



E-waste Product Stewardship
Framework for New Zealand
Final Report

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E-waste Product Stewardship

Framework for New Zealand

Final Report

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Executive Summary

Product stewardship schemes are used around the world to improve the life-cycle management of a wide range of products including, but not limited to, packaging, mattresses, mercury containing lamps, tyres, agricultural chemicals, even unwanted medicines, by shifting physical and/or financial responsibility to producers.

Product stewardship seeks to ensure that some or all responsibility for the end-of-life management of a product (being the collection, resource recovery, recycling and residual disposal) is wholly or partly fulfilled by the product manufacturer and / or brand owner.

New Zealand's Minister for the Environment approved project funding from the Waste Minimisation Fund (WMF) to assist in the development of a product stewardship framework for 'e-waste' through stakeholder engagement and consultation, collection and analysis of e-waste data specific to New Zealand and analysis of product stewardship options for e-waste.

In order to assess the end-of-life management of e-waste and consider an appropriate product stewardship option, this project fundamentally examined whether e-waste is an environmental problem that the market does not address and whether product stewardship is an appropriate approach to effectively manage e-waste.

It is impractical to consider all e-waste as a single entity; it is more appropriate to examine distinct categories of e-waste. This project has examined 11 categories of e-waste.

The e-waste categories were assessed using currently available research, knowledge of the current situation in New Zealand together with stakeholder advice and feedback in order to determine how product stewardship may address the issues of:

- Potential environmental harm of the e-waste product(s);
- Potential resource benefit from recycling or recovery of a product(s);
- Whether the product(s) can be effectively managed through a product stewardship scheme;
- Whether there is evidence that the product(s) can be effectively managed through a voluntary product stewardship scheme; and
- Public concerns about potential environmental harm.

This study accessed and reviewed existing information on e-waste in New Zealand through inviting stakeholders to provide data, accessing existing reports and studies and undertaking desktop research. It was not within scope to undertake empirical research.

The reasons for using data to inform policy decisions are well documented. The value of having evidence based policy is that it can;

- Provide some rigour and objectivity;
- Be used to estimate and/or measure the impact of proposed change in policy;
- Assist the decision maker(s) to select programme(s) to suit their needs; and
- Provides a tool to demonstrate the need to others.

Good information and evidence can provide an important base for rational assessment of options and from which other factors can be adjudicated on. There can also be risks associated with purely making decisions on data which is not considered reliable, however, it can be very useful as part of a broader decision making process, particularly where datasets are large, flexible and reliable.

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In this study, SLR has determined that the level of robustness of New Zealand specific data for e-waste products is currently insufficient to satisfy the requirements of the priority product designation criteria as detailed in **Section 2.3** of this report.

Although priority product designation and the need for a regulated scheme were supported by a number of stakeholders and stakeholders indicated that reasonable robust data was available and would be forthcoming, it is SLR's view that the information provided and reviewed for this study does not satisfactorily prove that current management of e-waste in New Zealand causes significant environmental harm and that significant benefits could be achieved through e-waste management under a regulated product stewardship scheme.

The study includes a review of existing e-waste schemes, whether voluntary, regulatory or a hybrid. This review finds that all types of schemes, including regulated schemes, have inherent advantages and limitations. For example, the Australian National Television and Computer Recycling Scheme established in 2011 required changes in 2013 and it is again under review over concerns of inappropriate treatment of e-waste materials and the scheme potentially reducing recycling of non-scheme e-waste.

While this study cannot recommend priority product designation, the Ministry for the Environment (MfE) may choose to undertake an alternative process to establish a pathway to designation or support processes to increase e-waste recovery and recycling outside of a regulated product stewardship scheme. The MfE may also have other regulatory mechanisms that can be explored as a means to support increased e-waste recycling.

The issue of incomplete and inaccurate data on New Zealand's e-waste has made the task of trying to develop a framework for managing this waste stream more difficult. A number of recommendations for improved data collection and management of e-waste are presented in the table below.

Recommendations for Future E-waste Data Collection and Management

Focus Area	Recommendation
Sales of electronic and electrical items in New Zealand (potential e-waste generation)	<p>Investigate purchase of market data (e.g. GFK and Infomart) for comparison with customs data.</p> <p>Further investigation and sensitivity analysis into the reuse lifespan assumptions of individual categories.</p> <p>Undertake further detailed review of export data to reconcile imports and exports customs data.</p> <p>Undertake further consultation with Statistics New Zealand to confirm assumptions regarding classification of product codes into WEEE categories.</p>
E-waste treatment and disposal data	<p>Undertake verification process to determine how much e-waste is currently being disposed in landfills and how much is currently being reused or recycled.</p> <p>Undertake detailed waste composition studies at waste disposal facilities (using proposed revised solid waste analysis protocol) to determine proportion of e-waste contained within the residual waste stream.</p> <p>Request annual reporting from recycling operators (possibly through the Resource Management Act or recycling standards schemes)</p>
Domestic recycling infrastructure capacity	<p>Undertake an infrastructure capacity gap assessment to determine existing capacity for e-waste recycling in New Zealand.</p> <p>Perform cost benefit analysis for investment into development of new facilities in New Zealand.</p>
Transboundary movement of waste	<p>Undertake a review of the existing transboundary movement of waste legislation and identify opportunities to improve responsible shipment of e-</p>

Executive Summary

	waste for re-use and reprocessing.
Standards for e-waste recycling facilities	Introduce a requirement that e-waste recyclers are required to meet minimum standards such as AS/NZS 5377:2013 or an appropriate certification scheme for e-waste recyclers, such as R2® or e-Stewards®.
Risk of harm	Undertake a review of emissions to the environment (principally to air and water) from solid waste treatment or disposal facilities e.g. landfills or reprocessing facilities licensed to accept e-waste (i.e. method 3) to determine a high-risk e-waste category shortlist.

Industry stakeholders may also consider options for increasing e-waste recycling which, may also assist in developing sufficient data to inform future any consideration of a regulated product stewardship scheme.

The final framework presented in **Section 5** of this report is intended to be used as a tool for determining whether a product is suitable for management under a product stewardship approach and what other complementary regulations might be used to support improved e-waste management.

Abbreviations, Acronyms and Terminology

AS/NZS 5377	Australian and New Zealand Standard for the collection, storage, transportation and treatment of electronic and electrical equipment (AS/NZS 5377:2013)
AWT	Alternative Waste Technologies
BAN	Basel Action Network
Basel Convention	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
CFCs	Chlorofluorocarbons
CRM	Critical Raw Materials
CRN	Community Recycling Network
CRT	Cathode Ray Tube
EC	European Commission
EPHC	Environment Protection and Heritage Council
EPR	Extended Producer Responsibility
EPRA	Electronic Products Recycling Association (Canada)
ERS	Electronics Recycling Standard (Canada)
e-Stewards®	e-Stewards® Standard for Responsible Recycling and Reuse of Electronic Equipment®
e-waste	Electrical and electronic equipment which enters the waste stream. Other designations include 'WEEE' and 'e-scrap'.
EoL	End-of-Life
HCFCs	Hydrochlorofluorocarbons
HFCs	Hydrofluorocarbons
ICT	Information and communications technology
LCD	Liquid Crystal Display
MEP	Ministry of Environmental Protection of China
MfE or Ministry	Ministry for the Environment (New Zealand)
MS2	Martin Stewardship & Management Strategies Pty Ltd
NTCRS	National Television and Computer Recycling Scheme (Australia)
OECD	Organisation for Economic Co-operation and Development
OHSAS	Occupational Health and Safety Standard
PRO	Producer Responsibility Organisation
PSI	Product Stewardship Institute
R2	Responsible Recycling certification
REE	Rare Earth Elements
RIOS	Recycling Industry Operating Standard®
RIS	Regulatory Impact Statement
RQP	Recycler Qualification Program (Canada)

Abbreviations, Acronyms and Terminology

RRW	Regulated Recyclable Waste (Taiwan)
SEWPAC	Department of Sustainability, Environment, Water, Population and Communities (Australia, now the Department of the Environment)
SLR	SLR Consulting
TV	Television
TVTb	TV TakeBack
UNEP	United Nations Environment Programme
UK	United Kingdom
US	United States (of America)
WEEE	Waste Electrical and Electronic Equipment
WEEE Directive	European Commission Directive 2002/96/EC on Waste Electrical and Electronic Equipment
WEEE Forum	European Association of Electrical and Electronic Waste Take Back Systems
WMA	Waste Minimisation Act 2008 (New Zealand)
WMF	Waste Minimisation Fund (New Zealand)
WRAP	Waste and Resources Action Programme (UK)

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1 INTRODUCTION

The Minister for the Environment approved project funding on 20 May 2014 from the Waste Minimisation Fund (WMF) to assist in the development of a product stewardship framework for waste electrical and electronic equipment (e-waste¹).

This report has been prepared by a project team comprising the following:

- SLR Consulting NZ Ltd (SLR) (project lead and project management);
- Martin Stewardship & Management Strategies Pty Ltd (MS2) (technical lead and stakeholder engagement in Australia);
- Synergine (stakeholder engagement in New Zealand); and
- Equilibrium (independent peer review).

Product stewardship can mean different things to different people and organisations and is really dependent on where they fit in across the lifecycle. For the purpose of this report the Ministry for the Environment (MfE) definition is used.

Product stewardship can be defined as shared responsibility for the environmental effects that products can cause in their life cycle among all sectors involved with the product (1).

It is also important to think of product stewardship in its wider sense that considers social and cultural impacts and can therefore be considered as an approach to managing the end-of-life (EoL) and/or life-cycle impacts of different products. This approach acknowledges that those involved in the production, sale, use and disposal of products have a shared responsibility to ensure that those products are managed in such a way as to reduce their impact on the environment and on human health.

Product stewardship schemes are used around the world to improve the life-cycle management of a wide range of products (including, but not limited to; packaging, mattresses, mercury containing lamps, tyres, agricultural chemicals, even unwanted medicines), by shifting physical and/or financial responsibility to producers. Small consumer electronic products appear to be the most commonly addressed products internationally.

The implementation of product stewardship can be through regulatory, co-regulatory and voluntary schemes.

The purpose of this report is to provide recommendations for the implementation of product stewardship options for e-waste, with clear reference to the following:

- New Zealand specific data (where available);
- Stakeholder feedback obtained during the course of this study; and
- Experience from similar international e-waste product stewardship schemes.

Core objectives of this project have been to effectively engage stakeholders in the development of an e-waste product stewardship scheme and to help ensure that the resulting recommended e-waste product stewardship framework approach is specifically tailored to meet New Zealand's needs. The outcome of this project is to provide the MfE with advice on, and recommendations for, implementation.

¹ Please note this report uses the term 'e-waste' instead of 'WEEE' or 'e-scrap' unless referring to formal names such as Europe's WEEE Directive (2002/96/EC)

This report also draws from the Preliminary Report (2) that was produced as part of this project and distributed in 2014 in order to:

- provide an overview of international experience on development and implementation of e-waste schemes;
- examine New Zealand's e-waste product stewardship experiences to date;
- raise context and issues that would affect the design of an appropriate long-term e-waste scheme for New Zealand that will be examined further; and
- raise questions for consideration and discussion by stakeholders during the project's significant engagement process.

A summary of the salient points from the report is provided in this report for completeness.

1.1 Background

The project was designed as a five-stage process (see **Figure 1**) to provide stakeholders complete transparency and multiple opportunities throughout the process to participate and contribute. The production of this Final Report is Stage 5.

This report is intended to provide recommendations for the development of an e-waste product stewardship scheme that builds upon: research reflected in the Preliminary Report, analysis of the e-waste data collected, subsequent desktop research and analysis and incorporating stakeholder views and experiences. This Final Report was produced following receipt of feedback from stakeholders on a Draft Report.

Figure 1 E-waste Product Stewardship Project Phases

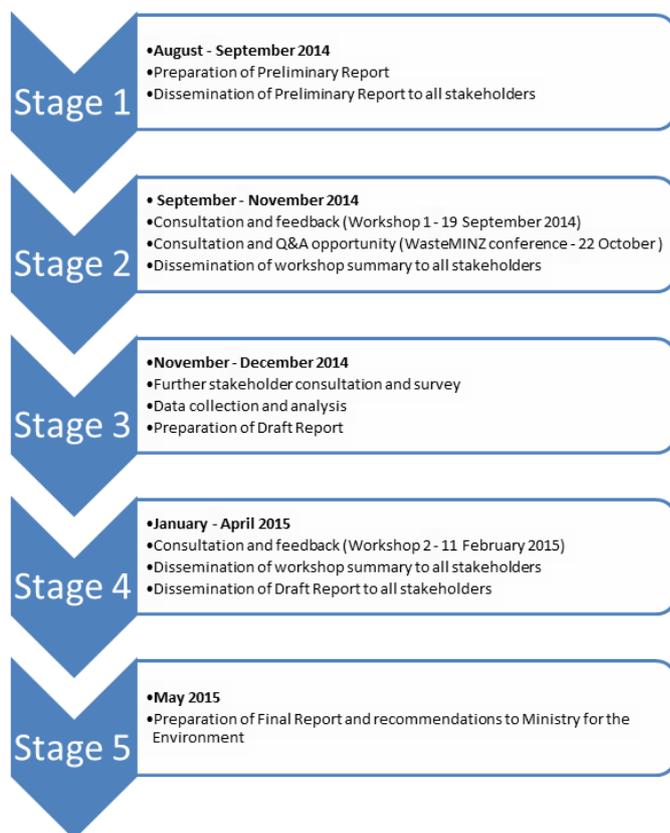


Table 1 below provides a summary of the stakeholder engagement activities undertaken as part of this project. The project team contacted more than 200 stakeholders directly through email correspondence throughout the project requesting that they provide feedback or comment on the relevant documents that were made freely available via an Internet sharing platform² (e.g. Preliminary Report, Workshop summary report). The reports were also made available through the WasteMINZ website which has more than 1,000 members throughout New Zealand. A dedicated email address and phone number were made available to all stakeholders throughout the duration of the project.

Table 1 Stakeholder Engagement Events for the E-waste Product Stewardship Project

Stakeholder Event	Date	Summary	Number of Participants
Workshop 1	19 September 2014	The workshop focused broadly on the following areas: <ul style="list-style-type: none"> • presentation of project objectives; • summary of Preliminary Report; • request for feedback on the Preliminary Report; • barriers to effective e-waste management; • experiences of e-waste programmes in New Zealand; • opportunities for future management of e-waste; and • likely benefits of improved e-waste management. 	50 participants representing 36 different organisations
WasteMINZ Conference E-waste Project Q&A Session	22 October 2014	The presentation at WasteMINZ provided the following: <ul style="list-style-type: none"> • a presentation of the project progress to date; and • an opportunity for a Question and Answer session on the Preliminary Report and outcomes of Workshop 1. 	Approximately 30 people attended the session
Stakeholder Interviews	October – December 2014	The stakeholder interviews provided each stakeholder group with the opportunity to: <ul style="list-style-type: none"> • review and discuss the key themes presented within the Preliminary Report; • provide context based on specific waste streams; • rate the effectiveness of possible performance measures; and • provide the project team with New Zealand specific data. 	Representation from 42 stakeholder organisations
Workshop 2	11 February 2015	The workshop focused broadly on the following: <ul style="list-style-type: none"> • project progress to date; • feedback from the various stakeholder engagement sessions; • draft e-waste data methodology, assumptions and results; and • recommended framework for e-waste product stewardship programme. 	52 participants representing 42 different organisations

Further details of the stakeholder engagement process and summary results are presented in **(Section 3.1)** of this report.

² Dropbox

1.2 Report Scope

This Final Report is intended to:

- define the problem of e-waste in New Zealand and the criteria for assessment in accordance with the Waste Minimisation Act 2008 (WMA) (**Section 2**);
- provide details of the project methodology and consultation process (**Section 3**);
- provide an overview of the product stewardship options and assessment criteria (**Section 4**);
- explain the framework for the recommended approach (**Section 5**); and
- provide general conclusions, recommendations and study limitations (**Section 6**).

Additional information relevant to this project is also appended to this document and includes the following:

- Stakeholder engagement workshop summaries (**Appendix A**);
- Australia / New Zealand Standard (AS/NZS) 5377:2013 E-waste Categories (**Appendix B**);
- Methodology for New Zealand e-waste generation data assumptions (**Appendix C**); and
- Average lifespan and weight of e-waste products (**Appendix D**).

Stakeholders were invited to comment on a Draft Report to help inform the conclusions and recommendations of this Final Report to be submitted to the MfE for consideration. A total of nine submissions were made on the Draft Report.

2 DEFINING THE E-WASTE ISSUE

2.1 Challenges of Managing E-waste in New Zealand

E-waste represents a significant set of waste streams. Due to the potentially hazardous components these waste streams can present challenges for governance, management, effective recycling and environmentally sound disposal. Key issues to consider in reviewing options for managing e-waste include:

- e-waste represents a growing waste stream in New Zealand, with an estimated 80,000 tonnes (3) being disposed annually;
- data on the volume of electrical and electronic equipment (EEE) entering New Zealand needs defining;
- trends in manufacturing mean products are routinely upgraded with older models phased out and replaced;
- e-products can become a waste before it has reached its end-of-life as consumers upgrade and dispose of older models while the product is still functional;
- many products that become e-waste contain hazardous and toxic substances that have the potential to impact on the receiving environment if not properly managed;
- reprocessing of recovered e-waste also has the potential to cause negative environmental and health impacts if not managed responsibly; and
- markets for resale for many e-wastes produced in New Zealand are off shore e.g. refurbished mobile phones, TV componentry, and microchips.

In trying to understand the most effective measures to manage this waste stream consideration must be given to the types of e-waste that present the greatest risk and how these products might be managed through existing legislation.

2.2 E-waste Definition and Classification for this Project

E-waste can be broadly viewed as any electrical or electronic product with a battery or a plug that has reached the end of its useful life and enters the waste stream. These items can be collected and reused or returned to use with additional processing or effort.

MfE has defined e-waste (1) as:

everything that uses electric current and enters the waste stream, including computers, all types of electrical appliances including air conditioners, washing machines, refrigerators, small household appliances and tools, mobile devices including phones, medical equipment, lamps, and batteries. The term e-waste can also refer to a subset, such as computers, computer peripherals, and televisions.

As a starting point for this project, and to enable comparison with other published national datasets, e-waste was grouped under the following categories:

- Large Household Appliances;
- Small Household Appliances;
- Information Technology and Telecommunications Equipment;
- Telecommunication Carrier and Commercial Equipment;
- Consumer Equipment;
- Electrical and Electronic Tools (with the exception of large scale stationary industry tools);
- Toys, Leisure and Sports Equipment;
- Automatic Dispensers;
- Lighting Equipment;
- Medical Devices (with the exception of all implanted and infected products); and
- Monitoring and Control Instruments.

These categories are consistent with the current Joint Australian and New Zealand Standard for electronic waste³ and the classifications as defined in the original European Union (EU) Waste Electrical and Electronic Equipment (WEEE) Directive⁴ and have been used to generate waste data assumptions to inform the recommendations in this report. Each primary category has between 5 and 15 sub categories, which are provided in **Appendix B**. There are ninety-eight sub categories in total.

One category that is omitted from the WEEE Directive list is batteries. This is because in the EU there is a separate batteries Directive⁵. During the stakeholder engagement process⁶, batteries were identified as items to be potentially included on the e-waste category list.

A more recent and slightly different classification system has been developed (subsequent to the work undertaken during this project) by the United Nations University (UNU) (4) which groups the items based on the following criteria:

³ AS/NZS 5377:2013

⁴ Directive (2002/96/EC)

⁵ Directive (2006/66/EC)

⁶ Particularly in response to questions provided in Stakeholder Workshop 2. See Appendix A.

a classification system should categorise products by similar function, comparable material composition and related end-of-life attributes;

products within the same category should have homogenous average weight and lifespan distribution which can simplify quantitative assessment for similar products; and

the categories should not be defined too specifically around products that are not posing a threat to the environment, or that do not contain valuable materials, nor having a large market share.

The revised classification system simplifies the above listed categories into the following six categories that will come into effect in the EU in 2017:

1. Temperature exchange equipment;
2. Screens and monitors;
3. Lamps;
4. Large equipment;
5. Small equipment; and
6. Small IT and telecommunication equipment with an external dimension of less than 50cm.

While the above recasting of the original categories potentially allows for more flexibility in the description of a product, for data collection purposes it may not permit the level of granularity for product designation under the WMA.

A recommendation for future development of New Zealand e-waste data collection would be to review whether the revised classifications described above would be more appropriate for data collection and analysis purposes, or whether the current classifications provide a greater level of detail required to assist with priority product designation.

2.3 Legislative Framework in New Zealand for Managing E-waste

The purpose of the Waste Minimisation Act 2008 (WMA) is to

...encourage waste minimisation and a decrease in waste disposal in order to protect the environment from harm and provide social, economic, and cultural benefits” (section 3(1)(a) and (b).

The WMA enables the Government to recognise and endorse both voluntary and mandatory product stewardship schemes through accreditation⁷. MfE recently undertook wide stakeholder consultation⁸ (1) separate to this project on whether specific waste streams, including e-waste, should be declared as priority products under the WMA, and if so, when.

As part of declaring a waste stream a priority product the Minister must be satisfied that⁹:

- *either (a) the product will or may cause significant environmental harm when it becomes waste, or (b) there are significant benefits from reduction, reuse, recycling, recovery, or treatment of the product (section 9(2)(a))*
- *the product can be effectively managed under a product stewardship scheme (section 9(2)(b))*

⁷ Section 15.

⁸ 21 May to 2 July 2014.

⁹ Section 9.

and has:

- *considered the effectiveness of any voluntary product stewardship schemes in relation to these matters (section 9(3)(d))*
- *considered public concerns about environmental harm associated with the product when it becomes waste and provided the public with an opportunity to comment on the proposal (section 9(3)(b) and (c))*
- *obtained and considered the advice of the Waste Advisory Board (section 9(3)(a)).*

If a product is declared a priority product, a scheme must be developed and accreditation from the Minister would need to be obtained¹⁰. Beyond declaration as a priority product and accreditation, regulatory powers under the WMA¹¹ that are potentially relevant to the management of e-waste include:

- prohibiting the sale of a priority product, except in accordance with an accredited scheme;
- controls or prohibitions on disposal, manufacture or sale, or product labelling;
- product take-back services, management fees for products, product deposits and refunds, quality standards for reusing, recycling, or recovery; and
- collection and reporting requirements.

Following adoption of the WMA in 2008, the Government wanted to give voluntary measures under the WMA an opportunity to demonstrate their effectiveness (1). E-waste was not included in the Government's 2009 Waste Minimisation in New Zealand discussion document (5) that was seeking feedback on policy proposed to implement the WMA, but was identified as requiring consideration for priority product designation by stakeholders¹² along with a few other products (waste oil, tyres and packaging) in the summary of submissions document (6).

Under the WMA the Minister for the Environment has so far accredited 13¹³ voluntary product stewardship schemes (7), the most recent of which is another e-waste stream managed by Fuji Xerox. In a recent announcement (8) the Minister for the Environment awarded Fuji Xerox accreditation under the WMA for its Zero Landfill Scheme. The scheme will aim to recycle and re-use an estimate 99.5 percent of equipment and products, including printers, copiers, toner bottles, print cartridges, drums, rollers and fuser oil, and packaging. It is estimated that the scheme will result in approximately 1,200 tonnes being diverted from landfill each year in New Zealand. The remaining 11 active accredited schemes manage the following products or materials:

- Glass packaging (bottles and containers);
- Agricultural plastics;
- Synthetic refrigerants (chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs);
- Agrichemicals and agricultural plastic containers;
- Paint and paint packaging;
- Used lubricating oil;
- PVC backed carpet tiles;
- Nappies, feminine hygiene products and adult incontinence products

¹⁰ Section 10.

¹¹ Sections 22 and 23.

¹² In total 166 of the submissions to the MfE made comment on priorities for product stewardship.

¹³ Information correct as of 15 June 2015.

- Fonterra Milk for Schools ultra-high-temperature milk tetra-paks (consumed in participating primary schools and any production packaging waste produced in relation to Fonterra Milk for Schools product).
- End-of-life packaging for public place waste; and
- Mobile phones (including smart phones, mobile data devices, mobile/smartphone batteries and accessories).

The scope of each scheme (which is defined on the MfE website (7)) defines the exact products included and the geographical coverage of the scheme within New Zealand.

The information and recommendations from this project will contribute directly to the Ministry's policy analysis and further consideration on priority waste streams for product stewardship intervention.

2.4 International Approaches to E-waste Management

Whilst some individual product categories such as computers may be economically viable on their own, costs to collect and reprocess various types of e-waste responsibly can exceed the value of recovered resources. Costs for collection infrastructure and systems, as well as storage, management and transport, must also be considered. Programmes must also manage risks such as demand for recovered materials and currency fluctuations, since most recovered materials are traded as commodities in international markets. Therefore, most e-waste product stewardship approaches operate at an overall net cost that must be met in order for collection and recycling to occur. These costs are invariably balanced with the costs of alternative approaches, including landfilling.

Allocation of programme costs is a fundamental parameter for developing schemes for product stewardship and the related approach of extended producer responsibility (EPR). The Organisation for Economic Co-operation and Development (OECD) defines EPR as:

...an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. An EPR policy is characterised by: 1. the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities; and 2. the provision of incentives to producers to take into account environmental considerations when designing their products. While other policy instruments tend to target a single point in the chain, EPR seeks to integrate signals related to the environmental characteristics of products and production processes throughout the product chain (9).

Product stewardship may be voluntary or have a regulatory underpinning, whereas EPR always has a regulatory underpinning.

Product stewardship or EPR approaches are increasingly being adopted. A recent survey of 384 EPR programmes for the OECD found that more than 70 percent had been adopted between 2001 and early 2013, and of these, 11 percent had been adopted within the past four years. Chile, Mexico, Brazil, Argentina and Colombia have just recently implemented their first EPR schemes. Even emerging economies including China, India and Indonesia have started to develop EPR (although these are generally not yet fully implemented) (10).

Although numerous approaches are available and may be implemented in combination, the OECD groups EPR or stewardship approaches into four principal categories (10):

- **product take-back requirements** that require the producer or retailer to collect the product at the post-consumer stage. In practice, these requirements are usually discharged through a collective group known as a producer responsibility organisation (PRO) funded by producers;
- **economic and market-based instruments** including deposit-refund schemes, advance disposal fees, material taxes, and upstream combination tax/subsidies that incentivise the producer to comply with EPR;

- **regulations and performance standards** such as minimum recycled content standards that can be either mandatory or voluntary; and
- **accompanying information-based instruments** including reporting requirements, labelling of products and components, educating consumers about product stewardship/EPR, and informing recyclers about the materials used in products.

Various representative international programmes have been examined to provide insights for New Zealand and are summarised below. Views were sought during the engagement process on the applicability of lessons learned from international programmes to New Zealand.

2.4.1 Europe

Europe takes a directive approach (i.e. introducing a legal act), where the European Commission (EC) establishes Directives that the Member States transpose into their own laws. Over the past decade, the EC Directive on e-waste (the WEEE Directive) has driven electronics recycling in Europe by imposing a variety of take-back and recycling requirements.

In theory, the directive approach should ensure consistency, but the reality is that each of the 28 Member States may go their own way. This has certainly been the case with the WEEE Directive, serving as an environmental measure with minimum standards that Member States can exceed. Because of the directive approach and variability of the resulting approaches, findings from the WEEE Directive itself are limited for New Zealand. This project has, however, incorporated lessons from Member States' implementation of the WEEE Directive throughout.

2.4.2 United States of America

Fewer than 10 EPR laws were in effect in the US as of end-2001. However, as of 1 June 2014, 81 EPR laws were in effect in 32 states across 10 product categories. State governments adopted all but three of these laws, with the remainder passed by local governments (11).

Half of the 50 US states have laws targeting e-waste; 23 are considered to be EPR, while the other two are considered to be product stewardship.

Since 2003, 25 states have enacted EPR or product stewardship legislation for consumer electronics. Each state has developed its own programme to accommodate different operational and statutory factors. However, their objectives are effectively the same as other EPR systems (11):

- *Reduce government costs - Alleviate the cost burden of electronics scrap management from municipalities and taxpayers.*
- *Divert material from disposal facilities - Divert material out of the general solid waste stream, thereby increasing recycling.*
- *Create jobs - Provide a steady funding stream and work flow for recycling companies and supports the jobs they create.*
- *Create incentive for environmentally preferable products - Seek to internalize management costs for manufacturers, encouraging design of products that are less toxic, more recyclable, and comprised of recycled materials.*

The scope of the US programmes varies significantly (11):

- *Nine states only accept major products (TVs, computers, and monitors), or a subset of these products.*
- *Ten states accept major products (TVs, computers, and monitors) as well as some computer or TV peripherals (e.g. printers, DVD players).*
- *Six states accept 10-18 equipment types, with Illinois and New York being the most comprehensive.*

The four principal financing models in the US are representative of most other programme models (11):

- *Market share - manufacturers are responsible for the costs of collecting and recycling a proportional amount of e-waste to their share of estimated or actual state sales of covered products.*
- *Market share for TVs only - TV manufacturers have a market share financial obligation, but information and communications technology (ICT) manufacturers do not.*
- *Hybrid market/return share - manufacturers are allocated the costs of collecting and recycling based on a mix of market share and return share (usually market share for TV manufacturers and return share for ICT manufacturers).*
- *Financing obligation mechanism not specified - manufacturers must develop and implement e-waste collection plans or programmes, without specifying financial obligations.*

A 2013 study found that in 2011, 7 percent of the recovered materials from e-waste reprocessors in the US were shipped to foreign markets (primarily Mexico, India, Hong Kong, China, and other Asia-Pacific countries); of those exports, 70 percent were refurbished for reuse, while 30 percent were disassembled commodities (11).

2.4.3 Canada

In 2004, Alberta became the first Canadian province to pass legislation for the responsible management of e-waste (12). Since that time nearly all provinces have developed similar regulations and by 2013 over 97 percent of the national population are covered by EPR regulations. The EPR programmes are regulated under the jurisdiction of provincial and territorial authorities, however there is a Canada-wide Action Plan (CAP) (12) that is designed to promote harmonisation and consistency of programmes across the country.

Although each of the schemes have some things in common (e.g. introduction of fees to finance program costs and limited coverage of items designated in e-waste regulations), there are also some notable differences such as targets, products covered by legislation and collection infrastructure. An industry-led organisation, the Electronic Products Recycling Association (EPRA), has endeavoured to harmonise programme collections, data collection and reporting, and administration in eight of the eleven Canadian provinces (13).

2.4.4 Taiwan

Taiwan progressively applied EPR across a broad range of electrical and electronic products, starting with TVs, air conditioning units and washing machines in March 1998 and computers in June 1998, progressing up to tablets and compact fluorescent lamps in March 2014 (14).

Manufacturers and importers of new regulated recyclable waste (RRW) products are assessed for product-specific recycling fees that are regularly revisited by the Recycling Fund Management Board in consultation with the producers. A Green Differential Fee Rate may be applied to encourage the development of environmental friendly products by decreasing the recycling fee rate for 'green product' producers or increasing the recycling fee rate on less 'environmentally friendly' product production. Funds on RRW products are used to subsidise licensed collectors and recyclers under Taiwan's Four-in-One programme (14).

2.4.5 Australia

Australia's National Television and Computer Recycling Scheme (NTRCS) targets televisions, computers and computer products. Once it was decided a regulatory scheme was the preferred approach, the process of regulatory impact assessments, technical studies, consultation and scheme design took about three years.

The NTCRS was finally established in November 2011 with adoption of the *Product Stewardship (Televisions and Computers) Regulations 2011*, and following more than a decade of debate and the adoption of the *Product Stewardship Act 2011*.

All importers and manufacturers of above threshold volumes of televisions and computers are required to join and fund an approved co-regulatory arrangement funded by industry and responsible for discharging member companies' obligations. Approved co-regulatory arrangements must meet progressively increasing annual recycling targets representing a proportion of total waste generation. The targets increase from 30 percent in 2012–13 to 80 percent by 2021–22. Approved co-regulatory arrangements must also meet 'reasonable access' requirements to provide free consumer access to collection opportunities that vary by geographic coverage and population.

Development of an appropriate regulatory 'safety net' to address free-riders was a primary concern of industry stakeholders and instrumental to development of the NTCRS. However, the Decision Regulatory Impact Statement (RIS) for TVs and Computers (15) found that the benefits of the proposed approach did not exceed the costs from a pure cost-benefit perspective and that an acceptance of society's willingness to pay for increased recycling rates of electronics (16) was necessary to justify the regulatory intervention needed to create the NTCRS.

A variety of changes were implemented in 2013-14 to address issues identified in the early commencement of the scheme (17):

- a single target for all products covered by the scheme to replace the separate targets originally established for televisions and computers;
- updated product codes and conversion factors to determine scheme liability based on Customs import data; and
- changes to enable approved co-regulatory arrangements to better manage financial risk, including pro-rata allocation of import share for part-year members.

Despite these changes the NTCRS continues to be controversial with some stakeholders as there have been reports of inappropriate management of e-waste materials, such as stockpiling and illegal disposal of leaded glass (see further discussion in Section 4.2.1), and of social enterprise recyclers being driven out of business because of the scheme's limited initial scope.

A detailed review of the NTCRS commenced in late 2014 and further changes are expected in mid-2015.

3 PROJECT METHODOLOGY

The methodology for this product stewardship project placed significant emphasis on;

- the role of stakeholder engagement and consultation to improve the understanding of how e-waste is currently managed in New Zealand; and
- collection and analysis of e-waste data specific to New Zealand.

The stakeholder engagement process was designed to maximise participation and ensure appropriate representation from each of the stakeholder groups.

The overall response to the stakeholder engagement process from stakeholders throughout this project was very positive and the contribution in the form of participation in workshops and detailed discussions was both useful and informative.

Part of the purpose of the engagement process was to canvass stakeholders with the intention of gaining access to available e-waste data sets to better quantify e-waste generation in New Zealand. While some useful data was provided it was not available at a level that would provide suitable indicators to establish a New Zealand baseline seen as sufficiently robust. This analysis and the recommendations contained in this report therefore reflect professional experience coupled with extensive research and stakeholder input. Limitations in underpinning data are noted.

During the later stage of the consultation process a recommendation to purchase information and communications technology (ICT) and other consumer electronics sales data was suggested by one of the stakeholders. The merits of purchasing these data sets were not explored but have been included in the final recommendations for this project (**Section 6**).

A summary of the methodology and outcomes for both the stakeholder engagement process and the e-waste data review are presented below.

3.1 Stakeholder Engagement Process and Summary Feedback

3.1.1 Preliminary Report

The Preliminary Report (2) was written in advance of the first stakeholder consultation event (Workshop 1). The purpose of the report was to provide relevant context on e-waste initiatives in New Zealand and internationally and to raise a variety of topics for stakeholder consideration. The Preliminary Report also raised design considerations for an appropriate long-term e-waste scheme for New Zealand.

Copies of the Preliminary Report were first made available via a Dropbox link on 12 September 2014. The link was emailed to all stakeholders and also included on relevant social media sites (e.g. Global Product Stewardship Council and WasteMINZ websites) to maximise exposure. The project was designated in social media as eWasteNZ or #eWasteNZ where possible. Stakeholders were invited to provide written comments on the questions raised in the Preliminary Report.

An access and download summary for the report showed the following:

- 127 people (88 from New Zealand, 24 from Australia and 15 from other countries) opened the link to the documents.
- 17 copies of the report (and 26 Workshop 1 Summary documents – see **Appendix A**) were downloaded directly from the email link; and
- a further 12 copies were emailed directly to the stakeholders upon request.

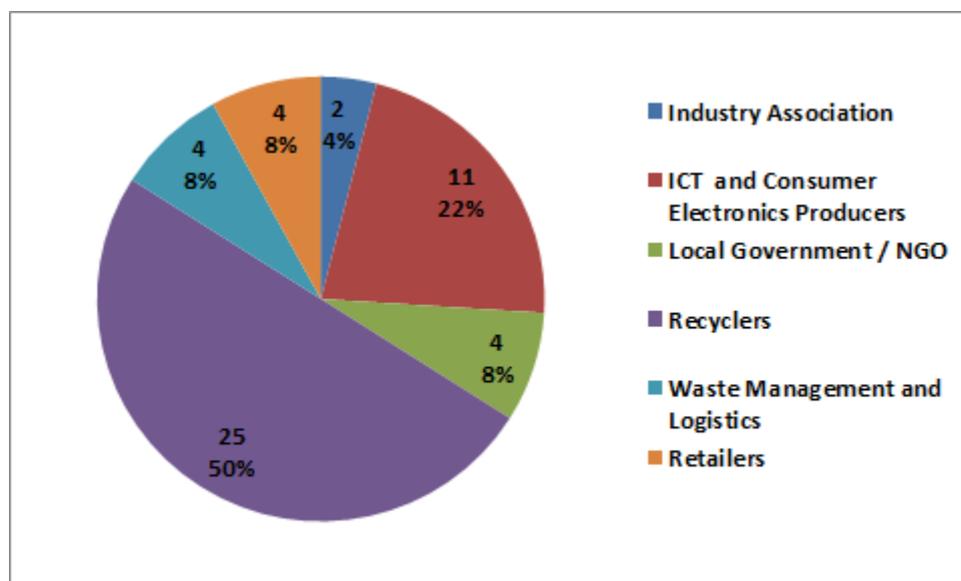
The two-month response period for comments on the Preliminary Report was further extended by 2 weeks. Only one formal response was provided, however feedback was provided informally from a number of stakeholders (including previous responses to the MfE's Priority Waste Streams Discussion Document (1)) and the questions were discussed further during Workshop 1 (discussed below).

3.1.2 Workshop 1

Workshop 1 was held on 19 September 2014 in Auckland and all stakeholders were invited to attend. Auckland was identified as the venue that facilitated the greatest opportunity for access and transportation options.

A total of 50 stakeholders attended Workshop 1. A summary of the proportion of stakeholder groups who attended the first workshop is presented below in **Figure 2**.

Figure 2 Proportion of Stakeholder Group Representation at Workshop 1



Note: Chart shows number of representatives and percentage of total.

The workshop focused broadly on the following areas;

- presentation of project objectives;
- summary of Preliminary Report;
- request for feedback on the Preliminary Report;
- barriers to effective e-waste management;
- experiences of e-waste programmes in New Zealand;
- opportunities for future management of e-waste;
- likely benefits of improved e-waste management; and
- solicitation of datasets on e-waste generation and disposal in New Zealand.

A summary of the key points from stakeholder discussions are presented below in **Table 2** and further details are provided in **Appendix A**.

Table 2 Stakeholder Engagement Summary Responses

Barriers to implementation of Product Stewardship	Opportunities for Implementation of Product Stewardship	General Observations
<ul style="list-style-type: none"> • Costs and who will pay? • Low disposal costs (landfill levy). • Inconsistent standards of recycling across the industry. • Lack of infrastructure. • Low economic value for some products. • Lack of public education and awareness. • Responsibility not shared. • Restrictions on export of e-waste materials. • Transport and logistics. 	<ul style="list-style-type: none"> • Responsibility is shared amongst all producers. • Potential for increase in recycling and recovery. • Introduce standards for recycling. • Improved e-waste data. • Scope to include all e-waste categories. 	<ul style="list-style-type: none"> • Voluntary approaches for some waste streams were proven to be limited in their ultimate outcomes. • Despite a lack of New Zealand specific e-waste data a significant e-waste issue remains to be addressed. • New Zealand can learn from extensive overseas experience. • Any regulatory scope should be defined broadly with hazardous projects generally viewed as a priority.

While the above responses do not represent the detailed views of all of the stakeholders consulted during the first workshop, they nonetheless identify some of the key issues raised and they have informed a number of the recommendations presented in this report.

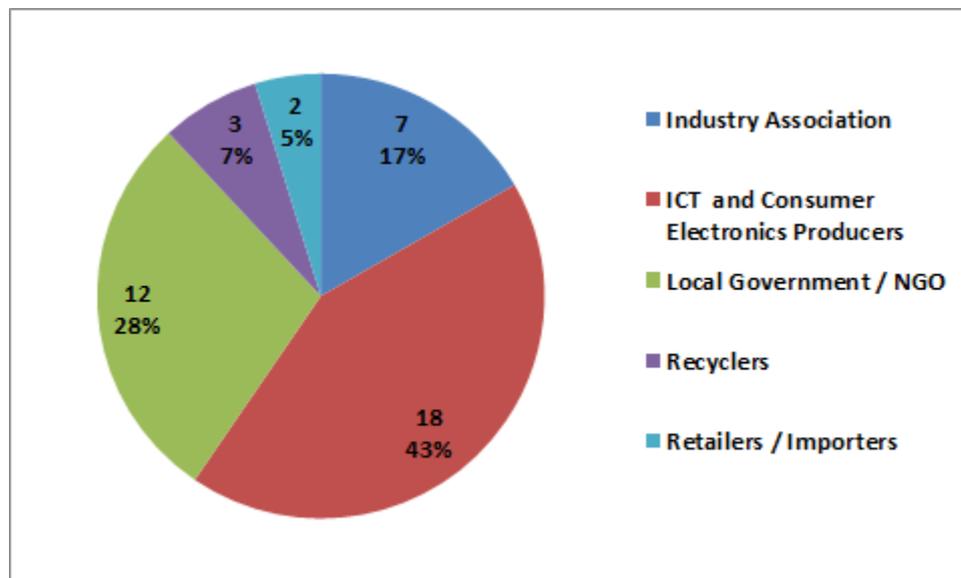
Findings from Workshop 1 were presented in a question and answer session held in conjunction with a product stewardship session at the WasteMINZ 2014 Annual Conference¹⁴.

3.1.3 Stakeholder Interviews

As a follow up to Workshop 1 and to develop a more comprehensive understanding of product stewardship options for individual e-waste product categories, detailed consultations were undertaken with 42 representative stakeholder organisations using semi-structured questionnaires. A representation of the stakeholders consulted is shown below in **Figure 3**. Stakeholder interviews were held between October and end December 2014.

¹⁴ WasteMINZ is a membership based representative body of the waste and resource recovery sector in New Zealand with more than 1000 members nationwide.

Figure 3 Proportion of Stakeholder Groups Consulted as part of the Stakeholder Interviews



Note: Chart shows number of representatives and percentage of total.

The greatest proportion of respondents belonged to the ICT and consumer electronic producer category (18 participants).

The representative industry associations facilitated many of these meetings. Significantly, not only do these sectors represent the producers that would bear primary direct responsibility for funding a product stewardship scheme, they brought to the consultations extensive experience in the development and implementation of e-waste product stewardship schemes internationally, especially Australia’s co-regulatory approach.

A number of additional stakeholders approached to contribute (but for whatever reason they elected not to participate) included; consumer groups, waste management companies and online retail groups.

The stakeholder interviews reinforced many of the points raised in Workshop 1 and provided substantial additional verbal feedback. Precise details of the interviews are confidential, however a number of general themes were common among many of the stakeholder groups and a summary of these themes is presented below.

Table 3 Stakeholder Interview Summary

Issue	Summary
Priority product designation will assist to address free-rider concerns¹⁵.	The failure of some voluntary schemes has been linked to the lack of consistent support and investment from producers of EEE. Regulation will provide stability and certainty in the market.
Identified need for consistent standards and reporting.	A lack of standards in the e-waste recycling industry presents risks to both environmental and workplace health and safety domestically and internationally. There is evidence in both New Zealand and Australia where companies have not met their obligations for responsible treatment. Standards are an important feature of European and US schemes. Standards should be enforceable.
Focus on household consumer	E-waste generated by ICT appears to be well managed and not identified as a priority for

¹⁵ Free-rider can be defined as a party that enjoys a benefit accruing from a collective effort, but contributes little or nothing to the effort (Business Dictionary)

Issue	Summary
products.	designation.
A number of industry led schemes are working.	While there was clear support for priority product designation of e-waste from a number of sectors it was acknowledged that some waste streams are being managed by existing arrangements (e.g. large household appliances and mobile phones) and there was a need for prioritisation of those product categories requiring more immediate intervention.
Implementation of Australia's NTCRS	Government regulation and the quality of reporting were not considered to be comprehensive enough. Customs and ABS codes were not flexible enough to reflect changes in products. Regulation does not always result in the development of efficient markets around collection and recycling of e-waste.
Risk of harm	There is insufficient evidence, in particular in New Zealand (and internationally), to support the assessment under risk of harm. E-waste can present a risk of harm if not handled properly, and if they are not correctly recycled.
Recycling Infrastructure	The recycling infrastructure is not mature enough to manage many e-waste streams which are then required to be transported overseas for treatment. There needs to be an infrastructure capacity gap assessment to determine existing capability for e-waste recycling in New Zealand.
Transboundary movement of waste	Inflexibility in transboundary movement of materials from recycling is restricting the volumes of material eligible for export to reprocessing internationally. This is particularly restrictive due to the lack of a domestic e-waste recycling industry.
Community expectation should be given equal weighting to risk of harm and resource benefit.	Priority product designation should not just be primarily about risk of harm and resource benefits but should also consider community expectations for product stewardship priorities.
Payment for scheme should be included in the price of the product.	Consumers are not willing to pay for recycling or disposal at end of life. The cost of management needs to be included in the purchase price.
A phased approach is recommended.	The majority of stakeholders recommended a phased approach for the following reasons: <ul style="list-style-type: none"> • target the e-waste categories which have the greatest impact; • target the e-waste categories not already being addressed through voluntary schemes or where voluntary schemes have proven to be unsuccessful; and • phased approach will allow for expansion of domestic recycling and reprocessing capacity.
Use of the WEEE Directive categories is sensible.	Preference for use of broader range of e-waste categories e.g. European WEEE Directive rather than limit to one category e.g. TV's and computers.
Use of targets will need to be carefully considered	Targets will need to be carefully considered due to; <ul style="list-style-type: none"> • a lack of existing comprehensive baseline data; • risk of limiting schemes success by placing an upper limiting target; • influence of market forces on recycling; and • restrictions on exporting some e-waste product materials e.g. plastics potentially containing brominated flame retardants may reduce the maximum recovery percentage of a product.

The combined feedback obtained during the interviews has been used to inform the assessment of e-waste management options discussed in Section 4.

The interviews also requested feedback on a series of possible performance indicators for any possible future scheme. The performance indicators were developed based on the project team research, knowledge and experience. Responses for those expressing an opinion on possible key performance measures are provided in **Table 4**.

Table 4 Stakeholder Preferences for Key Performance Measures

Parameter	Yes	No	No Preference
Total electronic and electrical items collected (tonnes)	6	1	1
Total electronic and electrical items collected (units)	8	1	
Total electronic and electrical items collected per capita (tonnes)	5	2	2
Total electronic and electrical items collected per capita (units)	4	2	
Total programme costs per tonne	5	1	2
Total programme costs per unit	5	2	1
Operational costs per tonne	4	1	2
Overhead costs per tonne	4	1	2
Percent of population covered by collection sites	5	3	
Percent of population covered by collection events	6	3	
Total permanent collection sites	6		1
Total collection events per annum	6	1	1
Percentage of population aware of the programme	8	1	1
Total electronic and electrical units re-used	7		1
Total weight of material recycled as percentage of material collected (by weight)	6		2
Proof of recycling / final disposition	8		1
Greenhouse gas emissions offset through re-use or recycling	4	2	3
Mass balancing	6		2
Trends in processing (e.g. material reduction in manufacturing, reduction in use of hazardous materials, or increased durability of product)	4	2	1
Compliance with the Australian and New Zealand Standard for the collection, storage, transportation and treatment of electronic and electrical equipment (AS/NZS 5377:2013)	5		1
Compliance with all applicable licensing and permit conditions	5		1

The stakeholder interviews raised some concerns about establishing specific material recovery targets, especially given the uncertainties about estimating the waste arisings for e-waste and the crossover occurring between different e-waste categories being recovered. These have been addressed as part of the study recommendations on improved data collection in **Section 6** of this report.

3.1.4 Workshop 2

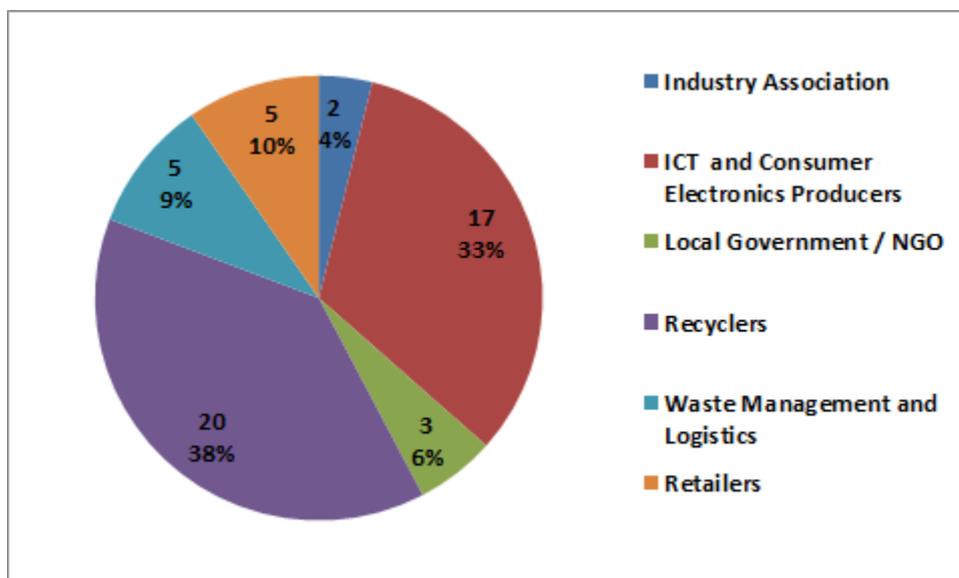
Workshop 2 was held 11 February 2015 in Auckland. All stakeholders were invited to attend. For stakeholders unable to attend there was the option to observe and hear the workshop using a web link provided by the venue.

During the workshop stakeholders were presented with the following

- results of discussions to date;
- results of the e-waste data review; and
- a summary of the recommended e-waste product stewardship framework presented in this report.

A total of 52 stakeholders attended Workshop 2. A summary of the proportion of stakeholder groups who attended the first workshop is presented below in **Figure 4**.

Figure 4 Proportion of Stakeholder Group Representation at Workshop 2



Note: Chart shows number of representatives and percentage of total.

Stakeholder feedback was also elicited through the use of a straw poll to stimulate discussion around the group's recommendations for priority product designation of particular e-waste product categories.

Voting was subjective and not all participants presented a preference for each e-waste category. It is therefore assumed that stakeholder preferences and appetite to vote for a particular category (either yes or no) was dependent on the participant's connection to each e-waste category. **Table 5** provides a summary of the responses.

Table 5 Stakeholder Voting on Priority Product Designation

WEEE Directive Categories Plus Batteries	Priority Product YES	Priority Product NO
A1 - Large Household Appliances	27	10
A2 - Small household appliances	24	8
A3 - Information Technology and Telecommunications Equipment	29	5
A4 - Telecommunication Carrier and Commercial Equipment	21	8
A5 - Consumer Equipment	30	0
A6 - Electrical and Electronic Tools (with the exception of large scale stationary industry tools)	18	5
A7 - Toys, Leisure and Sports Equipment	14	13
A8 - Automatic Dispensers	11	16
A9 - Lighting Equipment	27	4
A10 - Medical Devices (with the exception of all implanted and infected products)	13	10
A11 - Monitoring and Control Instruments	14	9
A12 - Batteries	35	2

Behaviours towards certain categories are representative in the voting. Where stakeholders are less engaged with a product there appeared to be fewer preferences put forward e.g. automatic dispensers, medical devices and monitoring and control instruments. On the other hand stakeholders appeared to have more of a preference when it came to batteries, large household appliances, and information technology and telecommunications equipment.

3.1.5 Stakeholder Engagement Outcomes and Limitations

The overall response to the stakeholder engagement process from stakeholders throughout this project was very positive and the contribution in the form of participation in workshops and detailed discussions was both useful and informative. However, despite strong participation from a cross section of respondents, limitations of the information elicited during the stakeholder engagement process include the following:

- with a lack of evidence based information the quality and completeness of the responses from the stakeholder groups could be open to interpretation;
- the overwhelming support in favour of product stewardship schemes and specifically priority product designation for e-waste categories (see **Table 5**) is based on broadly defined product stewardship categories and rather than specific management options and cost-benefit analyses tailored to each product category;
- limitations in determining New Zealand-specific e-waste generation and management data have been noted throughout the project and the data available for stakeholders to consider is less robust than desired; and
- results of MfE's consultations on priority product designation were not available for consideration during this project, potentially limiting the evidence base available to fully evaluate the priority product designation process, required under New Zealand legislation, (see **Section 2.3**).

The remaining assessment of options and recommendations presented in this report is largely informed by published data sources, international experiences of product stewardship and stakeholder contributions where provided.

3.2 E-waste Data Summary for New Zealand

Available and reliable data on e-waste generation has been highlighted as a potential barrier to implementing effective change (1). The issue of incomplete and inaccurate data on e-waste has made the task of trying to develop a framework for managing this waste stream more difficult.

A recent paper published by the UNU (4) in recognition of the difficulties in quantifying the e-waste data problem has attempted to develop a suitable framework that can provide a useful overview of the size of the market for EEE products within a country as well as e-waste generation. The paper recommended using EEE sales data as a primary data source.

In absence of any industry EEE sales data for New Zealand the Statistics New Zealand International Trade Statistics¹⁶, which provides customs details of all imported products into the country, have been used to estimate sales data for this study.

For the purposes of this study New Zealand is considered a net importer of EEE products, the proportion of exported household EEE items is considered to be comparatively low¹⁷ and unlikely to significantly distort the overall estimated e-waste (in kilograms) per capita (a commonly used measurement method). The dataset also only considers imported EEE items and therefore excludes any items manufactured and sold domestically (this is also considered to be a relatively low figure).

There are a number of different peer reviewed methodologies for calculating potential e-waste, all of which have advantages and disadvantages. The method chosen for this study, largely based on the likely available data, was the 'market supply method' (18). The market supply method uses total sales of products, the average lifetime of the new product and an average life of the product for reuse.

Equation 1 Market Supply Method

$$\text{WEEE Generation (t)} = \text{sales (t-d}_N\text{)} + \text{reuse (t-d}_S\text{)}$$

With d_N - average lifetime of new items
 d_S - average lifetime of second-hand items

A more detailed description of the methodology for estimating total e-waste generation in New Zealand and key assumptions are provided in **Appendix C** of this report.

Table 6 below provides a qualitative summary demonstrating SLR's confidence in the various assumptions used to estimate e-waste data generation.

Data accuracy, data quality and fluctuations in imports columns are all in reference to the level of detail captured by Statistics New Zealand. The average weight and average life span (new) are based on existing published data sources (see **Appendices C** and **D**), however, not all categories are included and therefore a lower confidence level is given to categories where weight and life span (new) have been estimated. The final column represents the approximate lifespan for reuse for each category and currently no comprehensive published datasets are available, therefore a 'best guess' estimate has been provided.

¹⁶ The International Trade Statistics are largely built from New Zealand Customs information however the exact process for converting the data and any significant changes in the conversion process are unknown

¹⁷ Comparative reviews of import versus export data of the same product was undertaken using Statistics New Zealand export and import data. The review did not include a detailed comparison of all EEE items.

Table 6 Confidence in Assumptions Used to Inform E-waste Data Review

WEEE Category	Data accuracy	Data quality	Fluctuations in imports	Average weight of items	Approximate life span (new)	Approximate life span (re-use)
A1 - Large Household Appliances	5	5	4	3	3	1
A2 - Small household appliances	4	4	4	3	3	1
A3 - Information Technology and Telecommunications Equipment	3	3	4	2	2	1
A4 - Telecommunication Carrier and Commercial Equipment	1	2	2	1	1	1
A5 - Consumer Equipment	4	3	3	3	2	1
A6 - Electrical and Electronic Tools (with the exception of large scale stationary industry tools)	3	3	3	3	2	1
A7 - Toys, Leisure and Sports Equipment	2	3	1	3	2	1
A8 - Automatic Dispensers	2	1	4	2	2	1
A9 - Lighting Equipment	1	1	4	2	3	1
A10 - Medical Devices (with the exception of all implanted and infected products)	1	1	1	1	1	1
A11 - Monitoring and Control Instruments	1	2	4	2	2	1

Key



Table 7 presents the estimated number of units, tonnes and kilograms per capita for each e-waste category and as a total. The total estimated future e-waste generated per person is 27.1kgs per capita or 28.8kgs assuming no reuse of items. The results present estimates for Year 15 (i.e. 2030) and can be used to understand the likely e-waste generation of the future.

Table 7 2030 Estimate for E-waste Generation Per Capita in New Zealand

WEEE / AS/NZS Category	Predicted Annual E-waste Quantities Per Capita (kgs) (No reuse)	Predicted Annual E-waste Quantities Per Capita (kgs) (Includes reuse)
A1 - Large Household Appliances	10.1	8.5
A2 - Small household appliances	3.1	3.0
A3 - Information Technology and Telecommunications Equipment	7.1	7.0
A4 - Telecommunication Carrier and Commercial Equipment	0.3	0.3
A5 - Consumer Equipment	3.6	3.5
A6 - Electrical and Electronic Tools (with the exception of large scale stationary industry tools)	3.8	3.7
A7 - Toys, Leisure and Sports Equipment	0.4	0.8
A8 - Automatic Dispensers	0.0146	0.0143

WEEE / AS/NZS Category	Predicted Annual E-waste Quantities Per Capita (kgs) (No reuse)	Predicted Annual E-waste Quantities Per Capita (kgs) (Includes reuse)
A9 - Lighting Equipment	0.3	0.3
A10 - Medical Devices (with the exception of all implanted and infected products)	0.02	0.02
A11 - Monitoring and Control Instruments	0.01	0.01
TOTALS	28.7	27.1
TOTALS (excluding A4 and A10)	28.4	26.9

Table 7 also includes an additional totals row that excludes categories A4 (telecommunications carrier and commercial equipment) and A10 (medical devices). The reason for excluding these two categories is that the input data was not considered reliable due to a lack of unit numbers and or weight data. This is also consistent with the reclassified WEEE Directive categories being introduced in 2017 (see **Section 2.2**) which have omitted these categories in future e-waste classification reporting. Previous estimates (1) for e-waste generation per capita in New Zealand based on European data suggested e-waste generation was between 16 and 19kgs per person per year¹⁸. The estimated e-waste generation figure in **Table 7** of 26.9kgs per person per annum is higher than previous estimates; however, this figure is a 2030 estimate and therefore is consistent with other sources suggesting the e-waste stream is increasing (19).

Table 8 below shows total e-waste generated in 2010 for selected European countries Netherlands, Italy, Belgium and France. The previously estimated 2014 New Zealand e-waste figure of between 16 and 19 kilograms per capita would suggest that New Zealand has the lowest e-waste generation per capita compared with the other European countries presented below in **Table 8** (assuming that each country's e-waste generation per capita would have increased since 2010).

Table 8 National E-waste Generation Country Comparison Per Capita in 2010 (kgs)

Netherlands	Italy	Belgium	France
23.7	18.9	26.2	24.3

Source: E-waste Statistics 2015

Stakeholders were requested throughout the study to provide further details as evidence for waste generation however data was not forthcoming.

The draft methodology and associated spreadsheets for estimating e-waste in New Zealand was peer reviewed by both MfE and Statistics New Zealand. A number of clarifications and recommendations were provided and subsequent amendments to the calculation model were made. Recommendations or comments which could not be accommodated due to time and resource restrictions but could be undertaken as a second stage review are detailed below:

- provide sensitivity analysis on the assumed growth rate (possibly replacing population with GDP etc.);
- further investigation and sensitivity analysis into the reuse lifespan assumptions of individual categories (currently aggregated per category);

¹⁸ This estimate was arrived at by multiplying a per person e-waste generation rate from international studies by the estimated resident New Zealand population in January 2014.

- consider expanding the datasets to include import data prior to 2011 (possibly back to 2000) to observe trends in consumption;
- undertake further detailed review of export data to reconcile imports and exports;
- undertake further consultation with Statistics New Zealand to confirm assumptions regarding classification of product codes into WEEE categories; and
- inclusion of batteries information.

Although estimates of future e-waste generation are useful and provide a good indicator for future waste infrastructure capacity requirements the data is less reliable as a baseline. The estimated New Zealand 2014 figure of 17 to 19kgs (1) is based on international data sets and therefore would benefit from a verification process to determine how much e-waste is currently being disposed in landfills and how much is currently being reused or recycled.

New Zealand has a solid waste analysis protocol (SWAP) which provides a classification system for component materials in the waste stream and guidance on how to appropriately sample and classify waste at a disposal facility. The current version of the protocol (20) lists electronic items under the non-ferrous metals category which would not allow sufficient granularity to separately identify e-waste as a proportion of the total waste stream.

Further details of recommendations for improved waste data collection are provided in **Section 6**.

4 PRODUCT STEWARDSHIP OPTIONS

This report considers an approach to assess e-waste product categories that would be most suitable for product stewardship solutions. Where a product or product category does not appear to satisfy the criteria for priority product designation (as provided in **Section 2.3**), recommendations for alternative product stewardship options or other WMA regulations (where appropriate) are considered.

In the development of a framework for e-waste this report considers the following:

- product stewardship options;
- threshold criteria for designation of e-waste as priority products; and
- application of criteria to e-waste product categories in New Zealand.

4.1 Product Stewardship Options

Product stewardship implementation models can be grouped into the following descriptions:

- industry voluntary product stewardship schemes;
- accredited voluntary product stewardship schemes;
- co-regulatory schemes; and
- regulated schemes.

4.1.1 Industry Voluntary Product Stewardship Scheme

An industry-led voluntary product stewardship scheme is an approach whereby a company, group of companies / industry association establishes a programme to support the take back and end-of-life management of its / their products in an entirely voluntary way. Such schemes do not have any Government intervention or specific regulatory underpinning (but may apply to receive funding through the WMA).

For example, Fisher & Paykel has a programme in New Zealand called “Take Back” that offers free collection and recycling of working but unwanted refrigerators and freezers. While this project is in partnership with the NZ Energy Efficiency and Conservation Authority it is not a regulated or accredited product stewardship scheme.

The Preliminary Report provided a summary of historical central government facilitated voluntary e-waste product stewardship schemes in New Zealand, these included eDay, the TV Takeback programme, e-waste recycling infrastructure. While it is acknowledged that these schemes attracted good participation, MfE estimated that e-waste diversion from landfill was approximately 1 percent (1). These previous experiences have helped to inform and shape some of the recommendations presented in **Section 5** of this report.

4.1.2 Accredited Voluntary Product Stewardship Scheme

Accredited (government endorsed) voluntary schemes are a means to support and facilitate product stewardship schemes where the potential impact of the product and its waste stream does not justify regulatory intervention. This may be because the nature of the product and its waste is not of significant volumes, is not inherently negative to the environment or is currently managed in such a way that regulatory intervention may not deliver a better environmental outcome.

Australia is the primary overseas example of accredited voluntary product stewardship, with the accreditation under the *Product Stewardship Act 2011* of voluntary schemes for mobile phones and their accessories and for mercury-containing lamps, as well as other materials such as tyres.

In New Zealand under the WMA the Minister for the Environment is able to recognise product stewardship schemes for their efforts to manage the end-of-life impacts of products and the meeting of certain minimum standards of operation. This is called “accreditation” under the WMA.

Accredited voluntary schemes vary from industry voluntary schemes as they can be applied to non-priority products to meet certain standards of operation such as having a scheme manager, stated objectives, a clear funding mechanism, published time frames for meeting objectives and processing for assessing and reporting performance.¹⁹ Under the WMA the Minister for the Environment has so far accredited 13 voluntary product stewardship schemes (details are provided in **Section 2.3**).

4.1.3 Co-regulatory Product Stewardship Scheme

Co-regulation for product stewardship is an approach involving some form of government regulatory action in support of or underpinning specific industry product stewardship schemes. In such approaches it is common for industry to run the scheme as it sees fit in order to achieve outcomes set and monitored by Government, with Government also providing some assurance of a level playing field for industry through mechanisms that discourage free-riders.

Examples include the Australian National Television and Computer Recycling Scheme (NCRS)²⁰ and the Australian Packaging Covenant.²¹ SLR is not aware of any co-regulatory product stewardship schemes in New Zealand.

4.1.4 Regulated Product Stewardship Schemes

A regulated product stewardship scheme in New Zealand must be developed following designation as a priority product and accreditation from the Minister. Beyond declaration as a priority product and accreditation, regulatory powers under the WMA that are potentially relevant to the management of e-waste include:

- prohibiting the sale of a priority product, except in accordance with an accredited scheme;
- controls or prohibitions on disposal, manufacture or sale, or product labelling;
- product take-back services, management fees for products, product deposits and refunds, quality standards for reusing, recycling, or recovery; and
- collection and reporting requirements.

A summary of the key advantages and limitations of each option (with the exception of business as usual) are presented below in **Table 9** to **Table 12**.

¹⁹ Waste Minimisation Act 2008 Section 14.

²⁰ <http://www.environment.gov.au/protection/national-waste-policy/television-and-computer-recycling-scheme>

²¹ <http://www.packagingcovenant.org.au/>

Table 9 Industry Voluntary Product Stewardship Scheme

Description	Although voluntary product stewardship can take many forms it is commonly recognised to be the establishment of operational and reporting requirements developed within a particular industry to achieve an improved environmental impact of a product's lifecycle.
Requirements	No specified requirements.
Advantages	<ul style="list-style-type: none"> • Flexible and not constrained by regulatory requirements. • Led by industry groups most willing to take action. • Able to be easily amended. • Can be implemented more quickly than a co-regulatory or regulatory scheme. • Consistent, targeted education campaigns can be helpful, although their impact is often greatest when they provide information on where consumers can take used products for recovery or other safe management. • Minimal resources required from Government.
Limitations	<ul style="list-style-type: none"> • No formal accreditation so environmental improvements and programme results are difficult to verify. • Participation is voluntary, therefore less responsible producers can choose not to participate and may obtain economic advantage through not managing waste streams according to best environmental practice. • Extent to which such efforts result in real producer responsibility or shift costs of local waste management could vary significantly with the specific projects and funding models used. • No formal process to consider other options and compare costs and benefits of the Scheme (for a co-regulatory or regulatory arrangement, this would be undertaken through cost-benefit and regulatory impact analyses).

Table 10 Accredited Voluntary Product Stewardship Scheme

Description	Voluntary product stewardship schemes can be accredited under the WMA product stewardship accreditation process.
Requirements¹	<ul style="list-style-type: none"> • A scheme manager must be nominated and is responsible for managing the operation of the scheme, reporting on the performance of the scheme and managing variations of the scheme. • Measurable objectives need to be set. • Methods for management, measurement and reporting must be identified by the organisation. • Accreditation must be publicised to purchasers, users and handlers of the product. • Details of funding for application and operation of the accreditation scheme must be provided. • Schemes are required to provide evidence of reduced environmental impacts of the product overall.
Advantages	<ul style="list-style-type: none"> • Formal accreditation under the Act can be considered a demonstration of environmentally responsible behaviour by producers within the scheme. • Schemes can recommend their own targets and reporting processes. • Formal reporting process can verify positive environmental performance. • Can result in process efficiencies and cost savings.
Limitations	<ul style="list-style-type: none"> • Accreditation process can be time and resource intensive and may present barriers to smaller producers. • Full cost is to be borne by the applicant. • Producer needs to provide evidence of full control over product's entire lifecycle. • Participation is voluntary and therefore less responsible producers can choose not to participate and may obtain economic advantage through not managing waste streams according to best environmental practice (1)

1. Guide to Product Stewardship for Non-Priority Products in the Waste Minimisation Act 2008 (21)

Table 11 Co-regulatory Product Stewardship Scheme

Description	Co-regulation for product stewardship can be an approach involving some form of government regulatory action in support of specific industry product stewardship schemes (22).
Requirements	Combination of industry self-regulation and government regulation.
Advantages	<ul style="list-style-type: none"> • Helps to address the ‘free-riders’ that can reduce programme cost-effectiveness and limit participation by industry leaders under purely voluntary approaches. • Improved environmental outcomes in the product lifecycle. • Can result in process efficiencies and cost savings. • Any producer within the sector can join (subject to meeting requirements). • Formal reporting process can verify positive environmental performance. • Government assistance may be available for accreditation.
Limitations	<ul style="list-style-type: none"> • Decision making and regulatory processes can be time and resource intensive and may present barriers to smaller producers. • Targets and performance measurement likely to be set by Government.

Table 12 Regulated Product Stewardship Scheme

Description	A regulated product stewardship scheme in New Zealand must be developed following designation as a priority product and accreditation from the Minister would need to be obtained.
Requirements	<ul style="list-style-type: none"> • Regulations could be placed on manufactures, importers, retailers, users or a combination of all stakeholders. • Compulsory participation, targets, measurement and reporting.
Advantages	<ul style="list-style-type: none"> • Creates level playing field for all manufacturers, importers and retailers as compliance is mandatory • Consistent national approach to product management. • Compulsory reporting will improve e-waste data for designated product categories. • Increase e-waste recycling for designated products. • Reduce environmental impacts of designated product categories. • Regulated e-waste product stewardship schemes have been successfully implemented internationally. • Provides the opportunity to shift the burden of local waste management costs back to the producers and consumers. • Mandatory recycling and diversion targets will create more certainty for recyclers and reprocessors and should result in increased treatment capacity. • Can incorporate, and be supplemented by, other non-regulatory and regulatory approaches
Limitations	<ul style="list-style-type: none"> • Additional reporting requirements for those producers not already involved in an accredited scheme. • Requires demarcation between product categories that increasingly change over time. • Cost benefit analysis could prove that costs of regulatory intervention exceed the benefits. • Additional resourcing required by Government to enforce, monitor and report.

Additional regulatory options available in relation to products, materials and waste under the WMA²² include:

- Control or prohibition on disposal (e.g. landfill bans), sale etc.;
- Take-back services, fees and refundable deposits;
- Labelling of products;
- Quality standards; and
- Information to be collected and provided.

These regulatory tools can be applied to products, materials and waste whether or not they have been declared priority products, meaning they can be used alongside or instead of priority product designation.

As with priority product designation there are a number of requirements which the Minister needs to consider and be satisfied before recommending the regulations:

(a) under subsection (1)(a²³), unless he or she is satisfied that there is adequate infrastructure and facilities in place to provide a reasonably practicable alternative to disposal or, if not, that a reasonable time is provided before the regulations come into force for adequate infrastructure and facilities to be put in place:

(b) under subsection (1)(b), unless a reasonably practicable alternative to the specified materials is available.

Before recommending the making of regulations under subsection (1), the Minister must—

(a) obtain and consider the advice of the Waste Advisory Board; and

(b) be satisfied that—

(i) there has been adequate consultation with persons or organisations who may be significantly affected by the regulations; and

(ii) the benefits expected from implementing the regulations exceed the costs expected from implementing the regulations; and

(iii) the regulations are consistent with New Zealand's international obligations.

A summary of the regulatory options are provided below.

4.1.5 Control or Prohibition on Disposal or Sale

Any consideration of landfill bans should consider phasing of such bans only after effective product stewardship approaches and alternative treatment capacity or markets for materials are in place and can provide a viable alternative to landfilling (23). While landfill bans can be effective supplements to product stewardship approaches, on their own they do not require producers to bear any responsibility for their products or shift local waste management costs to the producers and consumers of the targeted products.

²² Section 23

²³ Control or prohibition on disposal, sale etc.

4.1.6 Take-back Services, Fees and Refundable Deposits

Take-back services might include requirements for the producer or retailer to collect the product at the post-consumer stage and they are responsible for the reuse, recycling and recovery of the products. In practice, these requirements are usually discharged through a collective group known as a producer responsibility organisation (PRO) funded by producers.

Fees can be applied to different groups of people (e.g. corporate, non-corporate) or at different stages in the product lifecycle (e.g. manufacturer, importer and retailer). The fees would be used to pay for the management of the product (e.g. to fund collection and reprocessing facilities) and therefore the level of fee may be determined based on a number of factors such as weight, percentage of electronic componentry, hazardous material content etc. Assessment of 'who pays' and the administration of the fee process could be resource intensive.

Deposit refund schemes usually involve a fee applied to the sale of a product which is refunded to the purchaser in the form of a rebate when the item is returned for recycling. Internationally, deposit refund schemes are most commonly applied to the beverage industry to encourage the return of beverage containers (usually glass, aluminium and plastics) to the point of sale or a collection centre (24). Assessment of how this might work for e-waste in New Zealand has not been explored to date, however the way in which deposits are collected by industry may be limited by the ability to interact with EEE product manufacturers as the majority are overseas.

4.1.7 Labelling of Products

Labelling can assist with easy identification of potentially harmful product components. Mandatory labelling can also be applied to electronics advising consumers that the products need to be recycled at the end of life and not placed in general waste. This option would need to consider the availability and convenience of e-waste reprocessing treatment options for consumers and where possible be consistent with other international standards e.g. the European WEEE symbol of a crossed out wheellie bin.

4.1.8 Quality Standards

Certification and standards for addressing e-waste have grown in strength and influence in the past few years as their market demand and commercial significance have increased. Whilst particulars of certification programmes vary somewhat, their key features have grown more similar over time. Primary distinctions include geographic coverage and whether they allow export to non-OECD countries. Although addressed in the Preliminary Report a summary of the relevant international schemes are repeated below.

4.1.8.1 e-Stewards[®] and R2

There are two principal certification programmes to help ensure that e-waste recycling activities are conducted in an appropriate manner - Responsible Recycling (R2²⁴) and e-Stewards^{®25}.

The e-Stewards[®] certification is intended as an international standard, although in practice e-Stewards[®] only lists certified locations (146 in total) in North America and the UK as of end February 2015. On March 2012, the Basel Action Network (BAN) announced that e-Stewards[®] certification would include R2 practices. The e-Stewards[®] standard also has key provisions of International Organisation for Standardisation for Environmental Management Systems (ISO 14001) integrated within the standard.

²⁴ The R2 Standard and guidance materials are available at <http://www.sustainableelectronics.org/r2documents>, accessed July 2014.

²⁵ The e-Stewards standard is available for purchase at <http://www.e-stewards.org/certificationoverview/e-stewards-standard/access/>, accessed July 2014.

Four US states (Pennsylvania, Rhode Island, South Carolina, and Vermont) require that recyclers be third-party certified to R2 or e-Stewards®; these states passed their laws after the certification programmes were established, while other states preceded the certification programmes (13). Similarly, the US Government also requires that recyclers be certified to R2 or e-Stewards®. Such use of performance measures can be an effective means of ensuring outcomes without having to be overly prescriptive.

Over 500 facilities in 14 countries are R2 certified. TES-AMM's facility in Auckland is the only R2 certified facility in New Zealand as of end February 2015. A variety of facilities are certified to R2 in the Asia Pacific region.

An important distinction between e-Stewards® and R2 is that while both require compliance with all import/export laws, including the Basel Convention, e-Stewards® does not allow export to non-OECD countries, whereas R2 does allow such export. New Zealand also allows export to non-OECD countries in conformance with the Basel Convention, so e-Stewards® is not consistent with New Zealand Government policy. This could be an important factor in the case where recovered e-waste is shipped for reprocessing within the Asia Pacific region.

Under R2, required environmental, health and management systems can be compliant with either ISO Occupational Health and Safety Standard (OHSAS) (which are internationally recognised) or the Recycling Industry Operating Standard® (RIOS) (25). RIOS is a recycling-specific health and safety standard for electronics recyclers.

4.1.8.2 WEEELABEX

Beginning in 2009, the WEEE Forum, its members and other stakeholders began developing standards across the European WEEE industry known as WEEELABEX²⁶. Although WEEELABEX is not a formal certification process, there are strong commercial drivers for its adoption. In April 2011, the WEEE systems decided that they would require the operators with whom they have a contractual relationship to comply with the WEEELABEX requirements by 31 December 2013 (for old EC member states) and 31 December 2014 (for new EC member states). WEEELABEX applies across all WEEE categories under the WEEE Directive.

In Canada, the Electronic Products Recycling Association (EPRA) applies the Electronics Recycling Standard (ERS) as the standard for evaluating and validating reuse and recycling operations through its Recycler Qualification Programme (RQP) to ensure that only compliant, safe and environmentally responsible recyclers are authorised. Onsite audits and approvals of re-users and recyclers are conducted regularly.

4.1.8.3 AS/NZS 5377:2013

A new standard for the collection and recycling of e-waste in Australia and New Zealand called AS/NZS 5377:2013 Collection, storage, transport and treatment of end-of-life electrical and electronic equipment was released in February 2013. AS/NZS 5377 is not a legal requirement, although it has been incorporated into a variety of contractual arrangements for collection, transport and processing of e-waste. New Zealand incorporates AS/NZS 5377 in WMF deed agreements where applicable. A certification scheme to AS/NZS 5377 is currently under development.

²⁶ <http://www.weeelabex.org> accessed July 2014.

The need to provide a level playing field for recyclers and to raise the recycling industry up to an appropriate standard was consistently raised in project research and in stakeholder consultations. Achieving these objectives has a cost that needs to be recognised. However, requiring that recyclers of designated products be held to high standards such as AS/NZS 5377:2013 or an appropriate certification scheme for e-waste recyclers, such as R2[®] or e-Stewards[®], as part of gaining accreditation under the WMA should help to provide a level playing field whilst minimising costs of alternative approaches. Most responsible recyclers are already in compliance with these approaches and face being at a competitive disadvantage from recyclers that are not.

It is therefore recommended that at a minimum, the requirement that recyclers of designated products must be held to high standards such as AS/NZS 5377:2013 or an appropriate certification scheme for e-waste recyclers, such as R2[®] or e-Stewards[®].

Other performance measures such as collection targets are often applied to increase recycling rates, but can involve their own difficulties. For example, both Australia's NTCRS and Minnesota's Electronics Recycling Act 2007 include recycling targets and systems of recycling credits that are applied when producers collect more than their annual obligations, but had to modify how the credits towards the targets were counted. Some responsible entities stopped collecting e-waste upon achieving their collection targets and recycling credits, while other responsible entities were being held responsible for a recovery stream significantly different than what was entering the market or available for recovery.

Various representative international programmes were examined in **Section 2.4** of this report.

4.2 Threshold Criteria for Designation of E-waste as a Priority Product

The criteria identified in the WMA to assess e-waste items (identified in **Section 2.2**) for priority product designation is based on the following:

- Environmental harm;
- Resource benefit;
- Ability to be effectively managed under a stewardship scheme;
- Effectiveness to be managed under a voluntary scheme; and
- Demonstrated public concern.

In an attempt to make recommendations for a framework to identify e-waste categories for priority designation this report has evaluated each of the assessment criteria against the information gathered during both desk-based research and extensive consultations with stakeholders. The following sections summarise what evidence is likely to be required to undertake the assessment for each product category and to what extent SLR understands that evidence is available.

4.2.1 Harm to the Environment

E-waste items are known to contain a number of substances that have potential to impact on environmental and human health when disposed of or handled inappropriately.

These environmental and human health impacts can arise because e-waste contains the following types of materials (26):

- lead in circuit boards or cathode ray tube (CRT) glass;
- arsenic in CRTs from televisions and computer monitors;
- mercury in liquid crystal display (LCD) backlights and switches;
- brominated flame retardants in hard plastic casings;

- refrigerants such as synthetic greenhouse gases; and
- lead, mercury, cadmium and zinc in batteries.

However, the extent to which these items (e.g. lead from circuit boards, mercury in LCDs) exist within e-waste products can vary considerably depending on the product category.

The composition of electrical and electronic products also change over time (18) as technology designs become more sophisticated and therefore the level of harm posed by a particular e-waste product category will also change. Products can also become obsolete and therefore the future risk of harm from a particular toxic substance is depleted over time (e.g. the replacement of CRTs by LCD displays (18) will dramatically reduce quantities of lead entering the waste stream), however this does not mean replacement technologies are without risk, (as discussed above, LCD screens have a mercury content).

As described in Section 2.3 of this report, under the WMA the Minister for the Environment must not declare a product a priority product unless he or she is satisfied that either

(i) the product will or may cause significant environmental harm when it becomes waste; or

(ii) there are significant benefits from reduction, reuse, recycling, recovery, or treatment of the product;

and

(b) the product can be effectively managed under a product stewardship scheme.

This section of the report considers methods for evaluating the risk of harm from e-waste products. The information possibly required to assess risk of harm the environment and the availability of data to support an assessment is presented below in **Table 13**.

Table 13 Assessing Potential Harm to the Environment

Information for Criteria Evaluation	Assumed Data Availability	Assumed Data Accuracy	Description
Product composition	✓	✓	Understanding the composition of a product can assist with determining the potential impact of harm to the environment. To determine the accuracy of the data, composition information can either be provided by the manufacturer or through manual dismantling.
Product average life	✓	?	A product may contain potential harmful components however the overall risk is likely to depend on the average volumes of that product presented to the market for recycling or disposal. Determining how many are items are sold and what the average life of the product is will assist in quantifying the total volumes likely to be presented to the waste market for treatment or disposal. Currently there is data available to indicate total sales volumes and estimates for product average life however this data cannot be confirmed and is likely to fluctuate significantly between product types and brands.
Product quantities (or volumes) entering the waste market	?	?	
Product sales data	✓	?	
Management of e-waste	?	?	The way in which a particular product is managed is an important factor to consider when determining risk of harm. The level of exposure to risk to the environment and human health caused by materials contained within many e-waste products can vary depending on the way in which the item(s) are re-used, recycled or disposed. Evidence of waste material flows for e-waste is not widely available in New

Zealand and would need to be assessed by product category.

Table 13 identifies a number of data gaps for determining potential harm to the environment. Where data is difficult to assimilate or likely to change (e.g. location of disposal site) a different methodology may be required to assess risk of harm.

While some research suggests that dangerous substances are present in all e-waste appliances in varying amounts (18) further research is required to determine the degree to which a specific product category may cause harm.

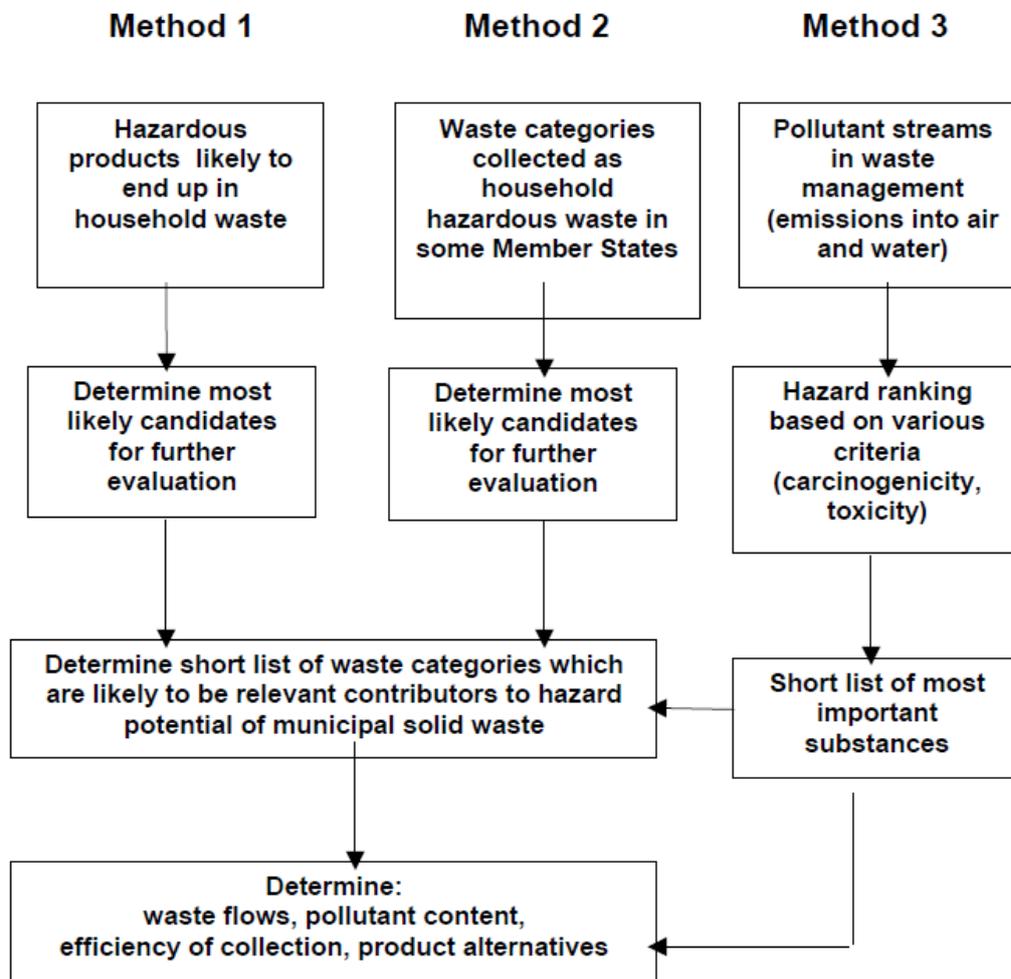
A report produced for the European Commission in 2002 considers three methodologies (see **Figure 5**) for identifying hazardous household products that are posing a potential threat to health and environment when disposed of by households and mixed with non-hazardous household waste (27). While this methodology focuses specifically on household cleaning chemicals it offers an alternative methodology to that presented in **Table 13**. A summary of the different methodologies provided in the report are presented below²⁷:

- **Method 1** – considers the composition of hazardous products likely to end up in the waste stream. The methodology requires a comprehensive and systematic analysis of the amount of substances with hazardous properties within specific product groups. This method is potentially inaccurate as not all e-waste product categories are made with the same materials and it would be impossible to undertake a comprehensive review of all individual e-waste products.
- **Method 2** – assumes that all products currently labelled as hazardous in other specific nations should be considered. The disadvantage with using this methodology is that there is an assumption of risk potentially based on obsolete data (e.g. products which previously contained harmful properties but due to changes in the manufacturing process or updates to technology no longer use the same materials will remain on the list) and does not always consider the disposal impacts in New Zealand.
- **Method 3** – recommends a review of emissions to the environment (principally to air and water) from solid waste treatment or disposal facilities e.g. landfills or reprocessing facilities. Applying this methodology it is possible to determine those substances most likely to cause harm and from that focus on the product groups most likely to contain contributors to the emission inventory. The hazardous substances entering the waste stream can then be ranked by order of importance. Ranking can be undertaken by multiplying the amount of each substance by a factor that expresses the relative toxicity compared to a reference substance.

The benefit of applying method 3 is that this process selects only those items most likely to cause significant environmental harm based on the amount of harmful substances contained (although the overall number of products going to disposal or treatment may also need to be considered).

²⁷ Methodologies have been adapted slightly to apply to e-waste products specifically.

Figure 5 Screening Process to Determine Priority List of Hazardous Household Waste



Source: European Commission 2002

A recommendation of this study would be to undertake a review of emissions to the environment (principally to air and water) from solid waste treatment or disposal facilities e.g. landfills or reprocessing facilities licensed to accept e-waste (i.e. method 3) to determine the e-waste category shortlist.

MfE has already classified fluorescent tubes and other mercury-containing waste²⁸ and discarded equipment containing chlorofluorocarbons²⁹ as hazardous waste materials (28). MfE has identified whiteware³⁰ as a problem waste due to the fact they can contain particular hazardous materials, however it is also assumed that the majority of these items are being recycled (29) and therefore the environmental impacts of this e-waste stream appear to be low.

²⁸ Product code 20 01 21

²⁹ Product code 20 01 23

³⁰ Defined by MfE as (domestic) refrigerators/freezers, clothes dryers, washing machines, dishwashers, ovens, stoves, rangehoods, waste disposal units, air conditioners/heat pumps, dehumidifiers and microwave ovens.

Stakeholder feedback and subsequent research has also highlighted the potential risk of harm from e-waste that is not disposed of in regulated landfills. More recently, a number of studies have been undertaken in the US to try and assess possible occupational health hazards associated with electronic scrap recycling (30) (31). The reports provide recommendations (engineering and administrative controls) for employers and employees to mitigate potential exposure to lead and other potential harmful metals. These reports suggest that, in the US, the potential impacts to the environment and human health from elements of e-waste recycling are recognised and there are recommended procedures in place to mitigate those risks.

Research from less developed regions such as parts of Africa and Asia highlight examples of a significant lack of safe recycling practices and illegal dumping of e-waste imported from more developed regions (32) (33) (34). Although these reports are now more than ten years old and therefore significant changes may have occurred since then, they do highlight the importance of maintaining a chain of custody with regard to the collection, processing and disposal of all e-waste materials.

The introduction of standards for all recyclers might be one way to improve the transparency of e-waste management. Another way to better regulate the management of waste would be to increase the number of domestic reprocessing facilities which would be managed and operated to New Zealand standards.

4.2.2 Resource Benefit

Similar to risk of harm to the environment, valuable resources³¹ are present to some degree in all e-waste items and as production of more electrical and electronic increases (4) so will the demand for precious metal components. Information technology items such as PC's, mobile phones and, tablet computers have been identified (35) as containing valuable components. As with risk of harm the quantity and type of resources and componentry will differ between e-waste categories and brands, and product design (and therefore resource value) may also change over time.

The assessment and evidence base for resource benefit (shown in **Table 14**) can be similar to the risk of harm assessment.

Table 14 Assessing Resource Benefit

Information for Criteria Evaluation	Assumed Data Availability	Assumed Data Accuracy	Description
Product composition	✓	✓	Understanding the composition of a product can assist with determining the potential value of the product. To determine the accuracy of the data composition information can either be provided by the manufacturer or through manual dismantling.
Product average life	✓	?	A product may contain potentially high value components however the overall economic value of recovery is likely to depend on the average volumes of that product presented to the market for recycling or disposal.
Product quantities (or volumes) entering the waste market	?	?	Determining how many are items are sold and what the average life of the product is will assist in quantifying the total volumes likely to be presented to the waste market for treatment or disposal.
Product sales data	✓	?	Currently there is data available to indicate total sales volumes and estimates for product average life however this data cannot be confirmed and is likely to fluctuate significantly between product types and brands.
Management of e-waste	?	?	Understanding the current capacity for resource recovery of each product and whether the reprocessing technology is

³¹ E.g. gold, silver and other precious metals

appropriate to extract valuable resources will be a key consideration. Evidence of waste material flows for e-waste is not widely available in New Zealand and would need to be assessed by product category.

Research indicates that information technology and telecommunications equipment; and possibly telecommunication carrier and commercial equipment (35) may have the greatest resource value.

Higher value products tend to lend themselves to market based solutions as the recycling or reprocessing of products is driven by demand for the products' raw materials e.g. gold, silver or other precious metals. This assumption was further supported during the project stakeholder engagement process³².

Remaining e-waste product categories may contain fewer precious metals or a higher proportion of other less valuable materials e.g. hard plastics. This can make the process of extracting the high value resources more expensive and therefore can cost more than the value of the recovered resources. In these instances the introduction of regulation may not provide a net benefit.

In recent MfE consultations on priority product stewardship, many responses highlighted the need to weight the criteria, valuing 'risk of harm' and 'resource efficiency' higher than the other criteria. In those consultations, the Australian Information Industry Association (AIIA) suggested placing greater emphasis on resource efficiency opportunity, citing a lack of international evidence for risk of harm. This view was reinforced in a range of direct stakeholder consultations for this project.

4.2.3 Effective Management

Before e-waste (or e-waste categories) can be declared a priority product there needs to be an understanding of whether product stewardship is a suitable option for management of the product or category. **Table 15** examines what information is likely to be required to determine if a product or category is suitable to be managed under a product stewardship programme.

³² Discussion with industry stakeholder group.

Table 15 Assessing Effective Management of E-waste under a Product Stewardship Scheme

Information for Criteria Evaluation	Assumed Data Availability	Assumed Data Accuracy	Description
Cost	?	?	The cost of a scheme should not far outweigh the benefits. Prior to the designation of a priority product a cost benefit analysis will need to be undertaken.
Product average life	✓	?	In order for a product stewardship scheme to be feasible there is a critical threshold for e-waste volumes or number of units being presented to the waste or recycling market to merit a change.
Product quantities (or volumes) entering the waste market	?	?	Determining how many items are sold and what the average life of the product is will assist in quantifying the total volumes likely to be presented to the waste market for treatment or disposal.
Product sales data	✓	?	Currently there is data available to indicate total sales volumes and estimates for product average life however this data cannot be confirmed and is likely to fluctuate significantly between product types and brands.
Management of e-waste	?	?	Need to understand and clarify the availability and access for consumers to e-waste recycling facilities/operations and whether the existing operations have the capability to reprocess the product. Evidence of waste material flows for e-waste is not widely available in New Zealand and would need to be assessed by product category. Costs for collection infrastructure and systems, as well as storage, management and transport, must also be considered.
Market for materials	✓	?	Costs to collect and reprocess various types of e-waste responsibly can exceed the value of recovered resources. Programmes must also manage risks such as demand for recovered materials and currency fluctuations, since most recovered materials are traded as commodities in international markets. Most e-waste product stewardship approaches operate at an overall net cost that must be met in order for collection and recycling to occur. These costs are invariably balanced with the costs of alternative approaches, including landfilling. Markets for materials will be predominantly overseas and therefore the environmental impact of transporting materials should be considered along with the quality of recycling practices (with regard to operational health and safety and environmental responsibility). Market values for many recycled materials (other than precious metals) can fluctuate considerably and will need to be considered as part of any further considerations.

SLR has determined that New Zealand specific e-waste data is insufficient to apply the above criteria to each of the e-waste product categories and provide a specific recommendation for each.

A qualitative response, based on the information available and through stakeholder consultation, might suggest that using the above criteria category A8 (Automatic Dispensers) would perhaps be identified as not having sufficient volumes to be considered for a product stewardship scheme. Similarly, while there was insufficient data recorded for categories A4 (Telecommunication Carrier and Commercial Equipment) and A10 (Medical Devices) feedback obtained during the stakeholder engagement process was that these waste streams are typically comprised of products which have high re-use potential (e.g. medical equipment³³) or contain high value components (e.g. telecommunication equipment³⁴) and therefore are less likely to be presented to the waste market for management. Further investigation is required to make a comprehensive assessment on the potential effectiveness of product stewardship schemes across all of the e-waste product categories.

Effective management must also consider the effectiveness of product stewardship or EPR schemes managing e-waste internationally as discussed previously in this report (see **Section 2.4**).

4.2.4 Effectiveness of Voluntary Schemes

If the industry producer(s) can demonstrate the product is being successfully managed through a voluntary scheme (e.g. through an accredited scheme) then it may not be required or appropriate to impose regulation, unless additional benefits can be achieved.

Consideration of the effectiveness of any voluntary product stewardship schemes might include the following:

- Evaluation of the outcomes from previous voluntary e-waste schemes in New Zealand;
- Stakeholder feedback on existing and previous voluntary project stewardship schemes both domestically and internationally; and
- Evaluation of the outcomes from international voluntary e-waste product stewardship schemes managed.

The Preliminary Report (2) provides summary details of all of the previous Government facilitated industry voluntary e-waste product stewardship schemes. MfE in its Priority Waste Stream Discussion Document (1) identifies that “*accredited voluntary product stewardship schemes are delivering mixed results in waste minimisation and harm reduction from their target waste streams*” and this was supported by many of the stakeholders who participated in this study.

Of the 12 currently active accredited product stewardship schemes three can be considered to fall into one of the e-waste categories³⁵; refrigerants, mobile phones and most recently printers (and related accessories).

In a recent announcement (8) the Minister for the Environment awarded Fuji Xerox accreditation under the WMA for its Zero Landfill Scheme. The scheme will aim to recycle and re-use an estimated 99.5 percent of equipment and products, including printers, copiers, toner bottles, print cartridges, drums, rollers and fuser oil, and packaging. It is estimated that the scheme will result in approximately 1,200 tonnes being diverted from landfill each year in New Zealand.

While the refrigerant scheme has been operating since 2010, the RE:MOBILE scheme only achieved accreditation in July 2014 and therefore reported data will not be available for the purposes of this study.

International experiences were also researched as part of this study (see **Section 2.4**), however the majority of those are focused on regulated product stewardship schemes or similar regulatory approaches, as they tend to collect and present more data.

³³ Discussion with industry stakeholder group

³⁴ Discussion with industry stakeholder group.

³⁵ Technically mobile phones are not included in the categories but have been implied for the purpose of this assessment.

4.2.5 Public Concern and Stakeholder Engagement

The focus of the stakeholder engagement process for this project has been to engage with industry, the community recycling sector, and local government rather than the general public, however MfE's (1) priority products public consultation included some local community engagement. The consultation document was placed on MfE's website and approximately 2100 stakeholders were emailed notifying them of the consultation.

A summary of the responses to the priority product consultation has been released and provides details of the feedback provided by stakeholders (36).

For all four identified waste streams proposed by MfE in recent consultations, a majority of submitters were supportive of these products as being the focus of potential government intervention. In addition, *"(m)any submitters want regulations to be developed to create a 'level playing field' for managing these product waste streams, but want to make sure any mandatory product stewardship schemes are well designed"* (36).

The consultation received 216 written responses in total and of those responses 75 percent agreed that electrical and electronic equipment should be a priority for Government to consider for regulatory intervention. Only 1 percent disagreed (the remainder were unsure, did not specify or did not comment).

Additionally, the high public participation response to the previous TV takeback scheme³⁶ could be used as an indicator of consumer concern. The scheme, which has now ended, collected more than 280,000 waste televisions³⁷.

During the stakeholder engagement process for this project some Councils provided feedback that residents are increasingly aware of e-waste recycling and existing collection schemes are being well utilised.

Auckland Council undertook a consultation process in 2012 on their Waste Management and Minimisation Plan and published a summary of the consultation responses (from 2008 responses). One of the summary results published³⁸ reported that 82 percent of submitters agreed with Council advocating to central Government to introduce mandatory product stewardship schemes for packaging. It is also understood that many of the respondents during the consultation specified e-waste as a product stewardship scheme they would like to have access to³⁹. Further public engagement would need to be undertaken to determine community expectation for e-waste recycling and to identify community preferences for priority product declaration.

4.3 Qualitative Ranking of E-waste Product Categories for Further Consideration

The options assessment highlights that the level of New Zealand specific data for e-waste products is currently insufficient to satisfy the requirements of the priority product designation criteria as detailed in **Section 2.3** of this report. Although there has been strong support from some stakeholder groups throughout this process for priority product designation, the information and evidence required by MfE to put forward a recommendation to Cabinet is currently not sufficient to make a determination.

³⁶ The MfE initiated the TV Take Back Programme in response to anticipated increased waste televisions as a result of the transmission from analogue to digital television.

³⁷ <http://www.tvtakeback.govt.nz/>

³⁸ <http://www.aucklandcouncil.govt.nz/EN/environmentwaste/rubbishrecycling/wastemanagementandminimisationplan/Pages/home.aspx#results>

³⁹ Anecdotal evidence provided by Auckland Council

The information gathered as part of this study, including available evidence from international experience and stakeholder engagement feedback has however provided a grouping of those categories which are most relevant for further investigation in order of importance. **Table 16** provides details of the qualitative ranking and reasons for the recommendation for further investigation.

Although a useful starting point for further investigation it must also be noted that the ranking below is based on stakeholders responding to the broad concept of a product stewardship scheme (and potential priority product designation) but the actual operation of any scheme and its ability to address stakeholders issues was not considered in any detail and will need to form part of future research.

Table 16 Qualitative Ranking of E-waste Product Categories

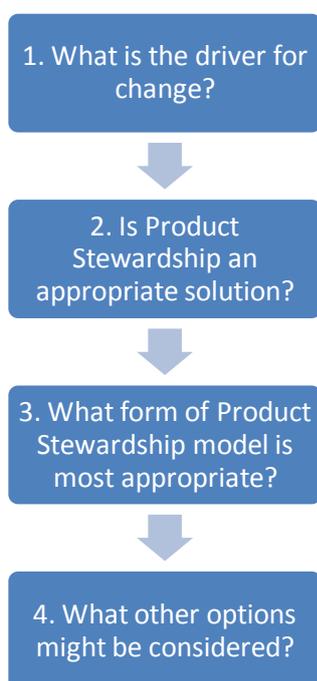
E-waste Product Category	Reasons for further investigation
<p>Information technology and telecommunications equipment, including video games and consoles but excluding mobile phones and their accessories</p>	<p>Information technology and telecommunications equipment accounts for approximately 26 percent (by weight) of the calculated likely future annual e-waste generation.</p> <p>Identified by various stakeholder groups as a priority for further investigation.</p> <p>Precedence shows this category is effectively managed through government led product stewardship schemes internationally</p> <p>Documented risk of harm from LCD screens and legacy CRTs.</p> <p>Published data suggests that the ICT products sector represents significant resource recovery value.</p>
<p>Consumer equipment, including TVs and TV peripherals and Electrical and electronic tools separate from their batteries</p>	<p>Accounts for approximately 13 percent (by weight) of the calculated likely future annual e-waste generation.</p> <p>Documented risk of harm from LCD screens and legacy CRTs</p> <p>Identified by a number of stakeholder groups as requiring priority product declaration to manage free-riders.</p>
<p>Batteries (including handheld batteries less than 4 kg and batteries embedded in IT, telecommunications and consumer equipment)</p>	<p>Batteries data not quantified during the data review however came through strongly in Workshop 2 as a priority for further consideration due to risk of harm and potential for resource recovery.</p>
<p>Refrigeration and air conditioning equipment requiring de-gassing prior to recycling</p>	<p>Accounts for approximately 3 percent (by weight) of the calculated likely future annual e-waste generation.</p> <p>Contains hazardous waste materials, however this waste stream was considered by some stakeholders to be managed through existing industry voluntary schemes.</p>
<p>Large household appliances</p>	<p>Accounts for approximately 10 percent (by weight) of the calculated likely future annual e-waste generation (including refrigeration).</p> <p>With the exception of refrigeration and air conditioning this category was not identified during stakeholder consultation and desktop based research as presenting a high risk of harm.</p>
<p>Mercury-containing lamps</p>	<p>Identified internationally as high risk of harm due to mercury content however available data to assess quantification of the problem is inaccurate and therefore requires further investigation.</p> <p>Some stakeholders highlighted that the use of mercury in the production of lamps was fading out and therefore may present an orphan product. Further investigation required to confirm.</p>
<p>Mobile phones, their batteries and accessories</p>	<p>Unknown proportion of the waste stream.</p> <p>High value components.</p> <p>Existing voluntary product stewardship scheme accredited by MfE (July 2014) with representation from all major mobile phone distributors.</p> <p>Need to evaluate success of the accredited scheme before recommending further action.</p>

E-waste Product Category	Reasons for further investigation
Small household appliances	The remaining e-waste categories have been identified as lower priority for further investigation by WMA for the following reasons; <ul style="list-style-type: none"> • Products represent less than 1 percent as a total proportion of the e-waste data calculated e.g. automatic dispensers, lighting equipment (other than mercury containing lamps) and monitoring and control instruments. Overall environmental and resource benefits unlikely to justify the costs of implementation. • Products are largely used and managed through by commercial entities and are considered high value so market forces drive re-use, recycling and recovery e.g. telecommunication carrier and commercial equipment and medical devices. Data for both these categories is insufficient and further research is required. • Relatively low value products with a high proportion of plastic or other materials and low proportion electrical or electronic components e.g. small household appliances and, toys, leisure and sporting equipment.
Telecommunication carrier and commercial equipment	
Toys, leisure and sports equipment	
Automatic dispensers	
Lighting equipment other than mercury-containing lamps	
Medical devices	
Monitoring and control instruments	

5 FRAMEWORK FOR RECOMMENDED APPROACH

The development of a suitable framework for the management of e-waste in New Zealand has used following key steps presented in **Figure 6** to form the basis of a decision making tool and has been informed by the information provided during this study and approaches used internationally (37).

Figure 6 Steps for Assessing E-waste Management Options



The first step is to consider the drivers for change and whether there is demonstrable evidence that a change needs to be made. The introduction of regulations by Government has a cost impact and there are many competing programmes for funding. Prior to funding allocation for new schemes MfE will need to consider whether there is an identified market failure or need for change, does the existing situation place additional burdens on government resources and what are the consequences of inaction.

The second step will be to consider whether a product stewardship scheme is an appropriate solution to the problem. Examples of success factors of product stewardship can be taken from many jurisdictions (38) (39). The example requirements or questions for product stewardship schemes are similar to the criteria for priority product designation but more broadly can be identified as the requirement to have:

- sufficient access to consumers;
- participation from product manufacturers;
- the potential for increased resource recovery, material conservation, greenhouse gas reduction and energy and water conservation; and
- confirmation of existing and appropriate regulatory framework.

If the product stewardship model is considered to be an appropriate solution for the product then the form of the product stewardship scheme, including suitability for priority product designation, will need to be considered. Assessment of the different product stewardship options is provided in **Section 4.1**.

The WMA also has provisions to implement other regulations (see **Sections 4.1.5 to 4.1.8**). These regulatory tools can be applied to products, materials and waste whether or not they have been declared priority products, meaning they can be used to alongside or instead of priority product designation.

A summary of the proposed framework for assessment of e-waste product stewardship options and some of the opportunities and barriers to implementation is presented below in **Table 17**.

Table 17 Recommended Framework for Assessment of E-Waste Product Stewardship Options

Assessment Process	Options	Evaluation Questions	Barriers and Opportunities to implementation in New Zealand
1	Can a market failure or barrier to demand be identified?	Are there increasing volumes of waste going to landfill or being disposed of?	Comprehensive details of e-waste items currently being disposed to landfill are not known. Not all e-waste is sent to landfill and therefore only those products currently not being managed should be considered.
	What are the consequences of inaction?	Does the product contain harmful substances which may impact the environment and / or human health?	Guidelines for assessment of risk of harm provided in Section 4.2.1 . It is assumed that not all e-waste items will have the same associated risk of harm.
	Existing burden on local or regional government to manage products	Is there evidence of increasing costs to municipalities to manage this waste stream?	Representative data has not been provided as part of this project however it is likely that this information would be available.
2	Is product stewardship an appropriate solution?	Sufficient access to the market?	Schemes will require a minimum volume of items to validate the expense, time and resource to implement and manage a scheme. Schemes in the more remote regional areas in New Zealand might be considered to be infeasible, however the broader national impacts can be considered.
		Resource benefit?	There will need to be a net benefit to implementation e.g. increased resource recovery, reduced environmental impact, greenhouse gas reduction.
		Existing and appropriate regulatory framework?	The Waste Minimisation Act 2008, discussed in Section 2.3 provides New Zealand with an appropriate regulatory framework for implementing product stewardship.
		Access to significant stakeholder groups?	E-waste data research (see Section 3.2) suggests that the proportion of EEE products manufactured in New Zealand is negligible and therefore the success of a product stewardship

		<p>scheme is reliant on relationships with importers, retailers and distributors of products. Existing relationships with other key stakeholders e.g. recyclers are in place.</p>
<p>3</p> <p>What is a feasible Product Stewardship model</p>	<p>1. Non-regulatory or market based solution</p> <p>Does the sale of the recovered materials more than cover the cost of the scheme? Does the market exist and is it easily accessible?</p> <p>2. Co-regulatory schemes</p> <p>Is there value in the product components? Can accessible markets be developed with some financial assistance?</p> <p>3. Regulatory PS Scheme</p> <p>Does the product satisfy the priority products criteria? Would the scheme deliver additional social or employment benefits? Would the scheme assist to meet other Government targets?</p>	<p>Products which have a high recovery value and are already shown to be managed effectively through existing programmes or accredited voluntary schemes. A number of organisations have already signed up to MfE's accredited voluntary scheme.</p> <p>Where there is a recognised value in recovery of materials but assistance is required to support the development of infrastructure a co-regulatory approach should assist in stimulating the market and establishing infrastructure. Co-regulatory schemes may also work in conjunction with a number of the other regulations available under WMA Section 23 (see Section 4.1)</p> <p>This study has identified that the level of New Zealand specific data for e-waste products is a limiting factor in attempting to satisfy the requirements of the priority product designation criteria as detailed in Section 2.3 of this report. Although the feedback from a number of stakeholder groups was clear on the need for a regulated scheme, based on the lack of New Zealand specific data available, SLR's view is that it may be difficult to meet the requirements for designating e-waste as a priority product.</p>
<p>4</p> <p>Other Regulatory Options</p>	<p>Control or prohibition on disposal</p> <p>Is there sufficient capacity/reprocess waste streams? Are resources available to monitor and enforce?</p>	<p>Landfill restrictions or bans will require the provision of alternative treatment capacity or markets for materials are in place and can provide a viable alternative to landfilling. The legislation requires that adequate infrastructure must be in place prior to such regulations or that there is sufficient time</p>

	<p>provided to allow for the development of infrastructure. The development of infrastructure to provide all consumers with access to facilities is likely to come at considerable cost and therefore is unlikely to be applied to all e-waste product categories without further assessment of risk.</p>
<p>Mandatory take-back, fees and refundable deposits</p>	<p>Can regulatory tools be applied to all stakeholder groups? Is sufficient infrastructure available to provide a national service? Assessment of how mandatory take-back and refundable deposit schemes might work for e-waste in New Zealand has not been explored in detail to date, however, the way in which deposits are collected, or take-back is enforced by government may be limited by the ability to interact with product manufacturers as the majority are overseas. Take-back schemes and deposit refund would rely on the development of a network of convenient drop-off locations for consumers.</p>
<p>Labelling of products</p>	<p>Can labelling instructions be adhered to by all consumers? Labelling can assist with easy identification of potentially harmful product components and education. Mandatory labelling can also be applied to electronics advising consumers that the products need to be recycled at the end of life and not placed in general waste. This option would need to consider the availability and convenience of e-waste reprocessing treatment options for consumers and is most likely to be used in conjunction with another option.</p>
<p>Quality Standards</p>	<p>Can standards be applied across the entire product lifecycle? The use of standards to improve management of e-waste reuse, recycling and recovery processes in New Zealand received support from many stakeholders. Regulated quality standards can be introduced to assist with creating a level playing field across all recyclers and can be used to assist with data collection. Quality standards may also be used to monitor the environmental performance of products sent overseas for recycling or reprocessing.</p>

6 CONCLUSIONS, RECOMMENDATIONS AND STUDY LIMITATIONS

E-waste is a complex and diverse waste stream and due to the hazardous aspects of the components can present challenges for governance, management, effective recycling and environmentally sound disposal.

This study accessed and reviewed existing information on e-waste in New Zealand through inviting stakeholders to provide data, accessing existing reports and studies and undertaking desktop research. It was not within scope to undertake empirical research.

The study includes a review of existing e-waste schemes, whether voluntary, regulatory or a hybrid. This review finds that all types of schemes, including regulated schemes, have inherent advantages and limitations. For example, the Australian National Television and Computer Recycling Scheme established in 2011 required changes in 2013 and it is again under review over concerns of inappropriate treatment of e-waste materials and the scheme potentially reducing recycling of non-scheme e-waste.

In this study, SLR has determined that the level of robustness of New Zealand specific data for e-waste products is currently insufficient to satisfy the requirements of the priority product designation criteria as detailed in **Section 2.3** of this report.

The reasons for using data to inform policy decisions are well documented (40). The value of having evidence based policy is that it can;

- Provide some rigour and objectivity;
- Be used to estimate and/or measure the impact of proposed change in policy;
- Assist the decision maker(s) to select programme(s) to suit their needs; and
- Provides a tool to demonstrate the need to others.

Good information and evidence can provide an important base for rational assessment of options and from which other factors can be adjudicated on (40). There can also be risks associated with purely making decisions on data which is not considered reliable, however, it can be very useful as part of a broader decision making process, particularly where datasets are large, flexible and reliable (41).

Although the feedback from a number of stakeholder groups was clear on the need for a regulated scheme and despite some stakeholders indicating that reasonable robust data was available and would be forthcoming, the information provided and reviewed for this study does not satisfactorily prove that current management of e-waste in New Zealand causes significant environmental harm and that significant benefits could be achieved through e-waste management under a product stewardship scheme.

While this study cannot recommend priority product designation, the Ministry for the Environment (MfE) may choose to undertake an alternative process to establish a pathway to designation or support processes to increase e-waste recovery and recycling outside of a regulated product stewardship scheme. MfE may also have other regulatory mechanisms that can be explored as a means to support increased e-waste recycling.

The issue of incomplete and inaccurate data on New Zealand's e-waste has made the task of trying to develop a framework for managing this waste stream more difficult. A number of recommendations for improved data collection and management of e-waste are presented in in **Table 18**.

Table 18 Recommendations for Future E-waste Data Collection and Management

Focus Area	Recommendation
Sales of electronic and electrical items in New Zealand (potential e-waste generation)	<p>Investigate purchase of market data (e.g. GFK and Infomart) for comparison with customs data.</p> <p>Further investigation and sensitivity analysis into the reuse lifespan assumptions of individual categories.</p> <p>Undertake further detailed review of export data to reconcile imports and exports customs data.</p> <p>Undertake further consultation with Statistics New Zealand to confirm assumptions regarding classification of product codes into WEEE categories.</p>
E-waste treatment and disposal data	<p>Undertake verification process to determine how much e-waste is currently being disposed in landfills and how much is currently being reused or recycled.</p> <p>Undertake detailed waste composition studies at waste disposal facilities (using proposed revised solid waste analysis protocol) to determine proportion of e-waste contained within the residual waste stream.</p> <p>Request annual reporting from recycling operators (possibly through the Resource Management Act or recycling standards schemes)</p>
Domestic recycling infrastructure capacity	<p>Undertake an infrastructure capacity gap assessment to determine existing capacity for e-waste recycling in New Zealand.</p> <p>Perform cost benefit analysis for investment into development of new facilities in New Zealand.</p>
Transboundary movement of waste	<p>Undertake a review of the existing transboundary movement of waste legislation and identify opportunities to improve responsible shipment of e-waste for re-use and reprocessing.</p>
Standards for e-waste recycling facilities	<p>Introduce a requirement that e-waste recyclers are required to meet minimum standards such as AS/NZS 5377:2013 or an appropriate certification scheme for e-waste recyclers, such as R2® or e-Stewards®.</p>
Risk of harm	<p>Undertake a review of emissions to the environment (principally to air and water) from solid waste treatment or disposal facilities e.g. landfills or reprocessing facilities licensed to accept e-waste (i.e. method 3) to determine a high risk e-waste category shortlist.</p>

The final framework presented in **Section 5** is intended to be used as a tool for determining whether a product is suitable for management under a product stewardship approach and what other complementary regulations might be used to support improved e-waste management.

It is acknowledged by SLR that there are a number of limitations to the data and data quality available to inform the outcomes of this study. Such limitations include an absence of data and reliance on a variety of international sources for e-waste data, an unavoidable degree of human bias and error, and time restrictions associated with deliverables.

The study did however also result in a number of positive outcomes which include:

- the high level of stakeholder participation at both workshops and during the stakeholder interviews;
- representation across the sectors was balanced;
- more than 130 stakeholders accessed, downloaded or requested copies of either the Preliminary Report or the Workshop 1 Summary; and
- throughout the engagement process there appeared to be an general consensus of understanding of the key options and issues.

The strong level of engagement from all stakeholders throughout the study has helped to inform and shape some of the conclusions drawn in this report.

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WORKSHOP SUMMARY REPORTS

E-WASTE CATEGORIES

NEW ZEALAND E-WASTE DATA METHODOLOGY

AVERAGE E-WASTE PRODUCT LIFESPAN & WEIGHTS

DRAFT