Department of Environment

Strategic *direction* for waste management in Western Australia

WMB
Waste Management Board

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Department of Environment

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August 2003

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Foreword

The Minister for the Environment

Communities throughout Western Australia are becoming increasingly focussed on the volumes of wastes that we produce and the resources that are wasted through disposal to landfill.

It's a concern that also recognises the very real environmental impacts that we as a community face if we don't continue to improve our waste management practices

For example, consider the potential impact that continued reliance on landfill can have our on groundwater supplies.

The Perth metropolitan area is situated over groundwater reserves that are important drinking water sources and play an important role in the environmental quality of the surrounding natural environment. The threat to these water reserves from wastes generated by our society highlights a genuine need for better management.

This document, the *Strategic Direction for Waste Management in Western Australia* aims to answer those concerns by working towards the State Government's key vision, as outlined in the document *Towards Zero Waste by 2020*.

This latest paper represents the State's first significant step towards developing a detailed action plan for achieving that vision. In particular, this document outlines the Zero Waste Model, which shows how all members of the community contribute in some way to the generation of waste, and provides a framework for improving the choices we make to avoid waste.

The document has been prepared as a public discussion paper to also provide a new opportunity for the Western Australian community to participate in planning and take action to realise the *Zero Waste by 2020* vision.

We all recognise that long-term changes are needed within the community and industry to move towards the goal of zero waste in Western Australia.

It is the responsibility of all members of the community to work cooperatively towards this goal. We will only be able to address this problem and move towards a more sustainable future if everyone accepts responsibility for their own involvement in the generation of waste.

This Strategic Direction document is the initial step on a long road towards sustainability. It is about changing what we understand as acceptable behaviour in the use of our resources and making sure everyone in Western Australia can help to identify actions and strategies that will achieve the zero waste vision.

Judy Edwards

Dr Judy Edwards, MLA
Minister for the Environment

Preface

Chair of the Waste Management Board

Mr Noel Davies (Chair)

The Strategic Direction for Waste Management in Western Australia has been developed by the Waste Management Board in conjunction with the Department of Environment. The Strategic Direction document has been developed to assist industry and the community in achieving the Towards Zero Waste vision identified in the WAste 2020 Report.

This document will be released as a discussion paper to allow the Western Australian community to participate in planning the strategic activities necessary to achieve the towards zero waste vision.

The first Section of this document sets out the underlying philosophy and principles on which decisions to address the problems of waste in Western Australia will be based. It also outlines what the Government aims to achieve through the implementation of the Strategic Direction document.

Section Two proposes a Strategy to achieve zero waste. This part of the document outlines the strategic actions by which we can achieve the vision outlined in Section One. This Section will be finalised after submissions have been received from the community of Western Australia.

The Strategic Direction document represents a transitional plan for the next three years, establishing the first steps between managing wastes and achieving zero waste and ultimately a sustainable Western Australia.

Feedback from the consultation process will guide priorities and spending on programs that can be supported from the Waste Management and Recycling Fund, to change behaviours and avoid or minimise waste generation.

Only through clear strategies, with targets and responsibilities, can all members of the Western Australian community play a role in achieving the Towards Zero Waste vision.

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Over the past 10 years, a number of reports and studies have contributed towards understanding and solving waste issues in Western Australia. Each of these reports have tried to address waste issues, with documents released in the early 1990s predominantly focusing on improving rates of recycling. The reports developed during 2000-2002 have shifted their focus and taken on a much more holistic approach for managing waste.

This focus draws on the waste management hierarchy to maximise the use of resources and products while generating the minimum amount of waste. The hierarchy establishes several waste management strategies, according to their importance and preference in descending order. These strategies are; avoid, minimise, recycle, treat and dispose. The hierarchy has been very successful in supporting programs aimed at recycling, however has been less successful on the top order actions of avoiding and minimising to address unsustainable consumption habits of our society.

Therefore a plan on how to address the management gaps of previous strategies is required. This requires a vision for the Western Australian community that embraces the following principles:

- Decisions about waste streams are based on the Waste Management Hierarchy;
- Resource use, including waste management, follows an Industrial Ecology approach in accordance with the principles of sustainability;
- Management approaches are based on Resource Stewardship consistent with product life cycle management; and
- Laws, regulations and policies reflect the principles of Environmental Justice.

The Strategic Direction for Waste Management in Western Australia has been developed to lead the way for managing waste in Western Australia. The document initially sets the strategic direction, principles and outcomes to achieve the vision of 'towards zero waste by 2020'. The development of the zero waste model is the schematic diagram that illustrates the cycle of continuous improvement to avoid the generation of waste in our community.

The Strategic Direction document comprises three parts. Part One of the document – Strategic Vision for Waste Management – outlines what the Western Australian Government aims to achieve through the implementation of the Strategy. This section lists the main objectives to achieve during the 2003-2005 period. These objectives provide an essential foundation for achieving the State's long-term vision of a waste free society. A core component of the first part is to communicate to the Western Australian community the need to embrace a new approach to the production and management of waste. This new approach focuses on avoiding the production of wastes, promoting the efficient recovery of resources from residual waste streams, and ongoing improvement towards sustainability and the towards zero waste vision.

Part 2 – Strategy for Achieving Zero Waste – outlines the strategic actions and seeks to identify responsible parties and timeframes in which to achieve goals. This section provides a blueprint for actions in moving towards zero waste. In its current form, the Strategic Direction for Waste Management in Western Australia is a transitional plan. The outcome of the community consultation phase on this draft document, will help to identify those priorities that are important to the Western Australian community. This process will begin the evolution from a society that is unsustainable to one that understands the value of resources and uses them wisely.

Finally, Part 3 – Transition to the New Paradigm for Solid Wastes – explains why waste management is an important ongoing concern for the community of Western Australia. It elaborates more fully the principles that have guided the development of the key actions for waste management. It also shows the growing volumes of solid waste that are being generated in Western Australia from unsustainable consumption habits. Section three focuses on the necessary changes that need to be made in the community, especially in our understanding of what is waste and unsustainable use of resources, to move towards the zero waste goal.

1 Strategic vision for waste management

1.1 Introduction

This part of the Strategic Direction outlines the main objectives planned for achievement during the period 2003-2005. These objectives provide an essential foundation for achieving the State's long-term vision of a waste free society.

A core element of the Strategic Direction is the need for our community to embrace a new approach to the issues surrounding the production and management of waste. This new paradigm is based on:

- Sustainable use of resources through the production process and the delivery of services;
- Avoiding the production of wastes wherever feasible;
- The efficient recovery of resources from residual waste streams; and
- Ongoing analysis and improvement to move closer towards Zero Waste by 2020.

Part 1 also establishes the Principles and Outcomes that the Government is aiming to achieve. A major concept within this section of the document is the development and explanation of the Zero Waste Model. The Zero Waste Model details how the Principles and Outcomes can be applied to assist decision making on current waste management issues.

1.2 The new paradigm

Waste is not an issue confined to Western Australia; communities worldwide are grappling with the waste problem. As the population grows in Western Australia, the generation of waste will continue to increase, creating environmental problems that must be addressed. Historically, the goal has been to try and 'manage' waste. However, this approach is not working, nor is it sustainable in the long term.

Focus on the Future, the draft State Sustainability Strategy[1], describes a broad policy framework within which the State's Strategic Direction in waste management should sit. Focus on the Future argues for an integrated and strategic approach to decision making that considers social, environmental and economic concerns.

The vision is that, by 2020, through the adoption of the new paradigm for waste:

- The term waste management will no longer be in common use as there will be little waste requiring management;
- Farsighted government policies, a changed economic basis, and a major shift in social and corporate values have resulted in significant decreases in the volumes and toxicity of waste – both industrial and municipal;
- Materials, previously disposed of to landfill, are now re-used and recycled. Manufacturers take responsibility for the life cycle of their products; businesses across the State are involved in industrial ecology;
- Product prices reflect their true environmental and social costs;

[1] Government of Western Australia (2002) *Focus on the Future: The Western Australian State Sustainability Strategy, Consultation Draft*. Department of Premier and Cabinet, Perth.

- Businesses, governments and international institutions are systematically tracking materials and energy flows and have created a base of data with which to measure progress and target future investments. This information is easily available to researchers, entrepreneurs and the public;
- Old industrial and municipal landfills are being mined – a profitable business;
- Cleanup of contaminated sites has largely been completed;
- Government subsidies no longer favour resource extraction and waste industries based on virgin materials; instead taxes are levied on resource use and waste production;
- A transformation has occurred in the generation of post-consumer household waste – sustainability is ingrained as a social value and individuals are aware of the environmental consequences of their consumption choices;
- Household waste generation is only a fraction of what it was at the beginning of the 21st century;
- Fewer hazardous chemicals are now used; consumers are better informed of potential risks from chemicals in the goods and services they use;
- There are close links between government, citizens and industry – meaning a more participatory approach to decision making; and
- Globally, heightened concerns have produced new institutions and policies to ensure wastes and materials are managed wisely worldwide.

1.3 Principles for the strategic direction

This Strategic Direction is founded on four Principles:

- Decisions about waste streams are based on the Waste Management Hierarchy;
- Resource use, including waste management, follows an Industrial Ecology approach in accordance with the principles of sustainability;
- Management approaches are based on Resource Stewardship consistent with product life cycle management; and
- Laws, regulations and policies reflect the principles of Environmental Justice.

The basis for these principles is elaborated on in Part 3 of this document.

1.4 Outcomes

In order to achieve a waste-free Western Australia, a number of key outcomes are proposed:

Outcome 1 Manufacturing and other industrial processes are operated in a sustainable manner that minimises the quantity of wastes produced.

Outcome 2 Products and services sold in Western Australia are designed and/or packaged to minimise waste production and facilitate recovery and re-use of secondary resources.

Outcome 3 All wastes are segregated and sorted close to source in a way that optimises resource recovery for higher end uses.

Outcome 4 Hazardous components in goods and services are substituted to increase resource recovery options.

Outcome 5 A comprehensive and diverse range of sustainable treatment facilities exist to treat and recover resources from all waste streams and manage residuals in an environmentally acceptable manner.

Outcome 6 Information and data related to waste generation, minimisation and life cycle assessment are continuously collected, analysed and reported.

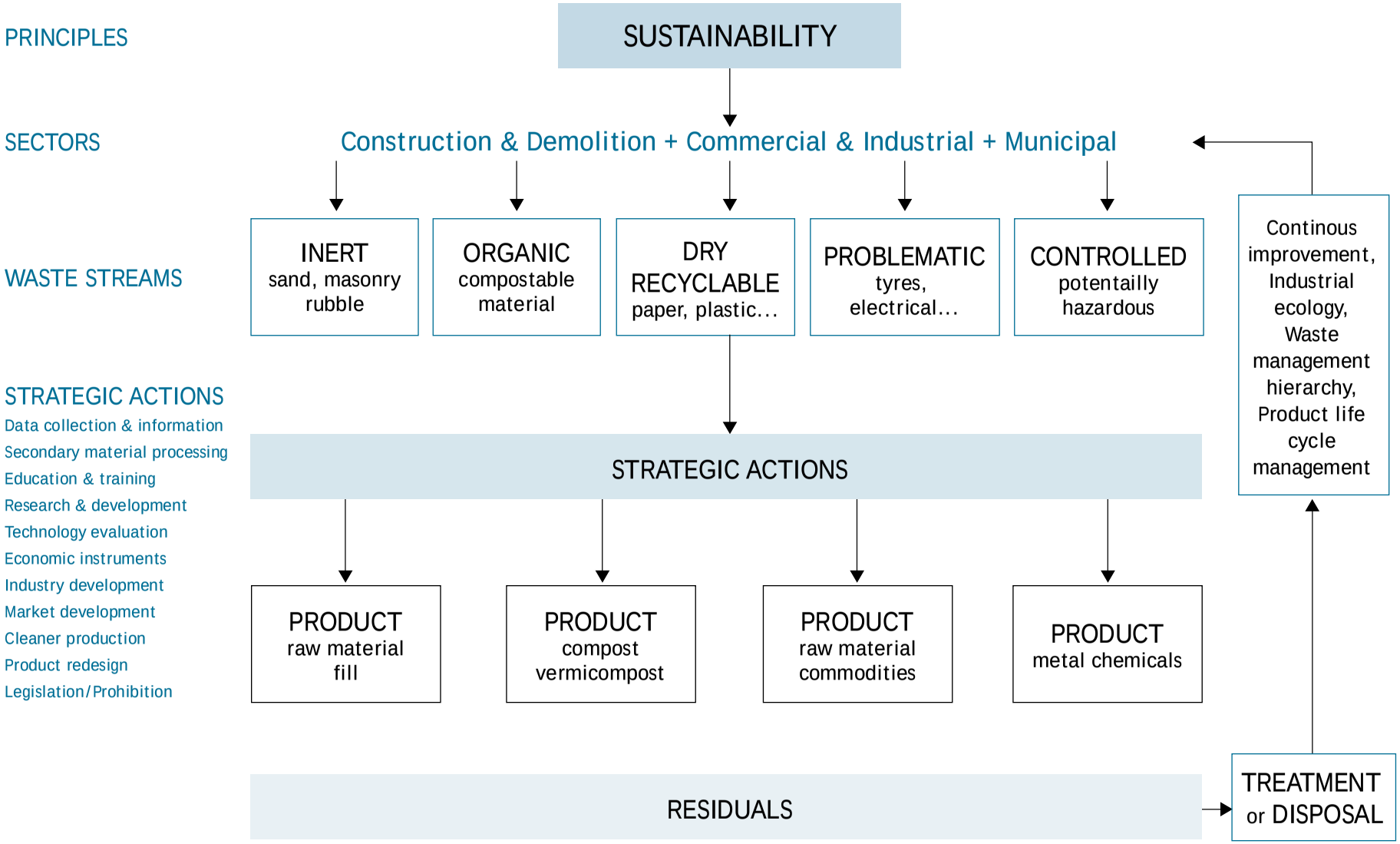
Outcome 7 Residual waste streams are continuously assessed and analysed and actions are taken to achieve enhanced recovery.

Outcome 8 The community is well informed and, as a result, each individual assists in the effective management of wastes that are by-products of our lifestyle.

Outcome 9 A comprehensive regulatory framework that is transparent and effective in ensuring the environment and community's health, is safeguarded.

These outcomes reflect the new paradigm and, together with the principles described above, form the basis for action planning.

Figure 1: Application of the zero waste model for sustainable resource use



1.5 Application of new paradigm to solid wastes

The Zero Waste Model is described in schematic form in Figure 1. This figure illustrates the cycle of continual improvement necessary to achieve the new paradigm, under the overarching principle of sustainability.

The model separates the activities that lead to waste production (sectors) from the categories of waste that are commonly produced (streams). It identifies the "strategic activities" which will result in a series of products from the waste streams. Residuals from these products will be managed until technologies are available to extend recovery and re-use. The goal is to reduce the waste stream, maximise the volume of materials recovered and recycled from existing streams, and minimise the residual component of the waste streams – in effect, zero waste.

Over time, continuous improvement in the waste management hierarchy will be achieved through the application of the principles of the new paradigm – industrial ecology, waste sectors, product life cycle management and environmental justice. This will ultimately result in a closed cycle where waste is no longer produced.

1.5.1 Sectors

At this layer in the Zero Waste Model human interaction occurs that leads to the production of solid wastes. A range of sectors has traditionally been held responsible for waste generation and management of distinct waste streams. In reality, the sectors produce waste in the common streams – inert, organic, dry recyclable, problematic and controlled - in varying amounts.

Common to all of the sectors are individuals who actually produce the waste. The extent to which individuals recognise that the collective impacts of wasteful choices are not sustainable, will finally decide the success or failure of the Zero Waste Model. Individual choices ultimately affect the production or prevention of waste.

1.5.1.1 Construction and demolition

The largest component of waste to the waste stream by weight in Western Australia consists of material and soils generated through construction and demolition activities. The materials generated by this sector are often natural materials (sand, limestone aggregate or products closely related to natural materials, concrete and bricks) and therefore largely inert. As a result, they represent a lower level of environmental threat than the waste streams generated in other sectors. Measured by weight, this source constitutes over 50% of existing waste streams.

The largely inert nature and natural origin of the wastes produced in this sector mean that they are not the highest priority for action. Also, under strict control and where it can be demonstrated that it is occurring for the purpose of rehabilitating a landform or creating a landform that is of benefit to the community, disposal of inert materials to a Class 1 landfill may be treated as a form of resource recovery.

Applying the Zero Waste Model in this sector has great potential to reduce the volume of inert waste directed to conventional landfill. Actions to facilitate this would include source separation during construction and demolition to improve the recovery of individual resources such as plastics, metals and timber. The use of the recycled materials in design or construction would assist recovery further. The removal of hazardous material, such as asbestos and PCBs, from construction will allow more complete recovery of resources from the construction and demolition waste sector in the future.

1.5.1.2 Commercial and industrial

This sector covers commercial, small and medium size enterprises, as well as general and heavy industry. Commercial and industrial facilities generate a diverse range of waste streams from a range of operations, including but not limited to processing and manufacturing industries, service, trade, transport and distribution. Waste originating from mining, minerals and energy production, agriculture and marine activities is not within the scope of this strategy and may require future attention.

The commercial and industrial sectors disposed 391 791 tonnes of waste to metropolitan landfills in 2002. The total amount generated in Western Australia is most likely significantly higher, with some commercial and industrial waste being recycled, in particular glass, cardboard, metals and plastics. Data on the composition of this sector's waste is incomplete, with only 30% of the total materials specified, the remainder being classified as mixed wastes.

Eco Office programs can assist resource recovery in these sectors. In these programs, materials are sorted at source, recycling activities are encouraged, and waste auditing undertaken so that each business unit knows what wastes are sent for disposal and the potential for those wastes to be recovered or avoided. This sector can also reduce the packaging of materials or products and include the cost of waste disposal in the price of goods. This is particularly relevant for hazardous wastes such as paints, acids and cleaning products.

1.5.1.3 Municipal

Local Government Councils are responsible for the collection and disposal of municipal solid waste in Western Australia. The municipal sector comprises of solid waste refuse from domestic households other than recyclables separated at source.

A variety of collection systems currently operate ranging from single bin collections, multiple bins to segregated bins, depending on the waste operations in the local area. The most common collection methods include weekly municipal solid waste collections in mobile garbage bins, predominantly fortnightly collections of traditional recyclables in either mobile garbage bins, crates or bags, and six monthly verge-side collection of either mixed waste or green and other waste including whitegoods and furniture.

Recycling the domestic waste stream targets all the materials disposed of from a domestic residence. Typically, 60-70% of domestic waste consists of organic materials and approximately 20% comprises dry recyclables such as aluminium, steel, glass, plastic and paper. The remaining material typically comprises problematic and hazardous wastes and all other contaminated non-recyclables. This data varies demographically but represents typical resource potential from a domestic waste stream.

Therefore, in excess of 80% of the domestic waste stream is available for recycling, with the largest potential from the organic waste stream. Many Regional Councils are investing in resource recovery technologies to achieve this. The facility at the Southern Metropolitan Regional Council of Western Australia recovers and composts a large portion of organic material in the domestic waste stream. The community can participate in these programs by understanding the requirements in their local area and separating their wastes as per the Council's requirements. These requirements have been designed to ensure maximum resource recovery and minimise contamination of their processes. It is only through active participation that contamination of the recovered material can be avoided.

1.5.2 Waste streams

The Zero Waste Model recognises that each sector generates components of the typical waste stream in varying proportions. This section defines these waste streams and details the preferred use or output of the recovered materials. It will also identify factors that may limit the recovery and best use of the materials from the residual waste stream.

1.5.2.1 Inert waste

The primary sources of these materials can be summarised as follows:

- The construction of new buildings. This produces wastes from two principal sources:
  - The preparation of building sites where excess or unsuitable materials, for example sand or limestone are removed offsite in order to produce a level site for construction. Increasingly these virgin materials find their way to inert landfill sites because this is the most expedient and economically viable option; and
  - Interim and post-construction cleanups of wastes from the construction process where materials are removed offsite, principally to inert landfill.
- The construction of new housing subdivisions and major road or freeway systems. Here, unsuitable soils, for example poor compacting peat-based soils or clays cannot be usefully retained onsite and are removed to inert landfill. Housing development is increasingly infilling areas of poorer soil types as the easy-to-develop free draining land is built out. As a result, volumes of materials from this sector are growing

- The demolition of old buildings, such as industrial or office buildings and homes. Typically some of the waste materials from demolition are salvaged and recycled, but the bulk is disposed of to inert landfill.
- Soils associated with old buildings and plant being demolished. Typically these wastes are sourced from old industrial sites where previous activity, in some cases conducted over 100 years ago, has led to contamination of the soil. In these cases detailed environmental assessment of the soils and site remediation requirements will dictate whether the waste material is remediated onsite, treated offsite and/or removed to landfill.

1.5.2.2 Solid organic waste

Green waste comprises vegetation from land clearing, public park and garden maintenance, roadside maintenance, sawmills and household gardens. Organic wastes originate from household food waste, commercial food waste and biosolids, litters and animal manures from intensive housing of livestock and poultry, and organic sludges. These wastes and non-recyclable paper and cardboard are possible compost feed stocks. This is not considered the optimal use for paper and cardboard which should be managed as a dry recyclable. Disposal methods include landfill and burning.

One of the factors limiting the effective composting of this waste stream is contamination from heavy metals, glass and plastics. While technologies exist that claim to be able to separate these contaminants, it is more effective to separate at the source. At a minimum, consideration should be given to the separation of the green and organic fraction from the dry fraction of the waste streams.

This would be a significant departure from existing kerbside collection systems but would improve the materials handling of this resource and the quality of the final product.

Production of quality compost will also increase the value of this product and maintain sustainable markets.

1.5.2.3 Dry recyclables

This stream is made up of traditional recyclable materials that are familiar to council kerbside collection and are largely generated from packaging. This includes glass, paper, plastic, cardboard, aluminium and inferior metals. These materials are readily separable with minimal contamination by mechanical means and as such are suitable to recovery. Product quality is only affected when the materials are contaminated with organic matter.

In Western Australia, we face problems of long transport distances and the high cost of back-loading waste packaging materials for recycling. There are few end-use markets for recycled packaging materials. We need viable long-term markets, and increased remanufacturing and re-usable packaging. A change in culture is also required at both the industry and household levels; for such a culture change we need an education policy based on sustainability.

The move towards zero waste must go beyond simply recycling more bottles and cans – there must be a fundamental redesign of industrial production and an increased recycled content for new packaging. Where possible, companies should incorporate all the Rs – Reduce, Re-use and Recycle – into their packaging as well as their products.

1.5.2.4 Controlled wastes

Controlled wastes are defined by regulation or policy as having physical, chemical or other properties that make them an environmental or health hazard. Because of their hazardous properties, more stringent controls are required over the production, transport and disposal or treatment of these waste types.

Comprehensive Controlled Waste Regulations, an extension of the *Environmental Protection (Liquid Waste) Regulations 1997*, will regulate the way in which these wastes are managed, but they will control the materials after generation and how they are presented for disposal. We need to prevent the generation of these wastes. Alternative materials or product substitution to less hazardous materials may be appropriate in some cases; end-of-life costs should be factored into the price of products; facilities must be provided to effectively recover these wastes in order to avoid chronic pollution in landfills. This is particularly relevant for household hazardous wastes.

1.5.2.5 Problematic wastes

Problematic wastes result from everyday consumption and are beyond the scope of the proposed Controlled Waste Regulations. However, all of these wastes have the potential to cause chronic environmental problems, especially contamination of groundwater. Under specific conditions, such as difficult-to-control subterranean fires in landfills (typically tyre fires), these wastes can have acute environmental impacts.

These wastes will become more of a problem as we rely increasingly on waste sorting and processing facilities and move away from landfill. They have a high potential for contamination or damage and therefore require sophisticated resource recovery infrastructure and separate management systems.

The following are examples of problematic products:

- Tyres;
- Electrical waste;
- Laboratory waste;
- Household hazardous waste;
- Waste oils; and
- Rechargeable batteries.

To effectively manage these wastes, it is essential that appropriate investment is made in infrastructure and that the price of the product includes end-of-life costs to support the technologies required.

1.5.2.6 Residuals

Residuals are the mixture of wastes that are left over after all practical recovery actions have been exhausted. We can consider wastes that currently go to landfill as residuals.

To become more efficient resource managers, we need to understand the waste stream and the reason why it is generated. Often, it could be as a direct result of the collection system that mixes wastes, reducing our ability to recover materials.

The Zero Waste model does recognise we will not achieve ideal systems overnight, so careful management of these residuals is essential as an interim step to zero waste. Technologies that can recover energy may prove appropriate.

While moving towards zero waste, we may still need to retain some landfill capacity. It may be necessary to accept waste that cannot be currently treated or recycled, as well as to provide a contingency disposal option in the event of shortfalls in treatment capacity due to breakdown or unexpected increased in waste production. Retention of the Intractable Waste Disposal Facility at Mount Walton would be required, both to maintain the integrity of residuals currently buried onsite and to accept occasional small quantities of low-level radioactive or intractable waste. Arsenic trioxides from gold mines, that cannot be treated to render them safe, need facilities such as Mt Walton. It is the reduction and elimination of residuals that is the key performance indicator for the achievement of zero waste.

1.5.3 Strategic activities

To address the waste streams that have been generated by the different sectors identified in Figure 1, a series of strategic activities are necessary. The strategic activities are important because they establish the necessary mechanisms to achieve the Towards Zero Waste objective.

Once the necessary structure is in place, it will be beholden upon these groups to undertake their roles and responsibilities to achieve the Towards Zero Waste vision. Many of the following strategic activities could be supported financially through the Waste Management and Recycling Fund (the Fund). Those strategic activities that will facilitate achieving the objectives of the Fund and the Towards Zero Waste vision, will have a greater opportunity to access funding.

The Western Australian Government envisages the following roles and responsibilities in relation to solid waste management in Western Australia.

State Government will:

- Continue to set policy and provide broad strategic direction;
- Regulate the waste industry;
- Educate and consult with the community in relation to waste matters; and
- Facilitate changes by:

  - maintaining the State's Business Plan for waste;

  - being a forum and catalyst for innovation and exchange of information and ideas; and

  - managing the levy/rebate system.

Local Government will:

- Be responsible for ensuring the provision of effective municipal waste collection and management services within its boundaries;
- Educate its local community; and
- Continue to be an operator where appropriate.

Private industry will:

- Increasingly become the service provider;
- Have responsibility for the life cycle of their products and production systems; and
- Facilitate waste reduction through increasing improvements in cleaner production processes.

The strategic activities link the theory of the Zero Waste Model to the actions outlined in Part 2 of this document that are necessary to achieve success in practice.

1.5.3.1 Data collection and information

In order to move forward efficiently, we will require good quality, readily understandable data on all aspects of the waste stream. This will be achieved by:

- Use of standardised classification and nomenclature for waste at a national and State level;
- Maintaining effective and efficient systems to collect and interpret data on waste at all stages of the cycle; and
- Developing and using effective tools for auditing and analysing waste streams to identify the makeup of residuals so that action can be taken prior to the creation of wastes.

Analysis of the data will result in the formulation of effective responses to make changes in the waste stream and to further reduce the quantity of residual waste requiring final disposal.

1.5.3.2 Secondary material processing

A range of environmentally suitable and commercially viable treatment and recovery technologies will be available. Government will perform normal environmental due diligence on these technologies, both on a site specific and non-site specific basis.

In the early years of this strategic plan we may need an independent body to evaluate these technologies. However, by 2020, we will have addressed the problem of mistrust within the community of waste treatment and management and no longer require such a panel.

1.5.3.3 Education and training

Waste education has a strong and measurable impact on people's capacity and willingness to adopt waste minimisation and sustainable living activities. Waste education will influence the knowledge, skills, values and ultimately the behaviours of all Western Australians to motivate and encourage long-term sustainable changes that lead us towards a waste-free society. Waste education will be part of the normal primary, secondary and tertiary school curricula to be most effective.

In the short term, Government will identify the strategic direction and priorities and develop a range of formal and informal programs, both short and long term, aimed at informing and educating the community. The Department of Environment's role will be to monitor the trends in data on the waste stream and to provide targeted programs which react to the new trends identified and help to link the information to specific learning outcomes desired by the formal education sector.

1.5.3.4 Research and development

Research and development plays a fundamental role in implementing the Towards Zero Waste vision. The ability of the Waste Management Board to provide effective and timely advice to Government is improved through the development of research programs that support the Strategic Direction.

In addition, strategic arrangements with private research institutions and organisations can lead to greater innovation and product redesign. This will help industry and the community to achieve the vision of the Strategic Direction.

1.5.3.5 Technology evaluation

There are technologies to improve the ability of facilities to process waste. As the State moves towards greater resource use efficiency, the ability to analyse the new technologies that enter the market, increases in importance.

The Waste Management Board will develop appropriate mechanisms to assess and compare the adequacy of the new technologies, and thereby enhance the Board's decision-making processes.

1.5.3.6 Economic instruments

The Government has committed to the principles of sustainability, as outlined by the draft State Sustainability Strategy. In the Strategy, one of the techniques identified for achieving sustainability is the economic valuation of environmental and social assets. The development of markets and the use of positive and negative economic incentives can also improve waste management in Western Australia.

The Resource Recovery and Waste Avoidance Bill will provide the legal framework for the use of economic instruments to address appropriate valuation of resources. In addition, the Bill will be able to limit socially unacceptable practices through increasing financial restrictions and supporting other actions such as market development, technology improvement and industry development.

1.5.3.7 Industry development

Geographical constraints related to our location and the lack of a large manufacturing base will constrain industry development in Western Australia. However, these limitations can be overcome, and even result in greater levels of innovation and organisational competitiveness.

1.5.3.8 Market development

Sustainable waste management relies on the existence of markets for the materials created through the processing of waste. Previously, effort has mainly been directed to promoting increased activities such as recycling. The promotion of demand for the products generated from recycling resources has received less attention.

The Government's role will include improving the recovery of resources and increasing the alternative use for these resources. The development of strong markets will also contribute to driving investment in innovative practices and technologies and industry development.

1.5.3.9 Cleaner production

Cleaner production is the continuous application of an integrated preventative environmental strategy. It aims to apply processes, products and services to increase eco-efficiency and reduce risks to humans and the environment. Cleaner production seeks to eliminate the causes of pollution, waste generation and resource consumption at the source.

The role of the Department of Environment is to promote and facilitate the development of cleaner production principles within industry. Through the adoption of these principles, the goal of Towards Zero Waste is promoted and industry efficiency and innovation encouraged.

1.5.3.10 Product redesign

Facilitating change through the new paradigm for waste in Western Australia will promote the re-engineering and redesign of products. Through programs and policies developed by the Government, industry and consumers will be encouraged to review their habits, consumption and manufacturing practices. A community that is educated and aware of the environmental, social and economic impacts of unsustainable products and practices, will make purchasing decisions that promote the development of new products and product redesign that is no longer damaging to the environment.

1.5.3.11 Legislation

By 2020 we will have policies in place that:

- Discourage waste production across all areas of government;
- Encourage recovery, re-use and recycling; and
- Ensure safe handling of all wastes.

We will have legislative frameworks with the necessary tools to prevent waste creation. There are a variety of tools available, including: extended producer responsibility; levies; taxes; bans on products; ability to legislate for incentives or rebates; coercive powers to direct recalcitrant industries, State Government agencies, local governments or members of the community.

A modern, effective regulatory framework will exist that gives the community confidence that waste treatment facilities will operate safely throughout their lives. The framework should be built around the following principles:

- Polluter pays;
- Openness and transparency (the community's right to know);
- Continuous improvement with community involvement;
- Prompt and appropriate action to rectify inappropriate behaviour;
- Equity for all parties, including the operator; and
- Incentives to encourage the community, industry and government to work at the highest possible level in the waste hierarchy.

2 Strategy for achieving zero waste

2.1 Introduction

This section is the pivotal part of the Strategic Direction, and outlines the strategic actions for achieving zero waste in Western Australia. In developing these tables it is recognised we are not a zero waste society and the strategic actions identified are transitional to achieving this vision, with many focussed on managing our wastes.

2.1.1 Strategic actions for achieving outcomes

The outcomes being pursued by the Western Australian Government are seen as fundamental to achieving the vision of this Strategic Direction. The following tables outline the actions to be taken to achieve zero waste. The tables contain the following information:

- Key objectives;
- Strategies to achieve each key objective;
- Performance indicators to measure the achievement of the objectives;
- Responsibility for implementing the strategy; and
- Timeframes in which to achieve the actions.

The performance measurement, identification of responsibilities and establishment of priority timeframes against each action will be discussed and negotiated as a key feature of consultation prior to finalising this Strategy.

2.1.1.1 Outcome 1 - Sustainable processes

Manufacturing and other industrial processes are operated in a sustainable manner that minimises the quantity of wastes produced.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
A policy framework is established to facilitate the adoption of cleaner production	Develop a range of grants, rebates and awards for the achievement of cleaner production targets			
	Develop training programs for staff within local and state government to promote cleaner production as part of their job responsibilities			
	Develop partnership programs to facilitate the transfer of knowledge of cleaner production programs and waste minimisation			
	Promote the development and adoption of eco-office programs			
Industry investment in design and plant and equipment upgrades reflect the principles of cleaner production	Negotiate tax incentives with Federal Government for investments in cleaner production infrastructure			
	Support for cleaner production initiatives is identified			
	Develop education and research programs for industry in cleaner production			

2.1.1.2 Outcome 2 - Sustainable products and services

Products and services sold in Western Australia are designed and/or packaged to minimise waste production and facilitate recovery and re-use of secondary resources.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Problem wastes and products have been identified	Audit residual waste streams from material recovery facilities (MRFs), secondary waste processes and landfills			
	Research international and national trends in waste and products			
	Develop a priority list of problem wastes and/or products			
Industry accepts responsibility for its role in post consumer waste and shares in identifying solutions.	Review the National Packaging Covenant to strengthen industry action plans			
	Develop a policy statement on product stewardship and extended producer responsibility			
	Industry to invest in product research and infrastructure to redesign products and services to enhance resource recovery and minimise residuals			
	Levies are developed to manage problematic wastes and products at their end of life			
	Set targets for the recovery of problem products			

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Industry invests in product research and infrastructure to redesign products and services, enhance resource recovery and minimise residuals	Enhance the operation of the National Packaging Covenant			
	Introduce levies to manage products at end of life			
	Maintain and enhance the kerbside and other collection systems to support resource recovery			
	Set targets on recovery of problem products (e.g. computers)			
	Support programs to develop markets for recovered materials			
Stable markets have been established for recovered materials	Support market development for recovered materials through influencing purchasing choices			
	Maintain kerbside and other collection systems to support the recovery of resources for market development			
	Research market development opportunities for recovered materials from priority wastes			
Government agencies adhere to the principles of the Sustainable Procurement Policy	Encourage government procurement of recycled materials			

2.1.1.3 Outcome 3 - Segregation at source with resource recovery

All wastes are segregated and sorted close to source in a manner that optimises resource recovery for higher end uses.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Most efficient collections systems are employed to maximise the value of recovered materials	Establish a cost benefit model to standardise comparison for various collection systems			
	Publish and promote a range of collection models for resource recovery			
The highest economic value of recovered resources is achieved	Establish sorting facilities at transfer stations for all waste streams			
	Adjust the Resource Recovery and Rebate Scheme to reward and support higher end use of recovered materials			
	Identify the barriers to resource recovery			
Government and stakeholders agree on the principles of segregation at source for waste management	Finalise the Zero Waste Model and promote the model and the principles that underpin it			
	Establish agreement on the hierarchy of resource recovery by commodity			

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Policies and legislation exist that support waste segregation and treatment	Establish regulations to restrict direct entry to landfills without prior sorting of specified wastes			
	Research best practice in waste segregation and treatment and establish research linkages			
	Implement a licensing and tracking system for vehicles that enter landfills			
	Provide incentives for Resource Recovery Centres through an increased levy on waste to landfill			

2.1.1.4 Outcome 4 - Reduce hazardous components to minimise risk

Hazardous components in goods and services are substituted to increase resource recovery options.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Hazardous components and contaminants that impede waste treatment and recovery have been identified	Research policy and practice nationally and internationally to identify methods to reduce hazardous components of the waste stream			
	Identify priority hazardous components and require regular reporting			
	Modify the National Pollutant Inventory to collect data on hazardous wastes			
Policies and programs exist to avoid impacts of hazardous wastes	Develop cleaner production programs for industries producing hazardous wastes			
	Encourage industries producing hazardous waste to adopt stewardship programs to recover hazardous materials			
	Prohibit disposal and/or apply differential levies to discourage disposal of hazardous wastes			
	Develop guidelines for alternatives to hazardous components			
	Develop a Household Hazardous Waste Education Program			

2.1.1.5 Outcome 5 - Comprehensive suite of treatment facilities

A comprehensive and diverse range of sustainable treatment facilities exists to treat and recover resources from all waste streams and manage residuals in an environmentally acceptable manner.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Policies and legislation for managing the waste stream and treatment and disposal facilities have been developed	Develop siting and operational criteria, with stakeholders agreement, for the main classes of treatment facilities			
	Identify appropriate waste technologies for Western Australia			
	Develop guidelines for best practice treatment facilities and residual wastes			
Stable markets exist for the treatment and recycling of wastes	Research markets for the treatment and recycling of waste			
	Develop programs to establish the markets for resource recovery and treatment			
	Monitor markets for the treatment and recycling of wastes			

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
A range of innovative and competitive technologies for resource recovery are available	Promote business and export opportunities for resource recovery technologies			
	Pursue investment opportunities for resource recovery technologies			
	Pursue opportunities for international conferences to be hosted in WA to showcase resource recovery technologies			
	Infrastructure exists for the safe treatment and disposal of residuals			
	Encourage the application of acceptable treatment options for residual wastes based on accepted guidelines			
	Refer to regulatory provisions outlined in Outcome 9			

2.1.1.6 Outcome 6 – A comprehensive data and information system

Information and data related to waste generation, minimisation and life cycle assessment are continuously collected, analysed and reported.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
A comprehensive and clear waste classification, measurement and reporting system exists and is used across WA	Develop waste auditing protocols			
	Develop a waste classification system			
	Develop a policy position on data reporting			
	Undertake an audit of waste generation to determine baseline data			
	Develop a centralised data storage system across all waste streams			
Impediments to resource recovery in the waste stream are understood	Research and analyse residual wastes			
	Develop programs to link litter survey and illegal dumping data and residual data, to problem wastes and producers			
	Waste disposal and production trends are reported			
	Analyse data and report by waste stream			
	Provide feedback on priority wastes and set targets for improvements			
	Obtain support to develop and maintain websites to facilitate the communication of information on waste			

2.1.1.7 Outcome 7 – Continuously minimise residuals

Residual waste streams are continuously assessed and analysed and actions are taken to achieve enhanced recovery.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Continuously reduce the amount of residuals in the waste stream	Support household hazardous waste programs within the community to remove contaminants in integrated resource recovery			
	Establish targets for reducing residuals in the waste stream			
	Undertake research into different options to achieve continuous reduction in residuals			

2.1.1.8 Outcome 8 - An informed and participative community

The community is well informed and, as a result, each individual assists in the effective management of wastes that are by-products of our lifestyle.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
The community are informed and responsible for the management of waste	Survey the community to establish baseline data on its knowledge of the waste stream, the hazards posed by waste and waste management facilities			
	Report to the community on data collected on the waste stream (this data has been collected through Outcome 3)			
	Develop and implement programs to communicate information to all stakeholders on waste reduction activities and purchasing			
Consumers are informed about the impacts of product choices and use this information in purchasing decisions	Survey consumer choices about problem wastes			
	Develop programs to influence consumer and industry to reduce problematic wastes			
	Publish the priority lists of problematic wastes			

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Community participation rates for cleaner production, waste reduction and recycling programs continuously improve	Audit community participation rates in cleaner production, waste reduction and recycling programs to establish benchmark figures			
	Survey the community to discover impediments to participation in cleaner production, waste reduction and recycling programs			
	Promote and report on targets for community involvement			
	Assist with the development of educational programs on cleaner production, waste reduction and recycling to encourage behavioural change			
	Develop a policy statement on how to improve community access to information			

2.1.1.9 Outcome 9 - A comprehensive regulatory framework

A comprehensive regulatory framework that is transparent and effective in ensuring the environment and community's health, is safeguarded.

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
The policy and regulatory framework has been established for waste management	Undertake research and consultation to identify gaps or shortfalls in the current policy and regulatory regime			
	Develop an open, regulatory framework agreed between Government and stakeholders			
	Identify problematic wastes and use the appropriate policy measures to manage these wastes			
	Develop a policy statement on the preferred hierarchy of options for managing wastes			
	Publish a State Waste Minimisation Policy			
	Develop a policy statement on the transportation of hazardous and controlled wastes			
Community confidence in the regulatory system is established	Allocate resources for the regulatory agency to implement legislation			
	Undertake strict policing of illegal or improper disposal			

Key Objective *What needs to be done?*	**Strategies** *How will the objective be achieved?*	**Measurement** *What are the performance indicators?*	**Responsibility** *Who will implement strategies?*	**Timeframe** *When will it happen?*
Industry reports on waste generated and stored, to allow monitoring to identify problem waste streams and industries	Collect data on waste streams, facilities and performance (see Outcome 3)			
	Ensure appropriate legislation exists to require data collection and reporting			

2.2 Milestones and goals

The Strategy includes objectives for each of the outcome areas. They have been selected to be both practical and challenging and to take account of the strong interest of the community, business and the waste management industry in making substantial improvements in waste avoidance and resource recovery. Some of the initial proposed policy actions are outlined below.

2.2.1 Initial policy actions for 2003-2005

Policies	Timeframe
Development of the Resource Recovery and Waste Avoidance Bill is initiated to ensure consistent legislation for the effective and efficient implementation of WAste 2020 policies and strategies.	Immediate
Work with the community to identify appropriate hazardous/industrial precincts in the Perth metropolitan area.	Immediate
Waste Management and Recycling Fund Review Paper released for comment.	30 September 2003
Initiate development of policies with Stakeholders on mechanisms to support waste avoidance goals, including product stewardship, extended producer responsibility and voluntary agreements.	31 December 2003
The State Government ensures that adequate resources are provided for the implementation of WAste 2020 policies and strategies through the Waste Management and Recycling Fund.	31 December 2003
Government endorsement of any changes to the Landfill Levy and Waste Management and Recycling Fund.	28 February 2003
Framework established for expenditure of the Fund on programs in cleaner production.	30 June 2004
A whole of government policy on the procurement of recycled products has been established.	30 June 2004
New landfill levy rates in place, with an annual review mechanism.	30 June 2004
A comprehensive Strategic Plan for Waste Management in WA will be in place.	31 July 2004
Establish reporting mechanisms for waste data and information systems. Data to be published on various waste streams.	31 January 2005
The State Government will require all its agencies to be accountable in their annual reports for their performance in recycling and the use of recycled products.	31 December 2005
Initiate policy development on banning greenwaste from landfill	31 December 2005
Commence implementation of the 2006-2010 Strategic Action Plan.	31 December 2005

2.2.2 Proposed targets for 2003-2020

We need to stabilise the amount of waste we generate in WA. This is necessary to stem the current trend of increased waste generation and to allow time to adopt and activate a detailed waste prevention strategy.

Increased recovery and use of secondary materials is receiving more attention with the exhaustion of landfills in metropolitan and regional areas. It is proposed that the following combined Minimisation and Resource Recovery targets are achieved by 2020 (Table 1). This will be accomplished through the commitment to the Strategic Direction for Waste Management by all stakeholders.

Table 1: Combined waste minimisation and resource recovery targets

Stream	Current (%)	2005 (%)	2010 (%)	2015 (%)	2020 (%)
Inert	N/A	60	90	100	100
Organics	N/A	50	75	85	95
Recyclables	N/A	70	90	100	100
Problematic	N/A	33	50	67	80
Hazardous	N/A	25	40	60	75

Recovering additional tonnages for reprocessing will not happen in a regular, linear fashion. Installation of new plants depends on investment decisions, satisfying planning and community consultation requirements and sourcing feedstock. Experience to date suggests that this can take up to five years. Product redesign or new reprocessing systems also take time.

2.2.3 Reaching goals through strategic action plans

A detailed Strategic Action Plan for 2003–2005 will be completed with the feedback from stakeholder response to this document. This Strategic Plan will be updated annually, with an operational budget for the year ahead, against which targets will be measured. The three-year forecast will be maintained, extending the action plan each year. In addition, the Waste Minimisation and Resource Recovery Targets until 2020 will be updated annually and Strategic Action Plans adjusted accordingly.

3 Transition to the new paradigm for soild wastes

3.1 Introduction

The current situation in Western Australia is based on waste management rather than resource stewardship. We must move from the current practice to the new paradigm.

The current waste industry is structured around disposal. Too often the quantity and hazard of waste has been held to be the responsibility of waste managers and within their capacity to control. Yet the problems have been produced elsewhere. As the limitations of the old system become clear, questions are being asked on how to devise an alternative system for reducing and neutralising the damage done by waste.

Waste must be connected back to the wider industrial system. Only through shifting the responsibility to the producers will we have the opportunity to change the design process which produces waste products.

This section of the document sets out the current waste management situation in Western Australia and the philosophical background of the Zero Waste vision proposed by the Board.

3.2 Current situation in WA waste management

3.2.1 Growing waste streams

Waste accounting systems were initiated through the Landfill Levy Scheme in metropolitan Perth. The estimated amount of wastes sent to landfill for disposal in Perth in the year 2002 was about 2.5 million tonnes. The National Waste Classification system defines three primary solid waste sectors: construction and demolition, commercial and industrial, and municipal. The contribution from the three sectors to landfill waste for 2002 is shown in Table 2.

The current accounting system for these waste streams still requires a variety of estimates. The lack of adequate measures at some landfills means that some data may be unreliable.

Table 2: Estimated Perth wastes (tonne) in year 2002

Sector	Tonne	%
Municipal	763,958	30.1
Commercial and Industrial	391,791	15.4
Construction and Demolition	1,385,416	54.5
Total	2,541,165	100.0

Figure 2 summarises the historical trend in solid waste generation. It is anticipated that similar amounts of material will be collected over the next few years. However, increasing separation and processing procedures will convert significant quantities of former wastes into resources for other uses. The result will be a trend of decreasing amounts of waste to landfill in subsequent years.

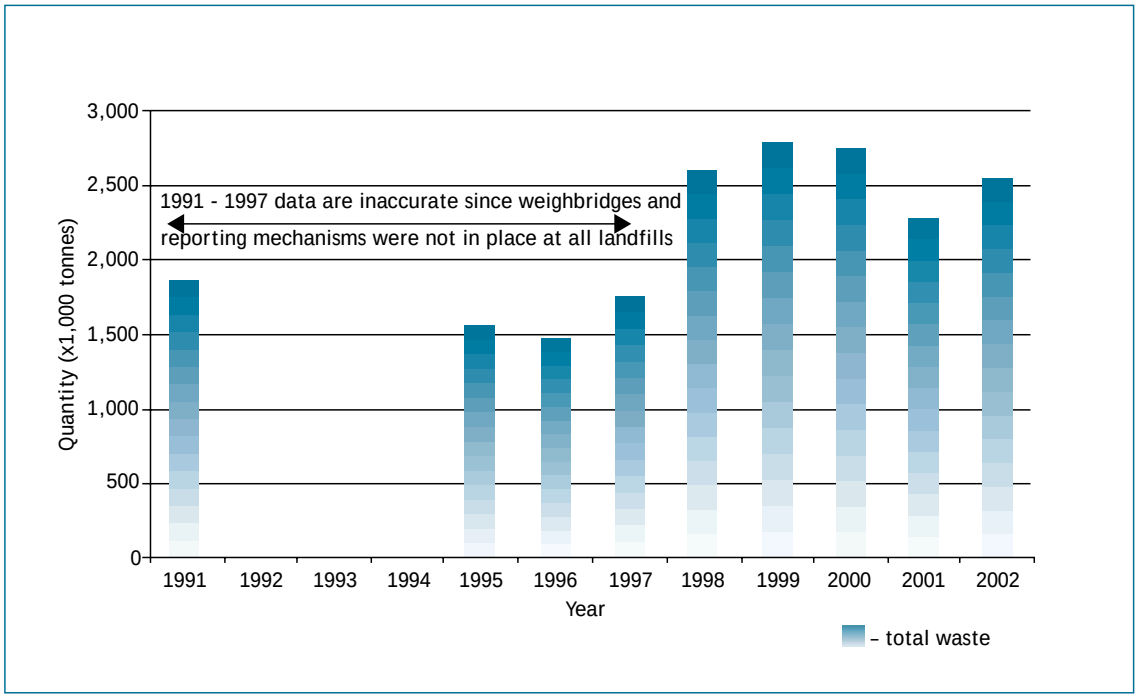


Figure 2: Waste to landfill in the Perth metropolitan region

3.2.2 Reliance on landfills in Perth, regional and rural areas

Metropolitan Perth currently has twenty landfills, seven of which can take non-inert waste. Their life expectancy is based on current landfill rates (Table 3). By 2006, the municipal landfill sites for putrescible organics will decrease from seven to four. With expected population growth and current disposal practices, it is estimated that the overall life expectancy of the remaining putrescible landfills is less than ten years. It is imperative that the predicted diversion of wastes from landfill is achieved to avoid a significant shortage of putrescible landfill space.

Table 3: Expected life expectancy of Perth landfills

Number of Landfills	Material	Landfill	Life Exp
1 x Class IV	Heavy Industrial	Red Hill, East Metropolitan	15 years
3 x Class III	Industrial and Putrescible	Red Hill, East Metropolitan Millar Road, Rockingham South Cardup	15 years 23 years 23 years
4 x Class II	Putrescible	Mindarie Ranford Road, Canning Henderson, Cockburn Hopkinson Road, Armadale	2-3 years < 1 year 11 years 10 years
13 x Class I	Inert	See separate Sector Report	Varied

Nine transfer stations service metropolitan Perth and two ex-landfill sites are used for green waste processing. There is also the Intractable Waste Disposal facility at Mount Walton for wastes that cannot be treated by other means.

The Department of Environment estimates that there were over 450 rural landfills five years ago. However, this number has been reduced significantly, to 249, since licensing of all landfills commenced in 1998.

As operators of landfills, councils typically receive significant quantities of commercial and industrial as well as some construction and demolition wastes. The sensitivity of Perth's groundwater to possible pollution, which currently accounts for 60% of the metropolitan drinking water, is making it difficult to justify new landfills above these aquifers. In recent years, the Department of Environment has licensed all landfills and has a policy that no new landfills will be permitted in environmentally sensitive areas, consistent with the Government's response to the Select Committee into Waste Management and Recycling.

All municipal landfills have limited lifetimes which, together with the imperative to minimise waste to landfill, and the inherent value in the materials being landfilled, has created a range of secondary processing activities.

3.2.3 Limited resources recovery facilities

Resource recovery is playing an increasingly important role in waste management. Primary resource recovery comprises a range of activities characterised by the recapture, treatment and/or separation of materials through mechanical and physical processes. Secondary resource recovery comprises a range of processes to recapture and treat materials or energy through thermal, chemical, or biological means.

A number of primary and secondary resource recovery facilities have operated within the Perth metropolitan area over the past 10 years. These range from material recovery facilities, which include a variety of separation processes, to various mulching and composting operations. Some large facilities are currently in the planning stage, including integrated material recovery facilities and proprietary composting systems. A number of major waste-to-energy proposals are competing to be the first to sell electricity back into the Western Power grid.

The decisions facing organisations and local government authorities in relation to the development of resource recovery technologies can be quite daunting. The technologies range from windrow to in-vessel composting, utilising biological breakdown to produce compost; waste-to-energy options range from incineration to pyrolysis in order to generate power. Anaerobic digestion can produce ethanol or biogas, depending on the bacterial cultures.

There are significant uncertainties with each of the technologies including:

- Sourcing waste;
- Costs involved;
- Separation technologies;
- Unproven processing technologies; and
- Uncertain markets for products.

Uncertainty also prevails over the optimal facilities for the management of hazardous and intractable waste, industrial liquid waste, household hazardous waste and the recycling of industrial waste. A significant strategic problem has been the increasing difficulty in locating waste processing and disposal facilities within reasonable distance of the populations which generate the waste. This essential infrastructure has not always been recognised as important in land use planning. The problem exists for all classes of wastes, from inert landfills and composting facilities to Class IV landfills for the disposal of contaminated soils.

3.2.4 Community concerns over current practices

The individual waste producers -- all of us who collectively make up the community – have a role to play. A community that understands that the collective impacts of wasteful consumer choices are not sustainable, will ultimately decide on the success or failure of the towards zero waste program.

Minimising the current and future environmental, social and economic impacts of waste in WA is totally reliant on participation and collaboration right across our society.

3.3 The future of waste management

At present there is confusion and conflict over the future of waste management, with two opposing views.

The first offers a centralised, capital-intensive system with different forms of incineration as its main tool, in reality allowing the traditional linear extraction-to-disposal economy to remain intact.

The second is the closed loop economy, featuring more complex flows and simple or specialist treatment, a decentralisation of collection and relocation of many forms of production, requiring community participation.

In future waste management must adhere to the principles of sustainability and zero waste. It will employ strategies such as the waste management hierarchy as a decision support tool and use product life cycle management to help manage product design issues. Its overall principle will be environmental justice: that regardless of income level, racial background or culture, we all have a right to a clean, healthy and productive environment.

3.3.1 Waste as a common cause

The wasteful nature of current industrial processes threatens to cripple civilisation in the 21st century. In fact, according to Hawken[2] and colleagues, we currently face not one, but three crises from waste:

- The deterioration of the natural environment;
- The ongoing dissolution of civil societies into lawlessness, despair and apathy; and
- The lack of public will to address human suffering and social welfare.

3.3.2 Sustainability

Learning to deal responsibly with waste is central to achieving sustainability. Waste is clear evidence of the unsustainable nature of our society. It occurs in every sector of the economy, raising questions about the toxicity of modern materials and the use of non-renewable resources.

[2] Hawken, P., Lovins, A. and Lovins, L.H. (1999) *Natural Capitalism: Creating the next Industrial Revolution*. Little, Brown & Co., Boston.

Addressing the problem of waste is critical to the achievement of a sustainable future globally and for Western Australia. Sustainability is meeting the needs of current and future generations through simultaneous environmental, social and economic improvement.[3]

The Western Australian Government has embraced sustainability as a fundamental driver towards a better future for all Western Australians. With the release of the draft State Sustainability Strategy, Western Australia is now also part of the global response to sustainability. There are compelling reasons why Western Australia should be part of this global agenda. While the State's economy is robust, the health of our natural environment is compromised by threats like salinity, loss of biodiversity and climate change. Sustainability challenges us to address these problems in an integrated way and to find opportunities that pursue new forms of development that do not compromise the health of our environment or society.

Excessive production of waste is ultimately a symptom of a non-sustainable way of life. The State Government is committed to minimising the production of wastes. Sustainability requires a shift toward a closed loop economy, where the wastes from one part of society become the raw materials for another and where we extract the maximum value from our natural resources.

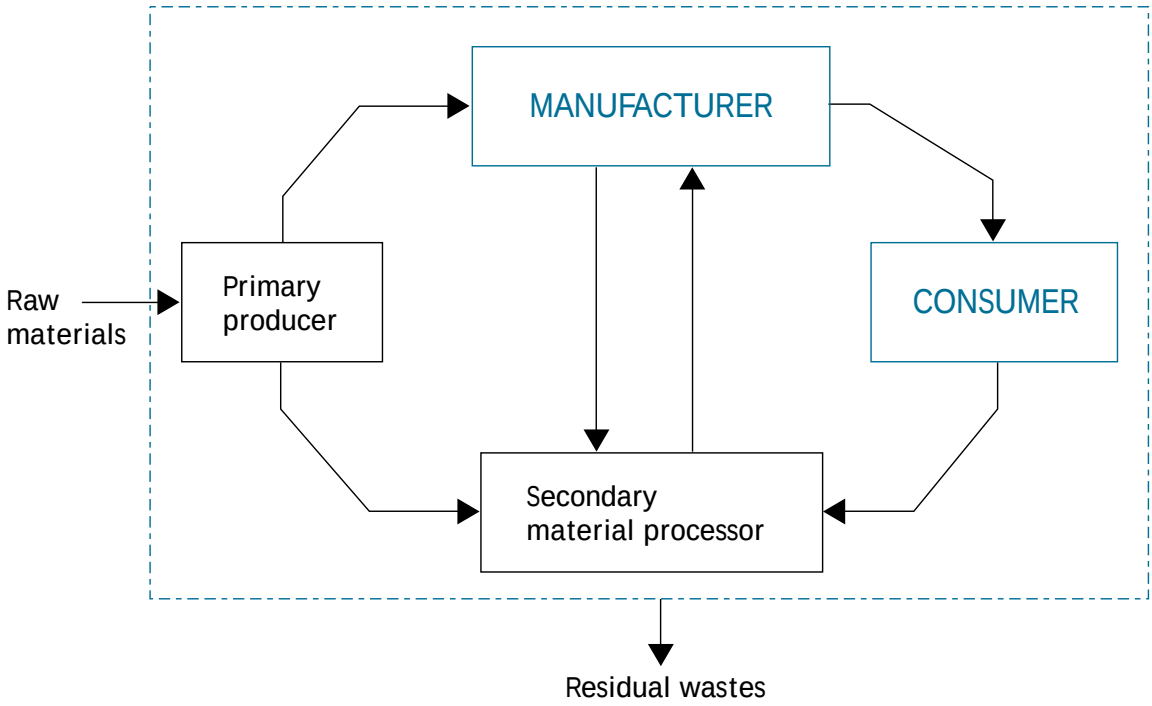
3.3.3 Industrial ecology

Industrial ecology is an approach based on systems engineering and ecological principles, that integrates the production and consumption aspects of the design, production, use and termination (decommissioning) of products and services in a manner that minimises the environmental impact while optimising utilisation of resources, energy and capital. The practice of industrial ecology represents an environmentally acceptable, sustainable means of providing goods and services.[4]

The idea of industrial ecology is based on an analogy with natural ecological systems. An ecological system in nature works through a web of connections whereby organisms live and consume each other's waste. Nothing containing useful energy or material will be lost. In the industrial context, this implies the use of products and waste products. Today we have linear systems, which recycle little and dispose of a great deal; the potential for change is vast. Ideas about industrial ecology have emerged from efforts at cleaner production and eco-efficiency; pollution prevention action is reinforced by technological developments allowing smaller scale, greater energy and materials efficiencies, and greater use of recycled materials.

As shown in Figure 3, an industrial ecosystem may be seen as consisting of four main components. These are (1) a primary producer of raw material, (2) a manufacturer, (3) a consumer, and (4) a secondary material (waste) processor. Raw materials or resources enter the system and residual wastes leave it. A successful industrial ecosystem is one that minimises both the materials required to enter the system and the residual wastes leaving it.

[3] Government of Western Australia (2002) *Focus on the Future: The Western Australian State Sustainability Strategy. Consultation Draft*, September 2002, Department of Premier and Cabinet, Western Australia.
[4] Manahan, S. (1999) *Industrial Ecology: Environmental Chemistry and Hazardous Waste*. Lewis Publishers, Boca Raton.



Source: Manahan, S. (1999)

Figure 3: An Industrial ecosystem

Greater efficiencies are possible when whole industries and networks of firms are considered. There are well-known examples of industrial parks – Denmark's Kalunberg[5] was the inspiration and now there are other examples. Cornell University is involved in some new initiatives and is expanding the scope of industrial ecology design to flexible manufacturing networks for bioregional developments. Networks of companies get together to produce collaboratively what they cannot produce individually. Cornell University insists that eco-industrial park development should bring returns on assets of 30 to 50% above the industry average.

3.3.4 The zero waste vision

The vision of waste as simply another resource is not enough. It is true that waste should be regarded as a resource, but it is not a natural resource and should be seen within a vision of a zero waste society.

The concept of zero waste does not imply just 'managing waste'. For zero waste the focus must change from waste management to industrial ecology, eco-efficiency and reducing consumption.

Ultimately the vision is to optimise consumption and products so that waste is no longer generated. Any residuals will be utilised as resource inputs into new products or services. There will be very active programs to shift to this new paradigm and minimise the production of wastes. By 2020 most waste streams will either be:

- Directly re-used or recycled;
- Treated then directed for re-use or recycling; or
- Directed to a waste-to-energy facility for the recovery of energy.

[5] Manahan, op. cit. pp. 62-5.

3.3.4.1 Leadership

There is need for Government leadership and a clear vision of the long-term alternative. Zero waste is information intensive and part of a wider project – the redesign of the system of industrial production and consumption to meet the imperatives of a post-industrial age. Products and materials must be designed and operated so that, once used, they can return again to the production circuit.

Zero waste is based on the premise of an end to cheap disposal, proposing a new, more efficient economy that exists within the limits of nature and factors in all costs to create efficiencies and competitiveness to eliminate waste. Zero waste incorporates a range of technologies to design waste out, or reduce and eliminate waste at all points along the supply chain. This requires an environment in which designers first consider the need for that product, and how to ensure there will be no waste created in production, use and final return. Zero waste involves each and every member of the community – every sector of society must be focused on the pursuit of zero waste.

3.3.4.2 Instruments to achieve zero waste

The instruments, strategies and technologies for achieving zero waste will be many and varied. Some of these are covered in the draft State Sustainability Strategy and include:

- Design for the environment;
- Design for disassembly;
- Remanufacturing;
- The need for much greater increases in productivity;
- Cleaner production;
- Dematerialisation – using less materials to create the same service;
- Extended producer responsibility; and
- Service rather than product sale.

3.3.4.3 Consumption

According to Agenda 21, the Action Plan for sustainability adopted at the 1992 Rio Earth Summit, the 'major cause of the continued deterioration of the global environment is the unsustainable pattern of consumption and production particularly in industrialised countries'.[7] The 15% of the world's population living in high-income countries account for 56% of the world's total consumption, while the poorest 40%, in low-income countries, account for only 11% of consumption.

Per capita consumption has increased and is expected to continue to follow GDP growth in the period to 2020. If everyone in the world were to live like an average person in the high income countries, we would need 2.6 additional planets to support us all, according to the Ecological Footprint Sustainability Measure, an independent measurement based on UN statistics.[8] Even current consumption and production levels, based on the global average ecological footprint, are 25% higher than the earth's sustainable resource base.

[7] United Nations (1993) *Agenda 21: The Earth Summit Strategy to Save our Planet*, Earthscan Press, Boulder, Colorado.
[8] United Nations (2002) Facts About Consumption and Production Patterns, World Summit on Sustainable Development, Johannesburg, South Africa 26 August - 4 September

Although product and technological innovations have reduced the energy and material intensity of many goods, the increase in volumes of goods used and discarded and consumer demand has outweighed many of these gains. The reasons include rising per capita income, changing demographics and changes in lifestyles.

We cannot continue to live beyond the earth's means. There needs to be a shift in the structure of consumption and production – i.e. the environmental and resource intensity is linked to different goods and services. Products of the future should use fewer resources, have lower impacts and environmental and societal risks, and prevent waste generation at the conception stage.

At each stage of the process of production, distribution, use and disposal there should be policy intervention to limit environmental impacts. At the post production stage there must be informed consumer choice and the polluter pays principle in product prices.

Some general conditions required to create a framework for sustainable consumption are:

- A price structure for consumer goods and services that internalises environmental costs and benefits;
- A policy and regulatory framework that makes clear the priorities and direction for change;

- Availability of a range of sustainable goods and services;
- An education and learning environment that motivates and enables consumer action; and
- The promotion and support of initiatives by private sector and community organisations.

A consumption policy should be an integral part of the Zero Waste Strategy. It will require a mix of instruments, focusing on the design of products and the creation of information and incentives for an efficient take-up and use of more sustainable products.

3.3.4.4 Dematerialisation

Dematerialisation is the reduction in the material inputs necessary for production, distribution and use of any good. As stated by Bakkes and van Worden for UNEP's first Global Environmental Outlook:

> "Given the assumed growth of the world's economy between 1990 and 2040, a 4 to 5 fold increase in overall efficiency is needed just to keep environmental pressure at its current level. In many cases this will not be sufficient to prevent degradation of environmental resources. Depending on assumptions made with respect to population growth, economic growth and efficiency improvements required within the next half century are estimated to be in the range of five to twenty fold. This can only be achieved by increased technological efficiency and the dematerialisation of production and consumption."[9]

A 90% reduction in energy and material intensity, what is referred to as Factor 10, is being targeted in several countries around the world. However, even Factor 10 goals are of little use if governments continue to create and administer laws, policies, taxes and subsidies that have quite the opposite effect. Inefficient and unproductive material and energy use is promoted by subsidies to such areas as mining, oil, coal, fishing and agricultural practices.

[9] Bakkes, J. and van Worden (eds) (1997) *The Future of the Global Environment: A Model-based Analysis Supporting UNEP's First Global Environmental Outlook*, UNEP, Nairobi.

3.3.4.5 Cleaner production and eco-efficiency

Cleaner production refers to the continuous application of an integrated preventative environmental strategy to processes, products and services, to increase eco-efficiency and reduce risks for humans and the environment.[10] The concept of cleaner production is closely related to that of eco-efficiency, defined by the World Business Council for Sustainable Development as 'the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with the earth's carrying capacity'.[11]

Whereas 'waste management' focuses on treating and disposing of wastes after they have been produced, 'cleaner production' seeks out and eliminates the causes of pollution, waste generation and resource consumption at their source. As such it entails materials input reduction or substitution, pollution prevention, internal recycling and more efficient production technology and processes.[12]

3.3.5 Waste management hierarchy

The Waste Management Hierarchy sets forth several waste management strategies, according to importance and preference in a descending order, as displayed in Figure 4. The Waste Management Hierarchy has taken many forms over the past decade but the concept has remained the cornerstone of most government strategies and policies. The aim of the hierarchy is to extract the maximum practical benefits from the products and to generate the minimum amount of waste.

At the top of the hierarchy is waste avoidance, followed by waste minimisation through reduction and re-use. These are waste prevention strategies and are highly preferred. Next in the Hierarchy is waste recovery and recycling. The remaining materials or residuals should be treated to ensure safe disposal. Treatment and disposal are control strategies and are least preferred under this concept. To this end, any residual wastes should be examined to determine opportunities to reduce their production through higher order strategies.

The advent of recycling programs saw the creation of a waste hierarchy that has largely been misunderstood. The three Rs: Reduce, Re-use and Recycle became an important phrase in recycling education. Unfortunately the importance of the first two Rs has been largely lost in the public's perception. The emphasis placed on recycling has achieved much to divert waste from disposal, but little to reduce consumption. To achieve zero waste, the new and expanded hierarchy will be necessary. We propose to use the hierarchy of the National Waste Minimisation and Recycling Strategy (CEPA, 1992).[13]

[10] United Nations Environment Program quoted in Gunningham, N. and Sinclair, D. (1997), *Barriers and Motivators to the Adoption of Cleaner Production Practices* report to Environment Australia, ACEL, Canberra.
[11] World Business Council for Sustainable Development (1995), Eco-Efficient Leadership, WBCSD Geneva.
[12] Gunningham, N. and Sinclair, D. (1997), *Barriers and Motivators to the Adoption of Cleaner Production Practices* report to Environment Australia, ACEL, Canberra.
[13] Commonwealth Environmental Protection Agency (1992) National Waste Minimisation and Recycling Strategy, CEPA, Canberra.

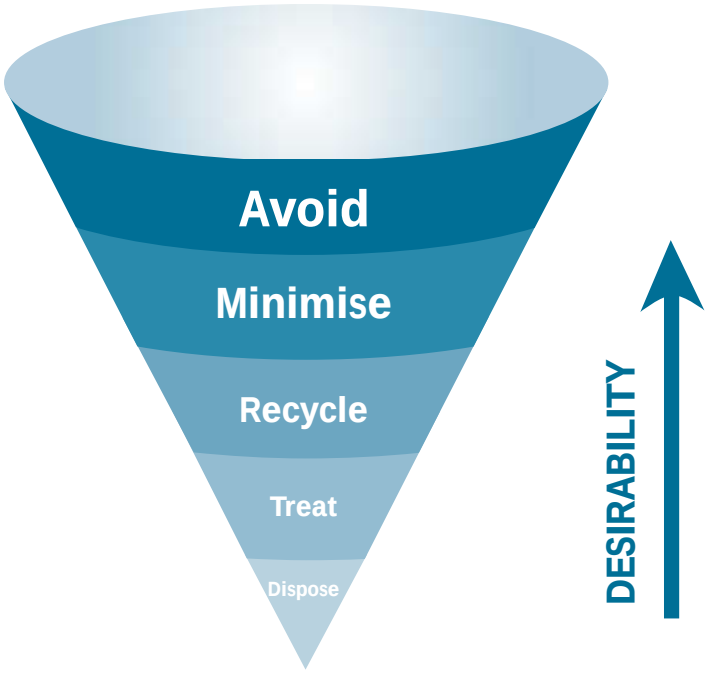


Figure 4: The waste management hierarchy

Outlined below is a brief explanation of the strategies of the hierarchy that are relevant to the Western Australian Zero Waste Model.

3.3.5.1 Waste avoidance

Individual consumption largely drives waste generation. As individuals, we must take responsibility for our choices. By avoiding unnecessary consumption, and re-evaluating what we really need and how we produce it, resources can be conserved.

Waste avoidance is the most preferred option and encompasses cleaner production activities. It is also the most cost effective; no waste means no cost is involved in its management. Producers should be examining how waste can be eliminated in production by redesigning processes and products for the environment. This can be achieved by considering if there are alternative production processes or substitutes for the raw material being used. Often much can be achieved by effective housekeeping.

3.3.5.2 Waste minimisation

This option encompasses both waste reduction and re-use. Waste reduction could involve redesigning packaging to use less materials and cutting out unnecessary packaging, looking into using materials more efficiently, implementing new processes and technology and replacing disposal products with re-usable and durable products.

Re-using the product more than once in its original form avoids excessive consumption of resources and waste generation; examples include the refillable drink container, re-using shipping pallets and passing unwanted clothing, books, toys, old furniture etc. onto others who can use them. Re-use can also involve using the product for different purposes. An example of this could be re-using milk cartons for children's art and craft activities or sprouting seedlings, reusing plastic containers and glass jars for storing food or hardware items. The list is endless, and limited only by imagination.

3.3.5.3 Recycling

When re-use is no longer possible the material should be recycled back into similar products or become secondary raw materials for the production of new products. Generally, producing new products from recycled materials consumes less energy and reduces the impact on the environment by substituting virgin materials, offsetting mining and primary production processes.

Most of us are aware of recycling through local government domestic kerbside recycling schemes for materials like paper, cardboard, glass, aluminum and steel cans, and plastic containers. Composting is also a form of recycling, turning green organic waste through the decomposition process into compost suitable for garden use.

Recycling is also firmly established within industry through metal recovery, cardboard and other commodities. Effective recycling is often only achieved by the separation of materials at source so they can be easily managed, and to minimise contamination.

3.3.5.4 Treatment

Energy recovery has often been claimed as a form of recycling but under the Zero Waste Model and the Waste Management Board Strategy it is highlighted as a treatment option for managing residual wastes. These wastes represent failings in our ability to recover resources.

Treatment also extends to problematic and hazardous waste streams and until we achieve a zero waste society we will be required to ensure the continued protection of health by supporting processes which decrease contamination, maximise resource recovery and minimise residual waste.

3.3.5.5 Disposal

This is the least preferred option in the hierarchy. There is usually some residual material left over as waste, even after going through the preferred strategies in the Waste Management Hierarchy. The leftover waste has to be disposed of properly to safeguard against environmental risks, pest problems and health and safety issues. Currently these wastes are disposed of to landfill, either directly or after some form of primary treatment.

The volume of waste sent to landfill is one of the primary indicators to measure our journey toward zero waste.

3.3.6 Product life cycle management

Materials in today's economy are not easily recycled because of their design features. Closing loops is easier if products are designed for recycling and re-use. Product Life Cycle Management is a policy approach to design for re-use, dismantling, recyclability, hazards reduction, perhaps for disposability and compostability. It considers the source of materials and the impact of the products' production and use. The product life cycle steps are shown in Figure 5.

Life cycle assessment (LCA), a tool of Product Life Cycle Management, determines the cradle-to-grave environmental impacts of products, processes or services, through production, usage and disposal. It has emerged as a valuable decision-support tool, for both policy makers and industry, in assessing the impacts of a product or process.

Three forces are driving the new approach. First, government regulations are moving in the direction of lifecycle accountability; a manufacturer is responsible not only for direct production impacts, but also for impacts associated with product inputs, use, transport and disposal. Second, business is participating in voluntary initiatives which contain LCA and product stewardship components. These include ISO 14000 standards and the Chemical Industry's Responsible Care Program, both of which seek to foster continuous improvement through better environmental management systems. Finally, environmental preferability is now a criterion in both consumer markets and government procurement guidelines. It is used as the basis of eco-labelling and consumer education programs throughout the world.

Consumers and producers need to become more responsible for the life cycle of products and services. One key mechanism, developing overseas for closing the loop, is the requirement to extend a producer's responsibility beyond the point of sale for a product. Extended producer responsibility makes a producer or manufacturer responsible, either financially or physically, for the environmental impact of their products throughout their life-cycle.

Consumers have become conscious of the wasted resources that are squandered on products which become obsolete. They are exerting pressure on suppliers to take trade-ins which are recycled when a replacement is bought. Only by considering the full life cycle impacts can the environmental cost be included at the point of sale. This approach should influence purchasing choices and ultimately product design as our markets become more sophisticated.

Figure 5: The product life cycle

The increasing waste from computer manufacture demonstrates the need for improved collaboration between consumers and producers. Improved software demands ever-increasing power from computer hardware, reducing computer life cycles to less than two years. Industry leaders are now offering trade-in values for old computers and recycling components to secondary markets or recovering materials for re-use. Some motorcar industry leaders have initiated similar programs.

3.3.7 Environmental justice

The move towards a waste free future is based on the principle of environmental justice. All people, regardless of race, culture and income level, have a right to a clean and healthy environment. No segment of the population should suffer disproportionately from adverse human health or environmental effects because of policies, programs or activities.

In the US, an Executive Order issued in 1994 by President Clinton called for 'improved methodologies for assessing and mitigating impacts, [and] health effects from multiple and cumulative exposure' to environmental risk for people in minority groups. The interpretation of the Executive Order by the US EPA establishes the 'fair treatment for people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies'.[14]

On the domestic front, it has long been recognised that environmental amenities on the one hand and hazardous waste sites on the other, are not uniformly distributed in relation to income group, class or ethnic communities. Internationally, there are marked and increasing disparities in the world community between those who have access to clean and safe resources and those who do not. Disparities of this nature may be the result of historical circumstances, contemporary economic and trade relations or simply inadequate or inappropriate governmental regulations.

Whatever the source, it is clear that an interdisciplinary approach is needed to understand and ameliorate these differences. To minimise risks, waste should be dealt with as close as possible, in time and space, to the source of the waste.

An informed and involved community is a necessary and integral requirement for sustainability. All communities must have access to information to allow them to participate in decision making meaningfully.

[14] USEPA definition, http://www.epa.gov/otag/retrofit/glossary.htm#Justice

4 References

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Hawken, P., Lovins, A. and Lovins, L.H. (1999) *Natural Capitalism: Creating the Next Industrial Revolution*, Little, Brown & Co., Boston.

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Commonwealth Environmental Protection Agency (1992) National Waste Minimisation and Recycling Strategy. CEPA, Canberra.

USEPA Retrieved from http://www.epa.gov/otaq/retrofit/glossary.htm#Justice on 8 April 2003.

5 Appendix 1:

Historical evolution of the new paradigm

This Strategy is designed to consolidate and fulfil a number of previous activities that have made valuable contributions towards solving waste problems over the past 10 years. This Strategy and the evolving plans will be continuously improved, with the document kept alive on the Internet at www.wastewa.com. This form of knowledge management will keep interested stakeholders informed, as well as provide an interactive medium for feedback.

In addition to a number of operational regulations and codes of practice, the following Western Australian documents have formed the foundation of this strategy:

You Can Recycle It, November 1989, Office of Cabinet.

Waste Management into the 21st Century, 1991 Report, Health Department of Western Australia.

State Recycling Blueprint, June 1993, Department of Commerce and Trade, Western Australian Municipal Association.

Select Committee Report on Recycling and Waste Management, December 1995, Select Committee of the Western Australian Legislative Assembly.

Draft Western Australian Waste Management Strategy, June 1997, Minister for the Environment.

Draft Western Australian Waste Reduction and Recycling Policy, June 1997, Minister for the Environment.

State Recycling Education and Promotion Program for Western Australia, December 2000, Minister for the Environment.

Towards Zero Waste, WAste 2020 TaskForce Report and Recommendations, January 2001, Minister for the Environment.

WAste 2020 Draft Action Plans, January 2001, Minister for the Environment:

- *Green and Organic Waste*
- *Commercial and Industrial Waste*
- *Construction and Demolition Waste*
- *Controlled Waste*
- *Municipal Solid Waste*
- *Packaging Waste*
- *Problematic Waste*

Cleaner Production Statement, May 2001, Western Australian Sustainable Industry Group.

Draft Waste Education Strategy, February 2003, (Nolan ITU), Minister for the Environment and Heritage.

Focus on the Future: The Western Australian State Sustainability Strategy, Consultation Draft, September 2002, Government of Western Australia.

Draft Summary Report of Waste to Landfill, Perth Metropolitan Region, Western Australia, 1998–2002, Department of Environmental Protection.

Why write a submission?

The submission process provides an opportunity for further comment on the Strategic Direction for Waste Management in Western Australia document. This ensures that the views of all interested parties are taken into account. This is an opportunity to suggest any changes, express an opinion and provide information that you believe should be included.

Timeframes

The Strategic Direction document will be available for public comment until the 15 December 2003. All the submissions will be reviewed and the Strategic Direction tables will be updated to reflect the views and priorities of the community. A summary of the submissions and the final Strategic Direction document will be released in 2004.

Public Forums

Public forums will be held during the consultation period to provide information on the Strategic Direction document and facilitate comment on the document. The details will be advertised closer to the time of the sessions, in both the newspaper and on the Department of Environment's website (www.environ.wa.gov.au) and the Waste Management Board's website (www.wastewa.com).

How should you prepare your submission?

Submissions can be individual or submitted by a group. To ensure that your submission is as effective as possible, please consider the following points when preparing your responses.

- Make it clear and concise;
- List points in relation to particular sections of the Strategic Direction document;
- Describe the issue on which you wish to comment;
- State your views on the issue, and support your position with relevant information if possible; and
- Suggest alternatives to deal with the issues on which you disagree.

In your submission, the Department of Environment and the Waste Management Board would welcome your response to the following questions:

- What are your thoughts on the key Outcomes listed in the document?
- What are your thoughts on the Objectives and Strategies that have been listed to achieve the Zero Waste Vision?
- Is there an opportunity for you to participate in, or take responsibility for, any of the Objectives and Strategies?
- Which of the Objectives and Strategies do you believe should be given the highest priority?

Where should you send your submission?

Comments can be forwarded by mail to:

Department of Environment
Waste Management Branch
PO Box 6740
East Perth WA 6892

Or by email to: info@wastewa.com

Department of
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Facsimile: 9278 0301
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