as well as with the National project for e-Waste Management.

The persons handling the e-waste must be provided with the necessary training on how the waste should be handled, stored, transported and disposed of. Therefore all employees must undergo a thorough training process prior to carrying out operations.

Initially MMC can focus on the nine categories of e-wastes and link with the companies who are currently operating old appliance collection systems in the country. For example the mobile phone batteries are collected by an operator. E-waste collection centre can function as the collection agent for Matale and receive reasonable economic benefits through this service. This way a part of the collected waste can directly be given to the producers and reduce the burden on the MMC to manage them.

It is advisable to develop the project as a buy back system for all other post consumer e-wastes by assigning reasonable economic values to the appliances the residents hand over. This will encourage the others to handover their e- wastes to the centre rather than disposing them to the environment.

Performance Indicator:

- Total Hazardous Waste Collected (per month)
- Number of households segregate hazardous waste for safe treatment & disposal

Measure of success:

- E-wastes is handed over to the dedicated centre and does not end up in the landfill

Benefits/Impacts:

- E-wastes can be collected separately and sent for proper treatment /disposal
- Landfill site is not contaminated with e wastes
- New Employment opportunities created for sorting and segregation of components from e-wastes
- Valuable resource can be recovered from the waste prior to disposal

Barriers:

- Lack of awareness of residents on e-wastes
- Lack of facilities for treatment/disposal of e-wastes

Link to other ISWM Schemes of Matale:

- S2 Establishing Links with Existing Waste Exchange Programmes
- S9 Establishment of Waste Exchange Centre
- S10 Promoting Private Sector Participation in recycling based industries
- S16 Setting up eco-kiosks

Scheme 18 - Setting up Intermediate Collection and Transfer Stations for Municipal Waste

Introduction:

In order to improve the solid waste management system in Matala city, UNEP, NCPC and the Matala Municipal Council developed an ISWM Plan which encompasses the principles of 3R (Reduce, Reuse, Recycle) to address all types of solid waste. The ISWM Plan is an active process which is made up of 31 schemes to streamline solid waste management, improve efficiency of the collection and disposal, divert valuable resources from the landfill site and add value to waste and generate environmental and economic benefits for the community. One of the most important factors in the development and implementation of the ISWM Plan is developing infrastructure without which the implementation of the plan will not be successful.

The daily Solid waste generation in the MMC is calculated to be around 47 tons. This waste is usually collected by the MMC using tractor trailers and waste compactors. The situation analysis carried out at Matala indicated that under the current system in Matala about 20% of the community goes without this service. One of the main reasons for this drawback is that the heavy and large collection and transportation vehicles currently being used by MMC are not suitable to the terrain and road ways of Matala. Another factor is that the available vehicles are inadequate to service the entire city and that the MMC is unable to purchase new vehicles.

Any Integrated Solid Waste Management System must include a thorough and efficient collection service available to all citizens. Therefore taking into consideration all these factors the ISWM Plan has developed a scheme to set up an intermediate collection point which will also act as a transfer station.

Purpose:

- Improve solid waste collection within the MMC by covering the entire community
- Improve community perception of MMC by providing an efficient collection system.

Desired Outcomes:

- To reduce distance travelled by large collection vehicles
- Introduce small scale hand operated carts to reach difficult lanes and households
- Increase collection and transport efficiency of solid waste
- Provide solid waste management collection to a larger population in the city
- Facilitate intermediate segregation in areas where segregation does not happen
- Reduce the solid waste loads reaching the land fill site

Nature of the Scheme: Infrastructure Development Project**Agencies Responsible:****Lead**

- MMC

Supporting

- NSWMSC
- NCPC
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- CDOs
- Funding agencies

Location: Matale (Selected Site)**Description:**

The plan proposes the use of a fleet of small low cost hand carts to reach narrow and difficult to reach lanes and households. These vehicles would also help to provide service coverage to the entire community in MMC area and not be a heavy cost burden on the MMC.

This collection system will be supported by central collection and transfer stations where the collected waste would be unloaded. The waste will then be transported by larger

vehicles to final destinations. These intermediate collection and transfer stations will improve the collection efficiency and provide better service to the whole community. In addition, these stations can be made available to scavengers to segregate non organic wastes such as plastics, paper, glass and metals for resource recovery. The transfer stations will further facilitate the removal of solid waste to final destination points such as recycling plants or the final disposal site.

Since generating employment is another key factor of the ISWM Plan the proposed transfer station will not be a mechanized operation. On the contrary it is advisable to allow scavengers and MMC waste collectors to separate out any valuable waste streams at this point. This will reduce the negative health impacts of rag picking by ensuring that it is a supervised operation and that the necessary PPEs are made available.

Resource (Non-financial) requirement

Human resource: The human resource requirement for the plant can be identified as follows

- Office staff/Administration staff 1
- Supervisors 2
- Scavengers (rag pickers) 10

Land Resource: 20 perches (due to limitation of space)

The land area should be concreted to avoid contamination of soil and underground water ways due to waste especially during rainy season.

Equipment and Machinery:

- Personal protective equipment
- Weighing Scale (50 Kg)
- Hand tools
- Rotating screen
- Baling machine
- Computer

In addition to this the workers must be provided with necessary facilities such as office area, restrooms and toilets. They must also have a proper area for meals.

All employees at this plant will have to be inoculated against Tetanus, Hepatitis “A” “B” “C” and Typhoid

Implementation:

The MMC will have to appoint an external consultant to carry out the implementation of the scheme under their supervision. The initial step in the implementation process will be identifying several suitable locations (with adequate space) within the MMC for setting up the intermediate transfer station. This process will have to be supported by the MMC especially in the case of acquiring a suitable land within city limits. Once the locations have been earmarked a preliminary environmental and social assessment must be carried out to identify which site would cause the minimum disturbance to the environment and the community. Depending on the results of this study the actual site where construction of the site will take place can be finalized. The consultant will then be required to prepare a design for the proposed site and conduct a techno-economic study to identify infrastructure, equipment and utilities as well as financial resources required. Once the resource requirement has been identified MMC would need to work together with the consultant to secure the funding by approaching donor organizations or the National government or the local government. When the funding mechanism is confirmed construction can be initiated.

Monitoring the progress of the operation of the plant is an important feature which should be included in the project. This will help the MMC to closely evaluate the progress of the plant and ensure its done not pose any environmental or social issues.

Budget: Rs 3,000,000/- (USD 28,000 approx)

This amount includes cost of

- Purchasing land for the site

- Construction of the plant and equipment procurement

Provision of PPEs for scavengers
Organizational expenditure
Awareness and training to plant operators and scavengers
Consultants fee

and excludes the cost of

Operation and maintenance of the plant
Salaries and wages for operators

Time Frame: 24-30 months

Performance Indicator:

% of waste collected per transfer station
Total waste transported
% community served

Measure of success:

Higher number of community to receive waste collection services from MMC

Benefits/Impacts:

- All residents receive waste collection services
- Reduce environmental impacts caused by residents disposing waste on their own by open burning or dumping to water ways and roadways
- Maximize material recovery
- Reduced collection costs
- Improve waste segregation
- Generate employment opportunities
- Scavengers maintain their income generation under safer and supervised conditions
- Ensure that recycling industries set up in Matale have access to a ready supply of raw material

Barriers:

- Community mistrusts and dislikes central collection point as they perceive these places to be waste dumps
- Willingness of scavengers to work under formal supervised conditions
- Lack of adequate space to set up a central collection point which is accessible to both small hand carts and large vehicles
- Lack of financial resources to set up a properly designed collection cum transfer station

Links to other ISWM Schemes of Matale:

- S16 Setting up Eco-kiosks
- S17 Setting up intermediate collection point for E-waste
- S19 Establishing a central collection and exchange point for construction and demolition waste
- S 20 Introduce compartmentalized trailers to transport separate waste streams
- S 12 Develop programmes to enhance living and working conditions of Sanitation workers

Scheme 19 - Establishing a Central Collection and Exchange Point for Construction and Demolition Wastes

Introduction:

In order to improve the solid waste management system in Matale city, UNEP, NCPC and the Matale Municipal Council developed an ISWM Plan which encompasses the principles of 3R (Reduce, Reuse, Recycle) to address all types of solid waste. The ISWM Plan is an active process which is made up of 31 schemes to streamline solid waste management, improve efficiency of the collection and disposal, divert valuable resources from the landfill site and add value to waste and generate environmental and economic benefits for the community. One of the most important factors in the development and implementation of the ISWM Plan is developing infrastructure without which the implementation of the plan will not be successful.

Construction and demolition waste which amounts to around 5 tons/day is currently being disposed off at road ways and waterways within the city. The MMC does not have the facilities to collect and dispose off this waste and since C&D waste is bulky in nature it would take up considerable space for disposal at the landfill site. In addition to this C&D waste includes many valuable resources which can be recovered with the right technologies, thereby reducing the burden on natural resources to meet our construction needs. Left as it is, this waste can cause many environmental issues as well as reduce the aesthetic value of the environment of Matale considerably. One of the major reasons behind the practice of open dumping of C & D Waste is that people do not have an alternative method to dispose off their waste. Construction material is a high cost resource in Sri Lanka and therefore recovery of resources such as sand, iron, glass, concrete, bitumen etc. will be an ideal means of income generation for MMC or any 3rd party which initiates the project.

Taking into consideration all these factors, the ISWM Plan has developed a scheme to set up a central collection and exchange point and thereby promote the reuse and recycle of construction waste.

Purpose:

To add value to C&D waste and encourage reuse and recycle of the material recovered
Divert valuable resources away from the waste stream

Desired Outcomes:

- A place to accumulate construction and demolition wastes
- Prevent haphazard dumping of construction and demolition wastes wayside.
- Facilitate reuse of C&D wastes by exchange of usable material
- Convert remaining C &D wastes to value added material
- Generate an income from the C&D material

Nature of the Scheme: Infrastructure development project

Agencies Responsible:**Lead**

- MMC

Supporting

- NSWMSC
- NCPC
- Matale Chamber of Commerce and Industry
- Urban Development Authority
- Road Development Authority
- Housing Development Authority
- Provincial Council (Central Province)
- Private Sector

Location: Matale

Budget: Rs 3,000,000/- (USD 28,000 approx)

This amount includes cost of

Purchasing land for the site

Construction of the plant and equipment procurement

- Provision of PPEs for scavengers
- Organizational expenditure
- Awareness and training to plant operators and scavengers
- Consultants fee

and excludes the cost of

- Operation and maintenance of the plant
- Salaries and wages for operators

Time Frame: 12 months

Description:

C& D Waste typically comprises of material which can be recovered, recycled and reused. Since this waste is very bulky in nature disposal at landfill sites is not recommended. Therefore an ideal alternative will be to set up a central point where construction and demolition waste can be transported to and collected and stored at. An appropriate site will have to be selected in Matala area where C&D waste can be brought to and where the resources can be recovered by means of suitable technologies. The site can be operated by the MMC or as a public-private partnership.

The collection point will be used to segregate material which can be used directly such as timber, fixtures, roofing tiles and sheets etc which can be sold or exchanged directly. The remaining waste needing reprocessing (i.e. bricks, concrete, tiles, iron and steel and asphalt) can be cleaned, crushed or shredded to reduce particle size and sold as a substitute for sand, as a filler or even as suitable building material or road base. The material removed from road repairs can also be brought to this site and reprocessed to recover material for road construction. This will help to considerably reduce road construction costs.

The introduction of such a site in Matala would have to be supported by a well developed collection system which would be able to cover the entire MMC area as well as some neighboring suburbs. The collection and transportation of C&D waste can be carried out by

the MMC or by a private party. A separate tractor trailer or lorry will have to be allocated for this purpose. People can be motivated to hand in their waste to the designated collector by making a payment based on types, weight or volume of waste handed over.

The waste will then be transported by larger vehicles to final destinations. A system will have to be designed through which generators of C&D waste can inform the site operators of the waste available.

Partial separation can be carried out using loaders or bulldozers to remove oversized or clearly recoverable materials (eg: wood, cardboard etc.). The remaining materials are loaded into a conveyor belt where useful material is separated manually. The separated construction waste streams are then crushed into small particles. Magnetic separation can be used to remove any small metal objects/particles that may have been missed in the manual separation process. The particles can then be screened into standard sizes and sold as road base or construction material.

The wood component in the waste once separated can be reused for construction work or recycled by shredding. Here too metal objects can be removed using magnetic separation. The wood particles can be used as fuel or to produce other value added products such as particle boards.

Any corrugated cardboard can be baled and sold for recycling.

Since generating employment is another key factor of the ISWM Plan the proposed transfer station will be a semi-mechanized operation. The process steps at the plant will include the following:

- Collection and Transportation of C & D Waste
- Unloading at site
- Preliminary sorting (Bulldozer)
- Second Stage sorting (Manual)

Processing (Crushing/Shredding/Separating/Cleaning)
Storing
Sale/Exchange

The operators of the site must ensure that all employees at the site are given PPEs and that the manual sorting process is a supervised operation.

Resource (Non-financial) requirement

Human resource: The human resource requirement for the plant can be identified as follows

Office staff/Administration staff 2
Supervisors 3
Machine operators 5
Scavengers (rag pickers) 10

Land Resource: 40 perches (This can be located away from the city)

A separate drop off area is needed

Equipment and Machinery:

Hand tools, Glass Crusher, Wood Grinder, Hammer Mill, Rotary Screen, Vibrating Screen, Hand carts / Wheel barrow, Conveyor belt, Magnetic Separator, Loader, Fork lift, Computer High Sided Open truck / Tractor Trailer, Personal protective equipment.

In addition to this the workers must be provided with necessary facilities such as office area, restrooms and toilets. They must also have a proper area for meals.

All employees at this plant will have to be inoculated against Tetanus.

Implementation:

The MMC will have to appoint an external consultant to carry out the implementation of the scheme under their supervision. The initial step in the implementation process will be identifying several suitable locations (with adequate space) within the MMC for setting up

the intermediate transfer station. This process will have to be supported by the MMC especially in the case of acquiring a suitable land within city limits. One option for finding a suitable land will be including this within the eco-industrial park. Once the locations have been earmarked a preliminary environmental and social assessment must be carried out to identify which site would cause the minimum disturbance to the environment and the community. Depending on the results of this study the actual site where construction of the site will take place can be finalized. The consultant will then be required to prepare a design for the proposed site and conduct a techno-economic study to identify infrastructure, equipment and utilities as well as financial resources required. Once the resource requirement has been identified MMC would need to work together with the consultant to secure the funding by approaching potential investors. When the funding mechanism is confirmed construction can be initiated.

Monitoring the progress of the operation of the plant is an important feature which should be included in the project. This will help the MMC to closely evaluate the progress of the plant and ensure it's does not pose any environmental or social issues.

Performance Indicator:

- Volume of waste exchanged
- Quantity of waste recycled
- % of waste recycled
- Total Waste Collected (per month)
- % of population served

Measure of success: Reduced dumping of C&D waste in Matale

Benefits/Impacts:

- Residents have a system into which their C & D Waste can be handed over
- Reduce environmental impacts caused by residents disposing C & D waste into water ways and roadways
- Better and streamlined management of C & D waste

- Maximize material recovery
- Generate employment opportunities
- Ensure that recycling industries set up in Matale have access to a ready supply of raw material

Barriers:

- Community mistrusts and dislikes central collection point as they perceive these places to be waste dumps
- Willingness of scavengers to work under formal supervised conditions
- Lack of adequate space to set up a central collection point which is accessible to both small hand carts and large vehicles
- Lack of financial resources to set up a properly designed collection cum transfer station

Links to other ISWM Schemes of Matale

- S2 Establishing links with existing waste exchange programmes
- S9 Establishing Waste exchange centre
- S10 Promoting private sector participation in recycling based industries
- S30 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 20 - Introduce compartmentalized trailers to transport separate waste streams

Introduction:

The collection of Solid waste is a high cost operation which causes a heavy drain on the financial resources available to the MMC. Even though the MMC spends around LKR 16,000,000/- annually for Solid Waste Management with the cost of collection and transport alone amounting to approximately LKR 14,000,000/- (Refer Chapter 11 for further details) the waste collection cannot be considered efficient or effective.

In addition to this the MMC collection system collects waste from residences, public places, religious institutes etc. in a commingled manner reducing its value for reuse and recycling. Many stakeholders expressed concern that even though they segregate their waste at source this waste is mixed during collection and transportation. The tractor driven trailers used for solid waste collection and transport in Matale does not have any compartments facilitate the collection of segregated wastes. Therefore even if waste is segregated at source they become mixed during transportation. This has also acted as a de-motivating factor to introduce source segregation to the community.

Since source segregation is an important feature of the ISWM Plan prepared for Matale several schemes and pilot projects are in place to encourage it at all levels of society. In order to ensure smooth operation of source segregation and other related projects (i.e. composting plants, biogas plants, recycling industries, waste exchange) MMC must ensure that the necessary infrastructure is in place to facilitate the collection and transportation of these separate waste streams. Ensuring that the waste streams are collected and transported separate will also help keep the waste material clean and thereby fetch a high price in the market.

Since the amount of non-organic waste is not large enough to warrant several vehicles for collection and transport it is recommended that compartmentalized trailers be used for

waste collection/transportation. The following scheme details out the introduction of compartmentalized trailers in Matale.

Purpose:

Collect segregated waste in unmixed form and transport to sorting centres, waste exchange centre or recycling park to recover valuable resources

Desired Outcome:

- Facilitate collection of segregated wastes
- Motivate community to segregate waste at source
- Prevention of wastes getting mixed while collection and transport
- Prevent no organic wastes ending up in landfill site

Nature of the Scheme: Project

Agencies Responsible:

Lead

- MMC

Supporting

- MoE&NR
- MoPC&LG
- Matale Chamber of Commerce and Industry
- NSWMSC
- Private Sector
- Funding agencies
- Lions Club/Rotary Club

Location: Matal MMC area

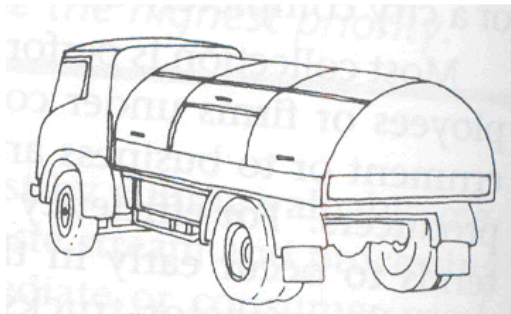
Budget: Rs 5,000,000/- (USD 46,750 Approx)

Time Frame: 30 months

Description:

The tractor driven trailers currently used for solid waste collection and transport in Matale does not have any compartments facilitate the collection of segregated wastes. These are often open, single compartment type trailers which lead to mixing of waste as well as spillage during transportation.

The alternative option recommended by this scheme is the introduction of trailers which have three or more compartments for different types of waste streams. As shown in the figure given below these trailers can be Compartmentalized “Roll-top” types which allows for the safe and separate transportation of solid waste



Each truck compartment door can be lifted up and the waste can be put into the compartment. The compartments can be painted according to the respective segregation color code.

The trailers can be used in turns in each street to collect non organic wastes at regular intervals.

As an alternative the MMC can handover this service to private sector so that the operator can make a payment to each household for collecting of segregated waste. This will create an economic incentive to households motivating them further to segregate their waste.

Implementation:

The introduction of compartmentalized trailers firstly requires acquisition of funds for purchasing of the vehicle or making the necessary changes to already existing trailers. The MMC should then prepare a route plan to maximize the efficiency of the use of the trailers.

The funds required for procuring a special vehicle with compartments is high and MMC will require the assistance of donor organizations or the National Government. MMC might be able to obtain a special vehicle through the Government as a donation without any expenditure to the MMC.

The vehicle may be procured by calling quotations from the reputed suppliers. The specifications of the vehicle may be obtained either from National Solid Waste Management Support Center (NSWMSC) or a technical consultancy firm dealing with solid waste management.

Once the vehicle is received MMC has to plan the routes for the collection of segregated solid wastes from residences and other establishments. MMC should make sure that all wards and streets including all by lanes are covered by the route plan to ensure all segregated wastes are collected regularly. MMC may use a special bell/siren to notify the households about the approach of vehicle.

The plan should also include what type of wastes is collected and what wastes are not collected and this information should be made available to all households in advance.

When the collection starts MMC should have planned where the collected is unloaded. If all these segregated wastes end up in the landfill people will lose confidence and segregation will stop.

Performance Indicator:

- % of households sorting waste
- % of households cooperating with MMC
- % increase in resource recovery

- % of waste recycled
- % reduction of wastes disposed to landfill site
- % waste uncollected
- Total income generated from resource recovery
- Number of complaints on non collection

Measure of success:

All segregated non bio degradable wastes in Matale are collected for value addition

Benefits/Impacts:

- The segregated wastes are not allowed to get mixed and end up in the land fill
- The non bio degradable are collected for value addition
- A culture of waste segregation is developed and more members from the community are motivated to participate
- MMC gets increase revenue through environmental services

Barriers:

- Securing funds due to high cost of a special compartmentalized vehicles
- Maintenance of the vehicle for regular use

Link to other ISWM Schemes of Matale

- S13 Provide segregation bins to residents of identified streets for promotion of source segregation
- S14 Re-introduce bell collection system for house to house collection
- S16 Setting up Eco-kiosks
- S18 Setting up Intermediate Collection and Transfer Stations for Municipal Waste
- S30 Develop incentive system to promote source segregation
- S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 21 - Locate suitable land for construction of Sanitary Landfill

Introduction:

Though the ISWM Plan is developed to reduce the quantity of waste generated and disposed it is inevitable that some amount of residual waste will be left over which will have to be disposed off. These waste types include hazardous waste material, residual waste from treatment plants as well as some waste material which cannot be recycled or reused. A properly engineered sanitary landfill site therefore becomes a requirement to accommodate those unrecoverable wastes. Sanitary landfill sites are

A major drawback in the municipal waste management systems existing in Sri Lanka is that almost all LGAs do not possess properly engineered sanitary landfills. The major factor contributing to this problem is that sufficient land space is not available to construct sanitary land fill sites. In addition to this sanitary landfills are often rejected by community groups, NGOs as well as politicians. The main causes for this are the “NIMBY” and “NIMET” Syndromes.

MMC too does not possess an engineered sanitary landfill though it follows to some degree the “Cell” type disposal system which is an upgraded version of the open dumps. Accordingly the dumped waste material is covered by a layer of soil to reduce the waste coming into direct contact with the surrounding environment. Though the correct practice is that the layer of waste is covered by a layer of 15-30 cm of soil at the end of each day's operations this is not carried out in a proper manner and therefore the waste causes great deal of damage to the surrounding environment. Currently no mechanism is in place to partially manage neither the leachate produced by the solid waste nor any technologies used to manage gases such as methane and CO₂.

Another drawback of the existing system is that it is not geared to handle hazardous waste and therefore generators dispose off this waste in any manner possible.

Taking all these factors into consideration it is essential that the MMC develop a project to set up a sanitary landfill. Since finding suitable land to construct a site has always been a barrier in Matale the MMC needs to identify and acquire a land prior to the actual design and construction. The following scheme proposes that the MMC locate a suitable land in which the sanitary landfill can be constructed at a later time.

Purpose:

Find a suitable land space to design and construct an engineered sanitary landfill site to accommodate the unrecoverable and residual wastes collected from Matale and Municipal council area.

Desired Outcomes:

Establish a engineered sanitary landfill site for final residual wastes and hazardous wastes
Establish the site with minimum

Nature of the Scheme: Infrastructure development project

Agencies Responsible:

Lead

- MMC

Supporting

- Ministry of Local Government
- Ministry of Environment
- NSWMSC
- Provincial Council (Central Province)
- Funding Agencies
- CBOs

Location: Close proximity to Matale City

Budget: not estimated

Time Frame: 24 months

Description:

Sanitary landfills are designed and engineered taking into consideration the following factors;

- Sitting
- Design
- Construction, operation and environmental monitoring
- Closure and post closure

The bottom and sides of the landfill is lined with natural or synthetic materials that keep the solid waste separated from the soil and the groundwater. The lining material may be compacted clay or thin plastic sheets. In addition to this, techniques to fully manage the leachate and the gases produced during decomposition ensure that this technology is the most environmentally sound disposal mechanism. The Sanitary landfills will also have monitoring mechanisms in place to continuously measure and maintain the leachate and gas levels at a minimum.

During the past few years several attempt were made by the MMC with support from donor organizations to set up a sanitary landfill site in Matale. A development plan was submitted by the JICA project identifying a suitable land in Rattota Pradseshiya Sabah. However this plan fell through due to community and political objections.

Therefore MMC must locate a suitable land taking the following factors into consideration.

- Geographical Location
- Capacity of landfill
- Distance to Matale City
- Availability of facilities such as electricity and water
- Land cost

MMC must ensure that the proposed landfill meet with international guidelines and standards of engineered sanitary landfills. Since the other programs in the ISWM plan will help to reduce the amount of waste to be disposed at the landfill the land required will be

far smaller than the case today. With the projections of solid waste generation and final disposal available for the next twenty five years, it is possible to estimate the amount of wastes going through the closed loop as recoverable materials. The remaining residual wastes and hazardous waste must be disposed to the sanitary landfill.

Implementation:

Identifying and Acquiring Land Space:

Securing a proper land is a key to the success of ISWM for Matale as it determines the effectiveness and the cost of the entire solid waste management process. The first step will be to identify several land sites available which are suitable to use as landfill sites. The suitable land should be in close proximity to Matale. Since the MMC does not have the experience or the time to carry out this study they should appoint an external consultant to do so.

Once several sites are identified Environmental Impact Assessments (EIA) will have to be carried out to comprehend environmental, social and cultural impacts of the sites in question. The selection of the most appropriate site will be done based on the EIA results. MMC should then negotiate for the price for purchase or for rental for a period of at least 20 years. The other alternative would be to lobby with the central Government to get the land acquired for this purpose. Compensation based on market value would have to be paid to the owner of the land in case land is acquired.

Once the site is decided upon an Environmental Risk Assessment will be carried out prior to initiating construction work to identify any possible threats to the environment. The land should then be properly surveyed to identify all nearby natural habitats and water streams and contour plans and survey plans to be drawn.

Then the MMC should handover the design of a proper landfill site with required infrastructure such as leachate treatment plant, landfill gas trapping system, access roadways, loading and unloading bays, etc to a consultant company with experience designing sanitary landfills. MMC can also request the assistance of the Nuwara Eliya

Municipal Council which has constructed such a landfill site and is successfully operating it.

The design should include the following

- Construction drawings
- Bill of quantities
- Costing for the construction

The designer should also agree to supervise the construction work.

MMC has to then make necessary financial allocations from the municipality budget or request special funds from the central government for the construction of the landfill site.

MMC should obtain the advice from associated agencies on this work and should be ready with other stages of solid waste management such as collection and transport before commencing the land filling at the new site.

Generating Stakeholder Support:

Since earlier experiences show how negative public opinion can impact such a project the MMC must carry out Awareness programmes continuously and concurrently to the above activities. These programmes should target all stakeholders with special emphasis on the general public. If the MMC can convince the citizens of Matale why a sanitary landfill is essential early on in the process the activities for implementation will be easier to carry out.

MMC must use the experiences of the Nuwara Eliya MC to convince its own stakeholders. It is therefore advisable to organize study tours to visit the Landfill site and to speak to people directly in contact with the landfill.

Performance Indicators:

- Remaining year of sanitary landfill
- Cost of disposal per ton of solid waste
- Total Waste Collected (per month)
- % cost of operating disposal site from total SWM cost
- % reduction in SWM expenditure due to resource recovery

Measure of success:

A land space for a sanitary landfill is legally acquired/purchased and a suitable design for the construction of landfill is commenced

Benefits/Impacts:

- Reduction of wastes generated in Matale industries
- Improved profits/revenue from the saved resources/wastes
- Less trouble in disposing solid wastes due to reduction in volume
- Improved environmental conditions in and around industries and in city of Matale

Barriers:

- Negative public opinion
- Political Pressure
- Limited land space availability in close proximity to Matale
- High cost of land
- High cost of construction of landfill site and the other infrastructure

Link to other ISWM Schemes of Matale:

- S25 Develop project proposals for setting up decentralized composting plants
- S26 Develop project proposal for setting up decentralized biogas plants
- S28 Effecting Policy Changes at Local Government Level
- S29 Lobbying for Approval of Municipal Council By- laws
- S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 22 - Conduct Cleaner Production demonstration project for wood based industries

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on the 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation is essentially required, particularly for source reduction and source segregation of waste. Though industrial waste is not included in Municipal Solid Waste it has to be included as an important component of any Integrated Solid Waste Management system. Many industries consume high quantities of natural resources and contribute greatly to environmental degradation. Therefore a suitable system must be in place to assist industries to reduce their solid waste levels.

There are over 10 wood based industries situated within the Matale Municipal area which produce around 3 tons of wood waste (mostly saw dust) on a daily basis. On average a wood based industry produces around 300 kg of saw dust daily. This is a considerable amount and this waste can be reduced considerably by using waste minimization strategies. The saw dust produced is currently disposed off at the site of generation or used as an alternative fuel source by other industries. The onsite burning of the saw dust is contributing to air pollution while a valuable resource is going to waste.

The primary strategy for recommended to reduce solid waste generated by wood based industries is Cleaner Production. Cleaner Production is a preventive environmental strategy which can be applied to products, processes and services to enhance efficiency and reduce impacts on the environment. Cleaner Production for processes such as wood based industrial activities includes reduction of resource usage by improving efficiency of the process, reducing/eliminating waste generation by using better and more appropriate technologies and improving housekeeping. There are 8 reasons introduced in Cleaner Production which can lead to waste generation. Each of these waste causes can be eliminated by the application of Cleaner Production.

The ISWM Plan recommends that a Cleaner Production demonstration project be conducted for the wood based industry sector in Matale to reduce/eliminate their solid waste and thereby reduce the impacts on the environment.

Purpose:

To demonstrate the how Cleaner Production methodology as an effective strategy to eliminate/reduce generation of wastes in industries

Desired Outcomes:

- Introduce Cleaner Production as a strategy for waste minimization in enterprises
- Show how to reduce waste generated by the saw mills in Matale
- Find a solution to reduce the saw dust generated by the saw mills
- Find an alternative use for saw dust generated by the saw mills in Matale
- Develop baseline information for future incentives and fines/surcharges

Nature of the Scheme: Demonstration project

Agencies Responsible:

Lead

- NCPC

Supporting

- MMC
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- Ministry of Industrial Development
- Central Environmental Authority
- Saw Mills
- Wood Industry Association of Sri Lanka
- External consultants

Location: Matale (Selected Saw Mills)

Budget: Rs 250,000/- (USD 2,350 approx)

This amount includes the

- Training of industry personnel
- Organizing and Conduction the training programme
- Preparing training material and handouts for training
- Conducting the Cleaner Production assessment
- Hiring of measuring equipment
- Preparation of the final report
- Preparation and printing of dissemination material
- Conducting final dissemination workshop
- Cost of external resource persons to facilitate the project

and excludes the cost of implementing options identified through the Cleaner Production Assessment

Time Frame: 8 months

Description:

The Cleaner Production demonstration project is usually carried out with a small group of chosen industries which are willing to disseminate the results of the project with other industries in their sector. Accordingly this demonstration project will include around 5 – 6 wood based industries. Representatives from each industry will undergo a three-day training programme on Cleaner Production audit methodology conducted by the NCPC. This training will develop the capacity of these industry representatives to carry out Cleaner Production Assessments at their individual plants and to identify measures through which the waste generated can be minimized, reused and/or recycled. Typically the CP assessment will include the following steps;

- Initial Walkthrough assessment to identify
- Appoint Cleaner Production Team
- Identify process steps and preparation of Process flow diagram

- Identify inputs and waste streams
- Quantification of waste
- Costing of waste
- Waste cause analysis
- Option generation through brainstorming
- Preparation of project report
- Preparation of Dissemination material
- Conduct dissemination seminar for other wood based industries in the region.

Implementation:

The implementation of a CP demonstration project needs trained facilitators from the area and industry personnel. Also the industry should be willing to release a few employees to function as the CP team. The commitment from the industry owners also is important for implementation of solutions found by the CP team.

A group of facilitators from Matala will be selected based on their availability, qualification and commitment and they will be provided with a suitable training on the CP methodology. Similarly a group of personnel from the selected industries also will be selected and trained.

The trained facilitators and industry personnel will be allowed to conduct a waste audit in the selected industries and they will be supervised by the trained consultants appointed by NCPC. The audit will comprise identification of waste streams, quantification of wastes, calculating economic value of wastes, finding causes of wastes and possible solutions both technical and behavioral. The solutions will be generated with the participation of other employees through brain storming.

The facilitators and the CP teams from each industry will study the entire process of the industry and identify usage of resources and the resultant wastes generated. The quantification and costing will indicate the total quantity of wastes and the value of the resources lost to the industry and the potential for recovery through the application of CP solutions. The solutions generated by the team through brain storming will include solutions

leading to improvements to house keeping, process changes, requirements for skills development and training and maintaining information and records as low cost solutions. Technology improvements and changes to plant and machinery will also be identified which will be solutions needing investment. The owners of these industries need to be willing to invest either through their own funds or through bank facilities to implement some of these solutions to reduce the waste loads from their industry which will eventually bring economic benefits to the industry through increased revenues and profits.

Performance Indicators:

- Quantity of waste recycled
- % of waste recycled into value added products
- % reduction in SWM expenditure due to resource recovery
- Water quality of water bodies in Matale

Measure of success:

- A successful training of facilitators and completion of demonstration project with a final report with solutions to minimize wastes
- Reduction in the wastes generated by the wood sector industries in Matale.

Benefits/Impacts:

- Reduction of wastes generated in Matale industries
- Improved profits/revenue from the saved resources/wastes
- Less trouble in disposing solid wastes due to reduction in volume
- Improved environmental conditions in and around industries and in city of Matale
- Enhanced capacity of the industrial personnel to reduce waste generation and improve efficiency of their industrial processes

Barriers:

- Non availability of technical staff in these industries to be trained on CP
- Reluctance of Proprietors and employees of the industries to change
- High cost of new technology in the sector when implementing CP solutions

- Non availability of low cost seed funds for investment in CP implementation

Link to other ISWM Schemes of Matale:

- S6 Conducting Training Programmes to key stakeholders
- S10 Promoting Private Sector Participation in recycling based industries
- S23 Conduct Cleaner Production demonstration project for Hotels and restaurants
- S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries

Scheme 23 - Conduct Cleaner Production demonstration project for Hotels and Restaurants

Introduction:

Integrated solid waste management (ISWM) plan for Matale city is based on the 3R (reduce, reuse, and recycle) approach. To achieve the targets for waste reduction and waste diversion for reuse and recycle, awareness raising and stakeholder participation is essentially required, particularly for source reduction and source segregation of waste. Though industrial waste is not included in Municipal Solid Waste it has to be included as an important component of any Integrated Solid Waste Management system. Many industries consume high quantities of natural resources and contribute greatly to environmental degradation. Therefore a suitable system must be in place to assist industries to reduce their solid waste levels.

There are over 55 small hotels and restaurants situated within the Matale Municipal area which produce around 500 kg (mostly food waste) on a daily basis. On average a hotel produces around 9 kg of food waste daily. Though this may seem like a minute quantity when compared with other waste generators the monthly waste generation and disposal by hotels is around 15 tons. This is a considerable amount and this waste can be reduced considerably by using waste minimization strategies. The food waste produced is currently disposed off to the MMC collection system and ends up in the landfill site.

The primary strategy for recommended to reduce solid waste generated by Hotels and Restaurants is Cleaner Production. Cleaner Production is a preventive environmental strategy which can be applied to products, processes and services to enhance efficiency and reduce impacts on the environment. Cleaner Production for processes such as wood based industrial activities includes reduction of resource usage by improving efficiency of the process, reducing/eliminating waste generation by using better and more appropriate technologies and improving housekeeping. There are 8 reasons introduced in Cleaner Production which can lead to waste generation. Each of these waste causes can be eliminated by the application of Cleaner Production.

The ISWM Plan recommends that a Cleaner Production demonstration project be conducted for Hotels and Restaurants in Matale to reduce/eliminate their solid waste and thereby reduce the impacts on the environment.

Purpose:

To demonstrate the how Cleaner Production methodology as an effective strategy to eliminate/reduce generation of wastes in industries

Desired Outcomes

- Introduce Cleaner Production as a strategy for waste minimization in enterprises
- Show how to reduce waste generated by the hotels and restaurants
- Improve housekeeping of hotels and restaurants and create good hygienic conditions
- Develop success stories to be followed by other hotels and restaurants
- Develop baseline information for future incentives and fines/surcharges

Nature of the Scheme: Demonstration project

Agencies Responsible

Lead

- NCPC

Supporting:

- MMC
- Matale Chamber of Commerce and Industry
- Matale Divisional Secretariat
- Ministry of Industrial Development
- Central Environmental Authority
- Hotels and Restaurants
- External consultants

Location: Selected hotels and restaurants in Matale

Budget: Rs 500,000/- (USD 4675 approx)

This amount includes the

- Training of industry personnel
- Organizing and Conduction the training programme
- Preparing training material and handouts for training
- Conducting the Cleaner Production assessment
- Hiring of measuring equipment
- Preparation of the final report
- Preparation and printing of dissemination material
- Conducting final dissemination workshop
- Cost of external resource persons to facilitate the project

and excludes the cost of implementing options identified through the Cleaner Production Assessment

Time Frame: 12 months

Description:

The Cleaner Production demonstration project is usually carried out with a small group of chosen industries which are willing to disseminate the results of the project with other industries in their sector. Accordingly this demonstration project will include around 5 – 6 wood based industries. Representatives from each industry will undergo a three-day training programme on Cleaner Production audit methodology conducted by the NCPC. This training will develop the capacity of these industry representatives to carry out Cleaner Production Assessments at their individual plants and to identify measures through which the waste generated can be minimized, reused and/or recycled. Typically the CP assessment will include the following steps;

- Initial Walkthrough assessment to identify
- Appoint Cleaner Production Team

- Identify process steps and preparation of Process flow diagram
- Identify inputs and waste streams
- Quantification of waste
- Costing of waste
- Waste cause analysis
- Option generation through brainstorming
- Preparation of project report
- Preparation of Dissemination material
- Conduct dissemination seminar for other wood based industries in the region.

Implementation:

The implementation of a CP demonstration project needs trained facilitators from the area and industry personnel. Also the industry should be willing to release a few employees to function as the CP team. The commitment from the industry owners also is important for implementation of solutions found by the CP team

A group of facilitators from Matale will be selected based on their availability, qualification and commitment and they will be provided with a suitable training on the CP methodology. Similarly a group of personnel from the selected industries also will be selected and trained.

The trained facilitators and industry personnel will be allowed to conduct a waste audit in the selected industries and they will be supervised by the trained consultants appointed by NCPC. The audit will comprise identification of waste streams, quantification of wastes, calculating economic value of wastes, finding causes of wastes and possible solutions both technical and behavioural. The solutions will be generated with the participation of other employees through brain storming.

The facilitators and the CP teams from each industry will study the entire process of the industry and identify usage of resources and the resultant wastes generated. The quantification and costing will indicate the total quantity of wastes and the value of the resources lost to the industry and the potential for recovery through the application of CP

solutions. The solutions generated by the team through brain storming will include solutions leading to improvements to house keeping, process changes, requirements for skills development and training and maintaining information and records as low cost solutions. Technology improvements and changes to plant and machinery will also identified which will be solutions needing investment. The owners of these industries need to be willing to invest either through their own funds or through bank facilities to implement some of these solutions to reduce the waste loads from their industry which will eventually bring economic benefits to the industry through increased revenues and profits.

Performance Indicators:

- Quantity of waste recycled
- % of waste recycled into value added products
- % reduction in SWM expenditure due to resource recovery
- Water quality of water bodies in Matale

Measure of success:

- A successful training of facilitators and completion of demonstration project with a final report with solutions to minimize wastes
- Reduction in the wastes generated by the sector industries in Matale.

Benefits/Impacts:

- Reduction of wastes generated in Matale industries
- Improved profits/revenue from the saved resources/wastes
- Less trouble in disposing solid wastes due to reduction in volume
- Improved environmental conditions in and around industries and in city of Matale
- Enhanced capacity of the industrial personnel to reduce waste generation and improve efficiency of their industrial processes

Barriers:

- Non availability of technical staff in these industries to be trained on CP
- Reluctance of Proprietors and employees of the industries to change

- High cost of new technology in the sector when implementing CP solutions
- Non availability of low cost seed funds for investment in CP implementation

Link to other ISWM Schemes of Matale:

- S6 Conducting Training Programmes to key stakeholders
- S10 Promoting Private Sector Participation in recycling based industries
- S22 Conduct Cleaner Production demonstration project for wood based industries
- S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries

Scheme 24 - Develop project proposal for setting up Industrial Estate for Recycling Based Industries (Eco town)

Introduction:

In order to improve the solid waste management system in Matala city, UNEP, NCPC and the Matala Municipal Council developed an ISWM Plan which encompasses the principles of 3R (Reduce, Reuse, Recycle) to address all types of solid waste. The ISWM Plan is an active process which is made up of 31 schemes to streamline solid waste management, improve efficiency of the collection and disposal, divert valuable resources from the landfill site and add value to waste and generate environmental and economic benefits for the community. One of the most important factors in the development and implementation of the ISWM Plan is developing resource recovery projects which will add value to waste material and ultimately generate employment opportunities.

Currently resource recovery is carried out in Matala though it does not have a major impact on reducing waste disposed at the landfill site. The following table clearly indicates that the quantities of material with recyclable values such as organic waste, paper/cardboard, plastics, metals and glass generated, recovered and sent to the Landfill for final disposal.

Accordingly it is clear that considerable quantities of valuable material which can be recovered through recycling end up at the landfill site. Though there may be several reasons contributing to this, the biggest factor is that there are no local recycling industries to use this material. Most of the recyclable waste is collected by middlemen who do not pay the actual market price to the waste generator. Therefore many waste generators are not motivated to collect the waste separately and send it for recycling.

| Component | Quantity (tons/day) | | | |
|------------------------|---------------------|----------|------------------|------------------|
| | Generation | Recovery | Disposal Pattern | |
| | | | Disposed | Sent to Landfill |
| Organics | 30.42 | 2.40 | 28 | 12.957 |
| Paper/Cardboard | 3.22 | 0.55 | 2.67 | 1.572 |
| Plastic (Soft) | 1.37 | 0.01 | 1.35 | 1.265 |
| Plastic (Hard) | 0.54 | 0.41 | 0.13 | 0.225 |
| Textile | 1.16 | - | 1.20 | 0.505 |
| Metals | 0.65 | 0.52 | 0.13 | 0.055 |
| Glass | 0.65 | 0.54 | 0.11 | 0.056 |

This situation has been taken into consideration in developing the ISWM Plan and a scheme has been proposed develop a project proposal to set up of a Eco-Park (WREco Park) for recycling industries.

Purpose:

To set up a group of micro industries within an industrial park to process non hazardous non organic wastes into raw materials and/or value added products

Desired Outcomes:

- A bankable proposal with technical and economic details on eco town
- To set up new recycling park planned for non-organic wastes at Matale
- Create new small enterprises for recycling or recovery of wastes
- Increase new employment opportunities
- Increase the volume of segregated wastes coming for recovery of resources

Nature of the Scheme: Preparation of project proposal for resource recovery

Agencies Responsible

Lead

- NCPC

Supporting

- MMC
- “Pilisaru” Project (MoE&NR)
- External Consultants

Location: Matala (Site to be selected in Matala)

Budget: Rs 300,000/- (USD 2800 approx)

Time Frame: 3 months

Description:

Based on the available data, the project proposal will include recycling of the following types of wastes are identified for establishing waste recycling business ventures.

- Organic waste
- Plastic waste
- Paper waste
- Construction waste

Organic Waste: With regard to the organic waste plans have been drawn and feasibility studies have been conducted to set up Bio gas and Composting plants. (Refer schemes 26 and 26)

Options proposed for Plastic Waste:

- Selling sorted and baled plastic waste (PET) to recycling industries situated in other parts of the country/world without processing.
- Recycling waste material to produce raw materials for further processing
- Small scale production plants to produce recycled plastic products.

Suggested Processes and machinery:

(A) Material Preparation Centre:

Considering the quantities generated in the city, one material preparation centre is proposed. At present, the value of good quality recycled plastic material in the market is high. This varies from LKR 40/- for LDPE to LKR 200/- (per kilogram costs) for engineering plastics such as Nylon. If careful separation into different types or common blends of LDPE/HDPE can be achieved value addition will be very high and a higher demand can be expected.

The facility will comprise of the following:

- Receiving center for plastic waste
- Initial cleaning of waste including removal of labels and any non-recyclable material.
- Manual or semi-automatic separation of waste into different categories (according to type)
- Temporary Storage
- Shredding into smaller particles
- Agglomeration
- Palletizing (Extrusion)
- Storing

(B) PET Collection and Crushing Centre:

The process will involve the following steps

- Delivery point
- Temporary storage
- Label removal and separating lids
- Crushing into small particles

In Sri Lanka pet recycling is carried out by a limited number of establishments. However the crushed and bailed material can easily be exported and will fetch high prices in the global/regional market.

(C) Recycling of Plastic Waste Other than PET:

Judging by the present level of collection the project proposal recommends the use of two injection molding machines of maximum 150 gms. The proposal also includes around 8-9 hand operated injection molding machines. The sizes and the number will be decided following the Market demand study.

Employment Generation:

Depending on the quantity of waste delivered and processed per day this operation will generate employment through manual sorting operations. The total number of employees required for material preparation assuming 2 tons of waste is processed per day will exceed 20.

Options proposed for Paper Waste:

- Selling sorted and baled paper and cardboard waste to recycling industries situated in other parts of the country without processing.
- Recycling paper waste to produce raw materials for other processes
- Small scale production plants to produce recycled paper products

Suggested Processes and Machinery:

(A) Material Preparation Centre:

Considering the quantities generated in the city, one material preparation centre is proposed. At present, the value of good quality recycled plastic material in the market is high.

The facility will comprise of the following

- De-inking and Bleaching operation
- Pulp making
- Sizing and drying
- Cutting into different sizes
- Storing

(B) Small-scale Industries for Recycled Products:

- A center for making hand made items of varying designs
- Small scale recycled paper packaging manufacturing center

Employment generation:

Depending on the quantity delivered per day the proposal foresees that the above activities will generate employment for many youth in Males and Females. The proposal also recommends setting up a Business Incubator exclusively for young craftsmen to develop recycled paper products.

Options proposed for Construction Waste:

- Sorting of C&D waste to categorize directly reusable material and material which requires further processing
- Selling segregated reusable construction waste directly without processing.
- Recycling and processing of remaining waste material

The expected construction waste comprised construction and demolition debris, deconstruction or dismantling waste, used building materials (eg: Scrap timber, doors, windows, plumbing fixtures, ceramics) roofing materials, bricks, asphalts and mixed demolition debris .

Suggested Processes and Machinery:

Value Addition:

Due to the heavy investment of recycling C&D waste it is recommended that the material be sorted and graded and sold directly for reuse. The process involves;

- Receiving construction waste
- Check for hazardous components which will not be accepted.
- Storage
- Grading of materials according to type and size.
- Preparing for more value addition such as removing nails in Timber.

Other Possible and Useful industries

The industrial park can also include industries which process and produce value added product using the following waste streams

- E-waste
- Saw dust
- Paddy husk
- King coconuts
- Textile waste
- Coconut shells
- Meat & fish wastes

Implementation:

The MMC has hired an external consultant to prepare the project proposal covering the details highlighted above. The development of proposal needs the inventories of different streams of non organic wastes which could be converted a value added raw material or a product. The proposal will study the different options available to convert them. The proposal will identify the suitable micro industries to match the quantities generated and nature of the wastes and the potential market for the products manufactured. The proposal should include the technologies to be used, plant & machinery required, other infrastructure, utilities required, labour requirement, investment and the working capital required.

In order to select the potential industries in the plastic and paper sector, the following preliminary steps are suggested:

- Conduct a market study for ascertaining the saleable product range, quantity and approximate market value.
- Identify subcontract items within the Matale district and the province to start with.

Since the objective is to cluster these micro industries together all general infrastructure should be planned as common to all and attention to be paid to form an eco-park. Therefore the project proposal will have to include the following

Facilities of the WREco Park:

The proposal recommends that the eco-industrial park should provide the following facilities to participating small businesses. Many of these facilities can be shared between the industries at a nominal fee, ensuring that the cost will not be a burden on the industries especially in the early years. Some of these facilities are:

- Warehouse space
- Operating equipment such as Forklifts
- Utilities such as drinking water
- Drainage and Sewerage disposal
- Industrial water treated to accepted levels
- Reliable electricity supply
- Pollution control equipment and services
- Conference rooms, Kitchen /lunch rooms
- Washing and rest rooms
- Communication Equipment (Copier, fax machine etc)

Alternatively some of the above services could also be provided through monitored service providers.

WREco Park Amenities:

Since the park is intended to be a model for other LGAs in the country it should include attractions which would bring in visitors to observe and learn from the park. In planning the park, space could be set aside for some of these activities, so that the implementation can be phased out.

The amenities could include.

Nature Walk- Create pathways, interpretive and warning signs, and viewing platforms near points of interest built from reused/recycled/compost-content products.

Children's Playground- Include playground equipment, surface finish, and fencing built from reused/recycled/compost-content products.

Demonstration Sites- Allocate space for production and use of compost, native plants, and integrated pest management to conserve water and decrease wasting. This could be located on either side of a pathway leading to the main entrance.

Artist in Residence and Displays- Provide workspace for artist(s) in residence who could assist all park businesses in creative design. Art from scrap and recycled products could be prominently displayed throughout the park.

Classroom- Provide classroom to host recycling and community programs

Showroom- Develop room to showcase products manufactured and remanufactured at this site, and for other reuse/recycled-content manufacturers in the area. Products would be available for sale from the showroom and guides would be available to other resale/stores to purchase other merchandise.

Environmental Education Display/Museum- Provide environmental displays and/or an environmental education museum to attract families to attend.

Business Incubator- An incubator for new recycling businesses could provide a lower cost location for such businesses to grow and prosper. The goal of the incubator is to support businesses until they are strong enough to move to their own location. Different types of incubators could be developed, depending on local needs and resources, including

- Start-up businesses share resources among other start-ups. These services could include conference rooms, copiers and faxes, receptionists, bookkeeping, and business technical assistance (e.g., review of business and marketing plans).

The success of an incubator will depend on the facilities and opportunities provided and also Entry and Exit policy that will be adopted.

Performance Indicators:

- % of waste recycled into value added products
- Total income generated from resource recovery

- % increase in resource recovery

Measure of success:

Recycling industries for Municipal solid wastes is established and employment opportunities created in Matale.

Benefits/Impacts:

- Reduction of non bio degradable recyclable wastes going to land fill
- New industries established within MMC area
- New employment opportunities in Matale
- Empowering CDOs to manage micro industries

Barriers:

- Unavailability of land and buildings for the industries
- Lack of investors to set up industries
- Inadequate quantity of non biodegradable recyclable wastes generated within Matale.
- Unavailability of low interest capital funds to investors to commence business

Links to other ISWM Schemes of Matale:

S2 Establishing links with existing waste exchange programmes

S9 Establishment of Waste Exchange Centre

S10 Promoting Private Sector Participation in recycling based industries

S11 Strengthening community based organizations

S16 Setting up Eco-kiosks

S17 Setting up intermediate ollection point for E-Waste

S18 Setting up Intermediate Collection and Transfer Stations for Municipal Waste

S19 Establishing a Central Collection and Exchange Point for Construction and Demolition Material

Scheme 25 - Develop project proposal for setting up decentralized composting plants

Introduction:

Solid waste generation and management is an issue of concern in many developing countries, as it is one of the most immediate, serious and escalating environmental problems. Waste, if just dumped on a landfill site will cause a variety of environmental impacts in the form of air, soil and water pollution. On the other hand waste is a resource which becomes a nuisance as it is not in the right place or in the right form or medium.

One of the most valuable of resources lost in this manner is the biodegradable component of Municipal Solid Waste. This type of waste is often misunderstood as valueless and disposed off at landfill sites. If untreated prior to disposal biodegradable waste can be extremely detrimental to the health of the environment.

A crucial step in any Integrated Solid Waste Management system is the treatment of waste prior to final disposal. This renders the waste innocuous and is therefore less harmful to the environment. In the case of Organic waste composting is an ideal treatment method which not only reduces the damaging effects of the waste but also produces a value added product which can be used as a soil conditioner or fertilizer. Composting is an aerobic biological conversion technology which involves the use of micro-organisms such as bacteria and fungi to breakdown the solid waste into a stable end-product. Composting is best suited to the biodegradable component in solid waste which has higher moisture levels. It is essential that the substrate (solid waste) used for composting have adequate nutrients to support the growth of micro-organisms.

Since the waste composition and socio-economical situation of Matale city strongly favors the setting up of decentralized composting systems the ISWM Plan proposes the following scheme.

Purpose:

To reduce the quantity of bio degradable wastes going to landfill by turning the wastes into a valuable resource

Desired Outcomes

- A bankable proposal with technical and economic details on small scale compost plants
- A set of designs/working drawings available for any donor/promoter
- Obtain approval/consent from relevant authorities on constructing composting plants
- Promote private sector/NGO/CBOs to set up small scale compost plants for commercial use

Nature of the Scheme: Preparation of project proposal for resource recovery

Agencies Responsible:

Lead

- NCPC

Supporting

- MMC
- NSWMSC
- External consultants
- Sevenatha

Location: Matale (Selected sites)

Budget: Rs 200,000/- (USD 1800 approx)

This amount includes the preparation of the project proposal and the consultants fee only.

Time Frame: 3 months

Description:

Composting is a process through which solid waste is decomposed by micro-organisms in the presence of Oxygen. The end product can be used as a fertilizer. There are several composting techniques which can be used from simple household composting to large scale commercial composting.

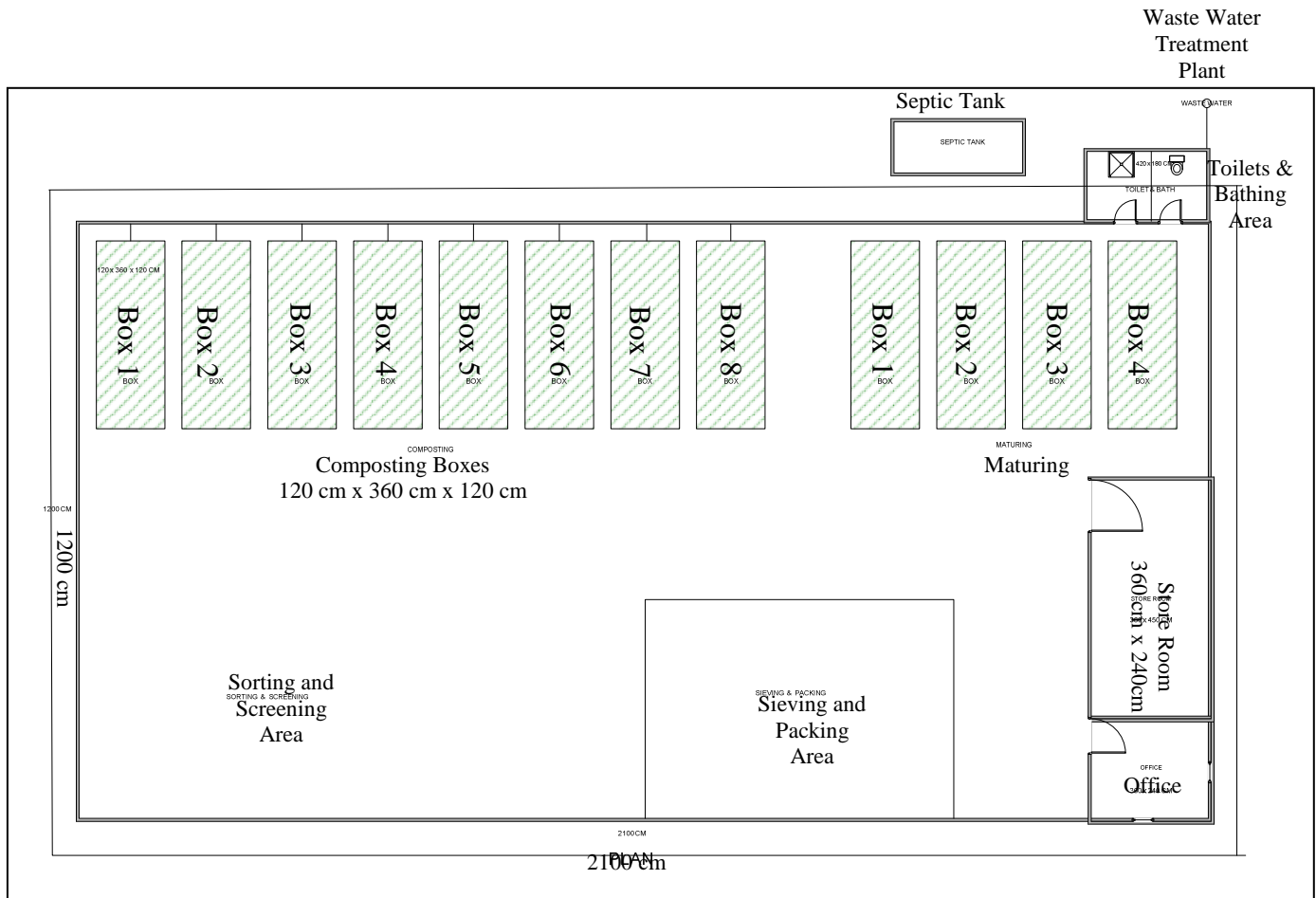
The ISWM Plan proposes to set up several small scaled decentralized composting plants in Matale. The small scale compost plant already established in the Matale city provides a sustainable solution to manage organic waste and acts as a good model for the city. To realize the long term objective of developing a city without a landfill site MMC has to find an alternative sustainable solution to the management of organic waste. Establishing several small scale composting plants at pre-selected sites to convert organic waste to compost will not only provide an alternative solution to the landfill site but also will be an income generating opportunity to.

Decentralized composting systems are more suitable to Matale for the following reasons;

- They are less dependent on complicated technologies, low in cost and can be constructed with locally available materials. In contrast centralized operations require machinery of high capital and maintenance costs as well as a high degree of specialized skills. Centralized plants are therefore more prone to failure.
- Decentralized plants are labor intensive and usually not totally mechanized processes. Therefore they are ideal to developing nations where generating employment is as important as managing solid waste. They provide ideal opportunities for public-private participation.
- Decentralized options are well suited for the waste stream, climate, social and economic conditions of countries like Sri Lanka.
- Decentralized waste management enhances and improves environmental awareness of the beneficiaries. Source segregation by the residents reduces the volume of solid waste earmarked for disposal effectively and increase the value of recyclables.

- Decentralized systems reduce the cost incurred for the collection, transport and disposal of waste by the Municipal council.

Since Matale is surrounded by several plantation estates and considered an agricultural district the producers will have the opportunity to sell the compost as soil conditioner/fertilizer. However to ensure a ready and continual market it is important to establish a marketing interface through a public private partnership between MMC and chambers/business community. Also maintaining uniform quality and meeting national standards for compost will be a plus factor for selling compost. In order to ensure quality the compost plants must adhere to the Sri Lankan Standard for Compost from Municipal Solid Waste and Agricultural Waste prepared by the *Sri Lanka Standards Institute (1246: 2003)*



Layout Diagram of Proposed Plan

| | |
|--|--|
| Carbonaceous substrates should be mixed with nitrogenous ones at a ratio | 4:1 or less, but never lower than 1:1 |
| Activator | 1% of the total weight of the substrates |
| Heat should be maintained | 50°C or higher |
| Composting time | 40-45 Days |
| Moisture content pile | 50% |
| C:N ratio | 25:1 |

Estimated budget requirement for construction and operation of decentralized plant (Figures for one 2 tonne capacity plant)

| Activity | Expenditure (LKR) |
|--|--------------------|
| Preparatory work (data collection, awareness, design etc.) | 500,000/- |
| Develop land | 100,000/- |
| Construction of plant building | 3,000,000/- |
| Procurement of Equipment (vehicles, machinery, laboratory) | 1,000,000/- |
| Operations | 600,000/- |
| Monitoring & Evaluation | 500,000/- |
| Total | 5,700,000/- |

Implementation:

The MMC will require the assistance of an external consultant to prepare the Project Proposal. The actual implementation of the project will be as follows (Based on the project proposal prepared for Decentralized Composting Plant)

A. Launching the composting project

Before starting a composting initiative MMC must have a clear vision of the objectives.

Determine the opportunities, strengths, weaknesses and threats for the composting project.

- Political
- Legal
- Economical
- Social
- Environmental

B. Identifying stakeholder interests

Activity 1: Identify project stakeholders

It is essential to identify stakeholders to assess their interests

- Members of the Municipal Council
- Municipal authority
- CEA officials
- Community organizations
- Religious leaders
- Schools
- Government institutions
- Children guilds
- Waste pickers/sweepers of informal sector
- NGOs / CBOs
- Private sector
- Donor agencies
- Fertilizer dealers

Activity 2: Identify Environment legislations and land use regulations

Activity 3: Identify potential marketing options

C. Assessing target community interests and land availability

Activity 1: Organize community meeting

- Community members (male, female, youth, children)
- NGO/CBO representatives
- Political and administrative representatives
- Collators/ Recyclers
- Municipal SWM staff

Activity 2: Conduct a survey using a questionnaire

Activity 3: Assess land availability and visit proposed sites

D. Data collection

Activity 1: Determine the solid waste generation

Activity 2: Analyze composition of solid waste

E. Preparation of business plan and financial projection

Activity 1: Develop an appropriate management model

- Municipality owned – Municipality operated
- Municipality owned – community operated
- Municipality owned – Privately operated
- Privately owned - Privately operated

Activity 2: Determine the viability of the project: benefit-cost analysis

- Set a time frame (e.g – 5 – 10 years)
- Annual revenues
- Project costs
- Annual net benefits etc.

Activity 3: Preparation of the contract for involved partners

- Preparation of MOU
- Signing of MOU

F. Development and Design of Collection System

Activity 1: Selection of most appropriate vehicles

Activity 2: Selection of appropriate waste collection system

- House to house collection

- Bell collection
- Communal bin collection

Activity 3: Number of vehicles required

Activity 4: Community participation and mobilization for waste collection

Activity 5: Organize and Introduce fee collection

Activity 6: promotion of source segregation

G. Design and Construction of Box Composting Facility

Activity 1: Planning and decision on the Composting plant lay out

Activity 2: Planning the required key features

- On-site water supply
- Sorting area
- Storage areas for rejects and recyclables
- Office
- Store
- Sanitary facilities
- Outlet (Kiosk)
- Organic farming demonstration site
- Waste water reuse system
- Rest room

Activity 3: Planning Staff requirements

Activity 4: Additional equipment and expendables

- Sorting
- Composting
- Sieving
- Bagging
- Miscellaneous

H. Operation and Maintenance

Activity 1: Operation and monitoring

Activity 2: Problems solving (troubles shooting)

Activity 3: Quality control

I. Marketing of Compost

Activity 1: Assessment of potential customers and competitors

Activity 2: Develop a Marketing strategy

Activity 3: Define the product

Activity 4: Create a map

- Matale city and surrounding area
- Locations of compost production units
- Organic waste sources – markets, fairs etc..)
- Customers and distant

The project period is two years. From the third year composting project should be implemented as a profitable business venture. Matale city requires five decentralized composting plants of the same type in order to be cover waste generated. However only testing laboratory will be required to test quality of final product.

Performance Indicators:

- Quantity of compost produced per plant
- % reduction in waste taken to sanitary landfill
- Income generated through selling compost
- Volume of waste given to composting / bio gas plants

Measure of success:

Five decentralized compost plants (capacity of 2 tonnes /day) established in Matale

Benefits/Impacts:

- The setting up of decentralized composting plant will reduce transporting distance of wastes

- The volume of wastes going to landfill will be reduced leading to a longer life time for the landfill.
- Solid wastes will be converted to value added product
- Impact on the environment due to decomposition of organic waste reduced

Barriers:

- Securing funds to implement the decentralized compost plants
- Difficulty in finding land area suitable to set up composting plants within the city limits
- Community disapproval due to odour problems
- Lack of community participation

Links to other ISWM Schemes of Matale:

- S21 Locate suitable land for construction of Sanitary Landfill
- S26 Develop project proposal for setting up decentralized biogas plants

Scheme 26 - Develop project proposal for setting up decentralized biogas plants

Introduction:

Solid waste generation and management is an issue of concern in many developing countries, as it is one of the most immediate, serious and escalating environmental problems. Waste, if just dumped on a landfill site will cause a variety of environmental impacts in the form of air, soil and water pollution. On the other hand waste is a resource which becomes a nuisance as it is not in the right place or in the right form or medium.

One of the most valuable of resources lost in this manner is the biodegradable component of Municipal Solid Waste. This type of waste is often misunderstood as valueless and disposed off at landfill sites. If untreated prior to disposal biodegradable waste can be extremely detrimental to the health of the environment.

A crucial step in any Integrated Solid Waste Management system is the treatment of waste prior to final disposal. This renders the waste innocuous and is therefore less harmful to the environment. In the case of Organic waste the preparation of biogas using decentralized plants is an ideal treatment method which not only reduces the damaging effects of the waste but also produces an alternative fuel source which can be used in place of fossil fuels. Biogas is generated when anaerobic microorganisms, which can metabolize without oxygen, ferment biodegradable matter. Biogas is usually made up of two main components; carbon dioxide and methane.

Since the cost of petroleum fuel has gone up during the recent past, the generation of bio gas can be an ideal solution to some of the institutions in Matale. For example the hospital which uses Liquid Petroleum Gas (LPG) for preparation of food and heating of water generates food wastes suited for biogas generation. Currently this food waste is disposed to the municipal land fill site. A biogas plant at the hospital will reduce the load to land fill and also will provide an alternative fuel to partially substitute for their fuel requirement for food preparation. Similarly establishing bio gas plants at selected locations will reduce the daily load to the municipal landfill and provide fuels to some members of the community.

Since the waste composition and socio-economical situation of Matale city strongly favours the setting up of decentralized biogas plants the ISWM Plan proposes the following scheme.

Purpose:

To reduce the quantity of bio degradable wastes going to landfill by turning the wastes into a valuable resource

Desired Outcomes:

- A bankable proposal with technical and economic details on bio gas plants
- A set of designs/working drawings available for any donor/promoter
- Obtain approval/consent from relevant authorities on constructing bio gas plants
- Promote private sector to set up small scale bio gas plants for commercial use

Nature of the Scheme: Preparation of project proposal for resource recovery

Agencies Responsible:

Lead

- MMC

Supporting

- University of Moratuwa
- NCPC
- Ministry of Health
- Matale Hospital
- External consultants

Location: Matale Hospital and other selected sites

Budget: Rs 200,000/- (USD 1800 approx)

This amount includes the preparation of the project proposal and the consultant's fee only.

Time Frame: 3 months

Description:

Different technologies have been developed for the production of bi gas under anaerobic condition. Conventional technologies such as Chinese type and Indian type have been omitted in the technology selection due to their high cost and low production rates. The operation of the digester is selected as “plug flow” type due to advantages it has over the other types of operations (i.e. batch and continuously stirred types). Due to the single stage process, all the reactions of anaerobic process take place in one reactor, separated in time. Therefore it does not require multiple reactors to separate the acetogenesis and methanogenesis stages in space. This results in the system being more cost effective. This type of reactor also has the ability to operate for a long periods of time without maintenance and again reduces operating cost. Plug flow reactors normally operate under batch process. Therefore employees are required for the feeding of the next batch. Compared to continuously stirred tank reactor (CSTR) this is a great advantage since the conversion of organic matter into biogas takes place in a sequence of reactions. They are liquefaction, acidogenesis, acetogenesis and finally methanogenesis which take place at different pH and temperature ranges created by the system itself. Plug flow reactor allows these reactions to take place without mixing therefore, no hindering occurs to one reaction by another.

The design parameters of the proposed biogas plant are given below.

| | |
|-----------------------------------|----------------------------------|
| Design Pressure/ working pressure | 1.5 bar/ 1.02 bar |
| Operating temperature | 30 °C |
| Operating stage | Mesophilic Stage |
| Feed | Organic waste / saw dust / water |
| Feed per day | 2000 /66.5/781.75 kg/day |

| | |
|-----------------------|---------------------------------------|
| PH | 7.0-7.2 |
| Organic load | 4.83kg TVS/m ³ /day |
| Total solid content | 30% |
| Conversion efficiency | 75% depending on the feed composition |
| Solid retention time | 20 days |
| Bio Gas Potential | 121 m ³ /day |

Corresponding features of these systems are:

Type of waste – the feed is food waste. Therefore, the solid content is high. C/N ratio is also not preferred. Saw dust is added to adjust the C/N ratio. This increase the volume and mass of total feed in to the digester.

Amount of waste – 1 ton of waste per day according to the data given. It is moderately high and when going for a low solid type digester, the reactor volume become very large. It increases the capital cost and not economically feasible.

Post treatment - low solid systems require expensive post treatment processes such as screw pressers and centrifuge. But high solid digesters require only the composting unit to treat the sludge from the digester. Therefore, considering all the above factors the digester should be high solid loading type. The total solid content is about 30%

Estimated budget requirement for construction and operation of decentralized plant (Figures for one 1 tonne capacity plant)

| Activity | Expenditure (LKR) |
|--|--------------------------|
| Preparatory work (data collection, awareness, design etc.) | 100,000/- |
| Develop land | 50,000/- |
| Construction of bio gas plant | 5,000,000/- |
| Purchase of Equipment (machinery, laboratory) | 2,000,000/- |
| Operations | 300,000/- |
| Monitoring & Evaluation | 200,000/- |
| Total | 7,550,000/- |

Implementation:

MMC will require the assistance of an external consultant to prepare the project proposal to develop decentralized biogas plants in Matale. The design of the plant will be based on the experience the MMC is having in the past. It is decided to use simple low cost technology which is user friendly. The design will take into unique conditions of Matale.

Once the engineering design is completed the project proposal will be developed to secure financing. The project proposal will include cost of construction, operational cost, and operational strategy, marketing of the final product, economic returns and other environmental and social benefits.

The project proposal developed will be then submitted to potential donors for securing required funding.

Performance Indicators:

- Quantity of biogas generated
- Income generated through selling biogas
- Change in energy cost due to usage of biogas at hospital
- Volume of waste given to composting / bio gas plants

Measure of success: Five decentralized bio gas plants are established in Matale

Benefits/Impacts:

- The setting up of decentralized bio gas plant will reduce transporting distance of wastes
- The volume of wastes going to landfill will be reduced leading to a longer life time for the landfill.
- Solid wastes will be converted to value added product
- Some community members in Matale will get alternative fuel for their use

Barriers:

- Securing funds to implement the decentralized biogas plants
- Difficulty in finding land area suitable to set up composting plants within the city limits
- Community disapproval due to odour problems
- Lack of community participation

Links to other ISWM Schemes of Matale:

S21 Locate suitable land for construction of Sanitary Landfill

S25 Develop project proposal for setting up decentralized biogas plants

Scheme 27 - Preparation of the Project Idea Note (PIN) and Project Design Document (PDD) for proposed biogas plants as CDM Projects.

Introduction

Integrated solid waste management (ISWM) plan for Matale city is based on the 3R (reduce, reuse, and recycle) approach. Several initiatives have been highlighted by the plan to divert valuable resources in waste streams away from the landfill to produce value added products. One of the biggest waste streams which can easily be recycled is Organic waste component. Almost 80% of the total waste quantity is made up of organic, biodegradable material.

The decomposition of biodegradable Municipal waste is a major contributor to green house gas emissions. Studies have shown that putrefying of waste emits both CO₂ and methane and that if this waste is not disposed to an engineered sanitary landfill these gases are directly released to the atmosphere.

The open dumping of MSW produces methane from the decomposition of organic matter. This methane is considered to be a dangerous green house gas with high potential to cause global warming when compared to CO₂. Global warming and Climate change has drawn much attention throughout the world and its effects are being felt in Sri Lanka today.

The ISWM plan includes a scheme to produce biogas from its organic waste component and thereby collect/trap the methane to be used as an alternative fuel source. This gas can replace LPG (and fuel wood) use in households and thereby reduce the demand on fossil fuel as well.

Based on the facts that generation of biogas reduced the release of methane into the atmosphere as well as reduces the consumption of fossil fuel the biogas plant(s) can be a CDM Project for Matale

Purpose:

To prepare the PIN and PDD for the Biogas plant with MSW in Matale City to obtain carbon credits

Desired Outcomes

- To develop CDM Project Identification Note (PIN)
- To prepare the CDM Project Design Document (PDD)
- To facilitate the validation and registration process of the CDM project
- To facilitate the selling of the ERUs by bringing potential buyers
- To facilitate building of monitoring report during the verification

Nature of the Scheme: Resource recovery project

Agencies Responsible:

Lead

- Nature Solutions (Private) Limited

Supporting

- MMC
- NCPC
- UNEP

Location: Matale

Budget:

Consultant will charge for the services on preparing PIN & PDD, once MMC gets the credits and as a percentage from the carbon revenue annually. This amount is expected to get 25% of the credits earned annually.

This amount includes the cost of consultant's fee

Time Frame: 12 months

Description:

The **Clean Development Mechanism (CDM)** is an arrangement under the Kyoto Protocol allowing industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. A crucial feature of an approved CDM carbon project is that it has established that the planned reductions would not occur without the additional incentive provided by emission reductions credits, a concept known as "additionality".

The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialized countries.

In the case of the Biogas plant set up for MMC carbon revenues will start after the 1st year from the commissioning of the project. (I.e. Project development cost PDD is born before the commissioning.)

Net income that is expected from carbon trading of the project for first five years is presented below.

| | Pre- Comissioning | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---------------------------------------|-------------------|---------|---------|---------|---------|---------|
| | Stage of Project | (US \$) | (US \$) | (US \$) | (US \$) | (US \$) |
| Revenue | | | | | | |
| 3000tCO2 @ US \$ 15 | | | 45000 | 45000 | 45000 | 45000 |
| | | | | | | |
| Cost | | | | | | |
| Preparation of PIN, PDD | | | | | | |
| Cost of monitoring report | | | 11250 | 11250 | 11250 | 11250 |
| Cost of Validation and Registration * | | | | | | |
| Annual Verification * | | | 9000 | 9000 | 9000 | 9000 |
| | | | | | | |
| Net Income | 0 | | 24750 | 24750 | 24750 | 24750 |

* International Companies are engaged.

Implementation:

The overall scope of this Proposal is to prepare the PIN and PDD for the Biogas plant with MSW in Matala City to obtain carbon credits. Consultant will also help to response for issues raised in the validation process by the DOE. During the verification of the project, consultant will help to prepare the monitoring report.

The implementation process for the development of the PIN and PDD are as follows;

Task 1: Collection of necessary data (Consultant will provide the list of required data once agreement is signed).

- The client shall be responsible for providing all necessary data required to develop of PIN and PDD of the project.
 - Copy of Central Environmental Authority approval if required
 - Copy of Feasibility study report if any
 - Other necessary documents which are specified by the consultant.

Task 2: Preparation of the Project Idea Note (PIN).

- The Consultant will prepare and forward the Project Idea Note (PIN) to client within a week after receiving the all required data.

Task 3: Preparation of the Project Design Document (PDD).

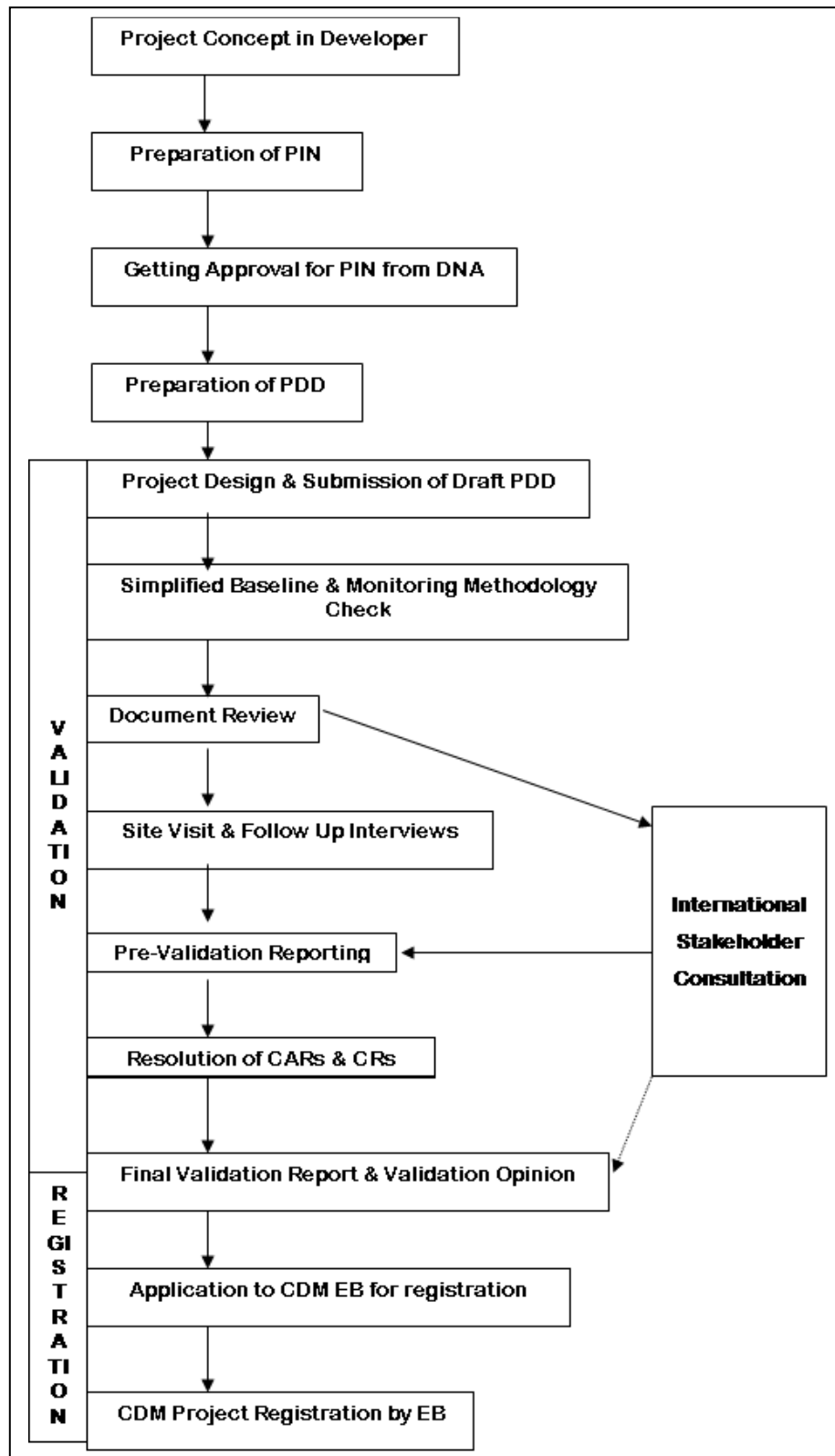
- The Consultant will prepare and forward the Project Design Document (PDD) to client within a month after receiving the all required data.

Task 4: Facilitate to the validation and verification process of the projects.

- Consultant will provide required assistance to validation, post-validation process that is required to get the project through the registration processes of the Executive Board.
- Consultant will provide the necessary assistance to prepare the monitoring report and assist to get the ERUs during the verification and post-verification process.

It is proposed to sign for an MOU between Nature Solutions (Private) Limited in charging for the services provided. The preparation of the PIN and PDD will be completed in 30 days from the day of collection of all necessary data from client.

The process of Registration of CDM is shown in the following diagram:



Performance Indicators:

- Quantity of biogas generated
- Total income generated through treatment plants
- Income generated through selling biogas
- Change in energy cost due to usage of biogas at hospital
- % income against expenditure for treatment
- % reduction in SWM expenditure due to resource recovery
- Volume of waste given to composting / bio gas plants

Measure of success:

Biogas Plant(s) are able to successfully obtain carbon credits

Benefits/Impacts:

- Carbon credits can be claimed by implementation of CDM Projects.
- Operators of the biogas plants receive financial incentives for reducing GHG emissions
- Encourage private sector participation in SWM
- Enhance technology transfer
- Improve energy efficiency
- Reduce environmental impacts caused due to methane generation
- Reduce dependence on fossil fuels

Barriers:

- Inability to register the biogas plant as a CDM project

Link to other ISWM Schemes of Matale

- S10 promoting private sector participation in recycling based industries
- S11 Strengthening community based organizations
- S26 Setting up Decentralized biogas plants

Scheme 28 - Effecting Policy Changes at Local Government Level

Introduction:

Municipal Solid Waste Management in all local government agencies has become a key issue due to ineffective collection and disposal by almost all the local government bodies. A major constraint in the effective solid waste management in the country is the prevailing policies and regulations. Under the current policies the Solid waste management is the sole responsibility of the local government body. As a result the cooperation by other stake holders is limited.

To overcome the shortcomings of the prevailing solid waste management practices, a key requirement is effecting policy changes at Local Government level. The existing policies make the Local Government responsible but it does not provide sufficient authority for them to effectively implement suitable solutions. Therefore the following scheme is developed in order to effect the much needed policy changes at Local Government level.

Purpose:

To affect necessary policy changes to make Local government bodies to have required power and authority to implement

Desired Outcomes

- Strengthen National solid waste management regulatory framework
- Address the weak areas of the regulatory framework to close the loopholes

Nature of the Scheme: Policy development

Agencies responsible

Lead

- MoPC&LG

Supporting

- NSWMSC
- All local government authorities
- NGOs

Location: This is a project at national level which should be initiated by Ministry of Local Government in Colombo

Budget: Not estimated as it is an internal activity of the Ministry

Time Frame: 36 months

Description:

Though the country has a very stringent environmental policy framework the emphasis on the solid waste management has not been adequate enough to pressurize the people to adhere to the required actions. A conspicuous limitation in the existing system is that little attention has been given to motivations and deterrents through incentives and fines. Also the publicity and promotion of the regulatory system is at a low level.

In solid waste management segregation at source, household hazardous waste management, closed transportation of wastes, open dumping on road side, landfill have not been addressed at all. Though there are guidelines for solid waste management these are not regulatory requirements.

Another major shortcoming is that though local government authorities are made the entities responsible for the collection, transport and disposal of solid waste in their areas of operation, adequate regulatory muscle is not provided to them to effectively implement these roles. Therefore it is important to address these issues at policy level so that all relevant authorities and other stakeholders follow the national regulations and local government by-laws. This could be achieved by effecting necessary policy changes for the management of solid wastes and empowering local government authorities as well as incorporating incentives and fines to citizens.

Implementation:

The policy changes should address the needs of all the local government bodies and therefore a consultation process with the participation of key personnel of these bodies is required. While the ministry of Local government should take the lead all local government bodies should participate in discussion and drafting the amendments to existing policies.

Once this consultative committee develops the draft of the proposed amendments which are translated into three languages (Sinhala, Tamil and English) and sent to legal draftsman for required changes and corrections. The corrected document is to be forwarded to Cabinet of Ministers and then to the parliament for approval.

The approved amendments are published in a gazette notification and becomes approved national policy.

Performance indicator:

All key performance indicators developed for the ISWM Plan will be applicable

Measure of Success:

Improved solid waste management and Clean & Green surrounding in local government bodies.

Reduced complaints from community on solid waste management.

Benefits/Impacts:

- Facilitate local government authorities to obtain community Participation
- Make sorting/segregation mandatory

Barriers:

- Participation of all local governments for consultative process
- Delays in process of legal documentation
- Difficulties in proper translation to all three languages to give the exact meaning

Links to Other ISWM Schemes of Matale:

- S29 Lobbying for Approval of Municipal Council By- laws
- S30 Develop incentive system to promote source segregation
- S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 29 - Lobbying for Approval of Municipal Council By- laws

Introduction:

Municipal Solid Waste Management in all local municipalities has become a key issue due to ineffective collection and disposal in almost all the Municipal Council areas. A major constraint in the effective solid waste management in the country is the prevailing policies and regulations including municipal by laws. Though under the current policies the Solid waste management is the sole responsibility of the Municipal councils within their area of operation the cooperation by other stake holders is limited.

To overcome the shortcomings of the prevailing solid waste management practices, a key requirement is strengthening legal framework for municipal operations. The existing by laws are inadequate or obsolete to address some of the current and emerging problems caused by urbanization, economic wellbeing and improved quality of life of the communities living within these municipal areas. Though the municipalities are responsible the existing by laws does not provide sufficient authority for them to implement suitable solutions to effectively control critical activities and issues.

Purpose:

To obtain approval for the already formulated Municipal by laws and enforce them early.

Desired Outcomes:

- Strengthen National solid waste management regulatory framework
- Address the weak areas of the regulatory framework to close the loopholes

Nature of the Scheme: Legal and regulatory frame work development

Agencies responsible:

Lead

- MoPC&LG

Supporting

- All local government authorities
- Provincial Council (Central Province)
- NSWMSC
- NGOs
- IUCN

Location:

This activity has to be carried out in Colombo with the Cabinet of Ministers and Parliament

Budget: Not estimated as it is an internal communication activity which needs involvement of key personnel of the municipal council.

Time Frame: 36 months

Description:

Ministry of Provincial Councils and Local Government through the participation of all Local Government authorities drafted a set of New by-laws for Municipal councils several years ago. The new by-laws address all relevant issues in the solid waste management at local level which were not addressed in the previous regulations and by-laws. If applied, these by-laws will empower Municipal Councils and other Local Government agencies to effectively carry out the solid waste management in their areas.

The Municipal Council by-laws are currently awaiting parliamentary approval to become effective. Unfortunately these have not yet been approved due to several minor issues in the by-laws. Attention should be given to these by laws again and the unresolved issues should be clarified and action should be taken to obtain parliament approval soon to make these by laws effective.

It is also essential that other central province local government authorities link with each other and work together towards obtaining this approval

Implementation:

The mayors and commissioners of the municipalities to meet key cabinet ministers and leaders of all political parties represented in the parliament to educate them on the

importance of immediate approval of municipal by laws to improve the management of public activities and improvement of effectiveness of the solid waste management through the new by laws. A small group of mayors can take the lead to lobby at the highest level to consider the approval of Municipal by laws as a priority issue and bring it forward in the agenda of the parliament.

Once approved the by-laws will be published in a gazette and effective soon after.

Performance indicators:

All key performance indicators developed for the ISWM Plan will be applicable

Measure of Success:

- Improved solid waste management
- Clean & Green surrounding in local government bodies.
- Reduced complaints from community on un-cleanliness of the streets, public places and on solid waste management.
- Pleasant public places and streets

Benefits/Impacts:

Facilitate local government authorities to carry out activities with authority

Barriers:

Reluctance of Key personnel of the Municipalities to take the lead in lobbying.

Links to Other ISWM Schemes of Matale:

- S28 Effecting Policy Changes at Local Government Level
- S30 Develop incentive system to promote source segregation
- S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 30 - Develop incentive systems to Promote Source Segregation

Introduction:

Municipal Solid Waste Management in all local municipalities has become a key issue due to ineffective collection and disposal in almost all the Municipal Council areas. A major constraint in the effective solid waste management in the country is the prevailing policies and regulations including ineffective market based instruments. Among market based instruments two key instruments are incentives and fines.

To overcome the shortcomings of the prevailing solid waste management practices, and to segregate wastes the community who cooperate positively by segregating wastes should be rewarded. This scheme is to develop new incentive schemes to those who segregate wastes and send them for recycling or recovery of resources.

Purpose: Encourage community to segregate waste through economic gains they receive from the wastes.

Desired Outcomes:

- Establish a system for rewarding individuals/organizations excel in solid waste management
- Create a competitive environment for improved solid waste management
- Improve community participation in solid waste management

Nature of the Scheme: Policy Development

Agencies responsible:

Lead

- MMC

Supporting

- NSWMSC
- NCPC

- Large business houses
- Banks
- Rag Pickers

Location: This has to be done at MMC with consultation from chambers, banks, businesses, rag pickers and community in Matale.

Budget: Not Estimated

Time Frame: 12 months

Description:

Non availability of recognition and rewarding system to individuals and organizations that excel in solid waste management within their areas is a major deterrent to effective solid waste management. Those who dispose their wastes as it is and those who reduce, segregate, reuse or recover resources are treated equally. There are no benefits available to motivate those who manage their waste or take leadership in doing so. Therefore a new rewarding scheme needs to be developed not only to reward persons who effectively manage their solid waste but also to motivate others to do so.

The scheme should include financial and non financial rewards and should address households, schools, commercial houses, businesses, industries, and public sector organizations. Also publicity through national and local media can be used as a system to recognize such persons/organizations.

The scheme should recognize the individual and corporate citizens who excel in solid waste management annually and they should be rewarded in a public function. Therefore an award scheme conducted yearly is recommended. Similarly they should be encouraged to continue with their good work by providing some financial incentives.

Implementation:

The municipal council should take a lead to call for a consultation workshop of community, banks, chambers, recycling industries and rag pickers and any other relevant stake

holders. During the workshop ideas can be generated on criteria for offering incentives for the wastes including the quality of wastes such as cleanliness, uniformity, age and other properties, the basis of payment (weight, volume etc), the method of payment (daily, weekly, monthly) and specific amount per unit of each waste.

The proposed scheme should be tested using a small geographical area as a pilot project. The pilot project will provide evidence for effectiveness and changes needed to improve it. Then it should be forwarded to another consultative group meeting and final version of the scheme should be agreed upon. The implementation of the proposed scheme of payment should then be monitored to measure the increase in solid waste diverting from the landfill to the recycling industries.

Performance indicator:

All key performance indicators developed for the ISWM Plan will be applicable

Measure of Success:

Higher community participation in segregation of solid waste

Benefits/Impacts:

Increase in segregated wastes

- Less wastes going to landfill

Barriers:

- Convincing policy makers on the incentive scheme
- Securing seed funding to initiate the project

Links to Other ISWM Schemes of Matale:

S28 Effecting Policy Changes at Local Government Level

S29 Lobbying for Approval of Municipal Council By-laws

S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Scheme 31 - Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Introduction:

Municipal Solid Waste Management in all local municipalities has become a key issue due to ineffective collection and disposal in almost all the Municipal Council areas. A major constraint in the effective solid waste management in the country is the prevailing policies and regulations including ineffective market based instruments. Among market based instruments two key instruments are incentives and fines.

To overcome the shortcomings of the prevailing solid waste management practices, and to segregate wastes the community who cooperate positively by segregating wastes should be rewarded. Similarly those who dispose wastes haphazardly and in mixed form should be fined or legally dealt with as a deterrent to all such people. This scheme is to lobby for developing a new structure of fines schemes to those who dispose wastes in mixed form.

Purpose:

- To reduce the commingled wastes ending up in land fill site
- To Increase the life of the landfill site

Desired Outcomes:

- Create an awakening among policy makers on the importance on using market based instruments to strengthen enforcement of environmental regulations
- Formulate a new scheme of fines for facilitate segregation of wastes

Nature of the Scheme: Policy development

Agencies Responsible:

Lead

- MMC

Supporting

- NSWMSC
- NCPC
- Large business houses
- Banks
- Scavengers

Location: Matala

Budget: Rs 50,000/-(USD 475 approx)

Time Frame: 12 months

Description:

The open dumping of solid waste at public places and road side is a problem faced by all local government agencies when implementing solid waste management systems. Usually these openly dumped solid wastes are commingled and its economic value is extremely low leaving no other choice other than to landfill them. To prevent this practice it is important to have effective fines and surcharges imposed on offenders who do this illegally.

Though there is an existing fine imposed on illegal waste dumping it is not adequate enough to be a deterrent to miscreants. New regulations should be incorporated specially into solid waste management to introduce high surcharges to discourage ungainly practice. Also proper regulations should be introduced to encourage segregation at source (household levels and organization level) before they are being disposed.

In addition to fines and surcharges it is also advisable that a system be introduced through which first time offenders are issued a formal warning by local magistrates.

Implementation:

The mayors and commissioners of the municipalities to meet key cabinet ministers and leaders of all political parties represented in the parliament to educate them on the importance of developing a scheme of fines as a deterrent to people for dumping and disposing garbage in commingled form. A small group of mayors can take the lead to lobby

at the highest level to develop and approve an scheme of environmental fines as a priority issue and bring it forward in the agenda of the parliament.

Performance indicator:

All key performance indicators developed for the ISWM Plan will be applicable

Measure of Success: A scheme of fines developed and enforced

Benefits/Impacts:

- Facilitate local government authorities to bring errant persons to law
- Encourage all households and organizations to segregate wastes

Barriers:

- Reluctance of Key personnel of the Municipalities to take the lead in lobbying.

Links to Other ISWM Schemes of Matale:

- S28 Effecting Policy Changes at Local Government Level
- S29 Lobbying for Approval of Municipal Council By- laws
- S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

7.2 Schematic Description of Schemes under ISWM Plan

| S1 Developing Information Sharing Systems | |
|--|---|
| <p>Desired outcomes:</p> <ul style="list-style-type: none"> • To make all citizens and other stakeholders aware of the problems arising from current waste management practices in the city • To communicate the proposed ISWM plan • Enlist the participation of community groups in SWM • Strengthen the relationship between the municipality and other stakeholders | <p>Lead Agency: Matale Municipal Council</p> <p>Support Agencies: Ministry of Local Government NSWMSC NCPC Regional Chamber of Commerce Divisional Secretariat Agriculture Department</p> |
| <p>Description:</p> <p>Under the current practises the cooperation of the citizens including the businesses operating in the MMC area does not provide adequate support and cooperation to manage solid waste and keep the city clean. Therefore it is identified that information sharing through effective communication is a vital requirement to the success of any solid waste management plan.</p> <p>The proposed scheme is to develop an effective information sharing system by the MMC with all stakeholders to keep them aware of difficulties faced in the current practises and proposed solutions under the newly developed integrated solid waste management plan. In addition to this the system should have a mechanism by which stakeholders can give their feed back and comments. The plan envisages including any and all possible information sharing methods for the purpose of generating interest in Solid Waste Management.</p> <p>The information sharing strategy should address all stakeholder groups with special attention to stakeholder who contribute to the solid waste problem most. An effective information sharing strategy will enhance the transparency of the process and thereby improve voluntary participation of more citizens to make solid waste management efficient.</p> | <p>Location: Environmental Education Centre (Matale)</p> |
| <p>Budget (Estimated): LKR 800,000/- (USD 7,500 Approx)</p> | |
| <p>Time Frame: 6 months</p> | |

S2 Establishing Links with Existing Waste Exchange Programmes

Desired Outcomes:

- To link the information on waste available in Matale to waste users and recyclers nationally
- Effectively link to the waste exchange platforms in operation by other institutes
- Facilitate waste generators to exchange their reusable/recoverable waste with any user quickly.
- Increase the economic value of wastes by listing of it as a usable resource

Lead Agency:

Matale Municipal Council

Support Agencies:

ITI
SMED-SPX
Regional Chamber of Commerce
NCPC

Description:

For a regional city like Matale with a small solid waste load, developing a new electronic waste exchange platform to list and exchange wastes is a task which will be time consuming and expensive therefore more likely to be beyond their capacity . Therefore it is advisable to link the available information with an existing waste exchange. There are a few material and by-product exchange centres operating in the country which provides information to buyers and users.

The waste exchange platform of the Industrial Technology Institute (ITI) provides details of wastes available in registered companies and also companies/individuals searching for sorted waste streams with the description of the wastes and quantities. MMC can register in the ITI waste exchange to seek for buyers of the available waste streams. Similarly the details of available waste can be registered in the Sub Contracting & Partnership Exchange (SMED-SPX) of the Federation of Chambers of Commerce and Industry of Sri Lanka (FCCISL).

Location:

In all relevant agencies

Budget (Estimated): LKR 50,000/- (USD 500 Approx)

Time frame: 12 months

S3 Developing Publicity Material in Sinhala, Tamil and English

Desired Outcomes:

- To ensure appropriate reading and reference materials are available for non English speaking citizens
- To ensure that simple and easy to follow reading material is available to stakeholders in Matale
- Public involvement in the implementation of ISWM plan

Lead Agency:

MMC

Support Agencies:

UNEP
 NCPC
 Consultants hired by MMC
 Regional Chamber of Commerce
 Divisional Secretariat
 Agriculture Department

Description:

One major reason for lack of support from the community for solid waste management is communication difficulties caused by the publicity materials. Most of the publicity materials are developed in English and no translations are available. However many people in Matale neither speak nor understand English very well. Since Matale is a multi ethnic city developing all communications including the publicity materials understandable to all is a prerequisite for success of any SWM plan.

The proposed ISWM plan has to be disseminated to the public and also a large amount of publicity materials has to be developed to win the public. The publicity materials will be developed in all three languages used by public in Matale (Sinhala, Tamil and English) while all available publicity materials will be translated to Sinhala and Tamil languages.

Another important factor in developing communication material is that regardless of the language the material should be simple and easy to understand. It is best to avoid highly technical terms which can cause confusion among stakeholders. It is therefore advisable that all communication material be pre-tested among the general public to further improve them to be most suitable.

Location:

In selected agencies

Budget (Estimated): LKR 1,000,000/- (USD 9350 Approx)

Time frame: 6 months

S4 Developing Awareness and Training Packages

Desired Outcomes:

- Appropriate Awareness and training packages available to trainers and MMC officers to organize and conduct training programs
- Special awareness package prepared on the regulatory framework related to environment in Sri Lanka
- Provide preset but uniform training materials to all participants
- Develop awareness materials and programs to suit all stake holder groups in Matale

Lead Agency:

MMC

Support Agencies:

NSWMSC
 NCPC
 Consultants
 Divisional Secretariat
 Agriculture Department

Description:

Solid waste management in Matale has its own problems due to specific nature of the local conditions. One major issue had been the lack of cooperation and participation by community in Matale. There had not been sufficient attempts to sensitize and educate the population in Matale on the issues of solid waste management in the past.

The non availability of suitable awareness and training packages had been one reason for not attending to this important aspect of waste management. Most of the awareness and training packages are inappropriate to the local conditions. Therefore a set of awareness and training packages need to be developed to address the local stake holders and their individual issues.

These packages have to properly communicate the issues related to solid waste, the ISWM plan and provide adequate training for all citizen groups on the effective solutions for the current problems as well as their roles, responsibilities. The awareness and training packages will be the foundation for all training activities conducted in the future.

As a prerequisite to developing such awareness and training material the project must identify the various stakeholders that are directly and indirectly impacting the solid waste situation in Matale and this links with each other and the ISWM Plan. The material must then be designed to suit all these stakeholders and their roles in implementing the plan.

Location:

In selected agencies

Budget (Estimated): LKR 500,000/- (USD 4675 Approx)

Time frame: 3 months

S5 Conducting Awareness Programmes to all Stakeholders

Desired Outcomes:

- Ensure all the stake holder groups are properly sensitized about the importance of effective solid waste management
- All members of the community understand the elements of ISWM plan
- Community groups supporting the effective implementation of ISWM
- Increase the community participation in SWM
- Initiate waste management programs in schools

Lead Agency:

MMC

Support Agencies:

NSWMSC
 NCPC
 Sevenatha
 Consultants / Trainers
 School teachers
 Children's societies
 CBOs
 Divisional Secretariat
 Agriculture Department

Description:

Involvement of all members of community is an essential requirement for effective implementation of ISWM. Therefore all community groups will be provided with sufficient awareness on the proposed activities to win their cooperation and support. The activity can start with schools and CBOs and then continued to other stakeholder groups. The general awareness will also inform the stakeholders of their role and responsibilities on the proposed ISWM and the negative effects of failing to fulfil them.

This will provide the way forward to the city vision of clean and green city and encourage more community groups to work together with the MMC in implementing new projects. This also will generate awareness that waste is a resource misused or mishandled. They will learn waste is their money lost unnecessarily. Therefore the community will learn to reduce or reuse and effectively segregate the waste for recovery of resources later by others.

In addition to awareness programmes organized by the project several other initiatives can also be taken to further improve awareness. These include pocket meetings through which smaller groups of the community can be targeted to a better effect and using community leaders such as religious leaders to create awareness through their own mediums.

Location:

Environmental awareness centre, MMC, local hotels, households in wards, schools

Budget (Estimated): LKR 1,000,000/- (USD 9350 approx)

Time frame: Continuously from 1st month

S6 Conducting Training Programmes to key stakeholders

Desired Outcomes:

- Provide training to different stakeholders on each relevant aspect of ISWM
- Develop competencies in carrying out activities under ISWM
- Train a group of trainers on ISWM to continue with community education
- Effective implementation of schemes and special projects
- Improved participation of different segments of the community in ISWM

Lead Agency:

MMC

Support Agencies:

NSWMSC

NCPC

Sevenatha

Consultants / Trainers

Schools

Children's societies

CBOs

Divisional Secretariat

Agriculture Department

Regional Chamber of Commerce

Description:

The success of activities listed under ISWM will depend on the effective participation of stake holders directly involved in Solid Waste Management in Matale. The different stakeholders require different knowledge, skills and training to carry out activities identified in the ISWM. Since all the stakeholders are engaged in varied day to day activities it is also important to re-train them at regular intervals.

Since both awareness and training will have to be carried out continuously regularly it is essential that a permanent group of stakeholders be developed as trainers in Matale. Therefore training programs should start with training a group of trainers. This group will include officers at MMC, school teachers, community leaders, public sector officials (e.g. Divisional Secretariat, agriculture department), regional chamber of commerce and NGO personnel.

Initially all the key stake holders who will have an identified role in ISWM should be given a training to ensure their competence, capability, accountability and responsibility. The initial training program will be based on the training need analysis prepared for all stake holder groups in MMC. The internal staff of the environmental & health division of the MMC including the community development officers too need to be trained on their added responsibilities in mobilizing CBOs in the proposed ISWM plan.

Location:

Depending on the nature of training program

Budget (Estimated): LKR 1,000,000/- (USD 9350 approx)

Time frame: 12 months

S7 Setting up Children's Societies at each Municipality ward

Desired Outcomes:

- Strengthening existing children's societies and setting up new ones in wards that don't already have societies.
- Mobilizing all children in MMC to be organized into societies within their wards
- Make use of children's innovativeness and creativity to find new solutions to solid waste problems
- Active participation of children in solid waste management and keeping the city clean.
- Children to act as motivating force to convince community groups to proactively involve in solid waste management.

Lead Agency:

MMC

Support Agencies:

Sevenatha
CBOs
Central Environmental Authority
Ministry of Environment
NCPC
Divisional Secretariat (Child Rights Promotion Officers)

Description:

Though there are children's societies in some of the wards of the municipality they are neither directly nor indirectly engaged in activities related to solid waste management. This has to some extent aggravated the solid waste problem as the children do not take part in the protection of the city from dumped garbage.

Children can be a motivating force who can guide the adults in the society, their parents and other family members, to be more proactive in their approach towards solid wastes. As future citizens of Matale the children should be instilled with the responsibility of caring for the city. Through such societies, children can take over projects to reduce, segregate and recover wastes. This will improve their knowledge on solid wastes management, and benefit them as adults to be active partners in ISWM in Matale.

The plan therefore includes strengthening and building capacity of existing societies to participate actively in the implementation of the ISWM Plan and to set up new societies in wards that do not already have them.

Location:

Each Municipal ward

Budget (Estimated): Rs 100,000/- (USD 950 Approx)

Time frame: 3 months

S8 Establishing Waste Minimization Cells in each Municipal Ward

| | |
|--|--|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> • Waste Minimization cells in all municipal wards • Improved awareness on ISWM among community groups • Reduce the solid waste generated at household level and ward level • Improved accountability by each ward for waste generated within their wards • Increase the community participation in solid waste management at Matale | <p>Lead Agency: MMC</p> <p>Support Agencies: Sevenatha CBOs NCPC Regional Chamber of Commerce Divisional Secretariat Village Development Societies</p> |
| <p>Description:</p> <p>The community based organizations in each ward can be strengthened and their participation can be improved in solid waste management by establishing waste minimization cells in each of the municipal wards. The goals of these waste minimization cells will be to assist households and especially housewives to reduce the waste generation through intelligent purchasing and consumption and then by vigilant sorting of wastes before disposing from the household.</p> <p>The waste minimization cell will be facilitated through training to quantify and assess waste generated within their own ward and segregate them so that their economic values are increased. The housewives will be educated by members of the Waste Minimization Cell/CBO of each ward to reduce the cost of living through reduced waste and earn additional incomes by selling sorted wastes to recyclers or re-users.</p> <p>A way to ensure success setting up and operating such cells is to give leadership of such cells to community leaders and other public figures that hold influence with the common people. This will also ensure that people are motivated and supportive of the cause. In addition to this a steering committee will be formed with representatives from each cell. This steering committee can then link up and communicate with the MMC regarding the ISWM Plan. A mechanism will also be in place to ensure that information flow occurs both upstream and down stream.</p> | <p>Location: Each Municipal ward</p> |
| <p>Budget (Estimated): Rs 100,000/- (USD 950 Approx)</p> | |
| <p>Time frame: 6 months</p> | |

S9 Establishment of Waste Exchange Centre

Desired Outcomes:

- Establish an electronic interface (Website) to link waste generators and buyers/users of wastes
- Establish a mechanism through which people who do not have access to the internet can also link waste generators and buyers/users of wastes
- Listing of all recoverable wastes in the electronic interface
- Streamline the exchange of wastes through quick communication
- Increase the amount of waste recovered as usable resources
- Reduce the amount of wastes ending up in landfill

Lead Agency:

MMC

Support Agencies:

NSWMSC

ITI

NCPC

Regional Chamber of Commerce

Divisional Secretariat

Vidatha Centre

Description:

The concept of waste of one organization is a resource for another organization is the basis for setting up of a waste exchange centre. Currently the recoverable or reusable wastes are not being exchanged as resources in Matale due to non-availability of information for the potential users. Therefore it is intended to develop communication channels (ie: Electronic Interface/website, centre) to offer the available wastes to those potential users/buyers.

The proposed waste exchange will only be an interface. It will not physically store the available resources at one place but will provide the information on wastes available for exchange, location (address), quantity and any other information required for a new user. The users can then directly communicate with the seller/disposer and make arrangements for exchange.

Through the scheme 1 (S1) under theme 1 the waste exchange will also be linked to the national waste exchanges already in operation and thereby the businessmen outside of Matale too can buy the materials offered through the waste exchange

Location:

Environmental Education Centre

Matale

Budget (Estimated): Rs 200,000/- (USD 1875 approx)

Time frame: 6 months

S10 Promoting Private Sector Participation in recycling based industries

Desired Outcomes:

- New businesses/SMEs started in Matale to carry out waste recycling
- Generate new employment opportunities within Matale
- Increase the amount of wastes recovered and ensure that benefits remain in Matale
- Give priority to private sector organizations in the Matale district in setting up and operating such industries (When ever possible)
- Active participation of private sector businesses in ISWM plan implementation

Lead Agency:

Regional Chamber of Commerce and Industry of Matale

Support Agencies:

MMC
Business associations
Ministry of Industrial Development
IDB
Divisional Secretariat

Description:

The previous experience in solid waste management in the other parts of the country has shown that commercial based projects cannot be operated by public sector due to many reasons. Therefore the trend has been to develop public-private partnerships and then win the participation of private sector in carrying out commercial projects in a sustainable manner.

Therefore several projects in the ISWM plan which depend on recovery of resources will be carried out on a market based approach to ensure its long term sustainability. However due to the small quantities involved it will not be possible to start large scale industries based on waste as the main raw material. This necessitates MMC to work with the regional chamber of commerce and industry to win the support of small industries to start a few small scale industries/businesses to add value to non organic recyclable wastes. It is important to give priority to industrialists and investors from within the Matale district when setting up such industries to ensure that the benefits reaped from them are enjoyed by the residents and business community of Matale.

This will further assist to build confidence between the business sector and the MMC and will lead to better cooperation for effective implementation of ISWM plan.

Location:

Matale

Budget (Estimated): Rs 50,000/-(USD 475 approx)

Time frame: 12 months

S11 Strengthening Community Based Organizations

Desired Outcomes:

- Improve the knowledge and capacity of community based organizations on solid waste management
- Make the CBOs capable of taking over some of the major activities of ISWM plan in future
- More households to become active members of the CBOs
- Improve community participation in ISWM plan implementation

Lead Agency:

MMC

Support Agencies:

Provincial Council (Central Province)
Divisional Secretariat
Sevenatha
Ministry of Local Government
NCPC
External consultants

Description:

Community based organizations are in existence in each of the municipality wards but their contribution to solid waste management needs further enhancement. If the CBOs are strengthened adequately they will be able to play a significant role in the implementation of the proposed ISWM plan. The community based organizations could become the promoters for reducing waste generation and waste segregation at source.

In addition to this CBOs will also play an important role as operators of proposed decentralized treatment plants such as composting and bio gas plants. Therefore the CBOs should be exposed to relevant technologies, basics of quality assurance, marketing and economics of production etc. By doing so these organizations will be capable of efficiently operating these plants in an economical and safe manner. The CBOs have to be strengthened also to look after the maintenance of these plants without external assistance in the long run.

It is also important that all CBOs be registered with the MMC or the Divisional Secretariat so that their activities, operations and participation in the implementation process can be closely monitored. Such a link will also help the CBOs to receive further assistance in their activities.

Location:

Each Municipal ward

Budget (Estimated): Rs 100,000/- (USD 950 approx)

Time frame: 12 months

S12 Develop programmes to enhancing living and working conditions of Sanitation Workers

Desired Outcomes:

- Improve health and safety of sanitation workers and their families
- Reduce risks to sanitation workers as well as the public caused by unsafe handling of waste.
- Create an enhanced image and better recognition to sanitation workers by the public.
- Increase motivation among them and improve attendance.
- Improve social status as well as living conditions of sanitation workers
- Improve efficiency of solid waste management system at Matale.

Lead Agency:

MMC

Support Agencies:

NSWMSC
 NCPC
 Divisional Secretariat
 Matale Hospital
 Social NGOs (eg: Melmadura)
 Sevenatha
 Funding Agencies

Description:

The low social status and poor public recognition of sanitation workers is a problem faced by all local authorities in Sri Lanka. This situation is no different in the case of Matale. As a result of that the community groups do not pay much attention to the living conditions of these people and the workers themselves do not attempt to enhance their living conditions. This leads to sanitation workers paying minimum attention to health and safety of themselves or the community they serve.

Besides that the workers are not provided with or do not use provided PSEs when carrying out their tasks. This often exposes them to accidents and poor health conditions which in turn and increased absenteeism. Since their motivation is at a very low level they are often negligent.

The proposed ISWM plan identified that the motivation and effective involvement of sanitary workers is a key ingredient for effective implementation of the plan. The first step in doing so is to change the term associated to them (scavenger). The active participation of workers can be ensured by recognizing them as an equal member of community and a key partner in the solid waste management system. This could be achieved by developing their working conditions and living conditions. There is a need to provide counselling and health care services to the workers and their families in order to ensure that their lives are improved. The employees must also be given at least primary education to be able to read and write.

Location:

As required

Budget (Estimated): Rs 1,000,000/- (USD 9350 approx)

Time frame: Continuous but start immediately

S13 Provide segregation bins to residents of identified streets for promotion of source segregation

Desired Outcomes:

- Identify a pilot project area to issue bins for waste segregation
- Reduce commingled waste coming into landfill site
- Increase economic value of wastes
- Improve the community participation for solid waste management

Lead Agency:

MMC

Support Agencies:

NSWMSC
CEA
Sevenatha
NCPC
Regional Chamber of Commerce
Funding Agencies
External Consultants

Description:

A few streets in the MMC are provided with facilities to segregate their wastes. The waste collected from these streets is better in quality and easy to manage. It is important to spread this practise to other streets and wards and involve more people from the community.

Therefore it is proposed to select several streets or a ward where no segregation is carried out at household level and to introduce a pilot project. Segregation bins/bags will be provided to households in the designated area and the necessary training will be given to ensure that the project will be successful. An active CBO will be appointed to lead the pilot project with the assistance of the MMC and NCPC. The bins or bags required for the project will be provided with the support of the CEA. Other donor organizations and banks will also be given the opportunity to provide the bins/bags for the project as CSR activities.

The segregation of waste will be into three major components which are the biodegradable organic waste and hazardous waste and other waste. The pilot project will also look into the possibility to provide home composting units to residents in the pilot project so that the biodegradable waste can be removed and thereby reduce the waste disposed to the MMC collection system. Simultaneously it is important to streamline the collection schedule/routine so that the participants are not demotivated.

Location:

Selected ward or street

Budget (Estimated): Rs 1,500,000/- (USD 14,000 approx)

Time frame: 6 months

S14 Re-introduce bell collection system for house to house collection

Desired Outcomes:

- Improve communication to public on solid waste collection routine
- Increase the efficiency of collection system
- More organized and complete service provided to community
- Eliminate unplanned dumping of solid waste on streets/roads

Lead Agency:

MMC

Support Agencies:

NSWMSC

CBOs

NCPC

Funding Agencies

Description:

The lack of communication between the collection workers and community has been a major drawback for effective collection of waste generated at households and also from commercial houses. There are complains from the public that MMC collection is neither efficient nor scheduled. On the other hand sanitation workers complain that the households and commercial houses dispose wastes on the streets haphazardly after the collection is complete. To overcome this poor communication bell collection system was introduced in Matale. During this exercise the collection vehicle was fitted with a musical horn which was loud and clearly audible to households on the streets in advance before the vehicle reached their premises. This system was very effective and the waste collection efficiency improved considerably.

Unfortunately this mechanism is not in used due to the breakdown of the horns. It is proposed to reactivate this system by providing a bell instead of a musical horn to each collection vehicle. The manually operated bell can be rung by the driver and people will know to bring their wastes to the vehicle instead of disposing them on the road.

Location:

Selected streets

Budget (Estimated): Rs 50,000/- (USD 475 approx)

Time frame: 3 months

S15 Restore the Environmental Education centre and provide necessary equipment to enhance its role

Desired Outcomes:

- Provide a permanent meeting place for all partners of waste management
- Develop the centre as a information clearing house and a training centre
- A place to set up the waste exchange centre
- A place for public to visit for information on solid waste management and learn progress on the on going projects
- Place for schools children to obtain ideas for school projects

Lead Agency:

MMC

Support Agencies:

Ministry of Environment
 Ministry of Local Government
 NSWMSC
 NCPC
 UNEP
 Department of Agriculture
 Zonal Education Office
 Funding agencies

Description:

The environmental education centre set up under JICA study has not been used for its original purpose in the last few years. The ISWM Plan requires a centre to facilitate the implementation of ISWM plan through training, meeting of partners and to act as performance monitoring centre. Since the Environment Education Centre is already in existence and certain equipment is already available it is suggested this centre be reactivated and updated to meet its new purpose.

Since the centre is provided with all required training facilities it can be taken immediately for commencing awareness and training programs. The centre will also be developed as a meeting point for CBOs and societies. In addition to this the centre will also act as an information dissemination point through which stakeholders can gain access to information regarding the ISWM Plan and solid waste management in general. Therefore a small reference library with internet access will be set up at this centre. The available computer facilities could be used for developing the electronic waste exchange database and link it to others, maintain all the performance monitoring records of ISWM plan implementation as well as act as the reference centre for all research projects on Matale environment.

Location:

Matale

Budget (Estimated): Rs 1,000,000/- (USD 9350 approx)

Time frame: 6 months

S16 Setting up Eco-Kiosks

Desired Outcomes:

- Facilitate waste segregation by community groups, households and commercial houses
- Provide a transfer point for selected segregated waste streams at convenient locations
- Improve the value of segregated solid wastes by collecting separately
- Create an enhanced image to solid waste management system (ISWM)
- Prevent roadside disposal of recoverable waste material.

Lead Agency:

MMC

Support Agencies:

“Pilisaru” Project (MoE&NR)
 Ministry of Local Government
 Regional Chamber of Commerce
 Divisional Secretariat
 Contractors
 NCPC

Description:

The eco kiosks which are referred to as take back centres or buy back centres are intermediate collection points for segregated wastes. It is not advisable to set up eco kiosks at all the places and streets but establish them at selected locations where non-organic waste generation is high.

In Matale non-organic wastes are generated by commercial houses, offices in and around the city centre. Therefore careful selection of suitable sites for the eco kiosks has to be done by the MMC. These kiosks can be handed over to private sector for operation. It is advisable to make a payment for clean, segregated waste to avoid people from using these kiosks as waste dumping points. The waste collected through the kiosk can be exchanged or recycled.

These kiosks should be open all seven days during daytime (even after 5 pm) so that the citizens can hand in their segregated waste. It is also advisable to give small tokens of appreciation to children who bring segregated wastes to the kiosks as a motivation to others to segregate and deliver wastes to these collection points.

Location:

Matale City Centre

Budget (Estimated): Rs 1,000,000/- (USD 9350 approx) for 5 kiosks

Time frame: 12 months

S17 Setting up intermediate collection point for E-Waste

Desired Outcomes:

- Create awareness on E-waste among community in Matale
- Prevent road side disposal of E-waste and hazardous substances getting into soil
- Create opportunities for recyclers to collect these E wastes for value addition
- Mitigate all negative impacts caused by haphazard handling of E-wastes

Lead Agency:

MMC

Support Agencies:

E-waste Project - Ministry of Environment
NSWMSC
Regional Chamber of Commerce

Description:

The increasing use of electrical and electronic appliances has lead to a new waste stream of E-waste coming into municipal landfills. Since most of the appliances have electronic parts which consist of heavy metals, toxic chemicals and other minerals which can be harmful to ecosystems and humans they are categorised as hazardous. Therefore E-waste can create serious problems if not managed properly.

Though the amount of end of use electronic appliances disposed is very small in Matale it is advisable to be prepared for future inrush of such waste. This is most prudent as the increasing economic standards of people in Matale will lead to higher purchase capacity of such items and within the next 10-15 years. In addition to this the Ministry of Environment is currently preparing a National Policy and strategy for E-waste in Sri Lanka under the Basel Convention.

Therefore it is advisable for the ISWM Plan for Matale to have in place strategies to manage E-waste in line with the National Policy. Accordingly a collection point for all categories of E-waste is to be set up in Matale and all such waste is to be collected here. These E-wastes can then either be given for dismantling and resource recovery or re-exported for recycling. The centre will collect and/or buy all E-waste including obsolete computers, televisions, fused fluorescent tubes, etc. This centre also can be operated by private sector through a partnership so that its sustainability is ensured.

Location:

At a pre-selected site

Budget (Estimated): Rs 500,000/- (USD 4675 approx)

Time frame: 6 months

S18 Setting up Intermediate Collection and Transfer Stations for Municipal Waste

| | |
|---|--|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> • To reduce distance travelled by large collection vehicles • Introduce small scale hand operated carts to reach difficult lanes and households • Increase collection and transport efficiency of solid waste • Provide solid waste management collection to a larger population in the city • Facilitate intermediate segregation in areas where segregation does not happen • Reduce the solid waste loads reaching the land fill site | <p>Lead Agency: MMC</p> <p>Support Agencies: NSWMSC NCPC Regional Chamber of Commerce Divisional Secretariat CBOs Funding agencies</p> |
| <p>Description:</p> <p>About 20% of the population do not receive the service under the current solid waste management system at Matale. This is mainly due to the difficulties of reaching the narrow lanes with the available collection and transport vehicles. Also the collection and transport equipment are inadequate in number to cover the entire city and the MMC is unable to invest in new collection and transport equipment.</p> <p>Therefore an alternative is proposed through the plan to use a fleet of small low cost hand carts to reach narrow and difficult to reach lanes and households. These vehicles would also help to provide service coverage to the entire community in MMC area and not be a heavy cost burden on the MMC.</p> <p>This collection system will be supported by central collection and transfer stations where the collected waste would be unloaded. The waste will then be collected for transport by larger vehicles to final destinations. These intermediate collection and transfer stations will improve the collection efficiency and provide better service to the whole community. In addition, these stations can be made available to scavengers to segregate non organic wastes for resource recovery. The transfer stations will further facilitate the removal of solid waste to final destination points such as bio gas plants, compost plants or the final disposal site.</p> | <p>Location: Matale (Selected Site)</p> |
| <p>Budget (Estimated): Rs 3,000,000/- (USD 28,000 approx)</p> | |
| <p>Time frame: 24-30 months</p> | |

S19 Establishing a Central Collection and Exchange Point for Construction and Demolition wastes

Desired Outcomes:

- A place to accumulate construction and demolition wastes
- Prevent haphazard dumping of construction and demolition wastes wayside.
- Facilitate reuse of C&D wastes by exchange of usable material
- Convert remaining C & D wastes to value added material
- Generate an income from the C&D material

Lead Agency:

MMC

Support Agencies:

NSWMSC

NCPC

Regional Chamber of Commerce

UDA

RDA

Housing Development Authority

Provincial Council (Central Province)

Private Sector

Description:

Currently construction and demolition wastes are dumped on the wayside or disposed on the banks of water ways within Matale City. This haphazard dumping is a long term problem. This practice also leads to the loss of resources which in turn is an economic loss. Since C&D waste is bulky in nature it takes up considerable space for disposal and as managing the existing landfill site is already a critical issue for the MMC, finding a site to dispose C&D waste will be a difficult task.

Therefore a suitable site can be selected in Matale area where C&D waste can be collected and the resources can be recovered and sold or reused. The collection and transportation of C&D waste can be carried out by the MMC or by a private party. People can be motivated to hand in their waste to the designated collector by making a payment based on types, weight or volume of waste handed over. The site can also be operated as a public-private partnership.

The collection point will also be used to segregate different value added material which will be sold or exchanged. The remaining waste can be processed to reduce particle size and sold as a substitute for sand, as a filler or even as suitable building material or road base. The material removed from road repairs can also be brought to this site and reprocessed to recover material for road construction. This will reduce road construction costs.

Location:

At a pre-selected site

Budget (Estimated): Rs 300,000/- (USD 2,800 approx)

Time frame: 12 months

S20 Introduce compartmentalized trailers to transport separate waste streams

Desired Outcomes:

- Facilitate collection of segregated wastes
- Motivate community to segregate waste at source
- Prevention of wastes getting mixed while collection and transport
- Prevent no organic wastes ending up in landfill site

Lead Agency:

MMC

Support Agencies:

Ministry of Environment
 Ministry of Local Government
 Regional Chamber of Commerce
 NSWMSC
 Private Sector
 Funding agencies
 Lions Club/Rotary Club

Description:

The tractor driven trailers used for solid waste collection and transport in Matale does not have any compartments facilitate the collection of segregated wastes. Therefore even if waste is segregated at source they become mixed during transportation. This has also acted as a de-motivating factor to introduce source segregation to the community.

If the MMC is to realize its vision of a “Clean and Green City” then it has to separate waste so that resources can be recovered. To achieve this target waste segregation at household level is the first step. The segregated wastes have to be then properly collected and transported to a pre destined location either for exchange or recycling. Since the amount of non-organic waste is not large enough to warrant several vehicles for collection and transport it is recommended that compartmentalized trailers be used for waste collection/transportation. The trailers can be used in turns in each street to collect non organic wastes at regular intervals.

As an alternative the MMC can handover this service to private sector so that the operator can make a payment to each household for collecting of segregated waste. This will create an economic incentive to households motivating them further to segregate their waste.

Location:

Matale MMC area

Budget (Estimated): Rs 5,000,000/- (USD 46,750 Approx)

Time frame: 30 months

S21 Locate suitable land for construction of Sanitary Landfill

Desired Outcomes:

Establish a engineered sanitary landfill site for final residual wastes and hazardous wastes

Lead Agency:

MMC

Support Agencies:

Ministry of Local Government
 Ministry of Environment
 NSWMSC
 Provincial Council (Central Province)
 Funding Agencies
 CBOs

Description:

The current MMC landfill site is not an engineered sanitary landfill. Therefore its leachate seeps into adjacent water bodies and soil strata while gaseous emissions cause odour and air quality issues. Though the MMC follows the standard practices of covering the waste with layers of soil it is inadequate to properly secure the waste and reduce harmful impacts on the environment. The current waste management system is also not geared to handle hazardous waste and therefore generators are left to manage this waste in any means possible.

Therefore it is important to find a suitable land to construct a landfill following international guidelines and standards of engineered sanitary landfills. Since the other programs in the ISWM plan will help to reduce the amount of waste to be disposed at the landfill the land required will be far smaller than the case today. With the projections of solid waste generation and final disposal available for the next twenty five years, it is possible to estimate the amount of wastes going through the closed loop as recoverable materials. The remaining residual wastes and hazardous waste must be disposed to the sanitary landfill.

Location:

Close proximity to Matale City

Budget (Estimated): not estimated

Time frame: 24 months

S22 Conduct Cleaner Production demonstration project for wood based industries

| | |
|--|--|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> • Introduce Cleaner Production as a strategy for waste minimization in enterprises • Show how to reduce waste generated by the saw mills in Matale • Find a solution to reduce the saw dust generated by the saw mills • Find an alternative use for saw dust generated by the saw mills in Matale • Develop baseline information for future incentives and fines/surcharges | <p>Lead Agency: NCPC</p> <hr/> <p>Support Agencies: MMC Regional chamber of Commerce Divisional Secretariat Central Environmental Authority Saw Mills Wood Industry Association External consultants</p> |
| <p>Description:</p> <p>Matale has a few saw mills generating saw dust and wood chips which are burnt for disposal. Though this reduces the burden to the municipal landfill, the open burning leads to gaseous emissions and air pollution. The main causes for the generation of saw dust and wood chips are poor technology and poor process control. The saw dust itself is a resource which can be a raw material or an alternative fuel for other industrial processes.</p> <p>Cleaner Production (CP) is considered an effective approach to prevent or minimize waste generated by enterprises. Through CP an enterprise not only reduces waste but also saves money. As an additional benefit the environmental impacts due to solid, liquid and gaseous waste discharge is minimized. Cleaner Production focuses on reducing waste prior to reusing or recycling the waste and thereby reduce raw material/resource wastage.</p> <p>The ISWM Plan includes a Cleaner Production demonstration project for the saw mills in Matale to reduce waste and find alternative uses for any waste generated. The reduction of burning of saw dust will lead to the reduction of air pollution. This aligns with the vision of Matale to become a “Clean and Green City”.</p> | <p>Location: Matale (Selected Saw Mills)</p> |
| <p>Budget (Estimated): Rs 250,000/- (USD 2,350 approx)</p> | |
| <p>Time frame: 8 months</p> | |

S23 Conduct Cleaner Production demonstration project for Hotels and Restaurants

| | |
|--|---|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> Introduce Cleaner Production as a strategy for waste minimization in enterprises Show how to reduce waste generated by the hotels and restaurants Improve housekeeping of hotels and restaurants and create good hygienic conditions Develop success stories to be followed by other hotels and restaurants Develop baseline information for future incentives and fines/surcharges | <p>Lead Agency: NCPC</p> <hr/> <p>Support Agencies: MMC Regional chamber of Commerce Divisional Secretariat Central Environmental Authority Hotels and Restaurants Wood Industry Association MOH DPDHS External consultants</p> |
| <p>Description:</p> <p>Matale has a number of hotels and eating houses which are responsible for generating large quantities of organic biodegradable and non-organic wastes. Most of this waste is currently disposed off as municipal solid waste and therefore collected by the MMC and sent to the landfill. This places a large burden on the MMC, and the loss of valuable recyclable material in the form of waste. The biodegradable waste can be easily converted to compost/biogas while the non-organic material can be recycled.</p> <p>Cleaner Production (CP) is considered an effective approach to prevent or minimize waste generated by enterprises. Through CP an enterprise not only reduces waste but also saves money. As an additional benefit the environmental impacts due to solid, liquid and gaseous waste discharge is minimized. Cleaner Production focuses on reducing waste prior to reusing or recycling the waste and thereby reduce raw material/resource wastage. The application of CP will further improve housekeeping and thereby improve hygienic conditions in these hotels and restaurants.</p> <p>The ISWM Plan includes a Cleaner Production demonstration project for the Hotels and Restaurants in Matale to reduce waste and find alternative uses for any waste generated. Since it is not possible to facilitate all hotels and restaurants to introduce CP with available limited resources a demonstration project will be conducted for a few selected hotels and restaurants. This will provide the necessary guidance for all hotels to implement CP thereafter.</p> | <p>Location: Selected hotels and restaurants in Matale</p> |
| <p>Budget (Estimated): Rs 500,000/- (USD 4675 approx)</p> | |
| <p>Time frame: 12 months</p> | |

S24 Develop project proposal for setting up Industrial Estate for Recycling Based Industries

- Desired Outcomes:**
- A bankable proposal with technical and economic details on Industrial estate
 - To set up new recycling park planned for non-organic wastes at Matale
 - Create new small enterprises for recycling or recovery of wastes
 - Increase new employment opportunities
 - Increase the volume of segregated wastes coming for recovery of resources

Lead Agency:
NCPC

Support Agencies:
MMC
“Pilisaru” Project (MoE&NR)
External Consultants

Description:

The non-organic waste generated at Matale is either removed by recyclers from outside districts or ends up in landfill. Either way the value of this material is lost to Matale. These non-organic wastes are collected by the municipal workers, scavengers or by intermediate buyers at a very low value from the generators. Since the people of Matale do not receive any benefits from this system many are not interested to make the effort to collect and give the waste in a manner that conserves the value.

The ISWM Plan will include a project proposal to set up a recycling park which will house several small industries that recycle or process various waste materials. These industries will include industries that recycle waste paper, plastic and dry cell batteries; dismantle E-wastes; convert C&D wastes to reusable building materials; convert saw dust to low cost particle boards etc. The recycling park will be managed by MMC but individual SMEs will be privately owned and as an incubator. The SMEs in the park will be provided all the basic infrastructure and facilities to operate within the park. The SMEs will have the freedom to collect and process the wastes from other Municipalities and Pradesheeya Sabhas in addition to the MMC. The growing SMEs will have the choice to move out when they feel secure to operate on their own.

This will be the first such recycling park in the country and can be a training institute for any business who wants to set up a recycling industry.

Location:
Matale (Selected site)

Budget (Estimated): Rs 300,000/- (USD 2800 approx)

Time frame: 3 months

S25 Develop project proposal for setting up decentralized composting plants

| | |
|--|---|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> • A bankable proposal with technical and economic details on small scale compost plants • A set of designs/working drawings available for any donor/promoter • Obtain approval/consent from relevant authorities on constructing composting plants • Promote private sector/NGO/CBOs to set up small scale compost plants for commercial use | <p>Lead Agency: NCPC</p> <p>Support Agencies: MMC NSWMSC External consultants NGO</p> |
| <p>Description:</p> <p>The small scale compost plant established in the Matale city provides a sustainable solution to manage organic waste and acts as a good model for the city. To realize the long term objective of developing a city without a landfill site MMC has to find an alternative sustainable solution to the management of organic waste. Establishing several small scale composting plants at pre-selected sites to convert organic waste to compost will not only provide an alternative solution to the landfill site but also will be an income generating opportunity to.</p> <p>Since Matale is surrounded by several plantation estates and considered an agricultural district the producers will have the opportunity to sell the compost as soil conditioner/fertilizer. However to ensure a ready and continual market it is important to establish a marketing interface through a public private partnership between MMC and chambers/business community. Also maintaining uniform quality and meeting national standards for compost will be a plus factor for selling compost.</p> <p>The ISWM Plan will include a project proposal to set up a number of small scale decentralized composting plants in Matale.</p> | <p>Location: Matale (Selected sites)</p> |
| <p>Budget (Estimated): Rs 200,000/- (USD 1800 approx)</p> | |
| <p>Time frame: 3 months</p> | |

S26 Develop project proposal for setting up decentralized biogas plants

Desired Outcomes:

- A bankable proposal with technical and economic details on bio gas plants
- A set of designs/working drawings available for any donor/promoter
- Obtain approval/consent from relevant authorities on constructing bio gas plants
- Promote private sector to set up small scale bio gas plants for commercial use.

Lead Agency:

MMC

Support Agencies:

University of Moratuwa

NCPC

Ministry of Health

Matale Hospital

External consultants

Description:

The solid waste generated in Matale has suitable materials for generation of bio gas. Since Matale is a city with limited land space the setting up of a landfill for all organic waste is a costly affair beyond the capacity of MMC. Therefore the city has a long term objective for finding alternatives to developing a sanitary landfill site for all organic wastes. To achieve this, the city has to process all wastes in a safe and useful manner.

Since the cost of petroleum fuel has gone up during the recent past, the generation of bio gas can be an ideal solution to some of the institutions. For example the hospital which uses Liquid Petroleum Gas (LPG) for preparation of food and heating of water generates food wastes suited for bio gas generation. Currently this food waste is disposed to the municipal land fill site. A bio gas plant at the hospital will reduce the load to land fill and also will provide an alternative fuel to partially substitute for their fuel requirement for food preparation. Similarly establishing bio gas plants at selected locations will reduce the daily load to the municipal landfill and provide fuels to some members of the community.

The ISWM Plan includes a comprehensive project proposal for the installation of few decentralized biogas plants.

Location:

Matale Hospital and other Selected sites

Budget (Estimated): Rs 200,000/- (USD 1800 approx)

Time frame: 3 months

S27 Preparation of the Project Idea Note (PIN) and Project Design Document (PDD) for proposed Biogas Plants as a CDM Project

| | |
|---|--|
| <p>Desired Outcomes:</p> <ul style="list-style-type: none"> • To develop CDM Project Identification Note (PIN). • To prepare the CDM Project Design Document (PDD). • To facilitate the validation and registration process of the CDM project. • To facilitate the selling of the ERUs by bringing potential buyers. • To facilitate building of monitoring report during the verification. | <p>Lead Agency: Nature Solutions (Private) Limited</p> |
| | <p>Support Agencies: MMC NCPC UNEP External consultants</p> |
| <p>Description:</p> <p>The decomposition of biodegradable Municipal waste is a major contributor to green house gas emissions. Studies have shown that putrefying of waste emits both CO₂ and methane and that if this waste is not disposed to an engineered sanitary landfill these gases are directly released to the atmosphere.</p> <p>The Clean Development Mechanism (CDM) is an arrangement under the Kyoto Protocol allowing industrialized countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. A crucial feature of an approved CDM carbon project is that it has established that the planned reductions would not occur without the additional incentive provided by emission reductions credits, a concept known as "additionality".</p> <p>The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialized countries. However, in recent years, criticism against the mechanism has increased. Critics claim many approved projects are not actually additional.</p> | <p>Location: Matale</p> |
| <p>Budget (Estimated): As per the proposal presented</p> | |
| <p>Time frame: 12 months</p> | |

S28 Effecting Policy Changes at Local Government Level

Desired Outcomes:

- Strengthen national solid waste management regulatory framework
- Address the weak areas of the regulatory framework to close the loopholes

Lead Agency:

Ministry of Local Government

Support Agencies:

NSWMSC

All local government authorities

NGOs

Description:

Though the country has a very stringent environmental policy frame work the emphasis on the solid waste management has not been adequate enough to pressurise the people to adhere to the required actions. A conspicuous limitation in the existing system is that little attention has been given to motivations and deterrents through incentives and fines. Also the publicity and promotion of the regulatory system is at a low level.

In solid waste management segregation at source, household hazardous waste management, closed transportation of wastes, open dumping on road side, landfill sites have not been addressed at all. Though there are guidelines for solid waste management these are not regulatory requirements.

Another major shortcoming is that though local government authorities are made the entities responsible for the collection, transport and disposal of solid waste in their areas of operation, adequate regulatory muscle is not provided to them to effectively implement these roles. Therefore it is important to address these issues at policy level so that all relevant authorities and other stakeholders follow the national regulations and local government by-laws. This could be achieved by effecting necessary policy changes for the management of solid wastes and empowering local government authorities as well as incorporating incentives and fines to citizens.

Location:

Colombo

Budget (Estimated): Not estimated

Time frame: 36 months

S29 Lobbying for Approval of Municipal Council By- laws

Desired Outcomes:

- Obtain parliament approval for the already drafted by laws without further delay
- Strengthen the weak areas of solid waste management regulations and by laws
- Networking with all local government authorities to eliminate the solid waste problem

Lead Agency:

Ministry of Local Government

Support Agencies:

All local government authorities
 Provincial Council (Central Province)
 NSWMSC
 NGOs
 IUCN

Description:

Ministry of Local Government through the participation of all Local Government authorities drafted a set of New by-laws for Municipal councils several years ago. The new by-laws address all relevant issues in the solid waste management at local level which were not addressed in the previous regulations and by-laws. If applied these by-laws will empower Municipal Councils and other Local Government agencies to effectively carry out the solid waste management.

The Municipal Council by-laws are currently awaiting parliamentary approval to become effective. Unfortunately these have not yet been approved due to several minor issues in the by-laws. Attention should be given to these by laws again and the unresolved issues should be clarified and action should be taken to obtain parliament approval soon to make these by laws effective.

It is also essential that other central province local government authorities link with each other and work together towards obtaining this approval.

Location:

Colombo

Budget (Estimated): Not estimated

Time frame: 12 months

S30 Develop incentive systems to Promote Source Segregation

Desired Outcomes:

- Establish a system for rewarding individuals/organizations excel in solid waste management
- Create a competitive environment for improved solid waste management
- Improve community participation in solid waste management

Lead Agency:

MMC

Support Agencies:

NSWMSC

NCPC

Large business houses

Banks

Description:

Non availability of recognition and rewarding system to individuals and organizations that excel in solid waste management within their areas is a major deterrent to effective solid waste management. Those who dispose their wastes as it is and those who reduce, segregate, reuse or recover resources are treated equally. There are no benefits available to motivate those who manage their waste or take leadership in doing so. Therefore a new rewarding scheme needs to be developed not only to reward persons who effectively manage their solid waste but also to motivate others to do so.

The scheme should include financial and non financial rewards and should address households, schools, commercial houses, businesses, industries, and public sector organizations. Also publicity through national and local media can be used as a system to recognize such persons/organizations.

The scheme should recognize the individual and corporate citizens who excel in solid waste management annually and they should be rewarded in a public function. Therefore an award scheme conducted yearly is recommended. Similarly they should be encouraged to continue with their good work by providing some financial incentives.

Location:

Matale

Budget (Estimated): Not estimated

Time frame: 12 months

S31 Lobby to increase fines and introduce new fines to discourage open dumping and disposal of commingled waste

Desired Outcomes:

- Regulations on solid waste management in place at national level
- Introduce new financial surcharges to discourage open dumping
- The solid waste is segregated at source
- Economic value of solid wastes increase

Lead Agency:

Ministry of Environment

Support Agencies:

Ministry of Local Government
Local Government Authorities
Provincial Councils

Description:

The open dumping of solid waste at public places and road side is a problem faced by all local government agencies when implementing solid waste management systems. Usually these openly dumped solid wastes are commingled and its economic value is extremely low leaving no other choice other than to landfill them. To prevent this practice it is important to have effective fines and surcharges imposed on offenders who do this illegally.

Though there is an existing fine imposed on illegal waste dumping it is not adequate enough to be a deterrent to miscreants. New regulations should be incorporated specially into solid waste management to introduce high surcharges to discourage ungainly practice. Also proper regulations should be introduced to encourage segregation at source (household levels and organization level) before they are being disposed.

In addition to fines and surcharges it is also advisable that a system be introduced through which first time offenders are issued a formal warning by local magistrates.

Location:

Colombo

Budget (Estimated): Not estimated

Time frame: 36 months

Chapter 8: Assessment of Technologies for Implementation of ISWM Plan

8.1 Introduction

According to the goals set in the previous chapter, recovery of waste prior to final disposal and providing solid waste management services to all residents under the MMC jurisdiction become two major focus areas of the ISWM Plan. In addition to this the chapter on Technology used for Solid Waste Management in the Situation Analysis report highlighted that several shortcomings in the technologies used by the MMC as well as lack of technologies have contributed greatly to the current solid waste related difficulties faced by the MMC.

Therefore it is abundantly clear that technologies used for the management of Solid Waste play an important role in achieving the goals and through them the ultimate vision of the plan. However it is prudent to keep in mind that local authorities in a developing nation such as Sri Lanka are unable to invest in the latest and the most efficient solid waste management technologies. Therefore the technologies selected and presented by the plan need to be not only efficient in solid waste management but also the most affordable ones.

Though all possible technological interventions available today are listed in this chapter only the most essential and economically feasible ones will be selected and described in detail. Therefore the following chapter will explicate technologies available while discussing the pros and cons of applying these technologies in terms of technical, financial and environmental feasibility in respect to Matale Municipal Council.

8.2 Segregation and Sorting Technologies

Waste segregation is an essential component of any Integrated Solid Waste Management system as separate waste streams will have more value and can be easily

recovered, recycled or reused. Separation also ensures that the wastes are clean enough to be reprocessed or reused and thereby minimizes the loss of valuable resources through final disposal. Therefore the plan for Matale will focus greatly on introducing waste segregation especially among residents, schools and commercial establishments where recyclable waste can become soiled with food wastes, hazardous wastes, oils etc. which will reduce their value.

In developing mechanisms to separate waste streams three possible avenues can be considered. Essentially segregation at source is considered to be the best and most sound segregation system. However segregation can also be carried out at central segregation plants set up at suitable locations. Already Matale has two small centralized segregation units where a small portion of the waste generated is separated out. The third method is through waste picking or scavenging by people throughout the waste management system.

8.2.1 Source Segregation

In the case of source segregation, the waste streams are separated out by the generators themselves. This allows for the generators to directly be involved in the Solid Waste management system and reduce the burden of separating waste at a later stage. Source segregation is also ideal as the waste streams are cleaner and therefore operational costs as well as water and energy consumption for cleaning at a later stage can be minimized by a great deal. The type of container used for storing the separated waste streams will have to be given due consideration in this case and several factors such as container shape, size and material of construction, lifetime/durability and price/cost need to be considered. In addition to this the type of house/building, the space available, and the income and education level of residents will also play an important role in deciding which containers are best suited.



Figure 8.1: Typical Waste Collection/Storage Bin with wheels



Figure 8.2: 10 Lt. Plastic bucket with lid



Figure 8.3: Typical plastic garbage bag

8.2.2 Waste Picking/Scavenging

Picking out recyclables from mixed wastes collected at street side bins, intermediate collection and transfer stations and final dumpsites is a common practice in Matale as in the case of cities in most other developing countries. Though this system is considered to be acceptable in poor communities the practice is risky as the scavengers/waste pickers are often exposed to hazardous wastes.

In the case of Matale waste pickers are responsible for separating out much of the valuable wastes and redirecting them to be recycled or reused. Many of the low income dwellers in Matale as well as MMC employees earn extra money through this practice. Therefore the MMC must be extremely careful in developing waste segregation system to ensure that the people whose livelihoods depend on scavenging are not adversely affected by a sudden change.

8.2.3 De-centralized Sorting Centres

De-centralized sorting plants provide an alternative to source segregation and can be a suitable option to densely populated cities where residents do not have enough space to segregate and store wastes at homes. The waste collected from residences, commercial establishments and other sources are brought to a central point where the

valuable materials are separated out and cleaned and sold for recycling. Though segregation plants can be a single large unit or several small-scale units, setting up smaller de-centralized units maybe more practical in the case of Matale.

These plants must be equipped with water and electricity to facilitate the segregation and cleaning of waste streams. Also they must have adequate space to store the separated waste streams in a clean and dry manner until they are taken away by recyclers. In addition to this if cleaning is carried out with water, a waste water treatment plant will also have to be constructed.

If the waste arriving at the segregation plants are mixed and contaminated with food, oils or any hazardous wastes they will have to undergo a thorough cleaning process. This can be far too expensive and create financial difficulties. However to overcome this problem, partial source segregation can be introduced at source level to separate out biodegradable waste, hazardous waste and other waste. The other wastes can then brought to the segregation plants and separated into various waste streams.

8.3 Waste Collection and Transportation Technologies

Waste collection includes not only the gathering of waste but also hauling this waste to locations where the waste is either temporarily stored or for final disposal. Most times the collection is based on an individual collector or a group of collectors who move through a collection service area with a collection vehicle and some hand tools. The vehicles used for collection can range from simple hand drawn carts to complex and fuel intensive compactor trucks. Therefore collecting and hauling waste can be a labour intensive and high fuel consuming activity.

The MMC is the sole authority for the collection of Municipal Solid Waste in Matale. As described under the chapter on Regulatory Framework in the Situation Analysis Report (refer page 12) the responsibility of collecting municipal solid waste rests solely on the municipal councils. The collection of waste from households, commercial

establishments and industries is carried out manually using hand carts, tractors with trailers and compactors. The collection routes and frequency are often ad-hoc in nature and one of the issues raised by stakeholders during the stakeholder concerns workshop was that collection is neither regular nor efficient enough to suit the rate at which the waste is generated. In addition to this the MMC is unable to provide collection services to around 2000 residents within its jurisdiction due to shortfall in vehicles and collectors and not having vehicles which can travel on the terrain of the areas. The result of all these factors is that the MMC is unable to collect and properly dispose all the Municipal waste generated within its limits and the uncollected waste is left to decompose and cause health and environmental impacts.

In order to improve this situation and deliver a better service to the community the MMC will need to consider several changes to its existing technologies and the method of using these technologies. Fleet management and re-evaluating the collection routes and schedules are essential in optimizing the collection system.






The selection of suitable collection technologies will depend on the type and density of waste, number of generation points and roadways that need to be travelled in collecting the waste. In addition to this the skills of the collection crew and the method of discharging the load at an intermediate collection point/final disposal point will also need to be given due consideration. In the case of developing nations such as Sri Lanka, Municipalities often have to use the same vehicle for multiple purposes to cover as much area as possible so that the work can be completed with the few vehicles available.

A large variety of collection vehicles are available though not all of them will be suited to Matale given its financial and geographical situation. The capital and labour cost for the particular collection technology as well as the local availability of spare parts and repair skills (technical expertise) will also play a role in identifying the most suitable type of vehicle.

8.3.1 Waste Collection Hand Tools

One of the most important factors to consider in the case of waste collection is the hand tools which will be used by the waste collectors. These hand tools ensure that the collectors do not come into direct contact with the waste and thereby eliminate any adverse health effects caused due to exposure to solid waste. The main tools used in waste collection are ekel brooms (for sweeping), hoes (collecting and transferring), dust pans and large cane baskets (transferring).

In the case of Matale waste collection is carried out by individual collectors who sweep the wayside garbage into piles that are later picked up by the collection vehicles. Therefore hand tools are essential for the waste collection. Hand tools make collecting waste easier and more efficient and less dangerous to the collectors.

| | | | | |
|--|--|---|--|---|
|  |  |  |  |  |
| Figure 8.4: Ekel Broom for street sweeping | Figure 8.5: Shovels for collection and transferring | Figure 8.6: Hoes for collecting | Figure 8.7: Dust pans for Collecting and Transferring | Figure 8.8: Cane Baskets for Transferring |

8.3.2 Roadside Waste Collection Bins

Collection systems in most countries depend on set out containers which are placed along the roadside for waste to be disposed into. Several types of roadside waste collection bins/containers can be used to facilitate the easier collection of solid waste. Roadside bins can be stationary or mobile types. Several such bin types used in Sri Lanka are given below.

| | | | |
|--|--|---|--|
|  |  |  |  |
| <p>Figure 8.9: Litter Baskets</p> | <p>Figure 8.10: 100 litre Half Oil Drums</p> | <p>Figure 8.11: Movable Plastic Colour Coded Garbage Bins</p> | <p>Figure 8.12: Stationary Concrete Bins</p> |
|  |  |  |  |
| <p>Figure 8.13: Stationary Trailers</p> | <p>Figure 8.14: Stationary Handcarts</p> | <p>Figure 8.15: Large Metal Containers</p> | <p>Figure 8.16: Compartmentalized Collection Bins</p> |

A major problem with roadside bins is that they are often open top type and allows animals to gain access to the waste. In other cases storage bins are insufficient and the waste is piled or heaped around the container. In addition to this if waste is not collected on a daily basis the waste putrefies and gives out bad odours causing a public nuisance. In the case of Matale all the above drawbacks have made road side containers more of an eyesore than a sound waste collection system.

8.3.3 Waste Collection and Transportation Vehicles

8.3.3.1 Small Scale Collection Vehicles / Muscle Powered Vehicles

Muscle powered carts pulled, pushed by people as well as Bicycles with compartments (figures 8.17 and 8.18) are important sound and low investment options for collecting solid waste from door to door. Such vehicles are inexpensive and easy to build and maintain. Under the prevailing fuel costs it would be best if door to door collection can be carried out using muscle powered vehicles.

Alternatively there are small scale vehicles (refer figure 8.19 and 8.20) that run on electricity or biogas which can service small areas and areas which are inaccessible to larger collection vehicles.

The advantage of using small vehicles and muscle powered vehicles is that they can travel and manoeuvre within small or limited spaces as well as densely populated areas. They are also suitable to travel in areas that have little or no street access, hilly and rough terrain. Another important advantage is that such vehicles are also suited to areas where relatively small volumes of waste are generated by a large number of densely settled housing units.

The disadvantages include facts such as limited travel range when compared to fuel powered vehicles and that the person riding the vehicle may be exposed to adverse weather conditions.

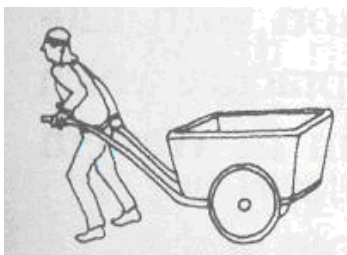


Figure 8.17: Human Hand Cart

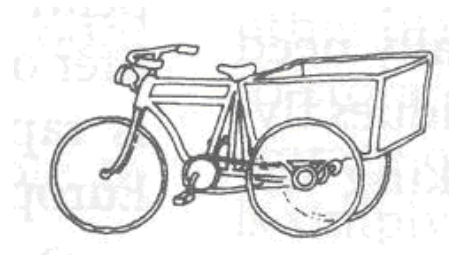


Figure 8.18: Human Pedal Cart

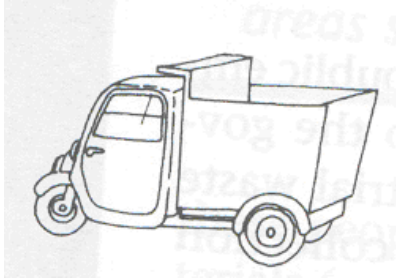


Figure 8.19: Three Wheeled Auto-Rickshaw

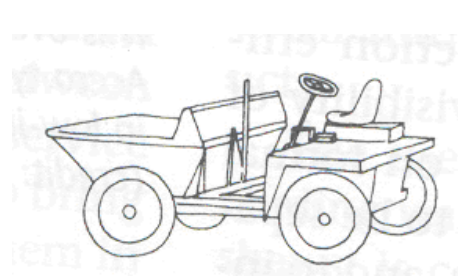


Figure 8.20: Dumper Truck

8.3.3.2 Non-compaction Trucks

Non compactor trucks a suitable alternative to compactors in areas where the waste generated is very dense and do not require to be compacted. Such vehicles are most suitable to small cities where the road ways are not broad enough for large compactors. Some non compactor vehicles are shown in figures 8.21, 8.22 and 8.23. These vehicles need to have a waste dumping mechanism to facilitate the easy discharge of solid waste. Open trucks or tractors with trailers can lead to other issues such as waste spillage during transportation as well as rain soaking the waste which can cause aesthetic and health related problems. In addition to this such vehicles can also be compartmentalized to facilitate the collection of segregated waste streams from various sources.

Non compactor trucks are ideal in the case of wet or dense waste which makes it difficult for the waste to be compacted. Though the initial capital investment may be high these vehicles can usually operate with a few waste collectors. Non compactor trucks are also ideal for collection on longer routes.

However there are a few disadvantages in adopting this technology in the case of Matala. These include factors like the requirement for regular and scheduled maintenance, need for specialized local maintenance and repair expertise. In addition to this at least one vehicle will have to be on standby to be used during downtimes.

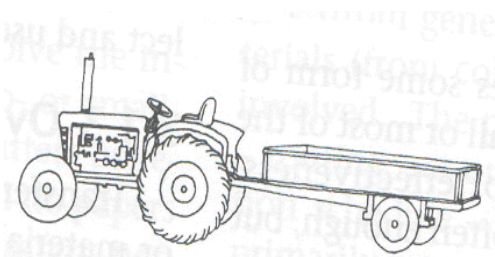


Figure 8.21: Tractor with Trailer

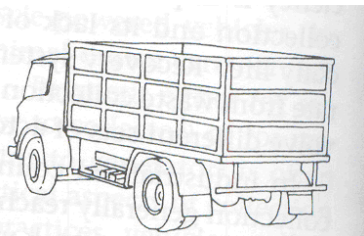


Figure 8.22: High Sided Open Top Truck

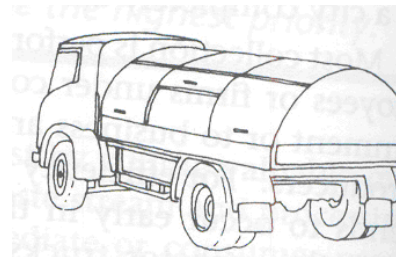


Figure 8.23: Compartmentalized "Roll-top Truck"

8.3.3.3 Compactor Trucks

Two main types of compactors are used in the world, the fore-and-aft semi-compaction tipper with press plate (figure 8.24) and the rear-loading hydraulic-compactor. These are mostly suited and used by developed countries where they are considered to be the best waste collection and transportation technology. Compactor trucks are usually best for wastes which are less dense in nature and require to be compacted. This technology can be used to reduce waste volumes using hydraulic or mechanical pressure.

However compactors are often ineffective in situations where the waste is already very dense and moist. This makes compactors inappropriate to developing nations. One major drawback of compactors is that the initial capital cost of vehicles is very high and that maintenance work needs to be carried out regularly in order to minimize breakdowns. As seen during the Situation Analysis the MMC already possesses two compactors but both vehicles are often off-road due to breakdowns.

In addition to this compactors are high fuel consuming vehicles raising the operating costs to a great extent. They also require well paved streets which are wide enough to allow passage and turning.

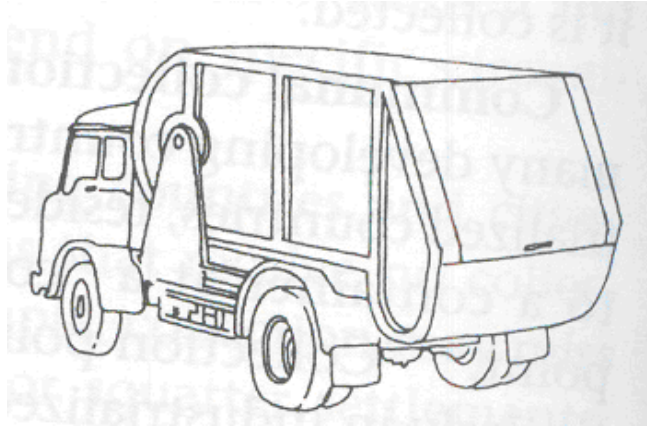


Figure 8.24: Fore-and-aft Tipper Truck

8.3.4 Waste Collection Route Design and Operation

Any waste collection system is based on a waste collection route designed by the responsible authority/organization. The routes are designed to allow maximum use of the vehicles, equipment and human resources and ensure that waste is collected in an efficient and planned manner. If the collection route is not well planned out it can result in poor waste collection.

In the case of the MMC 5 different waste collection routes have been designed to cover almost all of the 13 wards. However a key drawback of the existing route design is that the Gangaboda area within Kaludewala (Ward 13) is totally excluded from the MMC collection system. In addition to this a by-lane off the MC road is also excluded from the MC collection route.

In order to achieve efficient waste collection MMC must look into collecting as much waste as possible with the available human and financial resources and time. Waste collection has to be carried out before the daily city activities begin in order to avoid creating traffic and other issues. In addition to this if the vehicles used for waste collection are too small, several trips will have to be made to and from the final disposal site or the intermediate collection points leading further time losses. Also problems will arise where the terrain is too difficult for larger vehicles to pass through.

To design an optimal collection system means going beyond having the latest and the most efficient collection vehicle/technology. Several factors have to come together and work simultaneously to optimize waste collection. These factors include a well chosen waste collection frequency, a suitable time of collection avoiding times when the streets are crowded and ensuring that all residents in the area receive the collection service at least once a week.

The “Just in time” waste collection system is also a good system which allows residents to bring out their waste at the time the collection vehicle reaches their area. A bell or horn can be used by the collector to announce his arrival and to indicate that the waste should be brought out. However for this system to work best at least one person has to be home during the day or at the time the collection vehicle come by.

8.3.5 Intermediate Transfer/Collection Points

Intermediate transfer stations/points are centralized facilities where waste collected by smaller vehicles is temporarily stored to be reloaded and sent for treatment, reprocessing/recycling or for final disposal. The use of transfer stations is an ideal option when there is a need for small vehicles servicing a collection route to unload its waste and return to collection quickly to reduce time loss.

However transfer stations can have high capital costs especially if they are mechanized. A better alternative for developing nations is to make transfer stations manual involving labour to unload the waste and then reload the waste to larger vehicles.

Transfer stations also provide the ideal opportunity for MMC to develop a centralized segregation system where recyclable waste such as plastics, paper and cardboards, glass and metal can be separated out and sent for recycling. This would also reduce the cost of having to provide too many segregation bins/bags to waste generation points

such as households and commercial establishments where space can be a limiting factor.

When siting an intermediate transfer station several factors need to be considered. The location needs to be easily accessible to both small collection vehicles and larger ones such as trucks and compactors. The station should also have ample space for vehicles to come in, dump their waste, reload waste into other larger vehicle and to allow vehicles to move and turn easily. If the transfer stations are to double as centralized segregation points the space required will increase further. In addition to this many stakeholders felt during the stakeholder concerns workshop that intermediate transfer stations can become public nuisances especially if not maintained in the proper manner. Therefore when siting a transfer station the location should be far enough from residences to minimize odour, noise, leachate and traffic problems.

However in the case of Matale where land space is problem, finding a suitable location covering all the above aspects can become difficult. The city of Matale is densely populated further aggravating this situation. Therefore it will be better to locate a few smaller transfer stations rather than a single large one. The appropriate number of transfer stations to be located within the MMC will depend on the number of service areas and routes used by the MMC in collection. In addition to this the distance between the service areas, the collection technology to be used and the volume of waste generated will also have to be taken into consideration. In either case however, it will be the responsibility of the MMC to ensure that the neighbourhood is not adversely impacted by these stations.

8.4 Waste Recovery and Reuse Technologies

Waste recovery can be carried out in several processes including the separation of solid waste components, the processing of these components and transformation processes that alter the form of the waste. The materials separated from solid waste can be used directly as raw material for manufacturing and reprocessing or as feedstock for the

production of compost, biogas or other products. As composting and biogas production are discussed later on, this section will focus mainly on technologies that are used to recover and reuse non-biodegradable waste streams.

8.4.1 Intermediate Processing Technologies

Recovery of waste can only be carried out if the waste is properly collected, separated, reduced to a suitable size and cleaned to be free of any contamination. Prior to discussing the actual recycling technologies it is best to identify technologies available to process the waste to be suitable for recycling.

8.4.1.1 Collection

The collection of recyclable non-biodegradable waste can be carried out using the source segregation and centralized segregation technologies discussed in sections 6.2 and 6.3. In addition to this “Drop-off centres” can also be set up to facilitate the recovery of materials that would otherwise end up in a dump yard. Such centres are commonly known as “Eco-kiosks” in Sri Lanka. Drop off centres are ideal for wastes such glass, plastics, paper, metal, textiles and even electronic waste and construction and demolition wastes.

A slightly different approach would be to set up “Buy-back centres” where the main difference would be that a monetary incentive would be give to people who bring in their waste stream. This method will encourage more participation on the part of the residents. Several other options of incentives can also be considered instead of directly paying money.

8.4.1.2 Separation

Waste separation can be carried out either mechanically or manually. Manual separation of waste though labour intensive is less costly compares to automated

separation technologies. However proper PPEs will have to be provided to the separators to reduce any harmful impacts resulting from contact with waste.

8.4.1.3 Size Reduction

This involves mechanically reducing the size of waste material to form size reduced and uniform final product that can then be easily stored, transported, recycled or reused. The main types of size reduction technologies are shredders, grinders and mills. Several technologies are discussed below.

| | | |
|---|--|------------------------------------|
| | | |
| <p>Figure 8.25: Hammer-mill Type Shredder</p> | <p>Figure 8.26: Flail-mill Type Shredder</p> | <p>Figure 8.27: Shear Shredder</p> |

Whatever the shredding technology, the basic process is that the waste is either “hammered” or “cut” into smaller and homogenous particles which can then be recycled or reused. In addition to the technologies given above there are also Glass crushers and wood grinders that respectively crush glass and wood into smaller particles.

8.4.1.4 Screening

Once the waste material is crushed or hammered or cut into small particles these particles must be separated according to size using screeners. Screeners usually separate the crushed particles into two or more size fractions. The main objectives of using screening technologies are to either remove oversized particles or undersized particles, separate heavy particles such as glass and metal from lighter particles such as paper and plastics.

The technologies for screening are given below.

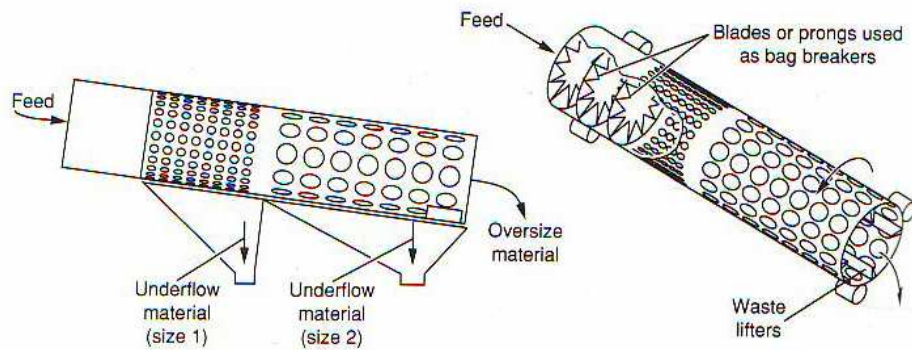


Figure 8.28: Rotary Screens

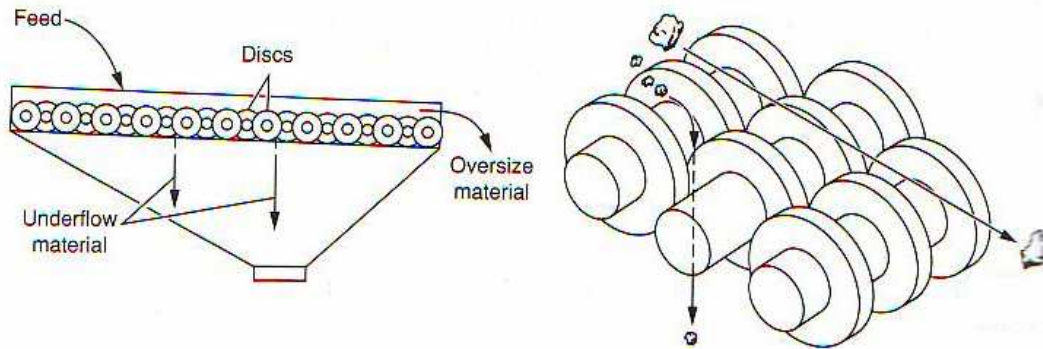


Figure 8.29: Disc Screens

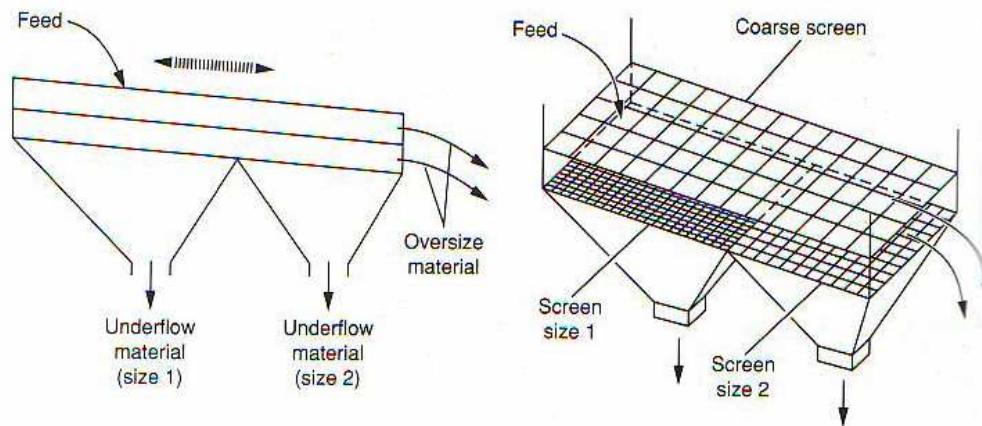


Figure 8.30: Vibrating Screens

In addition to mechanical screening there are also technologies like Magnetic Separation, and Density Separation that can also separated out waste particles. Density Separation basically separates materials based on the weight of the material in an air stream. Magnetic separation uses a magnet to separate out metal particles from non metal substances using their magnetic properties.

8.4.1.5 Compaction

Also known as Densification this process is used to increase the density of the waste materials through compaction and thereby making transportation easier. Several compaction technologies such as Balers and Can crushers can be used for this purpose. Typically these technologies are used for bulky waste material such as paper, cardboard, tin cans/metals which are either pressed together or crushed using mechanical force.

8.4.1.6 Transporting/Handling of Waste

Waste can be transported or transferred to another location using several technologies. The most obvious types of movement technologies are trolleys, carts and forklifts. In addition to these technologies there are also conveyor systems that help to transfer

material from one place to another, especially within a facility. The principal types of technologies used in waste management are hinge, apron, bucket, belt-drag, screw, vibrating and pneumatic conveyor systems.

Conveyor systems are often damaged if waste containing heavy material are dropped on them. Another draw back of using conveyor systems is that spillages and overflows are common place.

However conveyor systems are idea to be used in conjunction with manual sorting. Individuals placed on either side of the conveyor belt can pick out waste material from the moving belt. Therefore used together with manual labour this technology can vastly improve waste separation at centralised segregation plants.

Shown below are schematics of two main conveyor technologies used.

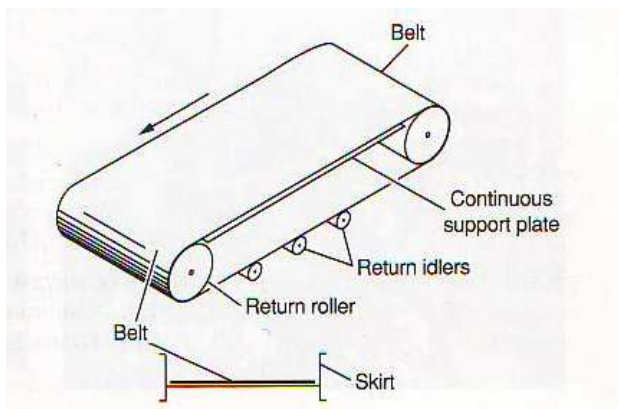


Figure 8.31: Belt Conveyor

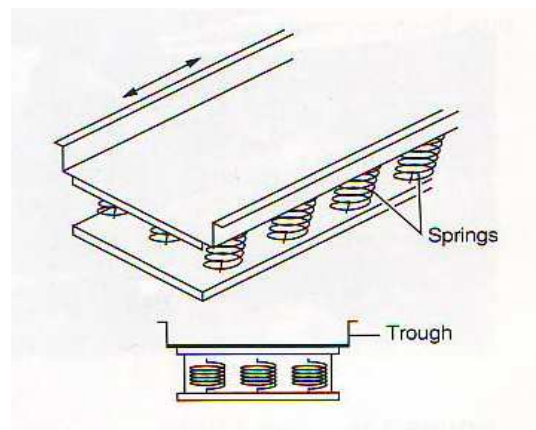


Figure 8.32: Mechanical Vibrating Conveyor

8.4.2 Recycling Technologies

The actual recycling technologies can vary according the type of waste material being processed. The recycling technologies used to process plastics, paper, and construction

and demolition waste are discussed in this section as these are the most abundantly available waste material in Matale.

8.4.2.1 Recycling of Plastic Waste

Plastics can be classified into seven categories. However the waste quantification and characterization carried out for the Matale Municipal Council under this project showed that the major plastic waste types found in Matale are PET, HDPE, LDPE and PVC.

Unfortunately the technology for converting PET to polyester fibres is far too cost intensive to be set up as a small scale industrial unit.

8.4.2.2 Recycling of Paper and Cardboard Waste

These technologies are designed to recycle post consumer paper and cardboard to manufacture products which range from recycled paper to building material to refuse derived fuels. Large scale paper mills that produce paper and cardboard use technologies and equipment that are financially and technically beyond the limits of many industrialists in Sri Lanka. The focus therefore would be to develop small scale paper recycling plants where the waste paper can be collected and converted to pulp and then produce paper. Several technological options are already available in Sri Lanka to recycle paper at cottage level or at micro/small industry level. The reduced capital and operational costs of these technologies make the final product more marketable.

There is a high demand both in Sri Lanka and abroad for hand made recycled paper. Therefore this would be an ideal opportunity to develop a small scale recycling unit within the MMC.

8.4.2.3 Recycling of Construction and Demolition Waste

Construction and demolition waste is usually the result of construction, renovation and repair and demolition of buildings and other man made constructions as well natural disasters. This waste is made up of about 30% wood and timber products and about 50% a mixture of concrete, asphalt, brick, sand and mortar with the remaining 30% being made up of other materials such as metals, glass, PVC and plastics, wiring parts, asbestos and contaminated wood parts. Though construction waste may be less in quantity (5 tons/day) when compared to municipal waste in Matale the sheer bulkiness of this waste stream creates a problem of disposal. Therefore a suitable recycling system will have to be considered to recover valuable material from this waste stream

The most suitable system is to design a central collection point with a tipping area where the construction material can be unloaded and sorted/separated. Partial separation can be carried out using loaders or bulldozers to remove oversized or clearly recoverable materials (eg: wood, cardboard etc.). The remaining materials are loaded into a conveyor belt where useful material is separated manually. The separated construction waste streams are then crushed into small particles. Magnetic separation can be used to remove any small metal objects/particles that may have been missed in the manual separation process. The particles can then be screened into standard sizes and sold as road base or construction material.

The wood component in the waste once separated can be reused for construction work or recycled by shredding. Here too metal objects can be removed using magnetic separation. The wood particles can be used as fuel or to produce other value added products such as particle boards.

Any corrugated cardboard can be baled and sold for recycling.

8.5 Waste Treatment Technologies

A crucial step in any Integrated Solid Waste Management system is the treatment of waste prior to final disposal. This renders the waste innocuous and is therefore less harmful to the environment. Treatment is most important in the case of healthcare wastes, household hazardous wastes, industrial hazardous wastes or any other waste which can be harmful to humans or the environment.

Waste treatment can be broadly classified into three main categories depending on the treatment process used. These are as follows;

8.5.1 Thermal Conversion Technologies

Thermal conversion technologies are defined as the conversion of solid waste into gaseous, liquid or solid products which results in the release of heat energy. This technology is generally termed as Incineration. Technologies falling under this category are;

8.5.1.1 Combustion

Thermal processing of solid waste by chemical oxidation with Stoichiometric or Excess Air quantity. The end product of this type of technology is combustion gases while non combustion residues such as ash are also produced. The heat generated through the process can be recovered by heat exchange from the combustion gases. The waste processed through this technology can be commingled waste in the case of mass-fired combustion systems or refuse derived fuel (RDF) for RDF- fired combustion systems. The heat recovery through combustion is usually carried out in two methods which are water wall combustion chambers and waste heat boilers.

8.5.1.2 Gasification

This term describes the process of partial combustion of a fuel in less than the stoichiometric quantity of air. It is often recognized as an energy-efficient technique to reduce the volume of solid waste and recover the heat generated through the process. The end result of the gasification process is a fuel gas which can then be used in internal combustion engines, gas turbines, or boilers. There are five different varieties of gasifiers available which are vertical fixed bed, horizontal fixed bed, fluidized bed, multiple hearth and rotary kiln.

8.5.1.3 Pyrolysis

This method involves the complete combustion of solid waste in the total absence of Oxygen. As in the case of combustion the waste can then be converted to gaseous, liquid or solid fuels. However pyrolysis requires an external source of heat to drive the reaction in an oxygen-free environment. Pyrolysis has not been a successful option for solid waste treatment anywhere in the world as the systems are far too complex.

8.5.1.4 Drawbacks of Incineration Technologies

Wastes generated in developing countries usually do not allow for good energy recovery, due to their high moisture and high content of organic matter. Due to the high humidity level in the waste, additional drying in the sun for five days will be mandatory. Even after that, addition of fuel will be required in order to sustain combustion. These actions increase operation costs for the incinerator dramatically. In most cases, solid waste in developing countries does not sustain combustion, making necessary the addition of fuel which will further add to the cost of an already expensive technology. Similar experiences with incinerators have been reported elsewhere in the developing world.

8.5.2 Biological and Chemical Conversion Technologies

This type of treatment system involves the use of micro-organisms such as bacteria and fungi to breakdown the solid waste into a stable end-product. This treatment technology is best suited to the biodegradable component in solid waste which has higher moisture levels. It is essential that the substrate (solid waste) used for biological treatment have adequate nutrients to support the growth of micro-organisms. Biological treatment can be aerobic or anaerobic in nature.

8.5.2.1 Aerobic Conversion

The solid waste is decomposed by micro-organisms in the presence of Oxygen. This process is often known as composting and is a simple and easy process. The end product can be used as a fertilizer. There are several composting techniques which can be used from simple household composting to large scale commercial composting. The technologies are given below.

Backyard Composting Systems

Composting at household level can be carried out using simple and easy to use technologies such as Bio-composting units, Barrels and Rotating Bins. These technologies are often identified as decentralized composting technologies and are suitable to kitchen waste and yard wastes. However if food waste is to be composted the technology should be more advanced to avoid attacks from pests and odour problems. However backyard composting is an ideal way to reduce the quantity of waste disposed off the Municipal collection system and at the same time produce compost which can be used at the home itself.

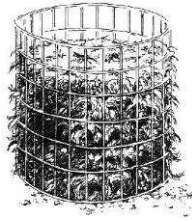


Figure 8.33: Bio Composting Unit (Jeewa Kotu)



Figure 8.34: Barrel Composting Unit

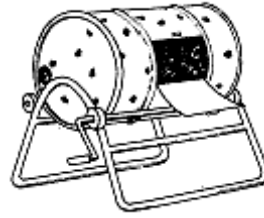


Figure 8.35: Rotary Composting Unit



Figure 8.36: Worm Composting

However one major drawback of backyard composting is that many people in developing countries cannot afford to buy the composting unit and therefore expect the government/local authority to provide them free of cost or at a subsidised rate. This has made introduction of household level composting difficult in Matale.

Large Scale Composting Systems

Large scale composting or centralized composting systems are usually carried out at commercial level and involve the use of large land areas and more capital and operational costs. There have been several attempts to set up centralized composting plants in Sri Lanka but only few have been successful. One such project already exists in Matale where the biodegradable solid waste collected from one particular area is composted. However this plant can process on 2T of waste a day and operates only at a rate of 1T/day due to lack of Market for the final product.

Four of the main composting technologies are given below.

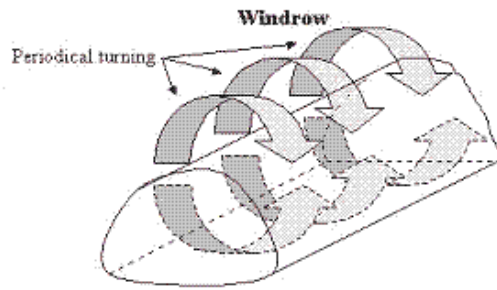


Figure 8.37: Windrow Composting System

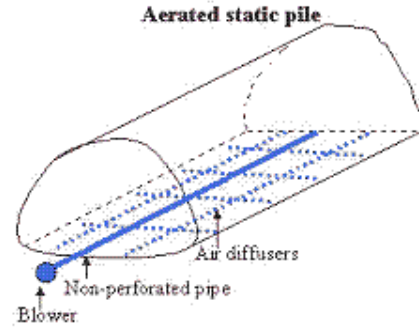


Figure 8.38: Aerated Static Pile System

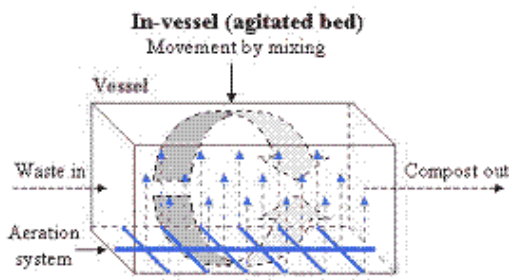


Figure 8.39: In-vessel Agitated Bed System

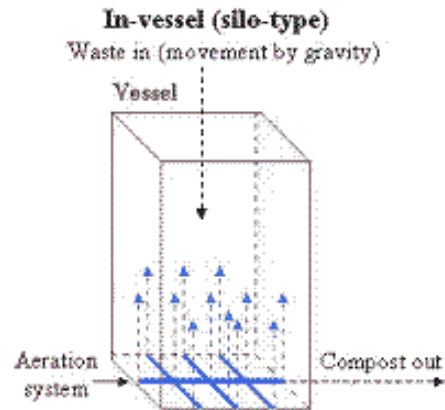


Figure 8.40: In-vessel Silo Type System

8.5.2.2 Anaerobic Conversion

Methane is produced from solid waste through anaerobic digestion or fermentation. This methane can then be used as a combustion fuel. This process is often known as biogas production. The organic component of the solid waste is converted to slurry and fed to a digester where the material is biodegraded producing methane rich biogas. However there are several key factors such as temperature, pH and the mixing of the solid waste that have to be maintained in a proper manner to ensure that the process is efficient.

At times chemical conversion can also be used to breakdown the solid waste.

8.5.3 Physical Technologies

These types of technologies involve altering the physical characteristics of waste streams. The final result is refuse derived fuel (RDF) which can be stored, transported and used as an alternative fuel source. One important factor in this case is that the fuel is homogenous in nature and therefore better suited for combustion. RDF can be produced by separation, shredding (size reduction), drying and palletizing.

Out of the three categories of solid waste treatment systems Matale is currently using composting as a means of reducing the volume and treating the biodegradable component of solid waste. However the plan will also look into developing Thermal and Biological treatment systems where energy can be recovered. Biogas production will be an ideal option for Matale as much of its solid waste is biodegradable organics. In addition to this incineration will also have to be considered especially in the case of healthcare waste and other hazardous wastes which are currently being disposed off along with the other waste streams.

8.6 Disposal Technologies

Final disposal of the solid waste is the most important phase of the lifecycle of waste management as it has the greatest impact on the environment especially if not carried out in an environmentally sound manner. The disposal of Solid Waste and residual wastes is usually carried out at a "Landfill site". Landfills can range from uncontrolled open dumps to well constructed sanitary landfills. Each of these technological options will be discussed under this section and the advantages and disadvantages of each technology discussed so as to identify which would be best suited to Matale.

The three main categories of landfills are as follows;

8.6.1 Open Dumps

Many of the landfills found in developing countries fall under this category. This is considered to be a cheap and easy method of disposing off Municipal Solid Waste. However open dumping is considered to be the lowest form of technology available for final disposal as this practice can be dangerous to both the environment as well as humans.

Open dumps have low initial capital costs where the cost is only in acquiring a large enough land space to dump waste. Such sites usually have no equipment or technology in place to avoid ground water contamination, soil contamination or air pollution. Open dumps are a health risk and aesthetically unpleasant. In addition to this, open dumps act as breeding grounds for much disease causing vectors and vermin.

8.6.2 Controlled Dumps

These are upgraded versions of the open dumps where simple and low cost methods are used to reduce the solid waste or leachate from causing ground water pollution. Controlled dumps are sited taking into consideration the geology of the land. The presence of a cover material such as soil is also an important consideration as the waste is dumped, compacted and then covered by a layer of soil to reduce the waste coming into direct contact with the surrounding environment. The correct practice is that the layer of waste is covered by a layer of 15-30 cm of soil at the end of each day's operations. In addition to this such dump sites must have a suitable mechanism in place to partially manage the leachate produced by the solid waste. However, usually these sites do not have technology in place to manage gases such as methane and CO₂.

8.6.3 Sanitary Landfills

Sanitary landfills are designed and engineered taking into consideration the following factors;

- Siting
- Design
- Construction, operation and environmental monitoring
- Closure and post closure

Usually an Environmental Risk Assessment is carried out prior to setting up the landfill to identify any possible threats to the environment. The bottom and sides of the landfill is lined with natural or synthetic materials that keep the solid waste separated from the soil and the groundwater. The lining material may be compacted clay or thin plastic sheets. In addition to this, techniques to fully manage the leachate and the gases produced during decomposition ensure that this technology is the most environmentally sound disposal mechanism. Sanitary landfills also should have monitoring mechanisms in place to continuously measure and maintain the leachate and gas levels at a minimum.

However a major drawback of this technology is that it is cost intensive and that the time taken for engineering a landfill is high. This technology also involves the use of high end equipment which will require regular maintenance.

The following diagram shows the typical design of a sanitary landfill.

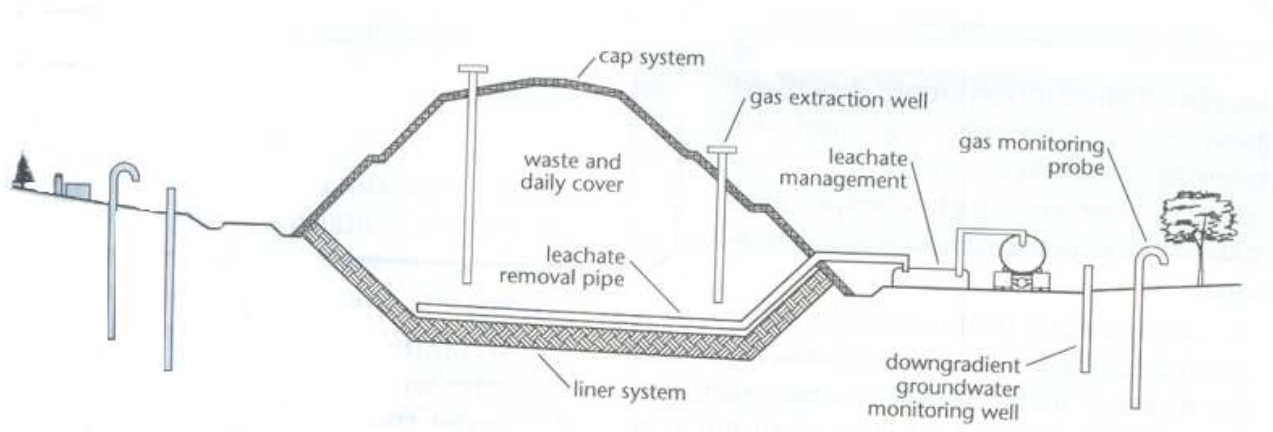


Figure 8.41: Schematic of a Typical Sanitary Landfill Site

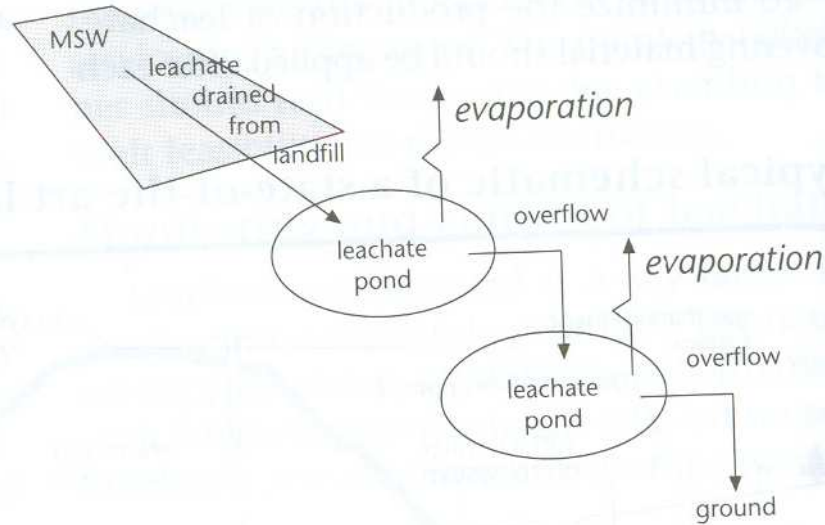


Figure 8.42: Leachate Treatment System

8.6.4 Drawbacks of Sanitary Landfills

Though Sanitary landfills are necessary for final disposal of the wastes that could not be prevented, reused, recovered or recycled the adoption of this technology has been slow in cities of developing countries. This has been due to several key problems that crop up when setting up and operating a sanitary landfill.

The biggest drawback of Sanitary landfill systems is the high capital and operational costs involved. A sanitary landfill involves the use of many technologies for leachate collection and treatment, gas extraction, monitoring equipment, as well as the construction of the landfill site itself where a considerable investment needs to be made. Therefore the setting up and operating of a sanitary landfill will be difficult in Matala under its existing financial constraints. In addition to this the landfills are often met with local opposition which is termed “Not in my backyard” or NIMBY syndrome. Many people especially in the low/middle income societies are opposed to having any sort of waste dump in close proximity to their homes. This problem may be more pronounced in Matala as there is no available land space within the area of MMC jurisdiction and therefore a land will have to be acquired from a neighbouring local authority. Here the

problem is that people are against having waste from the Matale city being disposed off in their areas especially if no benefit is received by them.

The third drawback is that sanitary landfills have a lifespan at the end of which a new location will have to be found. However the life span can be extended by diverting waste away from it as much as possible through waste prevention, reuse, recycling etc.

8.7 Comparison of Centralized Vs. Decentralized Technology Options

While the most relevant technology options have been discussed in the above chapter there is a clearly distinguishable difference in the operational scale and type. It is important to keep in mind that one size does not fit all and therefore the choosing the most appropriate technology will have to be carried out carefully. When deciding on a suitable technology one must keep in mind that technologies suited to developed countries are often unsuccessful within developing countries. Often bilateral and multilateral funding agencies insist on developing countries adopting technologies which are suited to developed countries and try to replicate their way of solid waste management. In such cases the existing socio-economic structure which provides an excellent backdrop under which waste management can be carried out with less capital and technology investments are often ignored and put aside as “ineffective”. However the environmental conditions, the characteristics of the waste generated and the prevalent socio-economic conditions as well as past experiences have shown that developing countries require a different approach.

Technologies can be categorized into centralized and decentralized types based on the scale of operation, investment required, quantity of waste handled and the mode of operation (manual or mechanical). Usually centralized technology options are undiversified, capital intensive and are not suitable to the economic conditions of developing countries or the waste generated. In addition to this centralized systems tend to be large in scale and therefore require more land area to set up and operate. In addition to this centralized systems do not allow for community participation in either

decision making or in operations which is often rejected by low/middle income generation societies. The biggest issue with centralized systems is that they are capital intensive and therefore not affordable by developing countries.

In contrast, decentralized solid waste management is more suited to cities like Matala where the space is a major limiting factor. They allow for small scale waste management units which can be located at several areas of the city so as to better service the entire community. In addition to this decentralized plants can be designed to be more labour intensive and thereby provide necessary employment to people of the area. By doing so the community participation can be improved and the resistance to setting up such plants can also be overcome. The investment required for decentralized plants is much lower than in the case of centralized plant. These plants can be operated using simple and cost effective technologies.

Therefore it is recommended that de-centralized systems be designed and set up for waste management activities such as segregation and sorting, intermediate collection and transferring, biological treatment and thermal treatment of solid waste, recycling and resource recovery.

8.8 Recommendations

Chapter 8 discusses the different technologies which can be used at each stage of the solid waste management cycle to assess which processes are most suitable for implementation at the Matala Municipal Council. This section of the chapter will focus on recommendations for the implementation of the technologies taking into consideration the existing technical, financial and social background of Matala.

8.8.1 Waste Segregation

In the case of Matala source segregation of waste would have to be limited to two or at the most three waste streams as majority of the residences, commercial establishments

and shops do not have adequate space to separate and store many different types of wastes. Therefore it is recommended that source segregation be introduced and that the wastes be separated into biodegradable, hazardous and non biodegradable waste streams. The segregation containers will also have to be looked into because bulky, large containers will not be suited at many of the sources. Therefore colour coded bags would be an ideal choice especially for food waste and hazardous wastes while the bulkier non-biodegradable waste (plastics, paper, glass, metals etc.) can be stored in 10 litre plastic bins. However in the case of commercial establishments this will have to be further thought out as the quantity of waste generated will differ from residences. Also many of the commercial establishments such as small shops and roadside boutiques will not have space to segregate and store their waste on site. Therefore waste segregation bins will have to be located at central points in close proximity to commercial areas of the city where the people can dispose off their non-biodegradable waste.

The mixed non-biodegradable waste can be brought to decentralized segregation plants where the waste is then separated out manually into separate waste streams. Such segregation plants should be set up at each ward to better facilitate the collection, transportation and segregation process.

Waste picking/scavenging can also be a useful method to recover any waste that is not already separated at household. The existing scavenging system though informal in nature, can be an ideal waste segregation mechanism especially as it is already in place within Matale. In addition to this it is essential that the ISWM Plan does not cause loss of revenue to scavengers. Any loss of revenue from the prohibition of scavenging or by waste being sorted at source level will have many adverse social implications to the scavengers most of who depend on scavenging for their live hoods.

Therefore several precautionary measures can be taken by the MMC to ensure that scavengers are not adversely impacted.

- Legalize scavenging activities and set up formal scavenging networks such as Scavenger cooperatives and micro businesses to improve working conditions and scavenging efficiency.
- Regulate waste picking by setting up specially designated picking areas at transfer stations/waste dumps with adequate facilities, proper supervision and guidance to minimize adverse health impacts.
- Provide Personal Protective Equipment to Scavengers
- Provide training to scavengers on the proper waste handling procedures and on identifying different waste categories.
- Provide alternative employment opportunities to scavengers at waste transfer stations and decentralized segregation points.

It is clear that one type of segregation system is not suitable by itself but rather all three should be used in combination to improve the efficiency of waste segregation as much as possible.

Chapter 9: Special Projects Identified under ISWM Plan

The activities to be undertaken for implementing the ISWM Plan have been classified into two categories depending on the implementation procedure. Pilot Projects will include activities which will be carried out during the process of developing the ISWM Plan to fathom the feasibility of implementing the activity and to identify any gaps that would have to be filled when the plan implemented. Sub Projects on the other hand include the activities for which project proposals will be developed during the planning of the ISWMP and implemented by the MMC based on their suitability and viability. The pilot projects and sub projects identified under the ISWM Plan for Matale MC are discussed below.

9.1 Pilot Projects

Two projects have been identified by the plan to be implemented at pilot scale within the MMC. Both activities are based in community involvement to further increase the awareness and participation of residents in Matale.

9.1.1 Source Segregation at Household Level

9.1.1.1 Description of Project

Several initiatives have already been made to introduce source segregation in Matale. However due to limiting factors such as lack of finances, adequately trained personnel to carry out training and technical difficulties these efforts have been limited to a small area within the MMC. The goal of the plan is to broaden the involvement of residents in Matale in Solid Waste Management and thereby reduce the already burgeoning pressure on the MMC. Therefore the plan proposes to initiate a pilot project within the MMC area to introduce source segregation. This will focus on households where most of the waste is generated.

9.1.1.2 Resources Required

The resources required for developing and implementing the pilot project are as follows;

- Segregation bins and bags
- Awareness and training material (handouts, manuals, guidebooks)
- Trainers with the capacity to conduct theoretical and practical training
- External consultant

9.1.1.3 Budget

Total budget allocation for the project is LKR 160,500 (Approx. USD 1,500)

9.1.1.4 Time Frame

The total time requirement for the project is two months within which the actual project implementation period will be one month.

9.1.2 Waste Minimization at Schools

9.1.2.1 Description of Project

Children are a key element of the society and therefore need to be involved in waste management from the earliest years. Involving them during the formative years ensures that the future generations that take over are better aware and are committed to properly managing solid waste. Convincing school children through proper awareness creation is also an ideal manner through which adult family members can be influenced. Therefore the second pilot project under the ISWM plan focuses on introducing waste reduction at schools in the Matale MC area with the objective of raising awareness and providing training to the students on waste reduction.

This project will be carried out in three levels. The first level will include creating general awareness through properly designed programmes to motivate school children to participate in waste management activities at homes and at their respective schools. The second level will include the environmental brigades already set up in schools. These students will be given in-depth training on source segregation and composting along with information on technologies such as bio gas preparation and recycling of material. These students will be the leaders and champions in their schools to strengthen the implementation of the plan. The final level will be developing and implementing a total solid waste management system for a chosen school within the Matale city. This school will then be used as a model to other schools in the area.

The objective of this pilot project is to reduce waste generation as well as disposal by schools in the Matale city area by introducing waste reduction techniques as well as methods by which resources can be recovered.

9.1.1.2 Resources Required

The resources required for developing and implementing the pilot project are as follows;

- Segregation bins and bags
- Compost barrels
- Awareness and training material (handouts, manuals, guidebooks)
- Trainers with the capacity to conduct theoretical and practical training
- External consultant

9.1.1.3 Budget

Total budget allocation for the project is LKR 150,000 (Approx. USD 1400)

9.1.1.4 Time Frame

The total time requirement for the project is three months within which the actual project implementation period will be two months.

9.2 Sub Projects

9.2.1 Decentralized Biogas Plant for Market Waste

The waste generated at the central markets in Matale city constitute to a large proportion of the total municipal solid waste generated. The Waste Characterization study showed that more than 80% of this waste is biodegradable in nature and can be converted to biogas. The plan proposes that a decentralized biogas unit be installed in close proximity to the Market Place where the waste material can be directly converted to biogas. This is help to divert a considerable portion of Municipal Solid Waste away from the final disposal site and produce a value added energy source which can be used by hotels and restaurants in the city area.

The plan includes the development of a project proposal to set up a biogas plant which will operate on a capacity of 2 tons/day of biodegradable waste. The proposals are presented in volume III of this report.

The total estimated budget requirement for the hospital biogas plant is LKR 3,000,000 (approx. USD 28,000).

9.2.2 Biogas Plant for Hospital Waste

The government hospital in Matale disposes around 700 kg of food waste on a daily basis which is collected by the MMC and disposed off at the landfill site. The ISWM Plan proposes to divert this waste away from the municipality landfill and at the same time assist the hospital produce biogas which can be used in the hospital kitchen for

cooking and boiling of water. The plan will include a project proposal for a biogas plant operating at a capacity of 1 ton/day of the kitchen and food waste generated by the hospital. This proposal is attached in volume III of this report.

The total estimated budget requirement for the decentralized plant is LKR 2,000,000 (approx. USD 18,700).

9.2.3 Decentralized Biogas Plants for Other Municipal Waste

In addition to the two plants given above the ISWM Plan proposes to set up three decentralized biogas plants of the capacity of 2 tons/day to process biodegradable waste generated from other sources within the city. These biogas plants will be an ideal alternative to composting as the end product is far more valuable especially given the current fuel price increases. These three plants will be set up as small scale business opportunities where low cost cooking fuel can be produced and sold to residents in Matale using their own biodegradable waste matter.

The total estimated budget requirement for the three decentralized plants is LKR 9,000,000 (approx. USD 84,000).

9.2.4 Decentralised Composting Plant

In order to achieve the goals set down under the ISWM Plan as well as the target of processing at least 40% of solid waste generated in the MMC area several decentralized compost plants will be established. As more than 80 % of the MSW generated within the city is biodegradable in nature a portion of this waste can be successfully treated using biological processes such as composting. Though a composting plant of the capacity of 2 Tons/day is already established in Matale it is unable to operate at full capacity. The main reason behind this is that the compost produced does not have a good market in the area. The root cause for this problem is

that the compost produced is not high in nutrition value and therefore not considered to be suitable by the farmers in the area.

When setting up decentralized composting plants for the Matale city several key aspects will have to be taken into consideration. They are:

- the type of composting technology to be used;
- the land area required;
- the solid waste to be processed;
- collection of adequate quantities of biodegradable waste to compost;
- ensuring the quality of the raw material (biodegradable waste);
- identify suitable markets for the final product and
- finally developing a strategy to market the compost.

The project will propose the setting up of four decentralized composting plants of the capacity of 2tons/day. The initial step in this sub project will be the preparation of the project proposal which covers the aspects given above.

The total estimated budget requirement for the four decentralized plants is LKR 6,000,000 (approx. USD 56,000).

9.2.5 Establishment of Waste Exchange Platform

Several waste streams generated in the city have commercial value and yet is being disposed off at the landfill site. The reason for this is that the waste generators do not have an idea of the value this waste or that there may be buyers willing to pay for them. Therefore the ISWM Plan proposes the establishment of a waste exchange (WEX) platform for the city of Matale.

The first step in this project will be the setting up of a database where information on the waste streams available and the generators of the waste will be identified and stored.

A computer based Waste Exchange Platform will be developed to facilitate waste exchange between industries. The best option in the case of Matale is to link to the existing waste exchange platforms rather than creating a solitary one. This will ensure that prospective buyers from all over the country can access the information. As internet and website usage is still low in Matale it is recommended that one or more waste exchange centres be set up where interested persons can visit and access information. These centres can also store samples as well as information such as physical and chemical characteristics of the waste available.

The WEX will deal with industry waste as well as post consumer wastes and will operate on current marketing practices.

The total estimated budget requirement for the WEX is LKR 3,000,000 (approx. USD 28,000).

9.2.6 Community Based Projects to Strengthen MMC relationship with Community

One of the major issues faced by the MMC in its solid waste management activities is the lack of support from the community. The first stakeholder consultation workshop highlighted that there is a sense of mistrust between the MMC and the community. If the ISWM Plan is to be implemented successfully the total commitment and support of the community will be essential to the MMC. Therefore the Plan proposes that several initiatives be taken by the MMC to develop trust and there by generate support from the community.

The plan has identified three main activities through which this can be achieved. They are described briefly below.

- Empower Community Based Organizations
- Organize “Shramadana’s” (City activities with community participation)
- Identify and celebrate a “Matale Day”

In addition to these activities it is essential that the MMC together with other enforcement agencies must implement and carry out their work in a transparent manner allowing all stakeholders to access necessary information regarding the implementation of the plan. The community should have access to information especially regarding the activities being conducted under the ISWM Plan. This is the main reason why the development of the plan was carried out in consultation with all stakeholders. The MMC will have to continue to do so in the implementation phase of the plan as well.

The total estimated budget requirement for the project is LKR 500,000 (approx. USD 4,675).

9.2.7 Preparation of Proposal for Setting up Waste Recycling Park (Eco-park)

As a part of the ISWM Plan for Matale city an investment proposal will be developed for setting up a Waste Recycling Park (Eco-park) with several recycling model industries utilizing waste generated within Matale as resource and working in close cooperation with MMC and community. This park will include small-scale waste recycling industries that will serve as models for other local authorities and industrialists.

The MMC will be the facilitator of the park while private investors/industrialists will own the individual recycling industries. The infrastructure facilities will be provided by the MMC at a reasonable cost to ensure long-term sustainability of the project. This will encourage investors to bring business opportunities to Matale and generate employment opportunities.

The park will have a training centre with reasonable library facilities for research and development studies by students in the area.

The total estimated budget requirement for the preparation of the investment proposal is LKR 300,000 (approx. USD 2,800).

9.2.8 Preparation of Awareness Raising Material on Hazardous Waste Management

The management of solid waste in Matale is not paid the necessary attention it requires. The waste from the hospital and other medical institutes contains hazardous wastes, which could be harmful to the environment and health of people if mixed with other wastes. These wastes are not handled by MMC but are disposed by the generators themselves. The hospital authorities directly sort, treat and dispose the hospital wastes using the WHO guidelines. The wastes from medical clinics, dispensaries and private hospitals are unmanaged and can get mixed with municipal wastes.

Taking into consideration the threat to the society and the environment the plan includes several initiatives to better manage hazardous waste in Matale. One of these initiatives is to develop materials on raising awareness about hazardous waste management. These materials will be prepared to suit all generators of Hazardous waste to create awareness on the repercussions of mismanagement as well as how the waste should be managed. The awareness material will include all Hazardous waste types including clinical waste, e-waste and household hazardous wastes. As a part of this initiative several meetings will be held with major stakeholders (industries, hospitals, businesses, etc.) for raising awareness on hazardous waste management.

Under this activity a dialogue among the contributing and affected parties will be started to improve the communication to ensure hazardous wastes does not end up in any of the other solid waste streams.

The total estimated budget requirement for the preparation of the awareness material is LKR 300,000 (approx. USD 2,800).

Chapter 10: Information and Communication Systems

10.1 Introduction to Communication

The effective implementation of the ISWM plan requires the support and commitment of all stakeholders concerned. It is essential that these stakeholders participate proactively and take over certain responsibilities and roles in the implementation process. Therefore each stakeholder group must be fully aware of the aspects of the ISWM plan and its various components. This can be achieved only if the plan is properly communicated to all stakeholders. Proper communication at the beginning to clearly define the responsibilities towards better waste management services and the subsequent communication of monitoring results and achievements while the implementation is in progress are important for realizing the final objectives of the ISWM plan. This will ensure that the entire plan development and implementation process is transparent.

Therefore all elements of the plan must be effectively and clearly communicated to relevant stakeholders. Since there are number of stakeholders with varied interests in the solid waste management the communication modes used will vary according to their nature, interest, education level and other specific criteria. The mode used for communication to each stakeholder group should facilitate two-way communication for information sharing to ensure suggestions; recommendations and other feed back reach the implementing agencies. Information dissemination will have to be conducted so as to outreach as many stakeholder groups as possible.

10.2 Stakeholder Groups Identified for Communication of Plan

The activities preceding the development of the ISWM Plan highlighted that all stakeholders either directly or indirectly have an effect on or are affected by solid waste management in Matale. Therefore it is important to identify and then carefully group different stakeholders before deciding on the mode/mean of communication with each

group. Several tiers of stakeholders were identified for this purpose and the quality and quantity of information to be provided to each will be different. This is depicted by the figure given below.

| Stakeholder Group | Target Group |
|---|---------------------------------|
| General Public | Residents |
| | Floating Population |
| | Tourists/Pilgrims |
| Public & Private Institutions & Entrepreneurs | Recycler & Middlemen |
| | Public Sector Officials |
| | Hospital Staff |
| | Proprietors |
| | Employees |
| | Customers |
| Community Based Orgs. & Media | NGO personnel |
| | Community Leaders |
| | Religious Leaders |
| | Media Personnel |
| Schools & Children's Societies | Environmental Brigades |
| | School Children |
| | Teachers and Principals |
| | Members of Children's Societies |
| MMC | Council Members |
| | Solid Waste Management Unit |
| | Scavengers/Drivers |
| | Other MMC Employees |
| Trainers | All selected trainers |

Table 10.1 Identified Stakeholders and Target Groups

10.3 Activities Identified for Information Dissemination

Several activities have been identified under the ISWM Plan to dissemination information and create awareness among stakeholders in Matale. These activities will be used concurrently to achieve the level of commitment and community participation required for the successful implementation of the plan. The approaches are listed below.

| Approach No. | Activity | Short Description |
|--------------|--------------------------------|---|
| A1 | Awareness Programmes | Programmes specially designed and delivered to convey the concept of the ISWM plan. |
| A2 | Posters and Banners | Well placed permanent notices and posters to generate interest and motivate public participation. These can also be used to spread successes achieved by the ISWM plan. |
| A3 | Signs and Notice Boards | Boards where temporary articles and notices can be displayed for the general public to read. |
| A4 | Print and Electronic Media | Written articles on the Plan as well as any successes achieved. All print media can be used for this purpose. Short programmes and discussion can be aired over electronic media. |
| A5 | News Letter | A News Letter prepared by the Environment Education Centre which can be sent out to identified key stakeholders. |
| A6 | Video Films | Video films on case studies and success stories from other cities that have implemented ISWM plans. |
| A7 | Special Events | Events that can promote the ISWM Plan in Matale. This can include street plays, a special day dedicated as the "Matale Day", "Shramadana" (Community based activities to bring stakeholders together) |
| A8 | Public Lectures | Motivational public lectures and speeches by eminent personnel on Environment as well as the responsibility of the public to keep the city clean |
| A9 | Pocket Meetings | Short meetings conducted with small community groups. This sort of meetings is already used by various organizations to disseminate information. The general public is receptive to this method |
| A10 | Religious Sermons | The Sri Lankan culture is intertwined with the religion. The leaders of various religious ordinances have large followings that respect and accept the advice given to them. This method of dissemination is ideal to spread the ideas behind the ISWM plan and its need for the society as well as benefits to Matale. |
| A11 | Street Plays/Cartoons | These methods are attractive ways to generate interest in the ISWM Plan among the general public. Both methods are currently used in Sri Lanka and have been found to be successful in spreading important messages |
| A12 | Competitions | Programmes among school children to generate awareness and innovation in SWM. Eg: Poster and Essay competitions / Quiz programmes |
| A13 | Environmental Education Centre | The EEC will be the focal point for all information dissemination activities in the ISWM Plan. |

Table 10.2: List of Identified Activities for Information Dissemination

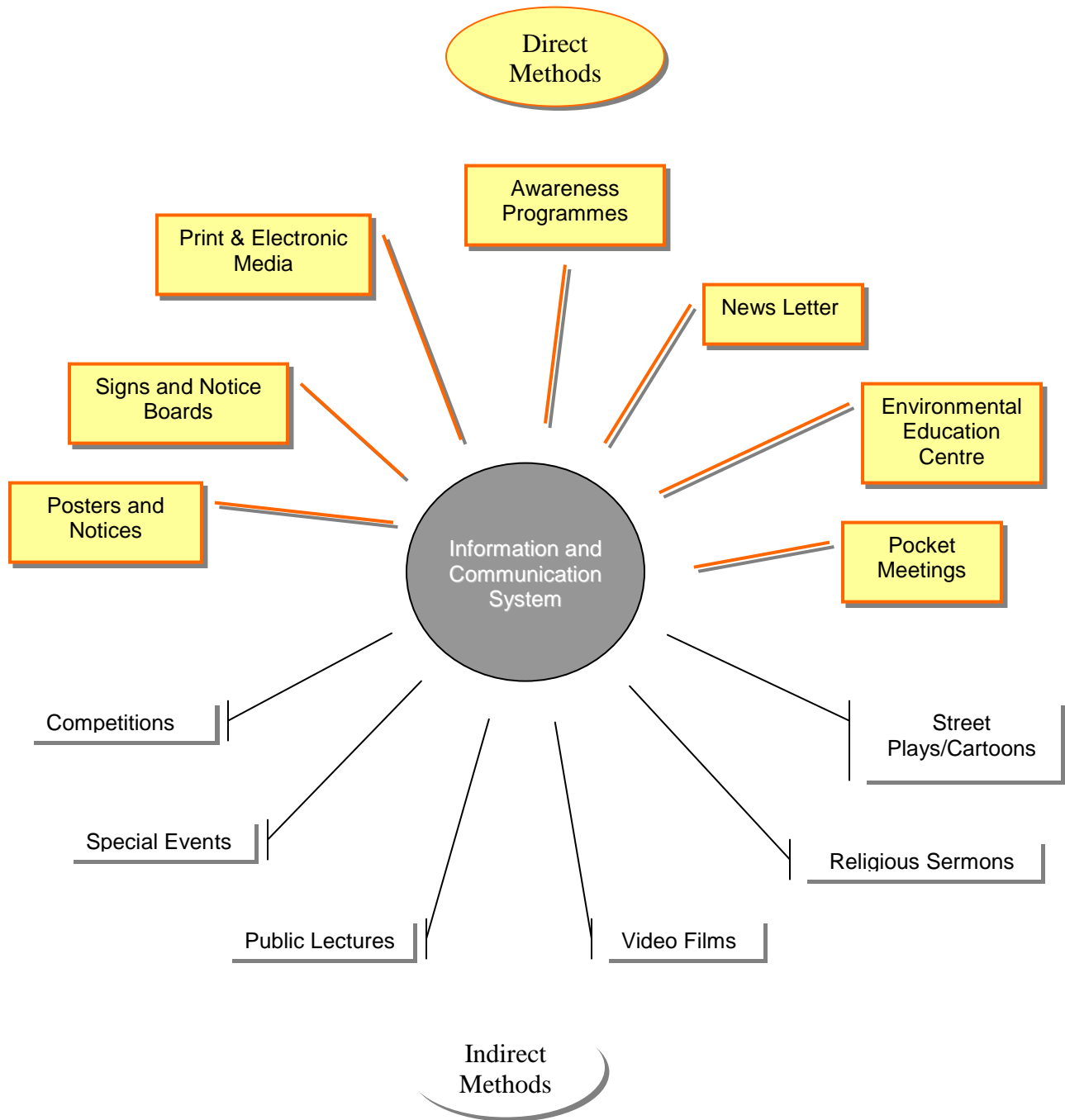


Figure 10.1: Information and Communication Systems for ISWM Plan

The table given below gives the Activity Matrix prepared for Matala under the ISWM Plan.

| Stakeholder Group | Target Group | Communication Systems | | | | | | | | | | | | |
|---|---------------------------------|-----------------------|---------------------|---------------------|----------------------------|-------------|-------------|----------------|-----------------|-----------------|-------------------|----------------------|--------------|--------------------------------|
| | | Awareness Programmes | Posters and Banners | Signs/Notice Boards | Print and Electronic Media | News Letter | Video Films | Special Events | Public Lectures | Pocket Meetings | Religious Sermons | Street Plays/Caroons | Competitions | Environmental Education Centre |
| | | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | A11 | A12 | A13 |
| General Public | Residents | | X | X | X | | X | X | X | X | X | X | X | X |
| | Floating Population | | X | X | X | | | X | X | | X | X | | X |
| | Tourists/Pilgrims | | X | X | X | | | X | | | X | X | | X |
| Public & Private Institutions & Entrepreneurs | Recycler & Middlemen | X | X | | X | X | X | X | | X | | | | X |
| | Public Sector Officials | X | | X | X | X | X | | X | | | | | X |
| | Hospital Staff | X | X | X | | X | X | X | | X | | | | X |
| | Proprietors | X | | | X | X | | | X | | | | | X |
| | Employees | X | X | X | | | X | X | | X | | | X | X |
| | Customers | | X | X | | | | X | | | | | | X |
| Community Based Orgs. & Media | NGO personnel | X | | | X | X | X | | X | | | | | X |
| | Community Leaders | X | X | | X | X | | X | X | X | X | | | X |
| | Religious Leaders | X | X | | X | X | | | X | X | | | | X |
| | Media Personnel | X | | | X | X | X | X | X | | | | | X |
| Schools & Children's Societies | Environmental Brigades | X | X | X | X | X | X | X | | | | X | X | X |
| | School Children | X | X | X | X | | X | X | | X | X | X | X | X |
| | Teachers and Principals | X | | X | X | X | X | X | | X | | | | X |
| | Members of Children's Societies | X | X | | | X | X | X | | X | X | X | X | X |
| MMC | Council Members | X | | | X | X | X | x | | | | | | X |
| | Solid Waste Management Unit | X | X | X | | | X | X | | X | | | | X |
| | Scavengers/Drivers | X | X | X | | | X | X | | X | | | X | X |
| | Other MMC Employees | X | X | X | | | X | | | X | | | | X |
| Trainers | All selected trainers | X | | | X | X | X | | | | X | | | X |

Table 10.3: Activity Matrix for Information Dissemination

Chapter 11: Resource & Institutional Considerations of Implementing ISWM Plan

11.1 Introduction

The situation analysis conducted for the existing solid waste management system at Matala showed that there were several shortcomings in allocating the available resources as well as utilizing the resources to manage solid waste. This has been a major contributing factor to the existing inefficiencies which have led to the mismanagement of Solid Waste. The reasons behind the deficiencies in the resource allocation and utilization can be attributed to two key factors which are the lack of resource management and the inadequacies in the existing institutional mechanisms.

As a part of the ISWM Plan several new projects and schemes have been proposed for the city of Matala. Some of these activities will require new technologies, equipment, infrastructure and human resources while others can be implemented under the existing mechanisms. They will also need the backing and facilitation from the important institutions that are involved in Solid Waste Management. Therefore thorough attention must be given to identifying the resource requirements as well as any changes that need to take place in the institutional mechanism. In addition to this it is also essential that the resource usage for the implementation of the plan be sustainable in nature so as to ensure that its benefits are fully enjoyed by the residents of Matala.

The following chapter is devoted to identifying and highlighting the resources and institutional links and interaction which will be essential for the smooth implementation of the ISWM Plan.

11.2 Resource Considerations

The successful implementation of ISWM plan requires many resources to be deployed for the purpose. They are mainly financial and human resources. The following

paragraphs looks at the currently available financial resources and human resources and the new requirements under the ISWM Plan in order to identify the gaps and to develop strategies to secure the required resources.

11.2.1 Financial Considerations

A key requirement for the successful implementation of ISWM plan is finding the financial resources required for the proposed activities. It is therefore important to identify and estimate the costs for individual schemes and projects so as to analyze how these funds can be obtained. In order to carry out a cost benefit analysis of the ISWM plan the existing SWM expenditure has to be compared with the estimated cost of the proposed activities.

It is essential however to keep in mind that the benefits from the proposed plan go beyond the mere financial factors and that the environmental and social benefits must also be given due consideration. It is difficult to internalize the cost of environmental degradation and the social issues arising from the poor management of solid waste into the existing cost structure. However due consideration must be made to the fact that the environmental social benefits arising from the proposed plan will far outweigh the

11.2.1.1 Financial Expenditure for the Existing Solid Waste Management Program

The following table (table 11.1) show the income and expenditure of the existing solid waste management system in the MMC along with the breakdown of funds received as well as expenses incurred. Accordingly it is evident that the expenditure for solid waste management has risen yearly while the income generation has been mostly from MC budget allocations.

The major costs involved in the current practice are the labour and transportation costs. MMC is unable to earn sufficient funds to spend for the plant and equipment as well as infrastructure required for management of solid waste. Therefore MMC has to depend

on donors and other funding mechanisms to secure fund for strengthening of the waste collection system, transport fleet and the disposal infrastructure.

The traditional practice in the country for solid waste disposal is that generators dump the waste along road ways for the MMC to pick them up. None of the residents are willing to pay for receiving the waste collection service of the municipality though they are ready to pay for specialized services.

Since the residents are not ready to spend funds on garbage the new ISWM should and would focus on the segregation of wastes for enhancing the value and allow residents to manage their own waste by applying the 3R concepts. The new ISWM plan will gradually shift the responsibility of waste management to residents and private sector though the MMC will have the final authority, responsibility and accountability.

| | | 2005 | 2006 | 2007 |
|--------------------|----------------------------------|--------------------|--------------------|--------------------|
| Income | Subsidy from National Government | 4,527,042 | 1,096,622 | 1,832,209 |
| | Subsidy from Local Govt. | 5,240,221 | 14,017,271 | 16,211,366 |
| | Allocation From M.C. Budget | 96,523,500 | 100,261,900 | 165,010,550 |
| | Donations/donor funding | 494,208 | 0 | 0 |
| | Income through Services offered | 6,629,085 | 6,927,675 | 8,975,000 |
| | Total | 113,414,056 | 122,303,468 | 192,029,125 |
| Expenditure | Labour | 8,888,750 | 11,219,500 | 11,448,600 |
| | Equipment | 1,717,547 | 2,153,987 | 2,496,696 |
| | Site | 8,919 | 359,651 | 261,907 |
| | Fuel | 642,450 | 2,905,423 | 1,975,000 |
| | Other Expenses | 341,739 | 108,500 | 126,000 |
| | Total | 11,599,405 | 16,747,061 | 16,308,203 |

Table 11.1: Comparison of Income and Expenditure for MMC

| Stage | Cost item | Annual Expenditure Breakdown (LKR) | | |
|--------------------------|------------------|------------------------------------|-------------------|-------------------|
| | | 2005 | 2006 | 2007 |
| Collection | Labour | 5,900,000 | 7,675,000 | 7,776,000 |
| | Equipment | 150,000 | 200,000 | 250,000 |
| | Other | 95,000 | 100,000 | 115,000 |
| | Sub Total | 6,145,000 | 7,975,000 | 8,141,000 |
| Transport | Labour | 2,200,000 | 2,700,000 | 2,800,000 |
| | Vehicle hire | 1,420,047 | 1,883,987 | 2,172,696 |
| | Fuel | 517,450 | 2,877,423 | 1,950,000 |
| | other | 4,000 | 6,500 | 7,500 |
| | Sub Total | 4,141,497 | 7,467,910 | 6,930,196 |
| Recycling | Sorting Centre | 8,919 | 9,651 | 11,907 |
| | Labour | 38,750 | 39,500 | 22,600 |
| | Other | 1,405 | - | - |
| | Sub Total | 49,074 | 49,151 | 34,507 |
| Disposal | Labour | 400,000 | 540,000 | 550,000 |
| | Equipment | 22,500 | 25,000 | 32,000 |
| | Site rental | - | 350,000 | 250,000 |
| | Other | 236,834 | - | - |
| | Sub Total | 659,334 | 915,000 | 832,000 |
| Miscellaneous | Labour | 350,000 | 265,000 | 300,000 |
| | Equipment | 125,000 | 45,000 | 42,000 |
| | Fuel | 125,000 | 28,000 | 25,000 |
| | Other | 4,500 | 2,000 | 3,500 |
| | Sub Total | 604,500 | 340,000 | 370,500 |
| Total Expenditure | | 11,599,405 | 16,747,061 | 16,308,203 |

Table 11.2: Breakdown of Expenditure for Solid Waste Management

11.2.1.2 Financial Resource Requirement for Implementing ISWM Plan

The financial requirement for the proposed changes cannot be fully secured by MMC alone. The major fund requirements are the cost of implementing schemes, pilot projects and other sub projects. Table 11.3 shows the finances required for the schemes proposed under the ISWM Plan while table 11.4 depicts the financial resources estimated for pilot projects and sub projects.

Accordingly the initially investment required for the successful implementation of all the schemes and projects is approximately **LKR 47,100,000 (USD 439,577)**. In the initial 2 years the cost of collection and transport also has to borne by the MMC until the new system is firmly accepted among the general public. Once the new ISWM plan is

embedded the cost of transport of solid waste, cost of landfill site and cost of hiring handling equipment could be totally eliminated or greatly reduced.

| S.No | Scheme | Estimated Cost | |
|------|---|-------------------|-----------------|
| | | LKR | USD (approx) |
| S1 | Developing Information Sharing Systems | 800,000 | 7,500 |
| S2 | Establishing Links with Existing Waste Exchange Programmes | 50,000 | 500 |
| S3 | Developing Publicity Material in Sinhala and Tamil | 1,000,000 | 9,350 |
| S4 | Developing Awareness and Training Packages | 500,000 | 4,375 |
| S5 | Conducting Awareness Programmes to all Stakeholders | 1,000,000 | 9,350 |
| S6 | Conducting Training Programmes to key stakeholders | 1,000,000 | 9,350 |
| S7 | Setting up Children's' Societies at each Municipality ward | 100,000 | 950 |
| S8 | Establishing Waste Minimization Cells in each Municipality ward | 100,000 | 950 |
| S9 | Establishment of Waste Exchange Centre | 200,000 | 1,875 |
| S10 | Promoting Private Sector Participation in recycling based industries | 50,000 | 500 |
| S11 | Strengthening Community Based Organizations | 100,000 | 950 |
| S12 | Develop programmes to enhance living and working conditions of Sanitation Workers | 1,000,000 | 9,350 |
| S13 | Provide segregation bins to residents of identified streets for promotion of source segregation | 1,500,000 | 14,000 |
| S14 | Reintroduce bell collection system for house to house collection | 50,000 | 475 |
| S15 | Restore the Environmental Education centre and provide necessary equipment to enhance its role. | 1,000,000 | 9,350 |
| S16 | Setting up Eco-Kiosks | 1,000,000 | 9,350 |
| S17 | Setting up intermediate collection point for E-Waste | 500,000 | 4,675 |
| S18 | Setting up and Intermediate Collection and Transfer Stations for Municipal | 6,000,000 | 56,000 |
| S19 | Establishing a Central Collection and Exchange Point for Construction and Demolition Material | 300,000 | 2,800 |
| S20 | Introduce compartmentalized trailers to transport separate waste streams | 5,000,000 | 46,750 |
| S21 | Locate suitable land for construction of Sanitary Landfill | | |
| S22 | Conduct Cleaner Production demonstration project for wood based industries | 250,000 | 2,350 |
| S23 | Conduct Cleaner Production demonstration project for Hotels and restaurants | 500,000 | 4,675 |
| S24 | Develop project proposal for setting up Industrial Estate for Recycling Based Industries | 300,000 | 2,800 |
| S25 | Develop project proposals for setting up decentralized composting plants | 200,000 | 1,800 |
| S26 | Develop project proposal for setting up decentralized biogas plants | 200,000 | 1,800 |
| S27 | Introduce Good Housekeeping (5S) systems to residences, schools, commercial establishments and other Institutions | 300,000 | 2,800 |
| S28 | Effecting Policy Changes at Local Government Level | - | - |
| S29 | Lobbying for Approval of Municipal Council By- laws | - | - |
| S30 | Develop incentive system to promote source segregation | - | - |
| S31 | Lobby to increase fines and introduce new fines | - | - |
| | Total Cost (Estimated) | 23,000,000 | 214,625 |

Table 11.3: Estimated Costs for Proposed Schemes

| Pilot Projects | | Estimated Cost | |
|----------------|---|-------------------|-----------------|
| | | LKR | USD (approx) |
| | Source Segregation at Household Level | 160,500 | 1,500 |
| | Waste Minimization in Schools | 150,000 | 1,400 |
| | Total | 310,500 | 2,900 |
| Sub Project | | | |
| | Decentralized Biogas Plant for Market Waste (2M/T) | 3,000,000 | 28,000 |
| | Biogas Plant for Hospital Waste (1M/T) | 2,000,000 | 18,650 |
| | Decentralized Biogas Plant (2M/T)- 3plants | 9,000,000 | 84,000 |
| | Decentralised Composting Plant (2M/T)- 4 plants | 6,000,000 | 56,000 |
| | Establishment of Waste Exchange Platform | 3,000,000 | 28,000 |
| | Community Based Projects to Strengthen MMC relationship with Community | 500,000 | 4,675 |
| | Preparation of Proposal for Setting up Waste Recycling Park (Eco-park) | 300,000 | 2,800 |
| | Preparation of Awareness Raising Material on Hazardous Waste Management | 300,000 | 2,800 |
| | Total | 24,100,000 | 224,925 |

Table 11.4: Estimated Costs for Proposed Pilot Projects and Sub Projects

11.2.1.3 Changes in the Financial Requirements for Solid Waste Management

The ISWM plan is developed on managing waste at local level through a value addition process by the participation of the community. With the proposed ISWM plan a large number of houses will segregate wastes at source and organic waste will be home composted. This will lead to a reduction in the collection and transport cost. The collected wastes is now expected to be delivered at the near by treatment plants such as bio gas and composting plants. Therefore long haulage will not be required reducing the cost of transportation further.

Since the wastes will now be treated at local level the requirement of the land fill site will also diminish and the operational cost will come down and length of the landfill site will be further increased.

Over a period of time most of the waste will be converted to value added products either through segregation, recovery or recycling where the sanitary employees, scavengers, community and other small scale businesses will financially benefit. Though MMC will not have a direct financial benefit, it will have a reduction of solid waste management cost.

It is seen that the annual cost of solid waste management is around LKR 16 million per annum but the total funds required for implementing the plan is around LKR 43 million. The total capital cost is only about three years' annual operating cost. Since MMC is unable to find own funds to implement all these schemes and projects, it can link up the ISWM plan with the national solid waste management program "PILISARU" in order to secure funding for implementing the project. MMC can forward these proposals to IUCN, UNESCAP and other bilateral donor agencies for securing funds for specific projects. Through the implementation of the 30 schemes and 10 projects MMC will be able to reduce their annual expenditure for solid waste management by at least 50% in the long term.

11.2.2 Human Resource Requirements for ISWM Plan Implementation

The prevailing solid waste management system of the Matale Municipal Council uses 121 employees daily. The proposed ISWM plan will gradually reduce the requirement of the sanitary employees for handling solid wastes. Therefore they could be used elsewhere for other development work within MMC.

Initially the total number of sanitary employees will be same as there will be collection and transport of wastes to proposed treatment plants. Gradually these amounts will be reduced and community organizations and private sector will take over the management of the wastes through the operation of the treatment plants. The requirement of labour for operating the final landfill site will also go down.

11.2.3 Transport Equipment Requirement for ISWM Plan Implementation

Since most of the wastes will not travel a long distance the requirement of compactors and large haulage equipment will reduce leading to a saving of fuel and the maintenance costs. Also reducing these large equipments will reduce the requirement of capital cost. However the new system necessitates the purchase of several new small-scale handling equipment (highlighted in chapter 8) for transporting waste from collection points to intermediate collection points or treatment plants. The requirement of these is elaborated in the Chapter 8 of this report. The number of these units will increase for effective implementation of the new plan. Since none of these require fuel or imported spare parts it will further reduce the burden on the MMC budget. Besides it will provide opportunities to local light engineering firms to fabricate them and repair them leading to better earning capacities.

11.3 Institutional Mechanism Required

There are several institutions and organizations involved in the Solid Waste Management process at Matale. They maybe at National Level, Provincial Level and/or Local Level and can be both regulators and service providers. The links between the institutions and organizations have been illustrated in the figure given below.

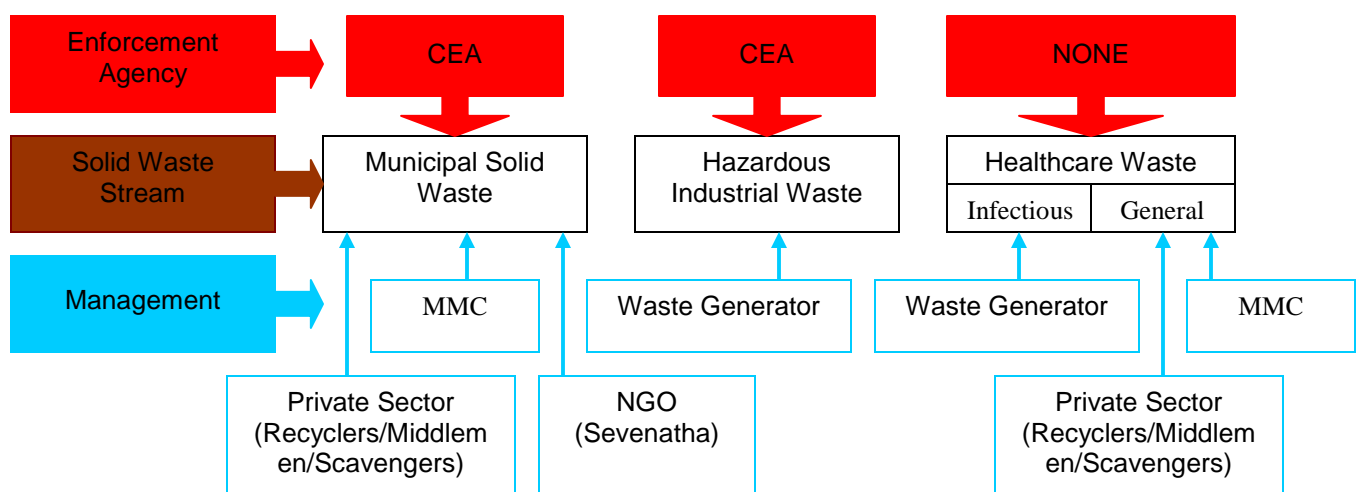


Figure 11.1: Existing Institutional Mechanism for SWM

The institutional framework which exists in Sri Lanka has a direct impact on the Solid Waste Management situation. As highlighted in the Situation Analysis report several institutions involved in Solid Waste Management are responsible for policy formulation, planning and enforcement. Each of the institutions has a specific and important role based on the type of waste generated and they have to come together and work very closely in order to achieve excellence.

However several limitations in the Institutional linkages identified under the situation analysis report have lead to the mismanagement of solid waste. The most significant of these issued is the lack of coordination among the institutions/authorities responsible for the enforcement of the laws and regulations which has caused ambiguity and confusion.

For example: The ownership of roadways is under the Road Development Authority while the ownership of Drains is under the Municipal Council. Therefore issues arise maintaining and cleaning of roadway in Sri Lanka.

Another major problem in the current mechanism is that the management of Healthcare wastes such as infections wastes as well as Hazardous industrial waste is carried out by the generators themselves. Therefore there is no method to ensure that the waste is handled and disposed off in an environmentally sound manner. This situation is further complicated in the case of healthcare waste as there is no designated enforcement agency to oversee the proper handling and disposal of waste.

Finally there is an evident lack of political commitment to implement the action plans as well as ensuring enforcement of regulations related to Environment especially in regards to illegal dumping of waste, open burning of waste etc.

While the ISWM Plan recognizes that significant reforms are required to the existing institutional mechanism for solid waste management especially in relation to clarifying the exact roles and responsibilities of the enforcement and implementation agencies the current political and administrative system in Sri Lanka will not allow for immediate

changes. This fact will also apply to the internal organization of the MMC. Therefore carefully thought out actions will have to be taken to bridge the existing gaps and to strengthen the role of the community in managing their own waste streams.

11.3.1 Proposed Actions to Strengthen Institutional Mechanism

Several actions proposed under the schemes and projects of the ISWM Plan will assist to overcome the existing issues in the Institutional links by shifting the responsibility of the proper management of waste to the generators. This will be further supported by providing the necessary awareness and training to the relevant stakeholders and building their capacities to carry out this work independently. The key aspect in this case is to allow the stakeholders to benefit from the proper management of solid waste by allowing them to develop businesses related to recycling and/or producing value added products from the waste streams.

11.3.1.1 Institutional Capacity Building

A key reason for the gaps in solid waste management in Matale is that many of the employees working in institutions related to solid waste management do not possess the necessary capacity to carry out their work efficiently. This is due to the lack of knowledge on new environmentally sustainable technologies for solid waste management. Since the proposed ISWM Plan includes a variety of schemes and projects based on such technologies and techniques the institutional capacity will have to be enhanced considerably to cope with them. This will be most applicable in the case of the MMC employees who are directly involved in waste management activities.

Prior to capacity building a thorough training need analysis will have to be conducted to identify which employees require which skills and training. Based on this analysis the following activities will be carried out to build institutional capacity.

- Awareness to all employees of MMC

- Special training to employees of the Solid Waste Management Unit including waste collectors and drivers.
- Continuous retraining programmes to relevant staff members
- Study tours to elected members and identified key personnel at the MMC
- Network with other local authorities carrying out similar work.

These activities have been further elaborated under the chapter on information and communication systems.

In addition to the MMC there will be several other institutions involved in the ISWM Plan implementation. These include academic institutions, NGOs, chambers and any stakeholders that may be involved in solid waste management. Such institutions and organizations will also need capacity building in order to be able to carry out their roles efficiently. This can be achieved by the following schemes.

- Establishment of an Environmental Education Centre
- Design and launch comprehensive awareness and training campaigns
- Developing industry university partnerships
- Developing public-private partnerships
- Establishment of Waste Minimization Cells
- Develop programmes to enhance living and working conditions of Sanitation Workers
- Setting up Children's' Societies at each Municipality ward

11.3.1.2 Restore the Environmental Education Centre (EEC) and provide necessary equipment to enhance its role

The EEC set up under JICA study has not been in operation for some time due to unavoidable circumstances. This centre was initially set up by JICA to fill the gap of not having a suitable centre in the MMC to carry out environmental awareness and training activities. Under the ISWM Plan a special centre is required to facilitate implementation

through awareness and training, meeting of partners and also as a performance monitoring centre. Since a centre with the necessary equipment is already available in Matale it is unnecessary to duplicate this work by setting up a new one. Therefore it is recommended that the existing centre be reactivated and reorganized so as to be able carry out environmental education and information dissemination activities with special focus on solid waste management. Another benefit of using this centre is that it is already equipped with all required facilities and therefore can immediately commence work.

The centre will provide a place to conduct regular meetings with CBOs and children's societies; develop a CBO network and also act as a commercial and marketing interface for compost. The available computer facilities could be used for developing the electronic waste exchange database and create links with similar sites. The centre will also maintain all the performance monitoring records of implementation of the plan and act as a reference centre for all research projects on Matale environment. The environmental education centre will be organized in a manner that the general public can visit and obtain information on solid waste management and learn progress on the on going projects.

11.3.1.3 Strengthening Roles of Community Based Organizations

Community based organizations are in existence in each of the municipality wards but their contribution to solid waste management is minimum at present. Through capacity building these CBOs could be further developed to contribute better to Solid Waste Management through improved community participation. At present the CBOs are neither aware nor ready to accept that their role and responsibility in SWM should be increased. Many CBOs act as organizations that criticize the MMC for poor management of solid waste rather than offering support to the MMC through activities at community level.

It is clear that in the case of the ISWM Plan the roles of the CBOs must be changed significantly to be more proactive in nature. They must act as support organizations to the MMC and help reduce the burden of Solid Waste Management. The MMC must also be ready to strengthen the CBOs and handover a major role in the proposed ISWM plan implementation to the CBOs if the plan is to succeed.

Another key role of CBOs is that they can operate the proposed decentralized treatment plants such as composting and bio gas plants. Therefore the CBOs should be exposed to basics of quality assurance; marketing and economics of production to ensure that their capacities are built up to efficiently operate these plants in an economical manner. Further these CBOs should be educated to closely cooperate and network with other CBOs in Matala and other parts of the country.

11.3.1.4 Setting up of Waste Minimization Cells

One of the main roles of the new and enhanced CBOs will be to act as waste minimization cells for each municipal ward. By linking the cells with the CBOs the community participation which is essential for waste minimization can be achieved. The goals of the waste minimization cells will be to assist residents and especially housewives to reduce the waste generation through methods such as intelligent and informed purchasing, environmentally responsible consumption and source segregation. The waste minimization cells will also have the necessary capacity to quantify and assess volumes of waste generated within each ward and segregate them at source so that the economic values of these wastes are increased. The housewives will be educated by members of the waste minimization cell/CBO of each ward to reduce the cost of living through reduced waste and earn additional incomes by selling sorted wastes to recyclers or re-users.

The linking of CBOs with the waste minimization cells will improve accountability of each individual ward for waste generated. It will also help to increase the community

participation in solid waste management at Matale and thereby overcome the gaps in solid waste management due to institutional gaps.

11.3.1.5 Develop Community Based Projects to Strengthen MMC relationship with Community

If the ISWM Plan is to be implemented successfully the total commitment and support of the community will be essential to the MMC. Therefore the Plan proposes that several initiatives to be taken by the MMC to develop trust and there by generate support from the community.

The plan has identified three main activities through which this can be achieved. They are described briefly below.

- Empower Community Based Organizations
- Organize Shramadana (City activities with community participation)
- Identify and celebrate a “Matale Day”

In addition to these activities it is essential that the MMC together with other enforcement agencies must implement and carry out their work in a transparent manner allowing all stakeholders to access necessary information regarding the implementation of the plan.

11.3.1.6 Promoting Private Sector and Local Chamber Participation in recycling based industries

The previous experience in solid waste management in the other parts of the country has shown that commercial based projects cannot be operated by public sector due to many reasons. Therefore the trend has been to develop public-private partnerships and motivate private sector investors to participate proactively in Solid Waste Management. The best method of doing this is encouraging entrepreneurs to establish commercial

projects based on Solid Waste. Several projects in the ISWM plan which depends on recovery of resources can and must be carried out with a market based approach to ensure its long term sustainability.

Since waste generated in Matale is small in quantity it is best to avoid setting up large scale industries and rather focus on micro, small and medium scaled operations. Therefore the MMC has to work with closely with the regional chamber of commerce and industry to identify and attract prospective investors. This will further assist to build confidence between the business sector and the MMC and will lead to better cooperation for effective implementation of ISWM plan.

A major benefit of this activity will be the Generation of new employment opportunities within Matale and increase income generation as well as living conditions of the residents.

11.3.1.7 Policy Based Changes

Though the country has a very stringent environmental policy frame work the emphasis on the solid waste management was not adequate to pressurise the people to adhere the required actions. Therefore several initiatives have been identified under the ISWM Plan for Matale to facilitate changes in the existing policies on Solid Waste. While the plan has been prepared to improve the management of Solid Waste under the current policy and administrative mechanisms it recognizes the fact that changes have to be made at policy level so as to achieve the long term targets set by MMC. Therefore the following proposals are made under the plan in order to bring about the necessary changes.

- Lobby to increase fines and introduce new fines
- Lobbying for Approval of Municipal Council By-laws
- Develop incentive system to promote source segregation
- Effecting Policy Changes at Local Government Level

Chapter 12: Monitoring of Progress of ISWM Plan

12.1 Introduction to Key performance Indicators

ISWM Plan for Matale needs to achieve several goals and objectives during its period of implementation. The successful achievement of short term and long term targets which are based on the goals and objectives requires effective monitoring of the performance of each and every scheme developed as a key task of the action plan. The results of monitoring will provide adequate information to the decision makers to review the performance and make necessary adjustments or changes to steer the course of the action plan to be more meaningful.

A good monitoring and review process will provide many benefits to all stakeholders such as,

- a) Provide information regularly to all stakeholders on the status of the ISWM plan.
- b) Analyze the status of the implementation of schemes
- c) Assess the effectiveness of the schemes and whether they lead to achievement of goals and objectives.
- d) Modify, change or strengthen the ongoing schemes in the ISWM plan.
- e) Develop new schemes to realize the goals and objectives more effectively.
- f) Lessons to be learnt on the success of the ISWM plan and share the newly gained knowledge with relevant parties

Though monitoring is a continuous process, for the purpose of review the plan needs to have time bound performance measurement. This could be achieved by developing a set of Key Performance Indicators (KPIs).

KPIs translate the performance of the Solid Waste Management activities into meaningful and concise quantitative measures which can be either assessed or compared against predefined targets. The KPIs will measure whether the ISWM plan is providing services at desired level through implementation.

The KPIs can be Operational, Financial or Social depending on the relevance of performance to various stakeholders.

The attributes of the **KPIs** should pass the **SMART** test as described below.

Specific

Each KPI should reflect the effectiveness of performance of a specific activity. The KPIs should not be developed to measure integrated or overall achievements of the ISWM. Instead they will indicate the effectiveness of each scheme and provide required information for decision making

Measurable

Each KPI should be based on quantifiable data and therefore the KPIs should be measurable instead of qualitative. There can be KPIs which measure qualitative impacts of ISWM but they will be translated into quantitative measures through data gathered on the output.

Achievable

All KPIs are based on achievable tasks and schemes. Some of the schemes which need national and provincial level decision making will not be measured using KPIs though they are essential for long term sustenance of the SWM in Matale and other parts of the country.

Realistic

All KPIs are relevant to Matale solid waste management and are derived from the system in place and proposed ISWM. Therefore all KPIs are actionable, realistic, and practical in nature and are outcome oriented.

Time bound

All KPIs should be calculated on a monthly or yearly basis. Also this attribute will facilitate the stakeholders to evaluate the progress and continual improvement of the ISWM over time. It will show whether a scheme implemented has been effective during

a particular period of time and if inadequate to adapt, modify or change the scheme to a more meaningful activity.

KPIs are developed to show the impact of the proposed ISWM plan on the solid waste management in Matale. These indicators therefore should be made public and transparent so that all stakeholders will immediately assess the impact of new ISWM in Matale. To achieve the goals and objectives MMC may have to build up partnerships with different parties in and outside of Matale. The KPIs will indicate the effectiveness of these partnerships and MMC could use the indicators for making decisions on the required adaptations, modifications and changes to the partnership. They also can use these indicators as one of the criteria for dissolving existing partnerships or developing new partnerships.

The Key Performance Indicators represent the “check” stage of the PDCA cycle used in management system planning. The PDCA cycle for the proposed ISWM plan for Matale could be drawn as follows

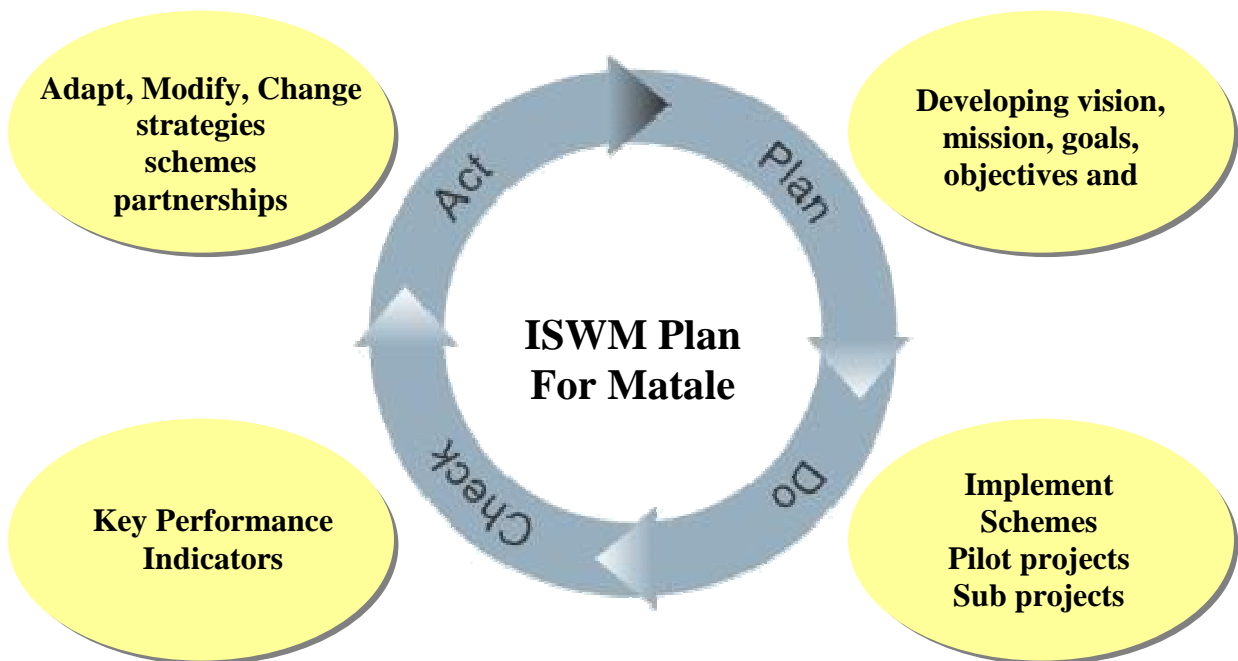


Figure 12.1: Role of KPIs in the Overall Plan Development and Implementation Process

12.2 Selection of Indicators

When developing a set of KPIs for Matale a simple and straight forward strategy was used. The Matale MC has formulated its ISWM vision, mission and goals and objectives to fulfill them. The goals and objectives were then translated into short term and long term targets. Also the achievement of each and every stage of the solid waste Management needs to be monitored to ensure smooth operation and to prevent the breakdown of the proposed plan. Therefore to meet the above expectations following procedure was adopted to develop the KPIs.

- 1) KPIs will be indicative of operational efficiency, financial diligence and the social satisfaction of the ISWM plan implementation.
- 1) All KPIs are linked to Goals, Objectives and the short term and long term targets
- 2) KPIs are designed for key tasks and schemes in all stages of ISWM
- 3) All KPIs are to be translated to quantifiable form
- 4) Performance data has to be gathered to calculate the KPIs

The effectiveness of the KPIs is dependant on the collection and recording of data. Therefore the availability and quality of data will be an important factor. A methodology should be developed to collect data for each KPI. This methodology should be simple and user-friendly to ensure that it is understood by citizens, MMC workers as well as other stake holders.

All the data gathered should be recorded in simple worksheets designed for that purpose and the format of each worksheet has to be determined after consultation of each user. Every effort should be made to make the data is reliable, complete and consistent and valid. Occasional spot checks and cross checks are essential to ensure that the methodology is used in an appropriate manner.

KPIs are drafted by a group of involved partners in developing the ISWM plan and these proposed KPIs will be submitted to a cross section of the major stakeholders during a consultation workshop for collective approval. The approved KPIs are final performance

evaluation criteria for the ISWM plan and will be acceptable to all stakeholders. Those KPIs could be of use to different stakeholders for different purposes.

12.2.1 The use of KPIs by different Stakeholders

Each of the KPIs developed must ultimately be used by the stakeholders to measure if the activities proposed by the ISWM Plan meet their expectations. The table given below illustrates how each of the stakeholders will use the KPIs during their role in the overall ISWM Plan.

| Stakeholder | How the KPIs will be Used |
|---------------------------------|---|
| MMC | <ul style="list-style-type: none"> • Judge the performance of the sanitary employees • To evaluate the effectiveness of strategies • To introduce new processes • Initiate new partnerships • Seek further funding • Rewarding the personnel involved in ISWM |
| Provincial Council | <ul style="list-style-type: none"> • Compare performance of different local authorities • To evaluate the effectiveness of the by-laws and other strategies |
| Ministry of Local Government | <ul style="list-style-type: none"> • To decide on allocation of funds for projects • Criteria for rewarding the local authorities excel in the SWM |
| Ministry of Environment | <ul style="list-style-type: none"> • To link the performance to national Solid waste management program • To provide financial assistance to worthy projects |
| Central Environmental Authority | <ul style="list-style-type: none"> • Identify gaps in the legal and regulatory systems • Strengthen the existing solid waste management policy frame work |
| Donors/Funding agencies | <ul style="list-style-type: none"> • Select the projects for funding • Evaluate the project performance • Benchmarking with other projects for future funding strategies |
| CBOs | <ul style="list-style-type: none"> • Evaluate the effectiveness of their actions in the ISWM • Seek ways to improve their performance in the ISWM projects |
| Citizen Groups | <ul style="list-style-type: none"> • Judge the effectiveness of the ISWM • Identify areas of concern for consultation and active participation |

Table 12.1: Stakeholder use of KPIs

12.3 Selection of Indicators

The performance indicators were developed based four main areas of concern in the management of solid waste which are, technical, financial, social and environmental issues. These have be listed below.

| Technical | | | |
|------------|--|---|---|
| Stage | Desired Outcome | Key Performance Criteria | Output Measure |
| Sorting | <ul style="list-style-type: none"> Segregation of large volume of waste | <ul style="list-style-type: none"> Availability of containers for segregation (bins/bags) | % households carrying out segregation |
| | | | % waste segregated per day |
| Collection | <ul style="list-style-type: none"> Waste collected from larger population Waste disposed by households and commercial establishments to be collected Collection of larger volume of solid waste | <ul style="list-style-type: none"> Collection equipment deployed Effective utilization of collection equipment Number of transfer stations available Higher population served | Total Waste Collected (per month) |
| | | | Total Hazardous Waste Collected (per month) |
| | | | % equipment used per total solid waste volume |
| | | | % of waste collectors |
| | | | % of population served |
| | | | % of waste collected per transfer station |
| Transport | | <ul style="list-style-type: none"> Transportation equipment used Number of trips carried out by each vehicle | Total waste transported |
| | | | % community served |
| | | | % of vehicles in use from total fleet |
| Treatment | <ul style="list-style-type: none"> More organic waste treated All hazardous waste treated | <ul style="list-style-type: none"> Larger quantity treated | % of waste treated |
| | | | % of hazardous waste treated |
| | | | Quantity of biogas generated |
| | | | Quantity of compost produced per plant |
| | | | Number of Households carrying out |

| | | | |
|---------------------------------|---|--|--|
| | | | composting |
| | | | % of waste composted at household level |
| | | | Number of Households that do not compost organic waste though possessing compost barrels |
| Disposal | <ul style="list-style-type: none"> • Effective disposal of residual waste • Availability of an engineered sanitary landfill | <ul style="list-style-type: none"> • No waste left behind in public areas • Longer lifetime of sanitary landfill | % reduction in waste taken to sanitary landfill |
| | | | Remaining year of sanitary landfill |
| Resource Recovery and Recycling | <ul style="list-style-type: none"> • More material recovered from waste | <ul style="list-style-type: none"> • Larger quantity of waste exchanged, re-used or sent for recycling | Volume of waste exchanged |
| | | | Quantity of waste recycled |
| | | | % of waste recycled |
| | | | % of waste recycled into value added products |
| Financial | | | |
| Stage | Desired Outcome | Key Performance Criteria | Output Measure |
| Sorting | <ul style="list-style-type: none"> • Reducing cost of providing containers for segregation | <ul style="list-style-type: none"> • High quality durable containers provided. | Total cost of containers provided |
| | | <ul style="list-style-type: none"> • Reusable containers provided | % of containers replaced within first year |
| | | <ul style="list-style-type: none"> • Sponsors for providing containers | |
| Collection & Transportation | <ul style="list-style-type: none"> • Optimize expenditure for effective solid waste management | <ul style="list-style-type: none"> • Reduction in expenditure per ton of waste collected and transported | Cost of collection and transportation per ton of solid waste |
| | | <ul style="list-style-type: none"> • Reduction in expenditure per | Cost of collection and transportation per employee |

| | | | |
|---------------------------------|--|---|---|
| | | <p>employee for collection and transportation</p> <ul style="list-style-type: none"> • Reduction in expenditure for collection and transportation per unit (household/commercial establishment/institution etc.) | <p>Cost of collection and transportation per household unit / institution unit / commercial unit</p> <p>Quantity of fuel used per vehicle per month</p> |
| Treatment | <ul style="list-style-type: none"> • Higher quantity of waste treated | <ul style="list-style-type: none"> • Increased income generation from treatment of solid waste | <p>Total income generated through treatment plants</p> <p>Income generated through selling compost</p> <p>Income generated through selling biogas</p> <p>Change in energy cost due to usage of biogas at hospital</p> <p>% income against expenditure for treatment</p> |
| Disposal | <ul style="list-style-type: none"> • Reduce expenditure on disposal of solid waste | <ul style="list-style-type: none"> • Lower cost of disposal • Lower cost of disposal per ton of waste disposed | <p>% cost of operating disposal site from total SWM cost</p> <p>Cost of disposal per ton of solid waste</p> |
| Resource Recovery and Recycling | <ul style="list-style-type: none"> • Increase economic returns to community from waste recovery | <ul style="list-style-type: none"> • Higher income generated from waste recycling/recovery • Reduce cost of SWM management through resource recovery | <p>Total income generated from resource recovery</p> <p>% income generated</p> <p>% reduction in SWM expenditure due to resource recovery</p> |
| General | <ul style="list-style-type: none"> • Effective SWM with least cost | <ul style="list-style-type: none"> • Cost of waste management reduced | <p>% income from environmental services</p> |

| | | | |
|-----------------------------|--|--|--|
| | | against total revenue | against total expenditure |
| | | | % of total expenditure against MMC budget |
| Social | | | |
| Stage | Desired Outcome | Key Performance Criteria | Output Measure |
| Sorting | <ul style="list-style-type: none"> All households educated on sorting All households understand the segregation of hazardous waste | <ul style="list-style-type: none"> More households commence sorting | % of households carrying out sorting (refer 1.1) |
| | | | % of Commercial establishments carrying out sorting |
| | | | Number of awareness programs held |
| | | | Number of persons in the community trained on sorting |
| | | | Number of households segregate hazardous waste for safe treatment & disposal |
| Collection & Transportation | <ul style="list-style-type: none"> All households manage their waste effectively | <ul style="list-style-type: none"> No wastes remain unattended | % waste uncollected |
| | | | % of households cooperating with MMC |
| | | | Number of complaints on non collection |
| | | | % of leave taken by MMC sanitary employees |
| | | | Number of MMC sanitary employees arriving to work on time |
| Treatment | <ul style="list-style-type: none"> All households either compost their organic waste or give it to a composting station | | Number of home composting units in operation |
| | | | Volume of waste given to composting / |

| | | | |
|---------------------------------|--|--|--|
| | | | bio gas plants |
| Disposal | <ul style="list-style-type: none"> All the members of community understand the importance of effective solid waste management High Community participation in solid waste management | | % of households not served by MMC system |
| | | | % increase of community participation in SWM |
| Resource Recovery and Recycling | <ul style="list-style-type: none"> Most of the non- organic wastes sent for recovery of resources | | Number of scavengers collecting wastes for recycling trained |
| | | | % increase in the number of households selling recyclable wastes |
| | | | Number of persons trained on recycling |
| General | <ul style="list-style-type: none"> Improved community awareness on SWM Higher participation of community in waste management Better working conditions for sanitary workers | | Number of awareness programs conducted |
| | | | % of community participated in awareness programs |
| | | | Number of trainers trained for future awareness programs |
| | | | Number of school initiatives on SWM |
| | | | Number of applicant for Best Solid Waste Management award scheme |
| Environmental | | | |
| Stage | Desired Outcome | Key Performance Criteria | Output Measure |
| Sorting | <ul style="list-style-type: none"> All households educated on | <ul style="list-style-type: none"> More households sensitized about | % of households sorting waste |
| | | | Number of awareness programs held |

| | | | |
|-----------------------------|--|---|---|
| | <p>Environmental Impacts of Solid waste</p> <ul style="list-style-type: none"> All households understand the harmfulness of hazardous waste to humans and environment | resource wastage and environmental pollution through solid waste | <p>Number of persons in the community trained on environmental pollution and resource conservation</p> <p>Number of households segregate hazardous waste for safe treatment & disposal</p> |
| Collection & Transportation | <ul style="list-style-type: none"> All households manage their waste effectively to minimize environmental pollution | <ul style="list-style-type: none"> No wastes remain unattended | <p>% waste uncollected</p> <p>% of households cooperating with MMC</p> <p>Number of complaints on non collection</p> <p>% of streets not cleaned daily</p> <p>% of households where waste not collected daily</p> |
| Treatment | <ul style="list-style-type: none"> All households either compost their organic waste or give it to a composting station | Major portion of the wastes are attended through recovery and treatment | <p>Number of home composting units in operation</p> <p>Volume of waste given to composting / bio gas plants</p> |
| Disposal | <ul style="list-style-type: none"> All the members of community understand the importance of effective solid waste management High Community participation in solid waste management | To dispose minimum volume of waste at an engineered sanitary landfill | <p>% reduction of wastes disposed to landfill site</p> <p>% school programs started</p> <p>% increase of community participation in SWM</p> <p>% reduction of waste going to landfill site</p> <p>% increase in resource recovery</p> |

| | | | |
|---------------------------------|---|---|---|
| Resource Recovery and Recycling | <ul style="list-style-type: none"> • Most of the non- organic wastes sent for recovery of resources | Annual increase of resource recovery from wastes | % increase in the number of households selling recyclable wastes |
| | | | Number of persons trained on recycling |
| | | | Number of awareness programs conducted |
| General | <ul style="list-style-type: none"> • Improved community awareness on SWM and environmental pollution prevention • Higher concern of community in maintaining a pollution free city • Clean & Green city surroundings | Annually improving the quality of life of the community by applying green practises | % of community participated in awareness programs |
| | | | Number of citizen suggestions received for clean city |
| | | | Number of school initiatives on resource recovery and pollution prevention |
| | | | Number of solid waste related complaints made to Provincial Environmental Committee |
| | | | Water quality of water bodies in Matale |
| | | | % Reduction of biodiversity loss due to improved solid waste management |

12.4 Summary of Selected Indicators

| |
|---|
| Technical |
| % households carrying out segregation |
| % waste segregated per day |
| Total Waste Collected (per month) |
| Total Hazardous Waste Collected (per month) |
| % equipment used per total solid waste volume |
| % of waste collectors |
| % of population served |
| % of waste collected per transfer station |
| Total waste transported |
| % community served |
| % of vehicles in use from total fleet |
| % of waste treated |
| % of hazardous waste treated |
| Quantity of biogas generated |
| Quantity of compost produced per plant |
| Number of Households carrying out composting |
| % of waste composted at household level |
| Number of Households that do not compost organic waste though possessing compost barrels |
| % reduction in waste taken to sanitary landfill |
| Remaining year of sanitary landfill |
| Volume of waste exchanged |
| Quantity of waste recycled |
| % of waste recycled |
| % of waste recycled into value added products |
| Financial |
| Total cost of containers provided |
| % of containers replaced within first year |
| Cost of collection and transportation per ton of solid waste |
| Cost of collection and transportation per employee |
| Cost of collection and transportation per household unit / institution unit / commercial unit |
| Quantity of fuel used per vehicle per month |
| Total income generated through treatment plants |
| Income generated through selling compost |
| Income generated through selling biogas |
| Change in energy cost due to usage of biogas at hospital |
| % income against expenditure for treatment |
| % cost of operating disposal site from total SWM cost |

| |
|---|
| Cost of disposal per ton of solid waste |
| Total income generated from resource recovery |
| % income generated |
| % reduction in SWM expenditure due to resource recovery |
| % income from environmental services against total expenditure |
| % of total expenditure against MMC budget |
| Social |
| % of households carrying out sorting (refer 1.1) |
| % of Commercial establishments carrying out sorting |
| Number of awareness programs held |
| Number of persons in the community trained on sorting |
| Number of households segregate hazardous waste for safe treatment & disposal |
| % waste uncollected |
| % of households cooperating with MMC |
| Number of complaints on non collection |
| % of leave taken by MMC sanitary employees |
| Number of MMC sanitary employees arriving to work on time |
| Number of home composting units in operation |
| Volume of waste given to composting / bio gas plants |
| % of households not served by MMC system |
| % increase of community participation in SWM |
| Number of scavengers collecting wastes for recycling trained |
| % increase in the No of households selling recyclable wastes |
| Number of persons trained on recycling |
| Number of awareness programs conducted |
| % of community participated in awareness programs |
| Number of trainers trained for future awareness programs |
| Number of school initiatives on SWM |
| Number of applicant for Best Solid Waste Management award scheme |
| Environmental |
| % of households sorting waste |
| Number of awareness programs held |
| Number of persons in the community trained on environmental pollution and resource conservation |
| Number of households segregate hazardous waste for safe treatment & disposal |
| % waste uncollected |
| % of households cooperating with MMC |
| Number of complaints on non collection |
| % of streets not cleaned daily |
| % of households where waste not collected daily |

| |
|---|
| Number of home composting units in operation |
| Volume of waste given to composting / bio gas plants |
| % reduction of wastes disposed to landfill site |
| % school programs started |
| % increase of community participation in SWM |
| % reduction of waste going to landfill site |
| % increase in resource recovery |
| % increase in the number of households selling recyclable wastes |
| Number of persons trained on recycling |
| Number of awareness programs conducted |
| % of community participated in awareness programs |
| Number of citizen suggestions received for clean city |
| Number of school initiatives on resource recovery and pollution prevention |
| Number of solid waste related complaints made to Provincial Environmental Committee |
| Water quality of water bodies in Matale |
| % Reduction of biodiversity loss due to improved solid waste management |

Chapter 13: Implementation Strategy

The ISWM Plan prepared by National Cleaner Production centre under the guidance of the United Nations Environment Programme (IETC) for the Matale Municipal council comprises of two phases.

Phase I - Planning

Conceptualization of an Integrated Solid Waste Management system suitable to the social-economic-technical conditions of Matale Municipal Council. This stage of the plan was carried out in consultation with the stakeholders at Matale.

Phase II – Implementation

Executing the schemes and sub projects identified in the ISWM Plan under the direction of the MMC with community participation

Monitoring the performance against KPIs set down in the plan

Making changes/alterations to the schemes based on the results of performance monitoring.

The planning phase of the ISWM system is now complete and the implementation will have to be organized. Therefore an implementation strategy must be developed to streamline the activities and ensure that the implementation takes place smoothly and efficiently.

Then transition from planning to implementation will be marked by a final dissemination seminar. This seminar provides the platform for Policy makers, donors and funding institutes as well as the stakeholders who have been involved in the planning process to come together and discuss issues related to the actual implementation of the 31 schemes and 5 subprojects.

A prerequisite for the implementation is the strengthening of the environmental committee of the MMC comprising many stakeholders. This committee can take the

lead in developing the partnerships and liaising with other organizations. Also it is very important to learn lessons from the previous studies and recommendations when the schemes and projects are implemented.

The implementation of the plan will require the integration of the aspects identified in the diagram below. Each of the aspects and their link to the plan have been discussed below.

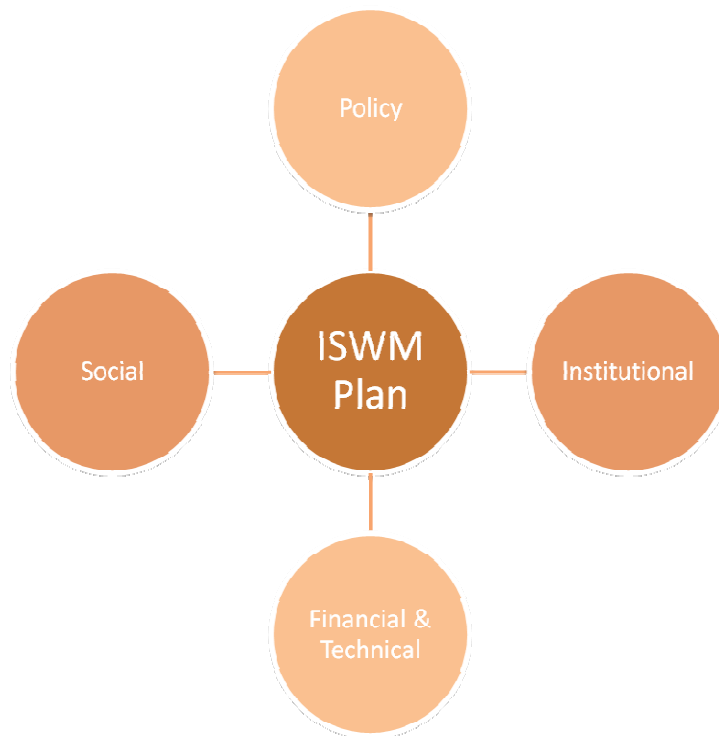


Figure 13.1: Aspects of ISWM Plan Implementation

Policy Aspect:

Support for the plan at policy level is an important factor for successful implementation. The policy changes includes the strengthening of the existing laws and regulations on solid waste management, enacting and enforcing new regulations where necessary and develop market based economic tools to motivate community to good practice and as a deterrent from harmful practices. The important policy reforms are highlighted in chapter 6 of this report

Institutional Aspect:

Several actions proposed under the schemes and projects of the ISWM Plan will assist to overcome the existing issues in the Institutional links by shifting the responsibility of the proper management of waste to the generators. This will be further supported by capacity building through awareness and training to the relevant stakeholders. The key aspect in this case is to allow the stakeholders to benefit from the proper management of solid waste by allowing them to develop businesses related to recycling and/or producing value added products from the waste streams.

A key factor for this is that employees working in institutions related to solid waste management are instilled with necessary capacity to carry out their work efficiently. Therefore knowledge on new environmentally sustainable technologies on solid waste management must be provided prior to implementation and thereby enhance the ability of MMC to cope with them.

Public-private partnerships with NGOs and CDOs must be encouraged during implementation. It is clear that in the case of the ISWM Plan the roles of the CDOs must be changed significantly to be more proactive in nature. They must act as support organizations to the MMC and help reduce the burden of Solid Waste Management. The MMC must also be ready to strengthen the CDOs and handover a major role in the proposed ISWM plan implementation to the CDOs if the plan is to succeed.

Financial/Technical Aspects:

The technological and financial aspects are grouped together as much of the financial resources will be required to purchase technologies, equipment and machinery and infrastructure required to implement the ISWM plan. The estimated financial requirements for the ISWM plan have been highlighted in chapter 11 of this report. Accordingly the initially investment required for the successful implementation of all the schemes and projects is approximately **LKR 47,100,000 (USD 439,577)**.

Since MMC will not be able to bear the entire financial requirement for implementation it will need to seek donor assistance to set up some of the schemes. Therefore MMC will need to engage consultants who can prepare project proposals for finance intensive schemes and submit them to various donor organizations. Some of the schemes can be implemented and operated as profitable business ventures and therefore investors can be approached to take over the implementation under supervision of the MMC.

Social Aspect:

Community participation is essential at each step of the implementation of the ISWM plan. Many of the Schemes and subprojects will therefore require awareness and capacity building as a precursor to actual implementation. The benefits from the implementation of the plan must trickle down to all members of Society. The MMC must also take steps to immediately follow up on the schemes designed towards enhancing the quality of life of sanitation workers and scavengers.

Employment generation and financial benefits to the community in Matale is another key point to consider during implementation. It is essential that any economic gains through recycling projects, waste recovery projects, biogas generation etc be translated into quantifiable benefits to the people of Matale. This will encourage community participation and secure long term sustainability of the plan.

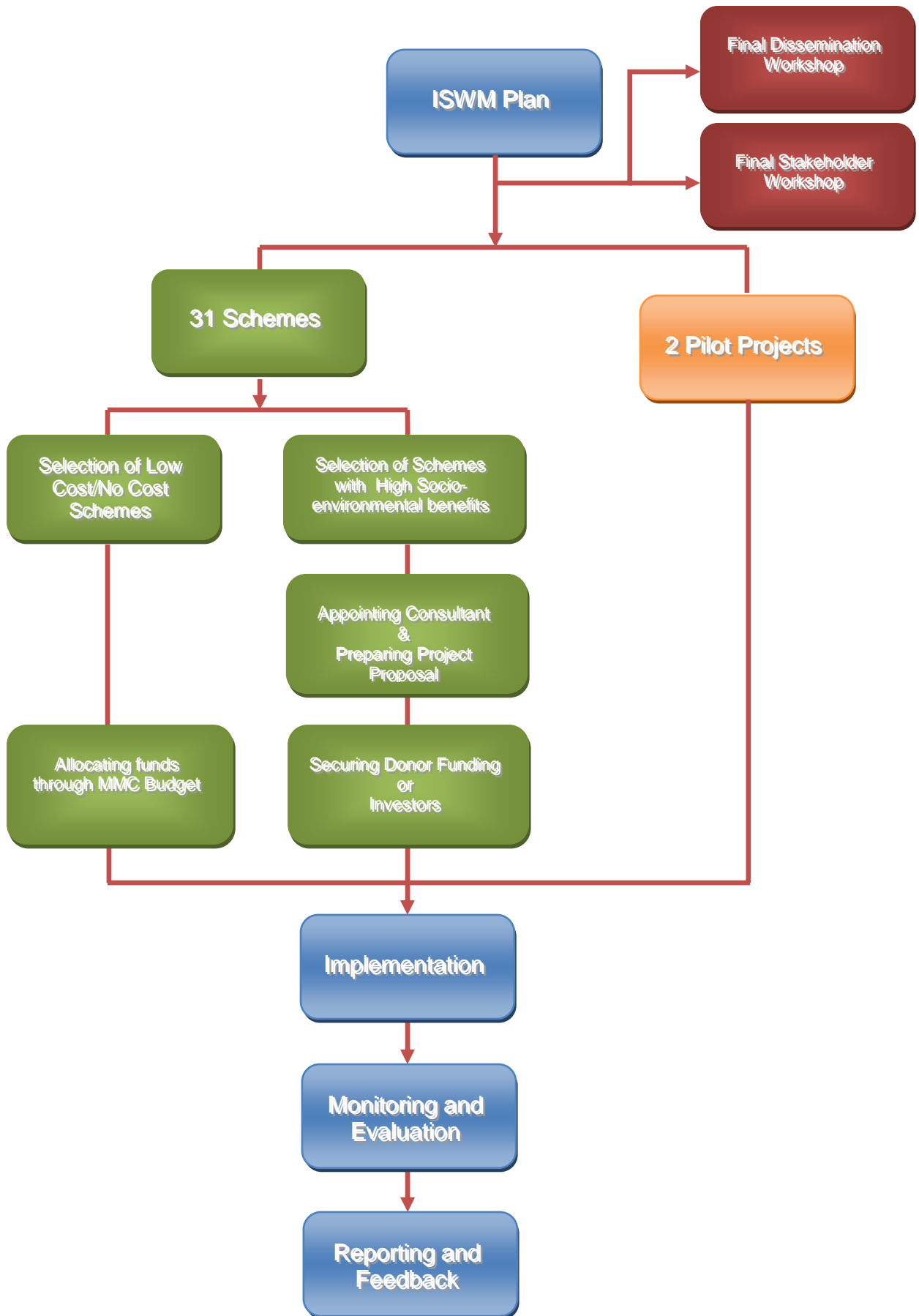


Figure 13.2: Implementation of ISWM Plan in Matala Municipal Council