# Landfill Full Cost Accounting Guide for New Zealand

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# Acknowledgements

The *Landfill Full Cost Accounting Guide for New Zealand* was a collaborative effort led by Tonkin & Taylor Ltd in association with Envirowaste Services Ltd and the Landfill Review Group for the Ministry for the Environment.

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## The review group

The review group for this project comprised a small group of local government and industry representatives who have an interest and expertise in landfill and environmental management. The group was asked to provide advice, opinions and direction during the development of the guide.

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## 1996 landfill full cost guide

The 1996 document prepared by Woodward Clyde NZ Ltd (now URS New Zealand Ltd) forms the base for the new Guide. Elements of this earlier document remain useful and valid, and form an essential core to the new Guide. They are duly acknowledged.

# Preface

The Ministry for the Environment conducted the 1998/99 National Landfill Census between November 1998 and January 1999. The census covered open and closed municipal landfills, dedicated landfills and cleanfills, and sought to establish the current state of landfill management practice in New Zealand. In brief, the results indicated:

- an improvement in the number of consented landfills, although there are still landfills operating without the necessary consents
- a significant level of non-compliance, with one-third of landfills having breached their resource consents since 1995
- a poor performance by landfill operators in the management of hazardous waste
- a decrease in open burning at landfills, although burning still occurred at 24% of landfill sites in 1998
- a small improvement in landfill management training
- conditions still varying considerably throughout the country
- evidence of inadequate management of closed landfills.

The 1998/99 census showed that there had been some improvement since the 1995 census, but that overall the standard of landfills and landfill management practice in this country is still not good enough.

The results of the latest survey stimulated the development of the Ministry's Landfill Management Programme. The Ministry's aims for this programme are the adequate management of landfills and their environmental risk, by councils and other owners, through:

- controlling adverse and potential environmental effects from open and closed landfills
- managing landfills in an efficient and effective manner.

The objectives of the programme are for:

- all landfills to be adequately engineered, consistent with national guidelines
- all landfills to be consented and compliant with consent conditions
- landfill consent conditions to reflect nationally consistent standards of environmental management
- the practice of open burning to be banned
- all landfills to be managed by appropriately trained operators
- hazardous waste to be effectively managed and controlled
- closed landfill sites to be monitored and effectively managed
- the true cost of landfill management to be met through the correct pricing of waste disposal.

The Landfill Management Programme comprises:

- the development and implementation (with local government and other interested parties) of landfill management guidelines
- an exercise to audit and review landfills around the country
- selected intervention in the resource consent process, where appropriate.

The Ministry's expectations are reflected in the guidelines that have been produced to assist the management of waste and landfills. The following documents produced by the Ministry for the Environment have been prepared through the programme:

- *A Guide to the Management of Closing and Closed Landfills in New Zealand* (2001b)
- *Guide to Landfill Consent Conditions* (2001a)
- *Guide to Managing Cleanfills* (2002)
- *Solid Waste Analysis Protocol* (2002)
- *New Zealand Waste Strategy* (2002)
- *Landfill Full Cost Accounting Guide for New Zealand* (2002).

In addition, the Centre for Advanced Engineering's *Landfill Guidelines* (funded by the Sustainable Management Fund) were re-published in May 2000. This guideline, together with the Ministry guidelines, provides a clear basis for the standards of landfill management the Ministry expects to be achieved by 2010.

For further information on using the FCA model, please contact:

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# 1 Introduction

## 1.1 Background

Traditionally, landfill charges have covered only a part of the actual (or real) costs incurred during the life of a landfill. This point was highlighted in the Parliamentary Commissioner for the Environment's report *Solid Waste Reduction Initiatives* (1993), which noted that many councils charge solely on the basis of landfill operating costs. This approach underestimates the real costs of landfill disposal, by ignoring factors such as the cost of the land, mitigation of environmental effects, unplanned closure, corrective actions, site rehabilitation and aftercare.[1]

In many cases councils do not apportion funding for the administration and overhead costs of landfills separately, which results in hidden costs and cross-subsidisation. This view was reinforced in the 1998/99 *National Landfill Census* report (Ministry for the Environment 2000), which noted evidence[2] suggesting that "councils do not accurately reflect the full environmental costs of landfill disposal".

## 1.2 Strategies for waste management

In the course of preparing the 1998/99 census the Ministry established a set of objectives for effective landfill management. The objective relating to cost stated that:

> *the true cost of landfill management [is] to be met through the correct pricing of waste disposal.*

This has been taken up in the New Zealand Waste Strategy (Ministry for the Environment 2002), in which waste disposal targets encourage waste generators to pay the true cost of waste treatment and disposal. This change may be gradually phased in where there is a big difference between the current charge and the true cost. Targets allow true cost accounting to be introduced over a period acceptable to the local community (see below for timeline).

Some local authorities may need to re-evaluate their funding policies for more flexibility and a fairer allocation of costs. These targets will be looked at again once the Strategy has been implemented and the second national waste data report delivered in 2003.

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[1] The PCE noted that this approach also ignores the indirect or social costs of landfills. This aspect is not covered by the model presented here.

[2] See section 2.3.1 for further detail on the 1998/999 census results.

The New Zealand Waste Strategy sets the following targets for waste disposal.

1 **By December 2003**, local authorities will have addressed their funding policy to ensure that full cost recovery can be achieved for all waste treatment and disposal processes.

2 **By December 2005**, operators of all landfills, cleanfills and wastewater treatment plants will have calculated user charges based on the full costs of providing and operating the facilities, and will have established a programme to phase these charges in over a timeframe acceptable to the local community.

3 **By December 2005**, all cleanfills will comply with cleanfill disposal guidelines.

4 **By December 2010**, all substandard landfills will be upgraded or closed.

5 **By December 2020**, all substandard wastewater treatment facilities will be upgraded, closed or replaced with systems that comply with all relevant regional and coastal plans, standards and guidelines.

Developing waste disposal pricing policies that, as far as practicable, reflect full cost is crucial to successfully implementing the Strategy. Failing to reflect all costs in the price of waste disposal weakens the incentive to prevent waste and avoid disposal.

## 1.3 How are local authorities affected?

Since the introduction of the Resource Management Act 1991 (RMA) many territorial local authorities (TLAs) have incurred significant cost increases, especially for the operation of small landfills. As a result, communities face the decision to either upgrade or expand existing sites, or close sites and open new facilities. This may include considering options such as transfer stations and regional landfills in light of the target set by the New Zealand Waste Strategy ("By December 2010, all substandard landfills will be upgraded or closed").

The Local Government Act (1974) and Local Government Bill require TLAs, through their annual plan process, to identify significant activities and consult with the community over options. This requires accurate information on the full cost of landfills, and the *Full Cost Accounting Guide* has been developed in response to this need. The Guide is recommended to TLA waste managers and other landfill owners as a formal method for costing landfills to achieve Strategy targets.

It is important to recognise that publicly and technically viable landfill sites are becoming an increasingly scarce resource. Existing landfills represent valuable assets in terms of their remaining disposal capacity, and should be priced accordingly. This will encourage the best use of existing assets and reinforce other initiatives aimed at minimising final waste disposal volumes.

In addition, if environmental costs are not fully counted, the environment subsidises the price of disposal. Where only part of the disposal cost is met from council rates, ratepayers are subsidising waste generators, or real costs are being deferred and will be borne in the future – by others. Inefficient pricing policies can also encourage waste flight to facilities that don't account fully for environmental cost.

Full cost pricing is a key waste management principle. It encourages both waste reduction initiatives and the minimisation of environmental effects by ensuring full environmental costs are, as far as practicable, reflected in the charges applied.

## 1.4 Purpose of the Guide

The purpose of the *Landfill Full Cost Accounting Guide* is to assist decision-makers to implement a consistent full cost accounting (FCA) approach to landfills, incorporating landfill planning, development, operation, closure and aftercare in a uniform and consistent way.

An FCA approach aims to accurately portray overall costs and risks associated with developing or owning and operating a modern landfill. It will enable landfill owners, including TLAs and other users of the model, to make meaningful comparisons of different waste management options in order to estimate, with reasonable accuracy, the basic cost of landfill disposal. This will help to decide not only appropriate gate rate charges, but also ways to fund and improve the efficiency of waste management services.

Local authorities as well as private companies need to determine the extent to which landfills are funded through user charges or other sources of funding. Use of the landfill FCA model will make the methods of funding and the cost of providing for landfill projects more obvious, more uniform and more consistent than is currently the case. The model can be used in conjunction with other tools for product life cycle assessment, or to determine overall waste disposal costs. (See the Ministry for the Environment website, www.mfe.govt.nz, for the latest information about such tools.)

*Note:* this Guide is intended to provide a sound approach to costing and pricing landfill services. It is not intended as a guide on how to account for landfills for financial reporting purposes. Section 3 does provide a summary background to financial reporting issues, but we strongly advise you to obtain specialist advice in relation to the detail of the issues involved in financial reporting for landfills.[3]

## 1.5 Using the model

What is this FCA model and how does someone use it? Put simply, the model is a user-friendly electronic spreadsheet, which you work your way through by entering information (numbers or text) into data entry cells, and selecting from the various check boxes, options buttons and drop-down menus. To operate the FCA model you will need to have an IBM-compatible personal computer and Microsoft Excel for Windows 97.

[3] A useful guide on this issue is *Accounting for Environmental Obligations: Guidelines for Applying FRS-15: Provisions, Contingent Liabilities and Contingent Assets* (NZ Society of Local Government Managers, 2001). Copies can be found on the society's website, www.solgm.org.nz.

The output of the model is an "indicative base cost of landfill disposal" (indicative base cost, or IBC). This is not an instant solution to what you should be charging at the gate of your landfill. This IBC figure may (and probably will) differ from the actual gate rate or user charge because it is simply the calculated cost, over the life of the asset, of providing for waste disposal. It does not account for related intangible costs or other charges such as:

- benefits/costs or levies related to waste diversion or recycling initiatives (other than overall reductions in waste quantity over time, which the model *can* account for)
- recovery of sunk costs from previous undercharging (where applicable)
- other charges
- tax.[4]

The IBC is thus a base figure which gives a good indication of the actual dollar cost of providing residual waste disposal to the landfill. Facility owners and managers then need to develop an *actual* charging structure from this figure, in the light of all other relevant factors (see sections 4.3 and 4.5). This is provided for on the **Model Summary** output page of the spreadsheet.

**A note on the limitations of the model**

The IBC and suggested or default / typical input data provided as part of, or derived from this model, must be treated as indicative only. The computational and accounting accuracy of the model algorithm have been verified, but outputs should not be solely relied on for financial reporting, forecasting or price setting. Engineering and accounting advice should be sought to ensure model accuracy and to set final charging structures.

## 1.6 Overview of the Guide

**Section 1 – Introduction.**

**Section 2 – Current Overseas and New Zealand Practice** outlines relevant overseas practice, New Zealand practice, and the key findings of the 2001 local authority waste managers' survey undertaken as part of the preparation for this Guide.

**Section 3 – Legislative Framework** sets out the legislative requirements for financial reporting (particularly relevant to TLAs and Local Authority Trading Enterprises or LATEs), and describes how the model output should be used and integrated with wider financial and other reporting processes.

[4] The IBC output calculated by the model is a pre-tax estimate. In order to convert this estimate to a post-tax estimate, it will be necessary to obtain specialist advice.

**Section 4 – Landfill Full Cost Accounting** explains the approach to full cost analysis and its accounting basis. It lists the types of costs that are included in the definition, outlines the benefits of using the model, details when it can be used, and describes the process of implementation. It sets out the rationale for using both Brownfields and Greenfields sub-models within the overall model structure. Section 4 also addresses issues of latent and contingent financial risk and risk minimisation options, and sets out, using flow charts, how the model is structured and how it functions.

**Section 5 – Model Input Parameters** works through the input (cost) items that are included in the model so that waste managers can assign costs to these items for their own site(s).

**Section 6 – Income Streams** describes the sources of income for a landfill and how they are included in the model.

**Section 7 – Model User Guide** outlines how the model can be used and describes the structure of the model for each option. It includes a description of the type, accuracy and general format for input data, as well as guidance for the use of default/typical data values where these are applicable.

**Section 8 – Expanding the Model: Other Waste Management System Costs** lists the cost items associated with other waste management facilities and services which would be included if a full cost analysis were expanded to include all waste management system costs.

**Section 9 – Illegal Dumping** provides an overview of the issues associated with illegal dumping, which is a potential negative outcome of implementing landfill charges based on full cost accounting.

The appendices include default/typical values for model input costs, a full worked example, the model algorithm, financial assurance and items/costs not included in the model.

# 2 Current Overseas and New Zealand Practice

## 2.1 United States of America

The United States Environmental Protection Agency (USEPA) has taken the initiative in promoting the increased use of FCA for solid waste management. The USEPA has worked closely with the US Government Finance Officers Association (GFOA) towards achieving this goal. It was with this goal in mind that the GFOA approved a recommended practice on *The Application of Full Cost Accounting to Solid Waste Management Activities* in 1998 (Gauthier, 1998). The USEPA and GFOA define full-cost accounting as "a method of accounting for all monetary costs of resources used or committed for municipal solid waste (MSW) services". The USEPA states that full-cost accounting "provides decision-makers with the whole picture of MSW costs in their community on an ongoing basis".

The GFOA's FCA manual published in conjunction with the USEPA February 2000 (GFOA, 2000) details a comprehensive menu-based modelling approach. The model presented in this Guide follows a similar logic, but is deliberately simplified in some areas to ease data entry and avoid the risk of gross errors due to misinterpretation of input data sets, duplication or omission.

## 2.2 Australia–New South Wales

The New South Wales *Environmental Guidelines: Solid Waste Landfills* (NSW EPA, 1996) states that the Environmental Protection Authority (EPA) "uses economic and educative tools alongside regulatory measures to achieve desired environmental outcomes". The broad goal of promoting waste reduction and the need to cover the cost of environmental externalities created by landfills are recognised in New South Wales through the promotion of true cost pricing at landfills and a levy on waste disposal.

## 2.3 New Zealand

To ascertain current New Zealand local authority practices in relation to FCA for landfills, data from the following sources were used:

- the 1998/99 *National Landfill Census* (Ministry for the Environment 2000)
- a survey of local authority waste managers in 2001, undertaken as part of the Guide preparation process.

### 2.3.1 1998/99 National Landfill Census

The 1998/99 National Landfill Census reported the following feedback.

- 63% of landfill operators had read the *Landfill Guideline: Landfill Full Costing Guidelines* Ministry for the Environment, 1997a). Of these, 77% (or about 45% overall) found the guide useful.
- Landfill operators reported that the guidelines are not useful for commercial operators, airspace utilisation needs to be related to financial performance, and the guidelines are overly complicated.
- 40% of landfills charged through general rates and 45% through user charges (or a combination of both).
- 26% of landfills operated a differential charging system for wastes at their landfill, compared with 47% who did not.
- Local authorities need to identify and assess the full costs of both currently operating and closed landfill sites.

### 2.3.2 2001 Survey of Local Authority Waste Managers

In early May 2001 all New Zealand TLA managers were sent a postal questionnaire, instructions for completing the questionnaire, a draft table of contents for the new FCA guide, a covering letter from the Ministry for the Environment, and a stamped addressed envelope for returning the questionnaire.

In total, 74 questionnaires were sent out to TLA waste managers. Responses were received from 58, of whom five said the questionnaire was not particularly relevant to their needs.

Data from the questionnaires were entered into a Microsoft Access database. Questions that entailed a text response were analysed manually. All questionnaire responses were treated as confidential and data were aggregated. The results have been categorised in terms of:

- the 1996 guidelines
- landfill funding and charging
- illegal dumping
- transitioning from current charging regimes.

Analysis of the questionnaire data indicated that there is currently huge variability in the manner of charging at landfills throughout New Zealand. This varies from 'notional' charging, based largely on known annual operations and overhead costs, to full cost pricing and charging (mainly at larger and privately operated facilities). In between, a range of rates-based and other formulae are used to set gate rates, usually based on a simple build-up of operations costs taking into account 'prior charges'. Often the gate rate set is quite artificial, and in some instances it is clear that gate rates are either cross-subsidised or transfer pricing methods are employed.

In only a few instances can a landfill gate rate be clearly identified as reflecting true cost. Even in 'commercial' cases the actual gate rate is affected by:

- waste flows (directly related to cashflow objectives)
- customer arrangements/volumes
- waste type
- timing
- actual cost of airspace development.

Moving to a more consistent basis for charging (or at least determining the true dollar cost of disposal) is essential if a nationally consistent, integrated waste disposal strategy is to be implemented, such that waste reduction, recycling and other initiatives fit realistically into the overall economic mix of waste disposal costs.

# 3 Legislative Framework

## 3.1 General statutory and financial reporting requirements

The statutory and financial reporting requirements applicable to companies and issuers[5] are contained in the Financial Reporting Act 1993 and the Companies Act 1993. The Financial Reporting Act establishes the overall financial reporting framework, whereas the Companies Act prescribes the administrative requirements regarding financial reporting by companies.

The Financial Reporting Act applies to all 'entities', as defined in section 2 of the Act. Entities are all 'issuers' and all companies. Issuers and companies are mainly private sector entities, although certain public sector entities such as SOEs, some Crown entities and some local authority trading enterprises (LATEs) are companies and therefore subject to the requirements of both the Financial Reporting Act and Companies Act.

- Under section 11 of the Financial Reporting Act the financial statements of all reporting entities are required to comply with Generally Accepted Accounting Practice (GAAP). GAAP is defined in section 3 of the Financial Reporting Act as: compliance with applicable Financial Reporting Standards (FRS).
- Where no provision is made in applicable Financial Reporting Standards and where there is no applicable rule of law, compliance with accounting policies that are appropriate to the circumstances of the entity and have authoritative support within the accounting profession in New Zealand.

## 3.2 Application to local government

Many of the readers of this Guide will be local government employees, so the application of statutory and financial reporting requirements to local government is relevant.

Some LATEs are subject to the requirements of both the Financial Reporting Act and Companies Act, as well as the Local Government Act 1974. For local authorities the Local Government Act, including its amendments, sets out the financial reporting requirements. TLAs are required to prepare annual financial reports in accordance with GAAP.[6] Applicable financial reporting standards (FRSs) are therefore those approved under the Financial Reporting Act.

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[5] An 'issuer' is essentially any party that has made a public issue of debt or equity securities. Issuers may be companies or entities other than companies, and include unit trusts, authorised life insurers, and all entities listed on the New Zealand Stock Exchange.

[6] The requirement for TLAs to comply with GAAP is achieved by the Local Government Act defining GAAP consistently with the definition of GAAP under the Financial Reporting Act.

The most relevant and applicable FRSs for landfill operations are FRS-15 'Provisions, Contingent Liabilities and Contingent Assets', and FRS-3 'Accounting for Property, Plant and Equipment'. These reporting standards were introduced in 2001. FRS-15 applies for reporting periods ending on or after 31 October 2001 and FRS-3 applies for reporting periods on or after 31 March 2002.

FRS-15 in particular is likely to have a significant impact on TLAs. It is intended to improve the consistency of current provisioning practices. Current practice has ranged from over-provisioning to under-provisioning, where there are significant existing obligations that have not been provided for. This latter situation is particularly relevant for TLAs, where it is clear that the sector has many potential and actual environmental obligations such as landfills and other contaminated sites. Consequently, accounting for environmental liabilities under FRS-15 is likely to lead to a significant and sector-wide increase in the number of provisions recognised for environmental restoration.

The following sub-sections briefly outline the effect that these two new FRSs have on accounting for landfills. The information provided draws heavily on a fuller guideline published by the Society of Local Government Managers,[7] which readers should consult for further detail.

## 3.3 FRS-15: Provisions, contingent liabilities and contingent assets

FRS-15 specifies the rules for recognition, measurement and disclosure of provisions, contingent liabilities and contingent assets. While the standard outlines specific clauses, an interpretation of them in the context of environmental obligations is required. Some of the key interpretation issues are outlined below.

A key clause of FRS-15 requires that:

> *A provision must be recognised when:*
>
> - *an entity has a present obligation, legal or constructive, as a result of a past event*
> - *it is probable that an outflow of resources will be required to settle the obligation*
> - *a reliable estimate can be made of the amount of the obligation.*
>
> *If these conditions are not met, a provision must not be recognised.*

[7] New Zealand Society of Local Government Managers, 2001. This document can be downloaded from the society's website www.solgm.org.nz. Also, note that this guideline contains a hypothetical worked example of accounting for a landfill under these new standards.

Key issues to note relating to obligations are as follows.

- A present obligation exists where it is more likely than not, at a balance date, that the entity will be required to settle an obligation created by a past event.
- In the context of environmental obligations, a "present obligation" for local authorities is often created by RMA requirements.[8]
- "Constructive obligations" can be difficult to ascertain for TLAs.[9] In some cases they may be construed to exist where a TLA has created an expectation.[10]
- An obligation can only exist when it arises as a result of past events independent of an entity's future actions: provision cannot be recognised when an obligation will only arise as a result of anticipated future actions.
- The standard envisages that it will be very rare for a provision not to be recognised because a reliable estimate cannot be made. Local authorities will have to make assumptions as to the environmental obligations they face, even if these obligations are forecast to occur some way into the future.

A more detailed discussion of these issues and others[11] can be found in New Zealand Society of Local Government Managers (2001).

## 3.4 FRS-3: Accounting for property, plant and equipment

FRS-3 deals with:

- accounting for items of property, plant and equipment under the historical or modified historical cost systems of accounting
- accounting for the consumption or loss of economic benefits embodied in items of property, plant and equipment.

Particular issues related to FRS-3 that impact on financial reporting for landfills are as follows.

- Closure and post-closure costs that have been recognised as a provision should be added to the cost of establishing the landfill operation and depreciated over the period the future economic benefits are enjoyed. FRS-3 notes that the cost of an item of property, plant and equipment includes the costs of dismantling and removing the asset and restoring the site.
- Subsequent expenditure on closure and post-closure costs (after acquisition and development on a landfill) should be capitalised.[12]

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8 Often via the required resource consents necessary for landfills and other contaminated sites.

9 For example, in relation to a closed landfill that was not subject to any resource consents.

10 For example, via public statements or policies, or past actions.

11 Relating to the measurement and disclosure standards.

12 Paragraph 6.1 of FRS-3 gives guidance in this area.

- It will be necessary to ensure that each component[13] of a landfill asset is accounted for separately. FRS-3 requires that when the components of an item of property, plant and equipment have different useful lives or provide benefits in different patterns, the cost of the item must be allocated to its components and each component accounted for separately.

This is a brief summary of the ways in which FRS-3 is relevant to the financial reporting of landfills. A fuller analysis can be found in the recent guide published by the New Zealand Society of Local Government Managers (2001).

[13] The main components include land cost, landfill development costs, property, plant and equipment, and closure and post-closure costs.

# 4 Landfill Full Cost Accounting

## 4.1 General

The cost of airspace development can be calculated for a landfill of any size or age at any site, amortised over the site life. To this can be added sunk and operational costs, corrected for financing, together with allowances for landfill closure and aftercare. These costs can be amalgamated using a timeline-based, ordered-input spreadsheet model to develop an overall 'indicative base cost' (IBC) of landfilling over the facility's life. This is what the FCA model does.

Using such a model, a whole-of-life IBC of landfill disposal is derived, which will only change if:

- financing costs change
- waste volumes (and hence the development timeline) change *markedly*
- operations costs increase *markedly* (for example, due to fuel or labour price hikes).

A carefully managed and operated landfill can, however, react to gradual change by utilising such a financial model to apply progressive costing refinements, reflected in smoothed changes in the gate rate. The biggest problems (in terms of artificial disposal costs or financial mismanagement) occur when:

- full costs are not properly recognised (especially at an early stage)
- there is undercharging for prolonged periods
- landfills need to be upgraded or significantly expanded to modern standards, causing capital cost shocks, which result in increased capital development costs and hence charges out of line with the (then) current charging regimes.

The most appropriate basis for charging is likely to be based on:

- estimating whole-of-life costs (IBC of disposal) using a comprehensive FCA model and adjusting for:
  - cashflow considerations
  - recycling or other local or national waste levies
- deriving a structured gate rate (price) from the above, in light of the actual 'global' financial position of the asset, depreciation, cashflow and tax considerations (all depending on the specific nature of the entity).

Adopting this approach for a new or expanding landfill could potentially result in – or highlight – significant pricing aberrations in the short term, but over the long term should even out to a predictable pricing range reflecting:

- the true (and relatively invariant over the short- to medium-term) cost of airspace development
- site-specific cost factors related to the site's age, size and throughput (economies of scale)
- other waste charges that may be applied for strategic/commercial reasons or to achieve long-term waste reduction targets.

## 4.2 Definition of 'full cost'

For the purposes of this Guide, 'full cost' is defined as:

> *Any real, definable and measurable cost, from any source, attributable to a particular landfill and incurred, or likely to be incurred, by the owner.*

Full cost accounting (FCA) encompasses the capital and operating costs that will be incurred over the life of a landfill, which have to be recovered and on which a return is required. Typical categories of costs include:

- management, administration and organisational overhead costs
- planning and resource consent costs
- land cost
- development costs
- operational costs
- closure and aftercare costs.

FCA is a dynamic process that needs to be able to respond to changes over the lifetime of a landfill project. This is readily achievable with the FCA computer model presented here. Once set up for a particular project, the model needs to be revised on a regular basis to reflect new and better information. For a landfill project it is recommended that full cost modelling be undertaken, or repeated, at the following stages:

- planning and project evaluation
- site selection and preliminary design
- detailed final design following resource consent processes
- at intervals throughout the landfill operating life, including reviews that take into account waste minimisation and recycling programmes, as their economic input on final disposal cost can be significant due to cashflow movements.

At each stage, refined information will be available to enable more accurate determination of actual disposal costs, or any charging or cost adjustments needed.

An FCA approach should also be used for analysing the overall costs of waste management systems. A waste management system covers all the services and facilities provided and, where required for the management and disposal of wastes, includes:

- administration and management
- planning
- education and promotion
- refuse collection
- recycling facilities and services
- composting facilities
- transfer stations and transport of refuse
- handling of special or hazardous wastes
- landfill.

The FCA model can also be used when planning new system components to determine the costs and benefits resulting from changes in waste flows.

## 4.3 Charging structures and gate rates

### 4.3.1 The basis for charging

Historically most landfill disposal sites in New Zealand have been run by TLAs. Normally, this has been on an 'actual and least cost' basis, with charges usually applied through a uniform service charge as part of council rates. In recent years, with the advent of commercial sector involvement (in commercial waste collection in particular), there has been a move towards a combination of charging mechanisms based on increased and improved tracking of waste quantities (by weighing) and recognition of the increasing full cost of waste disposal.

For purely commercial enterprises such as private sector landfills, disposal charges have had to reflect the full commercial cost of providing the service while making a commercial return on the landfill investment. This contrasts with a typical TLA situation where charges have often been based on contracted costs for collection and disposal operations.

However, this situation is changing with a better understanding of the full cost of waste disposal, and setting disposal changes now requires considering:

- creating incentives to reduce waste
- transparency
- meeting waste reduction targets
- New Zealand Waste Strategy principles
- equity
- user-pays considerations
- ease of applicability
- ability to accommodate change.

The last point applies particularly to situations where current charges are artificially low and a higher charge is required due either to development of a new facility or in recognition of full disposal costs. Phasing in charges based on full cost requires, in those circumstances, considering issues such as the potential for illegal dumping (fly tipping) and waste flight (to cheaper, remote facilities).

### 4.3.2 Types of charging structure

There are two main types of charging structures, each with advantages and disadvantages.

#### 100% user-pays

Here, the full cost of disposal is applied, with or without additional charges or levies to support recycling or composting operations. For private sector operations this includes the required commercial return on the investment. Some TLAs and LATES also apply this charging principle (the FCA model allows this to be included by way of a WACC figure).

| Advantages | Disadvantages |
|---|---|
| • Transparency – the full cost is borne by the waste generator.<br>• Encourages waste reduction due to high user charges. | • Unless uniformly applied waste diversion can occur.<br>• The method of calculating user-charges needs to be robust. |

### Subsidised charging (from levies or transfer pricing)

Often rates-based charging mechanisms follow this form, where a charge is made based on historical charges and an assessment of what is politically acceptable. The degree to which such charges reflect actual full cost on a per capital basis can be highly variable, and often depends on the sophistication (or conversely, simplicity) with which costings are prepared.

| Advantages | Disadvantages |
|---|---|
| • Simple – does not require accurate determination of system costs.<br>• Readily accepted by those who contribute the least to the total system cost.<br>• Unlikely to cause waste diversion to cheaper facilities. | • Full costs are not recognised.<br>• Costs are deferred, often with no basis for future funding.<br>• There is no incentive for waste generation. |

Clearly the latter scenario above is inconsistent with sound resource and financial governance, as well as with New Zealand Waste Strategy principles. It is simply how things have developed historically, and the current trend is to move rapidly towards knowing the full cost of disposal, driving down waste volumes using a range of measures, and applying the full cost residual disposal through appropriate tipping charges or rates-based disposal charges on a user-pays basis.

## 4.3.3 Setting gate rates

The process of setting an actual gate rate involves (depending on circumstances) a range of financial, political and commercial decisions. Attention needs to be given to the whole waste disposal structure for a facility, district or region, as the commercial considerations can prove very sensitive to fundamental factors such as waste tonnage (revenue) and transfer pricing/ subsidies (for example, in relation to recycling or organic waste diversion).

The model enables the user to test the sensitivity of the IBC to variations in key model parameters, of which income is a principal variable.

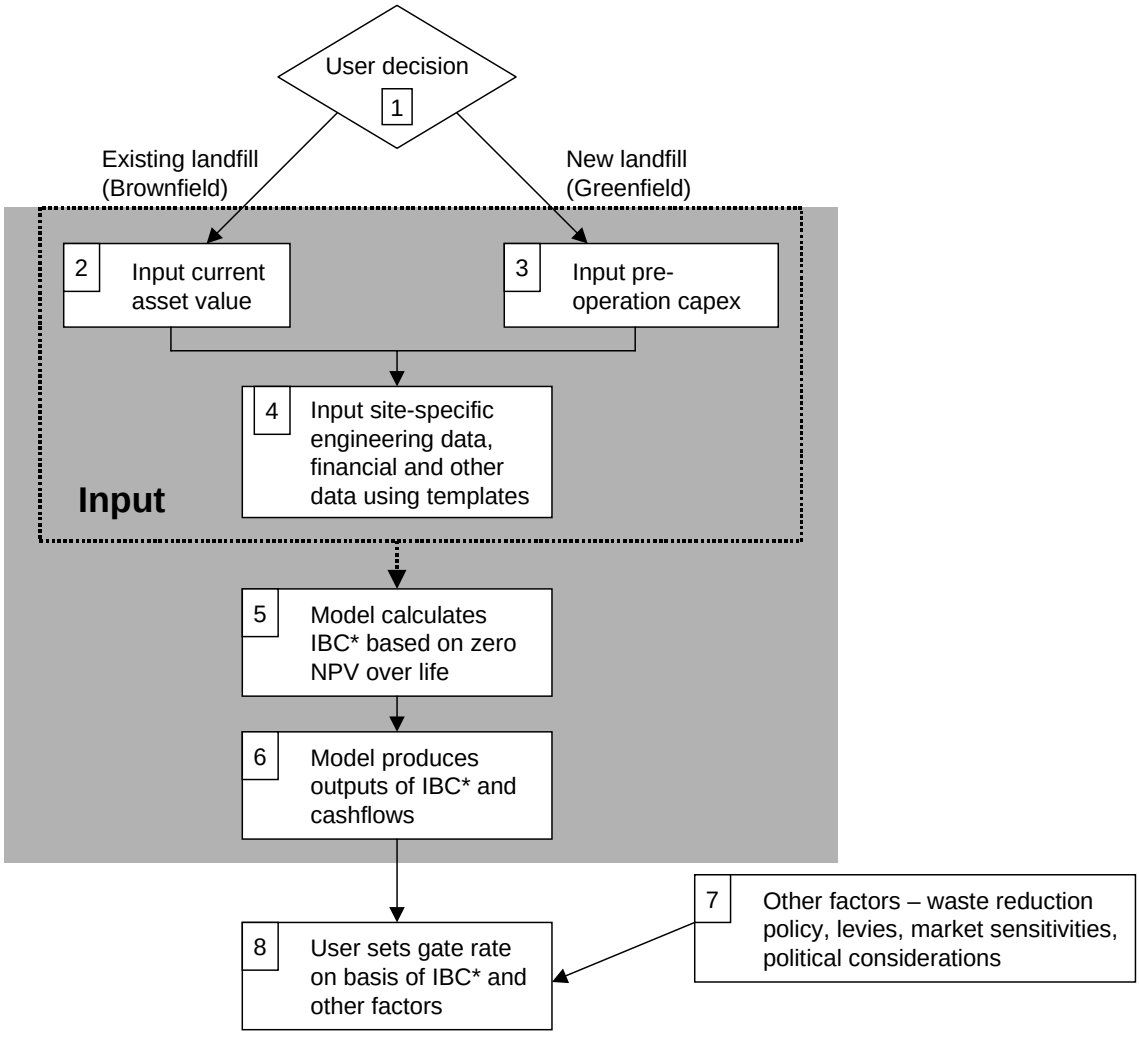
There is no simple formula or method for setting gate rates from the IBC. However, the model allows scenarios involving altered or increasing gate rates to be tested, and allows facility IBC figures to be readily checked and updated as circumstances change. This process is the fundamental management tool for assessing gate rates and other waste charges as the mix of disposal options and costs changes. At present this change is rapid and requires careful management by TLA managers of waste flows and disposal charges to ensure equity and balance in the waste system and charging structure.

In the case of a privately owned facility, setting gate rates tends to be commercially based and directly linked to confirmed or projected waste tonnages, capital investment and required rates of return. Therefore, determining the commercial gate rate tends to be a more straightforward exercise, even though actual charges may differ for commercial (and other) reasons over time.

## 4.4 Model overview

Figure 1 outlines the key interactions and processes of the model. Put simply, the model is a series of spreadsheets into which users enter known or estimated cost data. The model then carries out a series of calculations to derive an output, from which users can utilise as an IBC in order to derive an actual gate price (gate rate).

**Figure 1: Overall model structure**




* Indicative base cost of landfill disposal.

First, you need to decide whether you are modelling:

- a Brownfields site – an existing landfill with residual life, with or without future expansion; or
- a Greenfields site – a proposed landfill to be engineered on a new site.

### 4.4.1 Choosing between Greenfields and Brownfields

In most cases the approach to adopt will be obvious. However, a lateral or vertical extension of a Brownfields landfill may present some difficulties and require more specific judgement. If you consider that an extension will not present any extraordinary development or consenting issues, then you should treat the extension as part of the existing operation and develop a Brownfields model to cover the site's full residual life.

Periodic extensions (new cells) are often an integral part of an existing landfill facility and can be catered for in the business risks of the Brownfields operation itself through the financial parameters selected. However, if you consider the extension will present a materially *new* development, then you should treat the extension as a Greenfields development. The essential issue here is that where there is new and different or significant additional risk in the development of the extension, then the Greenfields option is the correct one to use. This is because the Greenfields option reflects the increased riskiness of new developments.

Once the decision is made on which type to adopt, you will need to makes a series of inputs. This is where the key difference between the Greenfields and Brownfields landfill models occurs. A Greenfields landfill requires data and cost inputs related to the pre-operation capital expenditure required to establish the landfill. A Brownfields operation requires the user to input the current asset value as the initial cost entry. This value needs to reflect the value of the landfill asset based on the relevant Financial Reporting Standard NZIV[14] requirements. Sections 5.3.1, 5.3.3 and 5.3.4 provide detail of the types of inputs required for a Greenfields landfill, and sections 5.3.2 and 5.4.1 provide guidance on inputting the current asset value of the landfill needed for a Brownfields landfill.

Once these inputs have been made, you need to make a further series of inputs related to site-specific engineering, financial and other data (see sections 5 and 7). The model does not provide costs, or cost estimates, for the various components of landfill development, operation or aftercare because these will be site-specific and are likely to vary in different parts of the country and over time. However, the model does provide qualified default values where possible. Waste managers will still need to obtain or estimate costs to ensure that the most up-to-date and site-specific information is used, based on the specific site locality, size, design and operational requirements.

The key financial data required pertain to 'cost of capital' calculations. Details of these are given in section 5.4.21.

[14] NZ Institute of Valuers.

Once all the inputs have been made, the model calculates an IBC of disposal. The model does this by 'solving' for a target revenue, given:

- the starting asset value (in the case of a Brownfields landfill) or capital expenditure required to begin operations (in the case of a Greenfields landfill)
- the various ongoing expenditures required (both operational and capital related)
- the cost of capital that reflects the return required for the particular operation the user is considering
- the defined waste stream.

On the last point, the cost of capital is used to discount[15] the cashflows the model derives after input from the user. These cash flows can then be converted to a present value, expressed in today's dollars. The model is constructed in such a way that, given these present value cashflows, it solves for a required revenue that returns to capital contributors their costs of capital (and no more). This condition can also be stated as the project net present value (NPV) equals zero (as per Figure 1). That is, over its life, the landfill project has revenues that just return its cost of capital to its capital contributors (and no more), so the NPV of the project is zero.

More detailed figures outlining how the model manipulates the input – including the interaction between engineering cost data and the cost of capital inputs – can be found in Appendix A.

The FCA model has been designed and developed to be intuitive, for ease of use. It is an Excel-based electronic spreadsheet, with the formulas and option buttons, macros, and other features embedded in several worksheets. This format makes the model an easy-to-use analytical tool, which is on a popular software platform. Section 7 gives a fuller description of the technical requirements of the model, and an outline of its structure.

## 4.5 Interpreting the FCA model output

The following are important points to note when interpreting the value of the IBC derived from the model.

1 The IBC is the base unit cost of disposal in dollars per tonne derived by the FCA model, and gives an indication of the actual dollar cost of providing residual waste disposal to a landfill.

2 The IBC does not include GST.

3 Over time the IBC does need to be adjusted to reflect inflation. A simple way to do this is to increase the IBC by an inflation estimate (for example, the Consumer Price Index). A more time-consuming (but accurate) method would be to re-estimate all inputs at today's dollar value, so that they would include only inflationary impact since the IBC was last calculated.

[15] Essentially, this discount factor accounts for both the 'time-value of money' (i.e. a dollar today is worth more than a dollar in the future) and the riskiness of a project, or business.

4 You can then set the landfill gate rate / tipping fee on the basis of the IBC and other factors including:

- the charging policy of the landfill owner/operator (the mix of rates and user charges)
- recycling / waste reduction levies
- refuse collection costs (kerbside)
- green waste / composting costs
- education and waste minimisation costs.

# 5 Model Input Parameters

## 5.1 Introduction

This section provides guidance on all the inputs the model requires in order to generate the IBC. As noted in Section 4, the model can accommodate the development of new landfills (Greenfields) or the ongoing operation and possible extension of existing landfills (Brownfields). The inputs required for these two types of investments are broadly similar. The key difference is in the estimation of the initial capital expenditure (in the case of the Greenfields model) rather than the opening asset value (Brownfields model). Apart from this, the rest of the input parameters are similar for both models, and the guidance on the input is the same. Specific instructions relevant to the Brownfields approach can be found in sections 5.3.2 and 5.4.1.

It is important to note that for variables that require dollar value estimates, you will need to input the value in *today's* dollars, even if the variable requires an input in a future period. There is no need to account for inflation in providing these estimates.[16] The model automatically accounts for dollar value inputs being in today's dollars, and produces output in today's dollars.

## 5.2 Costs not included in the FCA model

A more detailed description of the costs not included in the FCA model is given in Appendix C, but they can be summarised as follows.

- *Replacement costs* – the landfill FCA model does not include the provision of replacement funds for a future landfill, as these costs are attributable to a different project.
- *Aftercare of closed landfills* – the landfill FCA model does not include the aftercare costs of other landfills that are now closed.
- *Site selection costs* – the site selection process may involve research on many potential sites. Normally TLAs or private-sector landfill developers consider these costs as general expenditure. Only the costs of research and investigations that can be attributed directly to the site that is finally chosen should be included in the model. The model currently allows these costs to be included if required.
- *Environmental and community issues* – there are environmental and community issues relating to landfills that are not direct or indirect financial costs paid by the waste manager. These relate to externalities that occur on a local, national or global scale. Externalities are costs (or benefits) that are borne by (or accrue to) society in general, and which in the past have not generally been accounted for in decisions relating to landfills. Because legislation requires waste managers to avoid, remedy or mitigate some effects, some externalities are internalised – or taken into account – in the financial costs of

[16] Note, however, that over time the IBC will need to be adjusted to reflect inflation. See the discussion in Section 4.5.

landfill development, operation and aftercare through the resource consent process. The calculation of the cost to society of all externalities associated with landfills is beyond the scope of this Guide. However, externalities can have a significant effect on the decision-making process and therefore need to be considered by local authority waste managers.

- *Discharges to land, groundwater, surface water and air* – the cost relating to the effects on the environment of a landfill is considered to be accounted for in the costs of siting, resource consent applications, design, operation and monitoring, as these costs relate to the avoidance of actual and potential effects.
- *Effects on local ecology* – these are considered to be accounted for in the costs of siting, resource consent applications, design, operation and monitoring, as these relate to the avoidance of actual and potential effects.
- *Community effects* – community effects are partly taken account of in landfill siting, community consultation and resource consent procedures. The costs associated with these activities are included in the full costing model. These costs, however, may not take account of all issues. One approach adopted overseas, and used in New Zealand for some new large landfill sites, is the payment of 'host fees' to the local community affected by the landfill, for appropriate community projects such as a community hall. Host fees, where they apply, need to be included as a cost in the landfill FCA model.
- *Opportunity costs of land* – the value of the net benefit forgone by the community in using the land for a landfill, rather than for some alternative use, is the opportunity cost of that land. However, the value of land when used as a landfill may be higher than for the existing or alternative land uses, in which case opportunity cost does not apply. For this reason, and the fact that the waste manager incurs no cost, community opportunity cost is not included in the FCA model.
- *Remediation or corrective action costs* – if corrective action measures are required at a landfill facility, a detailed scope of work, appropriate cost estimates, and financial assurance documentation should be submitted to the appropriate regulatory authority. Corrective action plans will be site-specific and will vary widely. These costs are not included in the FCA model.

## 5.3 Landfill FCA model input parameters

The model is based on up to 11 information parameters and eight cost parameters relevant to landfill full cost accounting, as shown in Table 1. These parameters correspond to the item categories/headings in the model input worksheets (**General Input, Brownfields Input**, **Waste Input**, **Geometric Input**, and **Cost Input**), which provide the space for entering most data.

**Table 1: Landfill parameters**

| Model input worksheet | Parameter |
|---|---|
| General input | Situation – Section 5.3.1<br>Dates – Section 5.3.1<br>Waste – Section 5.3.1<br>Financial – Section 5.3.1 |
| Brownfields input | Existing conditions – Section 5.3.2<br>Works to be completed during residual life – Section 5.3.2<br>Stockpiles – Section 5.3.2<br>Financial – Section 5.3.2 |
| Waste Input | Waste – Section 5.3.1 |
| Geometric input | Site constants – Section 5.3.3<br>Development programme – Section 5.3.3 |
| Cost input | Sunk costs – Section 5.3.4<br>Planning and pre-development – Section 5.3.4<br>Base costs – Section 5.3.4<br>Development – Section 5.3.4<br>Operation – Section 5.3.4<br>Closure – Section 5.3.4<br>Aftercare – Section 5.3.4<br>Contingencies – Section 5.3.4 |

## 5.3.1 General input

The general input data include the following.

- **Situation** – selecting the Greenfields or Brownfields site development option.
- **Dates** – project commencement, operation commencement, duration of pre-development period, sunset date, duration of consented operating life, duration of actual operating life, duration of aftercare period.
- **Waste** – selecting the Custom Waste Tonnages or Generated Waste Tonnages option. If the Generated Waste Tonnages option is selected, the input data include the annual waste tonnage at the start of the operation, the annual waste growth/reduction rate, and the minimum annual waste tonnage. If the Custom Waste Tonnages option is selected, the input data need to be entered into the separate Waste Input worksheet. Input data relating to the waste stream (general and special waste proportions), waste charging (general and special waste), assumed compacted density, and target cover to waste ratio (hence volume utilisation), all form part of the General Input data irrespective of whether the Custom Waste Tonnages or Generated Waste Tonnages option is selected.
- **Financial** – the cost of capital (for planning and consenting, construction, operation, and aftercare), interest rate, and allowance to model real annual movement in the IBC (see section 5.4.21).

### 5.3.2 Brownfields input

The Brownfields input data include the following.

- **Existing conditions** – residual constructed airspace / constructed cell airspace remaining, life of residual airspace in constructed cell, footprint of existing landfill, continuing development (overlay or extension to footprint), stockpiles (volumes of existing topsoils, unsuitables, sub-topsoil, low permeability, and structural materials), opening / accumulated value of aftercare fund, capital cost to complete and close existing cell.
- **Opening asset value** – the Brownfields model requires an input related to the opening asset value of the existing landfill (see section 5.4.1).

### 5.3.3 Geometric input

The geometric input data include the following.

- **Site constants** – leachate generation (typical regional values or customised values), existing materials (topsoil, sub-topsoil, liner), landfill dimensions (liner, final cap), length of access road, length of boundary fence, timing of installation of leachate treatment and disposal, timing of gas management system installation.
- **Development programme** – quantities by cell associated with airspace, footprint, clearing, earthworks materials balance (topsoil, sub-topsoil, unsuitables, low permeability material, structural material, etc.), perimeter access road, subsoil drainage, leachate collection system, stormwater system, gas management system.
- **Cell Construction** – selecting the Cell Construction Staged in Equal Annual Amounts or Cell Construction Completed in Single Year option (see Appendix E: Typical Example).

### 5.3.4 Cost input

The cost input data include the following.

- **Initial/ sunk costs** for a Greenfields site or **existing asset value** for a Brownfields site.
- **Planning and pre-development** – project management, site selection, consultation, land pre-purchase/ pre-leasing arrangements, survey and preliminary design, geotechnical and groundwater investigations, other detailed studies (noise, traffic, visual, etc.), baseline monitoring, resource consent process (Assessment of Environmental Effects AEE and consent application, draft landfill management plan, legal, hearing, appeal), land acquisition and associated set-up costs, and proceeds from the disposal of excess land.
- **Base costs** – engineering (detailed design and documentation, and construction management), and contractors preliminary and general (P&G).
- **Development** – site access, site amenities and services, cell construction (earthworks, liner, and leachate), stormwater management system, gas management system, and final cover system.
- **Operation (direct and indirect costs)** – refuse placement, daily cover, nuisance control, general maintenance, salaries, wages and overhead, aftercare levy, royalty and/or host fees, intermediate cover, temporary roading, leachate treatment and disposal, monitoring and compliance, regional council costs, utility charges (rates, water, electricity) and bond.

- **Closure** – removal of facilities, modifications to site stormwater, leachate, landfill gas and other systems (final cover, landfill gas management system, leachate management system, on-site surface water control system, and design consultants/ third party engineering).
- **Aftercare** – administration, regional council liaison, site inspections, maintenance (of cover, vegetation, leachate system, gas system, stormwater system), environmental monitoring, removal of remaining facilities, and end of post-closure certification.
- **Contingencies** – contingencies for pre-development, development, operations, closure, and aftercare.

## 5.4 Landfill FCA model input costs and values

The following sub-sections provide guidance on some of the items. Indicative values or costs (range, typical and default costs or values) for items are provided in Appendix B by way of guidance.

**Special note**

You are strongly advised, before you take the results of this model beyond the initial drafting stage, to obtain advice on these inputs. The rates provided are for guidance only and are likely to alter according to relevant market and economic factors as well as site-specific data.

The sources – and therefore the accuracy – of costing information will depend on whether the site is an existing and operating landfill or a planned site, and the degree to which planning, resource consent processes and design have progressed.

Information sources will include:

- current site development costs
- operators of landfills of a similar size
- consultants' reports on landfill development
- contractor and supplier estimates and quotes
- tendered contract prices
- construction and contracting cost handbooks and indices.

### 5.4.1 Value of existing Brownfields asset

The Brownfields model requires an input related to the opening asset value of the existing landfill. This value should be as per Financial Reporting Standard 3 (FRS-3) or NZIV[17] guidelines. You should consult your accountant(s) or specialised financial advisers to ensure that the value you input here is consistent with these standards and guidelines.

### 5.4.2 Initial/sunk costs

Only the costs that can be attributed directly to the site finally chosen should be included as initial/sunk costs in the FCA model. Typically these would include site selection (directly related to the proposed site), planning and site investigations.

### 5.4.3 Planning and pre-development costs

#### Project management

This covers all costs for management, administration and organisation overheads associated with the landfill during the pre-development phase of the project, including:

- salaries and wages and benefits for management and clerical staff
- accounting costs
- communications.

#### Site selection

Only the costs of research and investigations that can be attributed directly to the site finally chosen can be included in the model. Sources of information on the costs of landfill site selection include:

- internal cost records from previous siting studies
- local authority waste managers who have undertaken siting studies
- consultants' reports and/or proposals on site selection.

[17] NZ Institute of Valuers. These guidelines are broadly consistent with FRS-3.

## Consultation

The costs of consultation are specific to the project and should include public consultation (meetings, information bulletins, media releases, etc) as well as consultation with interested and affected parties. Sources of information on the costs of the consultation include:

- internal cost records from previous consultation processes
- managers of similar sites or projects
- consultants' reports and/or proposals on consultation costs.

## Site investigations

The costs of survey and preliminary design, geotechnical and groundwater studies and other detailed investigations or studies (noise, traffic, visual, etc.) depend on the scale and significance of the project as well as the specific attributes of the site. Sources of information on the costs of site proving include:

- internal cost records from previous site-proving processes
- managers of similar sites or projects
- consultants' reports and/or proposals on site-proving costs.

## Baseline monitoring

A preliminary site assessment and discussions with the regional council as well as specialist advise from consultants can provide a guide to baseline monitoring requirements and associated costs.

## Resource consents

As with the site selection process, the resource consent process can be long and involve substantial cost. The time and cost can be expected to be greater for a new site than for an existing site. The resource consent process requires the following:

- extensive site investigations
- preliminary design
- consultation
- preparation of an assessment of effects on the environment in accordance with the fourth schedule of the RMA
- preparation of a landfill management plan
- pre-hearing meetings
- consent hearing
- (possibly) an Environment Court hearing
- (possibly) a High Court case.

In the model the resource consent item covers:

- AEE and consent application
- draft landfill management plan preparation
- legal
- hearing
- appeal.

Sources of information on the costs of the resource consent process include:

- internal cost records from previous consent processes
- managers of similar sites who have obtained resource consents
- consultants' reports and/or proposals on resource consent costs.

### Land cost

Land cost covers the cost of all land purchased and used for the landfill. It includes the cost of any land bought for leachate and/or stormwater treatment, access roading and buffer areas, legal costs, and the cost of negotiations associated with land purchase.

In some cases land may be leased for any of the above activities. Here it is important to ensure that any financial costs associated with the lease are reflected in the discount rate and not in the operating costs. This will avoid any risk of double counting such costs. Generalised guidelines cannot be provided in these cases and specialist input should be obtained.

Current landfill siting and design requirements mean that the types and locations of land appropriate for development as a landfill in a district are limited. For new landfill sites the cost of land may be significantly higher than the value of the land under its existing use. This is a reflection of the market demand due to limited availability of appropriate land and the likelihood that the land is more valuable to a council, or community, as a landfill than in some alternative use.

## 5.4.4 Base costs

The base costs of engineering (detailed design and documentation, and construction management) and contractor's preliminary and general (P&G) associated with landfill development are included.

## 5.4.5 Site access costs

All intersection upgrades, other roading network upgrades/contributions, access road to the landfill footprint, and special structures (diversions, bridges, etc.) required to cater for increased traffic or increased vehicle loads due exclusively to the landfill should be included.

### 5.4.6 Site amenities and services

This item covers:

- site entrance
- administration building
- weighbridge and kiosk (weighbridge, weighbridge kiosk, cash registers and any computer hardware and software)
- machinery shed/ maintenance facility
- power and phone, sewerage, water supply
- general civil works (sealing, parking)
- washdown/wheel-wash facility
- fencing (site boundary and security fencing)
- landscaping (screening bunds, planting, etc.).

### 5.4.7 Groundwater control

This covers all costs associated with the installation of groundwater collection drains and discharge of groundwater from beneath the site.

### 5.4.8 Earthworks

This covers all costs associated with bulk earthworks for site preparation, including the costs of removing or importing material.

### 5.4.9 Liner construction

This covers all costs associated with purchase of liner materials, liner protection materials (including temporary protection), liner construction and additional site preparation required prior to the placement of liner materials. Also included are costs associated with testing liner materials and quality assurance/quality control procedures employed during liner construction.

The geometric and cost inputs for liner construction allow for the use of up to six different liner types. Each liner type can incorporate subgrade preparation, low permeability material (i.e. clay), synthetic liner (i.e. FML and/or GCL), a liner protection layer, and a leachate collection layer.

In many cases, a single liner type will be suitable for the whole landfill, however in some cases, differing liner types may be required such as where the sidewall liner type differs from the base or floor liner type. The difference may be as small as omission of, or reduction in, the thickness or material type of one layer in the proposed liner.

Each cell can use any combination of liner types, however the default is Liner Type 1. All residual footprint area not allocated to another liner type is allocated to Liner Type 1.

Apart from the low permeability material, all layers are costed per square metre. Therefore the unit rate costs entered in the **Cost Input** sheet for each layer must be calculated to take account of any relevant thickness variations. Any layer which is not required for a given liner type should have its cost deleted (or set to $0) in the **Cost Input** sheet. Where low permeability material is not required for a particular liner type, its thickness should be set to zero in the **Geometric Input** sheet.

All geometric inputs are based on plan areas and not projected areas. Where slopes are particularly steep, some adjustment to the liner costs may be necessary to allow for the difference between the plan and projected areas.

At the initial project planning stage the type of liner may be unknown, and hence for this case the user should only input values for a default liner (Type 1).

The default liner suggested is the United States Environmental Protection Agency (USEPA) Subtitle D liner: a composite liner consisting of two components. The upper component must consist of a minimum 0.75mm (30 mil) flexible membrane liner (FML), and the lower component must consist of at least a 600 mm layer of compacted soil (clay) with a hydraulic conductivity of no more than $1 \times 10^{-9}$ m/s. Under Subtitle D, FML components consisting of high density polyethylene (HDPE) must be at least 1.5 mm (60 mil) thick. It should be noted that the model does not automatically calculate or allow for a Subtitle D liner.

## 5.4.10 Leachate collection and transmission system

This covers all costs associated with the development of the system, including pipes, sumps, cleanout ports, manholes, automated pump station (pumps, valves, fittings and electrical) and collection layer.

## 5.4.11 Leachate treatment and disposal

This covers all costs associated with the development of the leachate pre-treatment / treatment and/or disposal system, including:

- construction of leachate retention ponds
- construction of a leachate pre-treatment / treatment plant
- development of a leachate irrigation system
- connection of the leachate collection system to the local sewerage system (where applicable).

The costs of the system may vary considerably depending on the method of treatment and disposal and the quantity and quality of leachate. The model provides the flexibility to include all treatment and disposal options, including short-, medium- and long-term methods of leachate management to deal with changes in leachate quality and quantity over the life of the facility.

### 5.4.12 Stormwater management

This item covers all costs associated with the construction of major stormwater diversion (for example, dams and canals), open drains, stabilised drains / flumes, piped drains, and stormwater treatment (ponds and instrumentation).

### 5.4.13 Landfill gas management

This item includes the installation of any landfill gas collection and monitoring bores, pipework, treatment systems, vents, flares and sampling points, both in and around the site.

For existing sites this item should include the cost of property purchase or installation of gas cut-off trenches and barriers to reduce gas hazards in the vicinity of the landfill site when these actions are required.

### 5.4.14 Final cover, capping and revegetation

This includes the cost of all cover material, revegetation and any placement of final cover and revegetation not accounted for in the daily operations budget or operations contract.

The placement of daily cover and intermediate cover is accounted for in the landfill operations.

### 5.4.15 Landfill operations

This item covers either the contract for day-to-day landfilling operations at the site, or the costs of site staff and plant operation. In some cases it may be a combination of the two. Included are all the day-to-day operations undertaken by the contractor or site staff, such as:

- on-site management
- maintenance of access
- working face preparation
- gate control and fee collection
- waste acceptance and inspection
- refuse placement and compaction
- the disposal of special wastes, such as date-expired products, material seized by customs, and quarantine wastes
- placement of daily, intermediate and final cover
- maintenance of cover and vegetation
- control of nuisances due to litter, noise, dust, vermin, birds and odours
- prevention of scavenging
- routine monitoring carried out by site staff
- maintenance of records not included in administration costs

- health and safety procedures.

Where a landfill is a component of a larger waste management system, administration and overhead costs related to the landfill should be separated out and charged directly to the landfill.

## 5.4.16 Monitoring

This item covers the cost of environmental and other monitoring not carried out by staff on site, along with associated expert advice, interpretation, record keeping and reporting, and external costs. The types of monitoring to be accounted for are:

- stormwater
- groundwater
- leachate
- landfill gas
- local ecology
- waste analysis surveys
- landfill topographic surveys to determine volume of refuse in place
- cost of regulator involvement.

This item includes the cost of installing monitoring facilities such as groundwater monitoring bores, surface water weirs and landfill gas monitoring bores during the operating life of the landfill. It also includes the purchase of specialist monitoring equipment, if required.

## 5.4.17 Host fees

Host fees, where applicable, are payments made to the local community affected by a landfill for appropriate community projects (for example, a community hall). They can take the form of lump sum grants or an amount per tonne of refuse accepted at the site, or a combination of the two, for the development and/or maintenance of community facilities. The value of host fees may be calculated during the resource consent process.

## 5.4.18 Closure and aftercare

The *Landfill Guidelines* (Centre for Advanced Engineering, 2000) state that the minimum time period for aftercare of a landfill is around 30 years. The full cost accounting process for a landfill includes all costs associated with the post-closure rehabilitation and aftercare of a site until such time as the appropriate regulatory authorities determine that it has no significant potential for adverse effects on the environment.

Regulatory authorities generally require the preparation of a closure and aftercare plan prior to completion of landfilling at a site.

If the landfill user charges are derived from the full cost analysis and reflect the costs of aftercare, then this proportion of the landfill income will not be spent until after the site is closed and (possibly) available for other uses.

For existing or new landfills, the opportunity exists to levy each tonne of solid waste disposed at the facility via the tipping fee as a disposal cost levy (section 542 of the Local Government Act) to provide the funds for these costs. Another method is to pay the costs of closure and post-closure using rates or taxes collected from the relevant community, or a combination of rates, taxes and disposal cost levy. If financial assurance for meeting future costs has not been implemented during the operational life of the now-closed facility, the costs of closure and post-closure will probably have to be met by the community in the form of rates and taxes.

## 5.4.19 Closure and aftercare costs

The impact of the decisions made in the first three stages of the project (see 'Different WACCs for different Greenfields stages', section 5.4.21) on the environment will be felt in this final stage as the site is restored to a useable state. There is considerable uncertainty over the rehabilitation liability taken on by a landfill operator once the landfill is closed, and also over quantifying the cost involved in the clean-up and rehabilitation phase of the project. Also, the estimated time frame for the rehabilitation and clean-up stage (15–30 years beyond the closure date of the landfill) of the project is fairly uncertain, with the highest projected monitoring period as long as 35 years after closure. This estimate is dependent on the location of the site selected (for example, drier terrain will increase the time required for the waste to decompose, and vice versa).

The methane gas produced by the landfill may be able to be used to incinerate the leachate and produce electricity, which would result in a reduction in the cost of stage 4. This option is dependent on where the landfill is situated (near a power station or population) and the amount of capital expenditure required. If this possibility were to be factored into the cashflows for stage 4 and then did not occur, for technical or economic reasons, unexpected stage 4 costs would result. This adds to the uncertainty surrounding the cost that will be incurred during this phase and the level of risk.

As a result, this post-closure exposure period is best characterised as one of low expected costs, ideally covered by amounts calculated and funded during the operating period. At the start of the project evaluation an estimate will be made of the closure and aftercare costs. The sum of these must be accumulated during the operation of the landfill taking into account current deposit rates. The model will need to reflect the accumulation of the 'sinking fund' when calculating the gate price per unit.

While there are some closure activities that are common to all landfill sites, others are site-specific and/or resource consent-specific. Typical closure activities include:

- construction of the final cover and maintenance
- gas management system completion and maintenance
- leachate management system completion and maintenance
- surface water management system completion and maintenance
- environmental monitoring.

It is important to reiterate that actual costs will be site-specific and may vary significantly from those presented in Appendix B. The reader is also referred to *A Guide to the Management of Closing and Closed Landfills in New Zealand* (Ministry for the Environment, 2001b).

Closure and post-closure cost estimates are best developed using actual costs from current landfill operations, as well as historical costs from closure and post-closure activities. Changes

over time are likely to occur in the estimates due to increasing regulatory requirements and/or new technologies. The following major components of post-closure may be expected to decrease over time.

- *Leachate management:* the management of leachate has the potential to be the most expensive aspect of post-closure care. The decreases in volume of leachate produced at the site following final cover installation may reduce cost over time.
- *Compliance monitoring:* monitoring requirements of a landfill facility have increased since landfills have been consented under the RMA. However, if a facility is in environmental compliance, the regional council may reduce the frequency and extent of monitoring. Most landfill consent conditions include review provisions. Section 127 of the RMA allows consent holders to apply for a variation.
- *Gas management:* as the landfill ages and decomposition of refuse slows down, the production of LFG decreases, resulting in lower gas management costs.

Key financial considerations for closure and post-closure are as follows.

- In order to determine the cost of closure and post-closure care, the landfill owner/operator must determine the steps necessary, as required by the resource consent conditions, to close a facility as well as care for the facility post-closure.
- Closure and post-closure costs are scale-dependent and can be a significant part of the facility's tipping fee.
- Design, construction, operating practices and maintenance are all factors that influence potential closure and post-closure costs, as well as remediation or corrective actions.
- It is important to apply site-specific cost models when developing closure and post-closure cost estimates.
- Actual historical costs from site operations and construction activities should be used whenever possible. Cost guidelines and estimates from published sources should only be used as supplementary reference materials.
- Applying any 'typical' per hectare costs to sites should be avoided, as these could grossly underestimate or overestimate closure and post-closure costs.

## 5.4.20 Contingencies

Contingency costs associated with the pre-development, development and operation, closure and aftercare of the landfill should be included. Typically figures of between 5% and 25% are used, depending on the level of accuracy of the costs of the individual items in the analysis.

## 5.4.21 Cost of capital and weighted average cost of capital (WACC)

### Introduction

The cost of capital is defined as the return investors in a firm or project expect to earn given the degree of risk associated with that firm or project. It represents the opportunity cost of investing in an asset with risk comparable to the asset being evaluated. For example, a relatively risky

venture, such as investing in oil exploration, has a higher cost of capital than investing in a utility company.

Cost of capital can then be used to 'discount' the cashflows of projects or businesses as investors are forgoing the opportunity in the intervening period. When used in this way future cash flows are converted to a 'present value', expressed in today's dollars (a key component of the landfill model). Essentially, this discount factor accounts for both the 'time value of money' (a dollar today is worth more than a dollar in the future) and the riskiness of a project or business.

## Calculating WACC

The commonly accepted cost of capital is the weighted average cost of capital, or WACC. The calculation of WACC is a relatively complex task and you should seek specialised advice from either your accountant(s) or external sources before calculating the required input. WACC is not directly equal to debt cost.

The formula below broadly outlines the approach that should be followed in order to calculate the WACC input for the model:

$$WACC = \left\langle \frac{Debt}{Debt + Equity} \right\rangle Cost\ of\ Debt + \left\langle \frac{Equity}{Debt + Equity} \right\rangle Cost\ of\ Equity$$

Where:

Debt = market value of debt

Equity = market value of equity

Cost of Debt = pre-tax return required by debtholders

Cost of Equity = pre-tax return that shareholders expect.

In short, WACC is a weighted average of the returns expected by debtholders and equity or shareholders for investing in an asset such as a landfill.

The cost of equity, or the risk-adjusted return required by shareholders, is not directly observable, but can be estimated using the capital asset pricing model (CAPM). This estimate is made as follows:

$$Return\ to\ Equity = Risk\ free\ interest\ rate + \left\langle \text{"Beta" of Equity} \times Market\ risk\ premium \right\rangle$$

Where:

Risk free interest rate = the interest rate of risk free security

Market risk premium = the premium that the market returns over and above the risk free rate

"Beta" of Equity = the sensitivity of the returns of a firm's shares to fluctuations in market returns.

## Consistency of cashflows and discount rates

An important point to note in the context of both forms of this landfill model[18] is that the WACCs used need to be estimated in pre-tax and real[19] terms. This is because there needs to be consistency between the cashflows being discounted and the discount rate being applied. As the cashflows being discounted are before tax and 'real' (they are not adjusted for inflation), the discount factor or WACC must be consistent with this and so should be reflected in pre-tax real terms. Again, because of the complexity of this issue, you should seek specialised advice from either your accountant(s) or external sources before deciding on the appropriate discount rate.

## Different WACCs for different Greenfields stages

A Greenfields landfill project can be divided into four specific stages based on the types of risks that an operator will be exposed to during its life. These stages are outlined below.

- *Stage 1: Planning and pre-development* – ensure that the project is technically and economically feasible, prepare construction plans, and obtain all required planning and resource consents. Note that this period also includes the cost of acquisition of the underlying land required for the landfill and hence there will be an overall negative cashflow in this stage, as no revenue will be generated.
- *Stage 2: Development* – build the necessary landfill, lock volume commitments in place, and ultimately get the gates open. This phase again includes only negative cashflows.
- *Stage 3: Operating* – manage the day-to-day operations of the site, continue to source volume, and expand the landfill as necessary.
- *Stage 4: Aftercare* – close the site in the agreed manner, managing any on-going environmental exposure and closure risks. This phase is expected to last 15–30 years beyond the closure date, before all residual or potential liabilities can be safely assumed to have passed.

Examples of the level of WACC risk rating that each different stage would attract are indicated below. The differing discount rates will reflect the quite different risks faced in each phase of a landfill project. For example, typically the site selection phase is inherently more risky than the operation phase because of the relatively greater risks inherent in finding suitable sites.

**Table 2: Examples of WACC ratings at different stages of a landfill**

| | Stage 1 | Stage 2 | Stage 3 | Stage 4 |
|---|---|---|---|---|
| Project stages | Planning and pre-development | Development | Operating | Aftercare |
| WACC risk rating | Venture capital | Building company | Operating company | Operating company |

Note that in the case of a Brownfields landfill, only one WACC is required – relating to that of a landfill operating company. From stage 3, the risks are representative of the business risks of the landfill.

[18] Greenfields and Brownfields.

[19] As distinct from nominal, or including the effects of inflation.

## Indicative WACC values

As you may note the model already has data in the **Cost of Capital** data entry cells. These values are as follows.

**Table 3: WACC for different stages of landfill development**

| | WACC* |
|---|---|
| Planning and pre-development | 25% |
| Development | 25% |
| Operating | 10% |
| Aftercare | 10% |

* This should be expressed in real, pre-tax terms.

However, note that these default values are inserted only to enable the model to generate an IBC value.

Before taking the results of this model beyond an initial drafting stage, you are strongly advised to obtain advice on these inputs. These rates are likely to alter depending on relevant market and economic parameters.

# 6 Income Streams

Incomes from the landfill, or various components of the waste management system, may be included in the FCA analysis. Income can arise from the following sources and activities:

- landfill user charges
- uniform annual charges for waste management services in rates
- lease of land not used for landfilling purposes
- sale of trees or crops
- sale of landfill gas (this income may continue after landfill closure)
- sale of excavated material
- sale of rubbish bags
- sale of recyclables
- sale of compost
- income from rates.

In assessing income it is important to recognise the influence of other components of the waste system and the changing nature and quantity of residual waste to landfill. In some cases waste tonnages can be accurately forecast and hence income can similarly be forecast accurately. However, in other situations, commercial waste 'control', or changing residual waste quantities – such as a result of waste reduction or recycling initiatives, waste diversion, provision of alternate (cheaper) residual disposal facilities – can have a major effect on income, both short and long term, and hence can significantly affect landfill economics.

A key decision for TLA waste managers is the structuring of user charges – the basis of the 'income' component of the model. The specifics vary from case to case, but a key advantage of the FCA model is that the effect of changing tonnages and incomes can be readily modelled and the effects on gate rates and landfill development programmes rapidly re-assessed. This enables changes to be made to development planning and charging to suit changes in circumstances. In the case of Brownfields models, the sensitivity of the IBC and hence gate rate to changing waste tonnage/income needs to be carefully assessed, as such landfills can be susceptible to significant indicated movements in the IBC due to the effects of reducing waste tonnages.

# 7 Model User Guide

## 7.1 Introduction

The FCA model has been designed and developed to be easy to use. This section looks at how the FCA model was developed and provides general instructions and helpful hints for using the model to estimate the IBC for a landfill.

Specifically, section 7.2 focuses on the scope of the model and its underlying structure, including:

- suggested uses of the model
- underlying assumptions
- cost sources
- parameters relevant to landfill activities included in the model
- parameters considered but not included in the model
- model default values.

Section 7.3 provides additional specific assumptions used in developing the model and general instructions, tips, and examples for using the FCA model spreadsheet, including:

- data to collect for model input
- how to input data to the model
- how to adjust default cost values included in the model or override them with actual cost values
- the flexibility of the model.

**Special note**

Before continuing through this document, either download the FCA model to your computer to become familiar with it, or review the worksheets and other information included in Appendices A (Landfill FCA Model Overview, Structure and Algorithm Flowcharts), B (Model Input Costs – Default Values) and E (Landfill FCA Model Typical Example – District Landfill Site) of this document.

## 7.2 Scope of the FCA model

The formulae of the FCA model and its option buttons, macros, and other features are embedded in a Microsoft Excel Workbook. This format makes the model an easy-to-use cost analysis tool which is in a popular software platform.

The FCA Model is available on CD and also as a download from www.mfe.govt.nz (always the latest version available).

Intended users of the FCA model include both private sector and local authority waste officers/ managers. As indicated in Table 4 below, the model can be used to assess landfill full cost.

**Table 4: Potential uses of the FCA model**

| | |
|---|---|
| Estimate the indicative base cost of disposal (IBC) for:<br>• a Greenfields site<br>• a Brownfields site | Assess costs for:<br>• each aspect of a landfill from pre-development, development, operation, and closure through to and including aftercare. |
| Conduct cost analyses for:<br>• comparing various potential landfill sites<br>• comparing the landfill option with other disposal options<br>• effects on the IBC of implementing waste strategies (waste minimisation, waste to landfill reduction targets). | Compile or accrue actual costs for:<br>• historical and trend analyses<br>• budget development and forecasting<br>• goal setting<br>• performance measurement. |

The summary outputs allow you to analyse costs and adjust them by conducting 'what-if' analyses of specific parameters.

Before making the FCA model available to the public, its underlying assumptions, parameters, layout and usability as well as the spreadsheet's formulae and calculations were tested using actual landfill data gathered from several local authorities. The rest of this section discusses the assumptions and cost sources used in the model, parameters included and not included in the model, and the FCA model's default values.

### 7.2.1 Assumptions and cost sources

Several key assumptions used throughout the model are discussed below. Additional assumptions are presented throughout this Guide.

1 The FCA model user has collected data for the model input worksheets **– General Input**, **Brownfields Input, Waste Input**, **Geometric Input**, and **Cost Input**. Furthermore, the user understands the Full Cost Accounting concepts.

2 A New Zealand landfill would be consented under the RMA and developed and operated in accordance with modern best practice.

3 The model input costs (Appendix B) provide guidance on indicative costs (range, typical and default costs or values) for items scheduled in the model **Cost Input** worksheet. The rates provided are for guidance only and are likely to alter depending on relevant market and economic parameters, as well as site-specific data or conditions.

4 The FCA model excludes the items listed in Section 5.2 and Appendix C of this document.

5 The FCA model excludes inflation.

6 The FCA model excludes goods and services tax (GST).

7 The FCA model may be used for planning a new landfill facility, developing a specific site, or an existing landfill (with or without further development.

8 The FCA model output (the indicative base cost of disposal) excludes related intangible costs or other charges such as recovery of costs from previous undercharging and taxes considerations. In order to convert the IBC output to a post-tax estimate, it will be necessary to obtain specialist advice.

Use of the FCA model requires the compilation of cost data into an appropriate form to determine landfill unit costs, and hence the IBC.

The cost values used in the FCA model are primarily derived from known or published unit costs for all capital and non-capital expenditure. Where appropriate, estimates have been made in the light of expected engineering requirements and/or standards applicable to modern landfill design and operation, which have been brought into focus through recent consent processes.

Other sources of cost and conversion values that could be used in the model include:

- current site-development costs
- operators of landfills of a similar size
- consultants' reports on landfill development
- contractor and supplier estimates and quotes
- tendered contract prices
- construction and contracting cost handbooks and indices.

### 7.2.2 Parameters included

The model is based on up to 11 information parameters and eight cost parameters relevant to landfill full cost accounting, as given in Section 5 (Table 1). These parameters correspond to the item categories/headings in the model input worksheets (**General Input**, **Brownfields Input**, **Waste Input**, **Geometric Input**, and **Cost Input**), which provide the space for entering most data.

### 7.2.3 Parameters not included

A variety of cost parameters associated with landfill management could not be included in the model because:

- either limited cost data would be available to the model user; or
- gathering the cost data would be too burdensome or complicated; or
- the information was outside the definition of 'full cost' adopted for this Guide.

Such parameters include those listed in Section 5.2 and Appendix C. Although these parameters are not specifically used in the model, the model has the space and flexibility for you to manually enter additional cost items if the necessary data are available. You can do this by adding the information as a line item unit cost on the **Summary** worksheet. It is assumed that these additional costs have been derived outside the model (see Appendix A).

## 7.3 Using the FCA model

This section presents background information and general guidance for using the FCA model.

### 7.3.1 Hardware and software requirements

To operate the FCA model you will need to have an IBM-compatible personal computer and Microsoft Excel for Windows 97.

The model is an electronic spreadsheet. You can enter information (numbers or text) into *white* data entry cells, as well as selecting from the various check boxes, options buttons, and drop-down lists.

### 7.3.2 Getting started

1 The spreadsheet has been scanned for viruses, but if you are concerned then scan the spreadsheet before use. Excel's built-in macro virus protection will need to be turned off to use the model.

2 Open the file titled FCA Model. Before the model is completely operable, a security dialogue box may automatically pop up. At this point, you should press the Enable Macros button. The spreadsheet will then open and be fully available for use.

3 Immediately save this spreadsheet under a different name so that you always have an unchanged master copy. Each time you assess a new site or development options for the same site, save the spreadsheet under a new file name to avoid overwriting or loss of data on the last site or option you assessed using the model.

4 The spreadsheet has page tabs at the bottom titled **Version History**, **Instructions, General Input, Brownfields Input, Waste Input, Geometric Input, Cost Input, Summary, Cashflow Detail**, **Cashflow Summary, Cashflow Chart** and **IBC Chart**. The **Version History** page is for information only and records model corrections and modifications. The page tab for **Waste Input** is shown only if the Custom Waste Tonnages option is selected by the user. Similarly the **Brownfields Input** is shown only if the Brownfields option is selected by the user.

5 Clicking on a tab will select a worksheet in which data can be entered or reviewed. In the FCA model data may only be entered in the **General Input**, **Brownfields Input**, **Waste Input**, **Geometric Input**, and **Cost Input** worksheets. Limited data may also be entered on the **Summary** worksheet once the IBC has been calculated. The remaining worksheets are read-only. Blank copies of the **General Input**, **Brownfields Input**, **Waste Input**, **Geometric Input** and **Cost Input** worksheets are provided in Appendix F.

### 7.3.3 Using the model input worksheets – General Input, Brownfields Input, Geometric Input and Cost Input Worksheet

The model input worksheets are designed to be easy to use. All you need to do is look for the words 'Start Here' on the **Instructions** worksheet. Then follow the instructions and enter data as you work your way through each white data entry cell of the worksheet. When you have finished inputting data to that worksheet, clicking on the button on the bottom of that worksheet will automatically take you to the start of the next input worksheet.

The model input worksheets (**General Input**, **Brownfields Input**, **Waste Input**, **Geometric Input** and **Cost Input**) are where you will input all your data. Each of these sheets is divided into the parameters and the individual items that correspond to the various aspects of landfill management. In some cases the scheduled items will have drop-down menus, data-entry cells, check boxes, option buttons, tip boxes, error warnings, and colour-coded text and cells to help you as you move through them as follows.

- *Drop-down lists* allow you to select from a list of default options.
- *Check boxes* allow you to answer a yes/ no question by checking or unchecking the box.
- *Option buttons* allow you to select between two or more different options by clicking on the adjacent circle.
- *Tip boxes* coloured *pale yellow* drop down from some cells to indicate typical values and valid ranges.
- *Data-entry cells* are the only cells in which you can enter data and are coloured *white*. All the other cells are write-protected, so you don't have to worry about accidentally deleting default values or formulae. Data in *grey* text can be changed but is currently not in use by the model for the scenario (either Greenfields or Brownfields) being developed.
- *Errors/warnings* are provided in *red* to help validate certain items of data. During initial data entry warnings may appear before data are fully entered in all the worksheets. Don't worry. The warnings should be rechecked and fixed once data entry is complete and before solving the model (solving is accomplished by pressing the *Solve IBC for Zero NPV* button at the bottom of the **Cost Input** worksheet).

## 7.3.4 Inserting data

The following sections cover data input instruction and hints.

**Table 5: General input parameters data entry**

| Data cell | What to input |
|---|---|
| Situation | Select option button for Greenfields Site or a Brownfields Site. |
| Project commencement date | Enter full date (e.g. 1 January 2002 as 01/01/2002). |
| Operation commencement date | Enter full date (e.g. 1 January 2005 as 01/01/2005). |
| Commencement date of operation in new airspace | Calculated automatically. |
| Pre-development period/ assumed life of residual airspace | Calculated automatically. |
| Time of land purchase | Enter time (must be within the pre-development period). |
| Time of excess land sale | Enter time (must be within the operational life of the landfill). |
| Sunset date | Enter date, which will then display the consented life – the default is 35 years (under RMA maximum consent period). |
| Actual operating life | Calculated automatically, based on other input data (will not exceed consented life). |
| Aftercare period | Enter number of years (usually between 20 and 30 years). |
| Waste | Select option button for Custom Waste Tonnages or Generated Waste Tonnages. Selecting the Custom Waste Tonnages option will unhide the page tab titled **Waste Input**. Enter custom annual waste tonnage as tonnes/year (t/yr) or million tonnes/year (Mt/yr) using the same units used on the **General Input** sheet.<br><br>If the Generated Waste Tonnages option is selected, enter annual waste tonnage data and annual waste growth rate or reduction as outlined below. |
| Annual waste tonnage at start of operation | Enter as tonnes/year (t/yr) or million tonnes/year (Mt/yr) |
| Annual waste growth rate or reduction | Enter as +/- a fixed tonnage, or a percentage per annum. |
| Minimum allowable annual waste tonnage | Enter the minimum allowable tonnage for an operational landfill. (If for some reason the tonnage falls below this figure, the model will assume that the landfill closes on the date the tonnage reaches that figure.) |
| Waste stream characteristics | Enter percentage that is general refuse (e.g. if 100 % then the special waste proportion of the total waste stream will automatically display as 0 %). |
| Waste charging | Enter the relative disposal charges anticipated for various tiers of waste (i.e. the require % premium to be charged for special waste over the base charge). |
| Assumed compacted waste density (excluding cover) | Select from drop-down box (tonnes/$m^3$). |
| Target cover (daily and intermediate) to waste ratio | Select from drop-down box (hence volume utilisation in $metres^3$/tonne is automatically displayed) |
| Cost of capital | Enter percentage for each stage of the project (see section 5.4.21 of this document). |
| Interest rate | Enter rate at 0.5% higher than the 10-year Government Bond Rate. |

| | |
|---|---|
| IBC | Option buttons allow the user to selectbetween using IBC real annual movement or ramping the IBC from an initial (user entered) value to a final (unknown or goal seek) value over a set period of time. These options are outlined below. |
| IBC real annual movement | Select option button to apply real annual movement to IBC over whole operating life.<br><br>Enter as +/- percentage if required (i.e. if 0% then the IBC does not change over the life of the landfill - since inflation is not incorporated in the model). |
| Ramp IBC from initial (user entered) value to a final (unknown or goal seek) value over a set period of time | Select option button to ramp IBC from initial (known) value to a final (unknown) value over a set period.<br><br>Enter initial value (e.g. enter 30 for $30/t)<br><br>Enter year of operation from which to start ramping IBC (e.g. enter 2 for 2nd year of operation)<br><br>Enter year of operation in which to finish ramping IBC (e.g. enter 20 for 20th year of operation).<br><br>Once the model has been solved, the *IBC Chart* will show the IBC on an annual basis over the model duration. |

### Table 6: Brownfields input data entry

(See sections 5.1, 5.3.2 and 5.4.1).

| Data cell | What to input |
|---|---|
| Volume and area units | Select from dropdown box. **Brownfields Input** and **Geometric Input** worksheets must use the same units. |
| Residual constructed airspace at project commencement date of new project | Enter estimate of residual airspace in $Mm^3$ or $m^3$ (depending on which box was checked at the start). |
| Life of residual airspace | Calculated automatically (based on the relevant date entered in the **General Input** worksheet). |
| Footprint of existing landfill | Enter estimate of footprint area in Ha or $m^2$ (depending on which box was checked at the start). |
| Nature of continuing development | Check box for Overlay or Extension to Footprint as appropriate. |
| Existing flare station | Checking this box means there is an existing flare station in place that will be utilised for the new development as well. |
| Existing leachate pre-treatment | Checking this box means there is an existing leachate pre-treatment facility in place that will be utilised for the new development as well. |
| Existing leachate disposal | Checking this box means there is a leachate disposal system in place that will be utilised for the new development as well. |
| Stormwater works to be completed during residual life of airspace already constructed | • Stormwater open drains – enter length in metres<br>• Stabilised drains/ flumes – enter length in metres<br>• Piped drains – enter length in metres. |
| Gas system works to be completed during residual life of airspace already constructed | • Horizontal collection pipework – enter length in metres<br>• Vertical extraction wells – enter length in metres<br>• Main header pipe – enter length in metres<br>• Laterals to verticals – enter length in metres<br>• Condensate traps – enter number. |
| Final cap to be completed on residual airspace | Enter area in Ha or $m^2$ (depending on which box was checked at the start). |
| Stockpiles | Volumes of existing stockpiles for topsoil, unsuitables, sub-topsoil, low permeability material, and structural material – enter estimate of volume in $Mm^3$ or $m^3$ (depending on which box was checked at the start). |
| Value of aftercare fund that has been accumulated to date or amount to be set aside as a start-up fund if nothing has been collected. | Enter $ lump sum. |
| Waste | For the Brownfields situation waste data is input in the **General Inputs** sheet as outlined in Table 5 of this section. |

**Table 7: Geometric input data entry**

| Data cell | What to input |
|---|---|
| Volume and area units | Select from dropdown box; **Brownfields Input** and **Geometric Input** worksheets must use the same units. |
| Leachate generation | Select options button for typical values for region that automatically selects typical values for the location displayed or custom values which need to then be inserted by the user. |
| Assumed in situ topsoil depth | Enter depth in metres. |
| Depth of sub-topsoil to be recovered | Enter depth in metres (you may also choose whether or not sub-topsoil layer is to be recovered from fill areas). |
| Liner | Enter thickness of low permeability material (i.e. compacted clay) in metres for each type of liner to be used as outlined in section 5.4.9.<br><br>Also refer Appendix E – Typical Example. |
| | |
| Final cover layer | Enter thickness of each of the proposed components (topsoil, sub-topsoil, low permeability layers) in metres. |
| Main landfill access road | Enter length in kilometres. |
| Length of boundary fence | Enter length in metres. |
| Leachate pre-treatment facility installation | Enter number of years after commencing landfill operation. Zero or nothing means it will not be installed. |
| Leachate disposal system | Enter number of years after commencing landfill operation. Zero or nothing means that it will not be installed. |
| Landfill flares | Enter percentage of way through life when the flares will be installed (zero or nothing means that it will not be installed). |
| Net airspace | Enter estimate of airspace required for each cell from preliminary design or for a required life (duration) for each cell. Enter in $Mm^3$ or $m^3$ (depending on which box was checked at the start) |
| Cell Construction | The model allows the user to select the option of cell construction in staged equal annual amounts or cell construction completed in a single year.<br><br>Select button for option preferred. |
| Development Programme parameters | Enter estimate of footprint area of each cell and liner type based on a theoretical landfill configuration or from preliminary design for a specific site. Enter in Ha or $m^2$ (depending on which box was checked at the start). Similar estimates may be made for disturbed area, area of the fill zone (both inside and outside the footprint), area to be cleared (allowance should be made for areas cleared for access, ponds, perimeter track, etc.), bush area to be cleared, area of specialised sub-grade treatment, area of liner protection, and final cap area.<br><br>Estimates should be made of the required cut (existing grade to base grade), useable liner from this cut area, the required fill (existing grade to base grade), useable liner from this fill area, and unsuitables volume/ proportion in the fill area. Enter in $Mm^3$ or $m^3$ (depending on which box was checked at the start). The accuracy of these estimates depends whether a specific investigated site or a generic site is modelled. Earthworks quantities are automatically calculated from the data above to achieve a materials balance. |
| Landfill perimeter access track | Enter length in metres. |
| Subsoil drainage | Enter length in metres. |
| Leachate collection system | Enter proposed system (header pipes, collection pipes, sumps, clean-out) quantities in metres or numbers as appropriate. |

| | |
|---|---|
| Stormwater open drains, stabilised flumes, and piped drains | Enter length in metres. |
| Gas management system (horizontal collection pipework, vertical extraction well, header pipes, laterals to vertical wells, and condensate traps) | Enter in metres and numbers as appropriate. |

## Cost input data entry

It is important to note that for those variables that require dollar value estimates, the user should input the value in *today's* dollars, even if this variable is relevant for a future period.

There is no need for the user to account for inflation in providing these estimates. The model automatically accounts for dollar value inputs being in today's dollars, and produces output in today's dollars. That is, inflation is not incorporated in the model.

There is provision for the user to insert certain additional items by way of "Custom Inputs". Each custom input is allocated to the model in a different way. The method of allocation is explained in the **Cost Input** worksheet.

> **Special note**
>
> Where a particular item is not wanted in the situation being modelled, a zero ($0) should be entered against it.

Cost Input data cover the following.

### Sunk costs/asset value

(See sections 5.1, 5.3.2 and 5.4.21.)

- Enter $ lump sum.

**Table 8: Planning and pre-development**

| Data cell | What to input |
|---|---|
| Project management | Enter $ lump sum which is then equally distributed per year over the duration of the pre-development period. |
| Site selection | Enter $ lump sum. |
| Consultation | Enter $ lump sum. |
| Land pre-purchase/ pre-leasing agreements | Enter $ lump sum. |
| Survey and preliminary design | Enter $ lump sum. |
| Geotechnical and groundwater investigations | Enter $ lump sum. |
| Other detailed studies (noise, traffic, visual, archaeological, etc.) | Enter $ lump sum. |
| Baseline monitoring | Enter $ lump sum. |

| | |
|---|---|
| Resource consent process (AEE and consent application, draft landfill management plan, legal fees, hearing, and appeal) | Enter $ lump sum for each item. |
| Land acquisition and other associated costs | Enter $ lump sum. |
| Proceeds from the disposal of excess land | Enter $ lump sum. |

### Table 9: Base costs

| Data cell | What to input |
|---|---|
| Engineering– detailed design and documentation and construction management | Enter %. |
| Contractors preliminary and general | Enter %. |

### Table 10: Development – site access

| Data cell | What to input |
|---|---|
| Intersection upgrade (main road or state highway) | Enter $ lump sum. |
| Other roading/ network contributions | Enter $ lump sum. |
| Landfill access road (main road to footprint) | Enter $/km. |
| Special structures (diversions, bridges, etc.) | Enter $ lump sum. |

### Table 11: Development – site amenities

| Data cell | What to input |
|---|---|
| Site entrance | Enter $ lump sum. |
| Administration building | Enter $ lump sum. |
| Weighbridge and gatehouse/kiosk | Enter $ lump sum. |
| Machinery shed/maintenance facility | Enter $ lump sum. |
| Power and phone | Enter $ lump sum. |
| Sewerage | Enter $ lump sum. |
| Water supply | Enter $ lump sum. |
| General civil works (amenities area, earthworks, sealing, parking) | Enter $ lump sum. |
| Wheelwash/wash-down facility | Enter $ lump sum. |
| Fencing | Enter $/m. |
| Landscaping | Enter $ lump sum. |

**Table 12: Development – cell construction (earthworks, liner, leachate)**

| Data cell | What to input |
|---|---|
| Sediment control structures and measures | Enter $ lump sum. This sum will be applied to each cell. |
| Clearing | Enter $/m$^2$. |
| Clearing bush | Enter $/m$^2$. |
| Perimeter road | Enter $/m. |
| Topsoil – cut to stockpile | Enter $/m$^3$. |
| Unsuitables – cut to stockpile | Enter $/m$^3$. |
| Sub-topsoil – cut to stockpile, stockpile to liner, cut to fill as liner, and borrow to fill as liner | Enter $/m$^3$. |
| Low permeability material | Enter $/m$^3$. |
| Structural material – cut to stockpile, stockpile to fill, cut to fill, and borrow to fill | Enter $/m$^3$. |
| Groundwater control/subsoil drainage | Enter $/m. |
| Preparation of subgrade for laying liner | Enter $/m$^2$ for each liner type Set to zero where this feature doesn't apply to a particular liner type. Refer section 5.4.9 and the Typical Example in Appendix E |
| Specialised subgrade treatment | Enter $/m$^2$. |
| | |
| Liner supply and installation (synthetic) | Enter $/m$^2$ for each liner type. Set to zero where this feature doesn't apply to a particular liner type. Refer section 5.4.9 and the Typical Example in Appendix E |
| Liner protection layer | Enter $/m$^2$ for each liner type. Set to zero where this feature doesn't apply to a particular liner type. Refer section 5.4.9 and the Typical Example in Appendix E |
| Leachate collection: | • Leachate collection header pipes (including fittings, etc.) – enter $/m.<br>• Auxiliary leachate collection pipes (including fittings, etc.) – enter $/m.<br>• Leachate collection sump – enter $ for each.<br>• Clean-out ports – enter $ for each.<br>• Automated pumpstation (pumps, valves, fittings and electrical) – enter $.<br>• Leachate collection layer – enter $/m$^2$ for each liner type. Set to zero where this feature doesn't apply to a particular liner type. Refer section 5.4.9 and the Typical Example in Appendix E |
| Leachate pre-treatment facility | HDPE lined lagoon, aerators and temporary leachate collection and storage tanks – enter $ lump sum. |
| Leachate disposal system | Enter $ lump sum. |

### Table 13: Development – stormwater management system

| Data cell | What to input |
|---|---|
| Major stormwater diversions (e.g. dams, canals, etc.) | Enter $ lump sum. |
| Open drains | Enter $/m. |
| Stabilised drains/ flumes | Enter $/m. |
| Piped drains | Enter $/m. |
| Stormwater treatment – pond and instrumentation | Enter $ lump sum. |

### Table 14: Development – gas management system

| Data cell | What to input |
|---|---|
| Horizontal collectors | Enter $/m. |
| Vertical extraction wells | Enter $/m. |
| Ring header (below grade) | Enter $/m. |
| Laterals to vertical wells (above grade) | Enter $/m. |
| Condensate traps | Enter $ each. |
| Flare stations – interim and final | Enter $ each. |

### Table 15: Development – final cover system

| Data cell | What to input |
|---|---|
| Topsoil – stockpile to final cover and import topsoil to final cover | Enter $/$m^3$. |
| Unsuitables – stockpile to final cover and shortfall to make up with sub-topsoil | Enter $/$m^3$. |
| Sub-topsoil – stockpile to final cover and borrow to final cover | Enter $/$m^3$. |
| Low permeability material – stockpile to final cover, cut to final cover, and borrow to final cover | Enter $/$m^3$. |
| Geosynthetic layer | Enter $/$m^2$. |
| Drainage layer | Enter $/$m^2$. |
| Vegetation (grassing) | Enter $/$m^2$. |

### Table 16: Operations

| Data cell | What to input |
|---|---|
| Refuse placement | Enter range of $/tonne. This is a significant cost item, but is a non-capital expenditure item and hence has no financing/interests costs associated with it. Any decrease or increase in the operation cost will result in a directly equivalent decrease or increase in the (IBC). |
| Daily cover | Enter range of $/tonne. (Note that this is $/tonne of refuse placed and not $/$m^3$.) |
| Nuisance control (litter, odour, birds, vectors) | Enter range of $/year. |
| General maintenance | Enter range of $/year. |
| Salaries wages and overhead – onsite management, gate control and fee collection, audit fees, secretarial fees, accounting fees, legal, consultants, insurance, waste acceptance and inspection, and health and safety | Enter range of $/year. |
| Aftercare levy | Calculates automatically during *Solve IBC for Zero NPV* ($/tonne). |
| Royalty and host fee | Enter $/tonne. |
| Intermediate cover | Enter $/tonne. |
| Temporary/cell roading | Enter $/tonne. |
| Leachate treatment and disposal | • Trucking prior to treatment installation – enter $/m3<br>• Operation after treatment installation – enter $/$m^3$.<br>• Trade waste discharge for untreated leachate – enter $/$m^3$<br>• Trade waste charge for treated leachate – enter $/$m^3$. |
| Gas control | Enter $/ha/year. |
| Stormwater maintenance | Enter $/year. |
| Monitoring – stormwater, groundwater, leachate, landfill gas, local ecology) | Enter $/year. |
| Environmental compliance | Enter $/year. |
| Bond | Enter $ lump sum. |
| Regional council costs | Enter $/year. |
| Rates | Enter $/year. |
| Water charges, electricity charges | Enter $/year. |

### Table 17: Closure

| Data cell | What to input |
|---|---|
| Removal of facilities | Enter $ lump sum. |
| Modifications to site stormwater, leachate, landfill gas and other systems | • Final cover – enter % of construction cost.<br>• Landfill gas system – enter % of construction cost.<br>• Leachate management – enter % of construction cost.<br>• On-site surface water control system – enter % of construction cost.<br>• Design/engineering – enter % of construction cost. |

**Table 18: Aftercare**

| Data cell | What to input |
|---|---|
| Administration | Enter $/year. |
| Regional council liaison | Enter $/year. |
| Site inspection | Enter $/ha/year. |
| Final cover system | • Inspection – enter $/ha/year.<br>• Maintenance – enter $/ha/yr.<br>• Vegetation maintenance – enter $/ha/year. |
| Leachate system maintenance | • Leachate disposal – enter $/$m^3$.<br>• System maintenance – enter $/ha/year.<br>• Electricity – enter $/ha/year. |
| Gas system maintenance | Enter $/ha/year. |
| Environmental monitoring system | • Groundwater – enter $/ha/year.<br>• Landfill gas – $/ha/yr.<br>• Leachate – enter $/ha/yr.<br>• Stormwater – enter $/ha/yr. |
| Removal of remaining facilities | Enter $ (lump sum). |
| End of post-closure certification | Enter $ (lump sum). |

**Table 19: Contingencies**

| Data cell | What to input |
|---|---|
| Pre-development | Enter %. |
| Development | Enter %. |
| Operations | Enter %. |
| Closure | Enter %. |
| Aftercare | Enter %. |

## 7.3.5 Using default values or user-supplied values

Cost estimates can be calculated using the FCA model's default values, user-entered actual values that override the default values, or a combination of default and actual values. Cost can be quickly estimated using the model's default values. More accurate cost estimates can be generated by collecting and entering actual data specific to a site or geographic location.

In general, the more data gathered and entered into the model, the more accurate its output will be. For these reasons you should (1) identify and gather specific information on your site and on local costs (labour, equipment, material, etc.), and (2) become familiar with the scope of your specific project.

The default values used in the FCA model are considered to be national averages and should be adjusted to reflect local conditions wherever possible.

Appendix B provides tables of all of the default values used in the model. You may enter your own values in the appropriate *white* data entry cells in the **General Input, Brownfields Input, Waste Input**, **Geometric Input**, and the **Cost Input** worksheets. This process allows you to customise the model according to your specific case.

### 7.3.6 Using the summary and cashflow sheets and charts

The **Summary** worksheet is a summary of all of the critical inputs and outputs of the model. When you have worked through the **General Input**, **Brownfields Input**, **Waste Input**, **Geometric Input** and the **Cost Input** sheets, go back over all the input sheets to look for any error warnings (in *red*). If there are no warnings, press *Calculate IBC for Zero NPV* button at the bottom of the **Cost Input** sheet. This will calculate the IBC and automatically display it on the **Summary** sheet. You may then:

- add a mark-up / margin to the derived IBC; and
- add unit costs of other items in the blank *white* data entry cells/spaces provided (for example, refuse collection costs, transfer station costs, freight costs, recycling costs, green waste / composting costs, education/ waste minimisation costs, and other costs which the model does not derive but which have been calculated or estimated outside the model). The waste management system may include costs associated with assets other than the landfill itself (for example, existing or new transfer stations). The costs of operating existing transfer stations can be included as a unit cost in the blank *white* data entry cells.

This completes the model run. In addition to the **Summary** sheet you can print the following reports for the modelling scenario:

- *Cashflow Detail* – full tabulation of costs and income over the duration of the model. The forecast annual waste tonnage is also shown in this table.
- *Cashflow Summary* – summary tabulation of annual costs under the main cost input parameter headings and income over the duration of the model. The forecast annual waste tonnage is also shown in this table.
- *Cashflow Chart* – gives a graphical output showing the income, expenditure and cashflow, along with the value of the aftercare fund and the forecast annual waste tonnage. The graphical output covers the model duration plus the aftercare period. You should click on the 'Set Chart Limits' button on the **Cashflow Chart** sheet to reset the timeline once the IBC has been solved.
- *IBC Chart* – gives a graphical output showing the IBC on an annual basis over the model duration. You should click on the 'Set Chart Limits' button on the **IBC Chart** sheet to reset the timeline once the IBC has been solved.

All sheets may be viewed and printed. The print set-up of any worksheet may be altered by choosing Page Set-up from the File menu.

*Note:* A typical example of a Greenfields district landfill facility development is included as Appendix E.

# 8 Expanding the Model: Other Waste Management System Costs

This section lists the cost items associated with other waste management facilities and services that would be included if an FCA analysis were expanded to include all waste management system costs.

Landfill managers may also operate other waste management facilities and/or services. A full costing of the system should be carried out including these components as detailed.

To calculate the costs of these other facilities and services, a detailed FCA analysis may need to be undertaken for each of the components in the same manner as recommended for landfills.

## 8.1 Management and administration

This covers all costs associated with management, administration and organisation overheads for the waste management system.

## 8.2 Planning

This covers short- and long-term planning costs relating to the waste management system which are not included in the management and administration category. These costs may be combined with the administration and management costs.

## 8.3 Education and promotion

This includes all costs associated with education and the promotion of waste management services and waste minimisation. Some or all of these costs may be accounted for in the management or administration costs, or specific items relating to collection, disposal and waste minimisation.

## 8.4 Refuse collection

This is the annual cost of refuse collection services. The cost of disposal charges paid for landfilling of collected refuse can be included provided this is also included as an income in the system costing.

## 8.5 Composting

The income from tipping charges and sale of product should be included in the system income.

## 8.6 Recycling

The income from sale of recyclables should be included in the system income, net of any implementation or system costs.

# 9 Illegal Dumping

Sometimes changing from a low-cost gate rate to one reflecting full cost can result in significant increases in the gate rate. This increases the risk of illegal dumping occurring, and TLA managers in particular need to consider the risk, implications and prevention methods required to overcome this problem.

Illegal dumping is disposal of waste in an unauthorised or non-dedicated area. If not addressed, illegal dumps often attract more dumping. The health risks of illegal dumping can be significant, and the costs to local government of cleaning up illegal dump sites can be significant.

## 9.1 Preventing illegal dumping

Programmes need to be specific and targeted. Successful programmes are founded on:

- leadership and support of local government
- co-operation among authorities, community, and industry
- an integrated approach
- publicising success.

The principal tools are:

- maintenance and control of existing or historical dump sites or locations
- community involvement
- targeted enforcement
- programme monitoring.

We will now look at each of these tools in detail.

## 9.2 Site maintenance and control

Clean-up projects require a co-ordinated effort. Local government and community groups can assist in landscaping and aesthetic improvements. Sites must be cleaned up before health and safety hazards develop, and a plan must be developed to remove any dumped materials and keep sites clean.

Many illegal dumping areas continue to experience problems after being cleaned up. Signs, lighting and barriers can be used to reduce or eliminate continued dumping in a given area. In addition, a plan needs to be in place to maintain the dump area and remove any materials that are dumped.

## 9.3 Community involvement

### 9.3.1 Community programmes

Community programmes established to organise special waste clean-up events and support community-oriented policing can be effective in tackling illegal dumping problems. Many regional councils and city or district councils (including Auckland Regional Council, Auckland City Council, Canterbury Regional Council, Christchurch City Council) have programmes in place.

The focus of any community involvement should be to teach residents:

- what can be done to prevent illegal dumping
- how and why they should get involved
- who to contact for assistance or to report an incident.

In some communities, organised community groups serve as the main catalyst for resident involvement and information exchange. Organised events (clean-up days) to collect and properly dispose of illegally dumped materials involve resources provided by the council and industry and the efforts of local residents and interested parties.

### 9.3.2 Education

The most important component of a successful illegal dumping programme is public education. However, information and education programmes are only effective when the behaviour of the targeted audience is changed and then sustained at the desirable level.

An effective information and education programme involves:

- targeting the audience
- keeping the message simple
- communication
- feedback and monitoring
- ensuring adequate resources are available.

## 9.4 Targeted enforcement

The critical element of effective enforcement consists of ordinances or bylaws that regulate waste management and prohibit illegal dumping. Ordinances/ bylaws must be effective and tailored to meet specific needs. Council officers must then have the proper authority to conduct surveillance, inspections, and investigations as well as sufficient resources to undertake their tasks.

## 9.5 Programme monitoring

Tracking and evaluation should be used to measure the impact of illegal dumping prevention efforts and to determine whether the goals of the programme are being met. Baseline data must be established for indicators such as annual clean-up costs, facility compliance, fine collection, convictions, complaints, and numbers and locations of problem sites.

# Glossary

| | |
|---|---|
| **Account** | A financial record of cash movements, collecting specific types of outlays or inflows of financial resources. |
| **Accounting basis** | An accounting concept whereby expenditures, expenses and related liabilities are recognised in accounts and reported in financial statements. It relates exclusively to timing on either the cash or accrual method. |
| **Accrual basis** | A basis of accounting under which transactions and other events are recognised when they occur (and not only when cash or its equivalent is received or paid). Therefore, the transactions and events are recorded in the accounting records and recognised in the financial statements of the periods to which they relate. |
| **Amortisation** | A method of determining the annual costs associated with obligations for future outlays (e.g. the reduction of debt by regular payments sufficient to retire the debt by maturity). |
| **By-product revenues** | These are generated from the sale of marketable products created as a by-product of solid waste management, such as recyclables, compost, energy from waste, and landfill gas. |
| **Capital outlay** | An outlay of cash to acquire a resource that will be used in the development of the landfill over more than one year. Capital outlays (past, present, and future) must be converted into annual costs for full cost accounting purposes. |
| **Cash flow accounting** (also known as cash basis accounting) | A basis of accounting that recognises transactions and other events when cash is received or paid. It measures financial results for a period as the difference between cash received and cash paid. |
| **Contingent risk costs** | Defined in this Guide as the costs of remediating unknown or future releases of pollutants (such as leaks from municipal landfills), as well as the liability costs of compensating for as yet undiscovered or future damage to the property or persons of parties who are affected adversely by municipal solid waste (MSW) activities. |
| **Cost** | The dollar value of resources used for the landfill. |
| **Depreciation** | The measure of consumption of the economic benefits embodied in an asset, whether arising from use, the passing of time or obsolescence. |
| **Direct costs** | Costs that are clearly and exclusively associated with the landfill and vary in proportion to volumes. |
| **Discount rate** | The rate of exchange between various time periods. |
| **Environmental costs** | In this Guide include environmental degradation that cannot be easily remedied or measured, is difficult to value, and is not subject to legal liability; these costs are often termed environmental ‘externalities’. |

| | |
|---|---|
| **Externality cost (or benefit)** | A cost or benefit that is borne by (or accrues to) society in general but which is not generally accounted for in a financial manner. |
| **Fixed costs** | Include interest, depreciation, and amortisation for past or future landfill capital outlays and other costs (e.g., security) that cannot be reduced quickly in response to lower waste disposal tonnage. |
| **Full cost** | Any real, definable and measurable cost, from any source, attributable to a particular landfill and incurred or likely to be incurred by the owner. |
| **Full cost accounting** | A systematic approach for identifying, summing and reporting the actual costs of solid waste management, taking into account past and future outlays, oversight and support service (overhead) costs, and operating costs. |
| **Future outlay** | An expenditure of cash in the future that is obligated by current or prior activities. |
| **Hidden costs** | As used in this Guide are the costs of activities or resources that appear to be free. |
| **Indicative base cost of disposal (IBC)** | The base unit cost of disposal derived by the Full Cost Accounting (FCA) model; the IBC gives an indication of the actual dollar cost of providing residual waste disposal to a landfill. |
| **Indirect costs** | Costs that are not exclusively related to the landfill but that relate to more than one local government activity. Such indirect costs for solid waste management (and other local government activities) can include accounting and payroll, personnel, legal, purchasing, data processing, records management, and executive oversight (e.g. the mayor's salary and office expenses). |
| **Integrated solid waste management** | Incorporates several different approaches for handling the entire MSW stream. Using a combination of approaches allows each type of waste to be managed according to environmental and economic considerations, with priority going to source reduction, reuse, and recycling, while reserving landfills as the least desirable waste management method. See also *Waste management hierarchy.* |
| **Net cost of a solid waste management activity or path** | Its full cost minus its by-product revenues. The net cost divided by the tonnes of waste managed yields the net cost per tonne for that activity or path. |
| **Net cost per ton** | This is the best common denominator for comparing the current costs of solid waste management within or across local authority jurisdictions. |
| **Net present value (NPV)** | The present value of cash inflows less the present value of cash outflows. |
| **Operating costs** | Regularly recurring costs of resources that are normally used immediately or over a relatively short period of time (i.e. within a reporting period) in order to support ongoing operations. |
| **Opportunity cost** | The value of the net benefit forgone on one investment through making an alternative investment. |

| | |
|---|---|
| **Outlay** | An expenditure of cash. |
| **Overhead costs** | The management and support costs of running the solid waste programme. |
| **Present value (PV)** | The value today of a future payment, or series of payments, discounted at the appropriate discount rate. |
| **Routine cash outlays** | For solid waste management activities are the same as the operating costs of those activities. |
| **Social costs** | In this Guide are impacts on human beings, their property, and welfare that cannot be compensated through the legal system; also termed 'social externalities'. |
| **Upfront costs** | Reflect the initial investments and expenses necessary to start an MSW activity or path. |
| **Weighted average cost of capital (WACC)** | Represents the return a landfill owner should expect from investment in a landfill. When used in this context, it is sometimes referred to as the 'opportunity cost of capital'. It represents what a landfill project should return in order for the landfill owner to adequately compensate its financial backers, regardless of whether they are debt holders or equity providers. |
| **Variable costs** | Of land disposal include costs of operation and maintenance and other costs that can be reduced quickly in response to lower waste disposal tonnage. |
| **Waste management hierarchy** | Emphasises a preferred order of management approaches: first, source reduction; second, recovery; third, waste combustion with energy recovery; and finally, landfilling. |

# References


Centre for Advanced Engineering. 1992. *Our Waste: Our Responsibility*. Project Report: Towards Sustainable Waste Management in New Zealand, Centre for Advanced Engineering, Christchurch.

Centre for Advanced Engineering. 2000. *Landfill Guidelines*. Centre for Advanced Engineering, Christchurch, New Zealand.

Chang N, Chang Y, Chen Y. 1997. Cost-effective and equitable workload operation in solid waste management systems. *Journal of Environmental Engineering.*

Department of Environment. 1995. *Landfill Design, Construction and Operational Practice*. Waste Management Paper No. 26B. Department of Environment, HMSO, London, UK.

Gauthier Stephen J. 1998. *Applying Full Cost Accounting to Solid Waste Management Operations*. Government Finance Review, Chicago, USA.

Kortegast AP, Amputch AR, Khire, MV. 1999. *Financial Modelling for Landfill Management*. Proceedings of the 11th Waste Management Institute NZ Inc Conference (WasteMINZ '99), Queenstown, New Zealand, November.

Ministry for the Environment. 1994. *Waste and the Resource Management Act.* Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 1997a. *Landfill Guidelines: Landfill Full Costing Guidelines*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 1997b. *The 1995 National Landfill Census.* Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2000. *The 1998/1999 National Landfill Census.* Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2001a. *Guide to Landfill Consent Conditions*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2001b. *A Guide to the Management of Closing and Closed Landfills*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2002a. *Guide to Managing Cleanfills.* Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2002b. *New Zealand Waste Strategy*. Ministry for the Environment, Wellington, New Zealand.

Ministry for the Environment. 2002c. *Solid Waste Analysis Protocol*. Ministry for the Environment, Wellington, New Zealand.

Moore VF, Inhat MJ. 1996. *Cost Savings Are in the Details: The total project cost approach to landfill design*. Waste Age, Atlanta, USA.

New South Wales Environmental Protection Authority (NSW EPA). 1996. *Environmental Guidelines: Solid waste landfills.* NSW EPA, Sydney, New South Wales.

New Zealand Society of Local Government Managers. 2001. *Accounting for Environmental Obligations: Guidelines for applying FRS-15: provisions, contingent liabilities and contingent assets*. NZ Society of Local Government Managers. URL: http://www.solgm.org.nz.

Nickodem A, Vladic D, Menoff S. 1996. *Landfill Closure and Post-Closure: Future costs not to be forgotten*. Waste Age, Atlanta, USA.

O'Leary P, Walsh P. 1992. *Landfill Closure and Long-Term Care*. Waste Age, Atlanta, USA.

Parliamentary Commissioner for the Environment. 1993. *Solid Waste Reduction Initiatives.* Parliamentary Commissioner for the Environment, Wellington, New Zealand.

United States Environmental Protection Agency. 1994. *Design, Operation, and Closure of Municipal Solid Waste Landfills*. EPA report no. 625/R-94/008. Washington, DC, USA.

United States Government Finance Offices Association (GFOA). 2000. *Full Cost Accounting: Practical Guidance on Converting to FCA.* United States Government Finance Offices Association under co-operative agreement with the United States Environmental Agency, Washington DC, USA.

Van Fleet H. 1997. *Getting to the Bottom Line*. Waste Age, Atlanta, USA.

# Appendix A: Landfill FCA Model – Overview, Structure and Algorithm Flowcharts

**Figure A1: Full cost model overview**

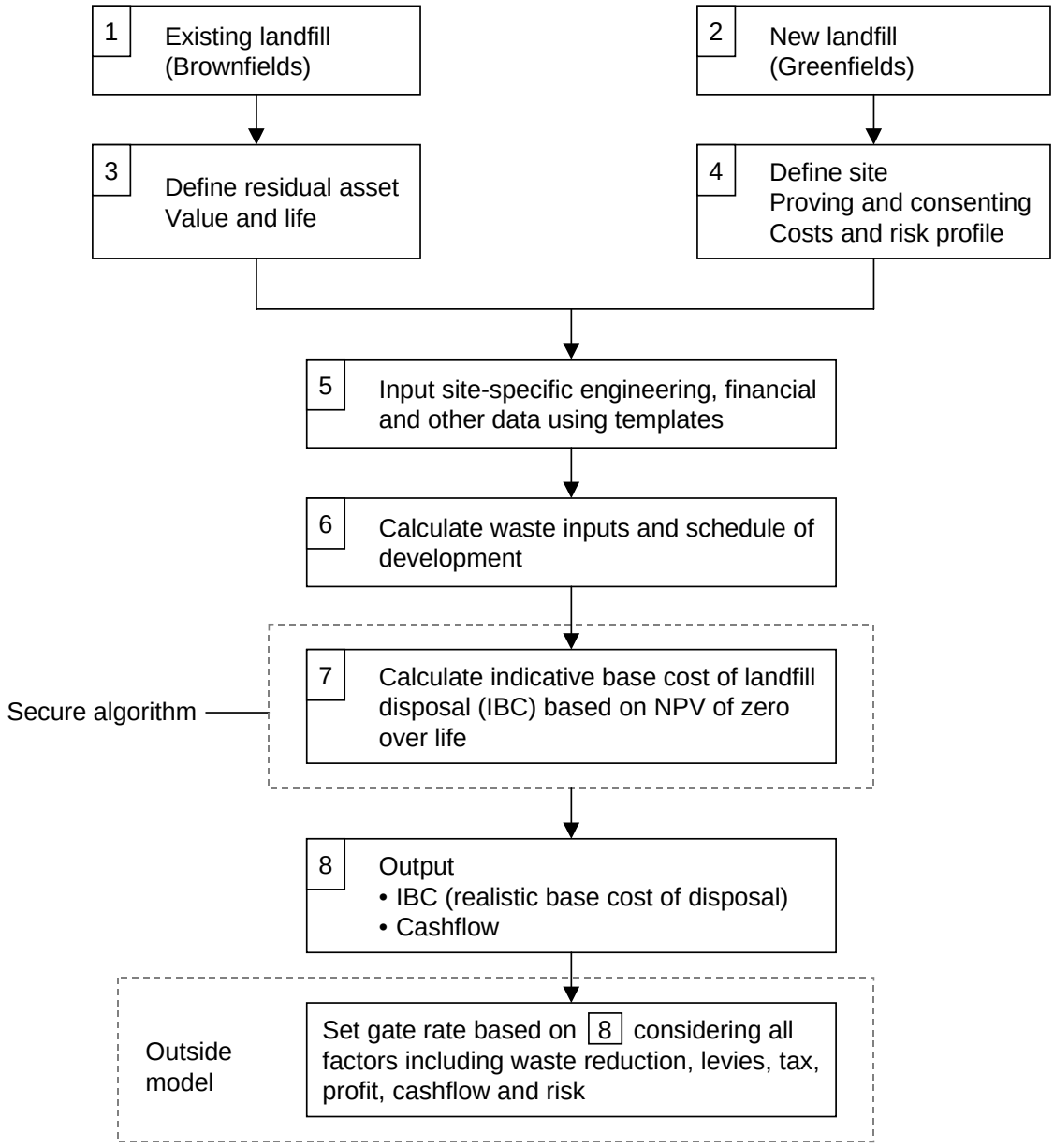


**Figure A2: Overall model structure**

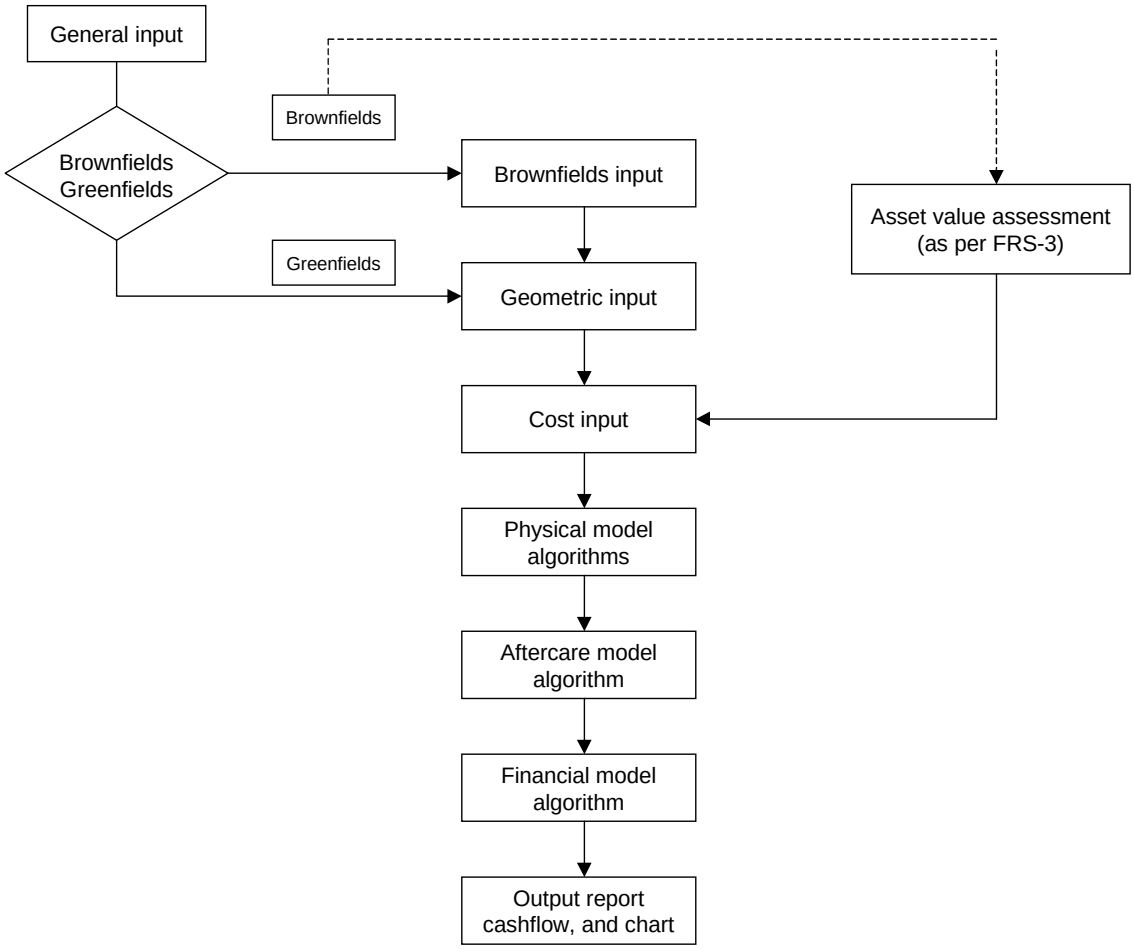
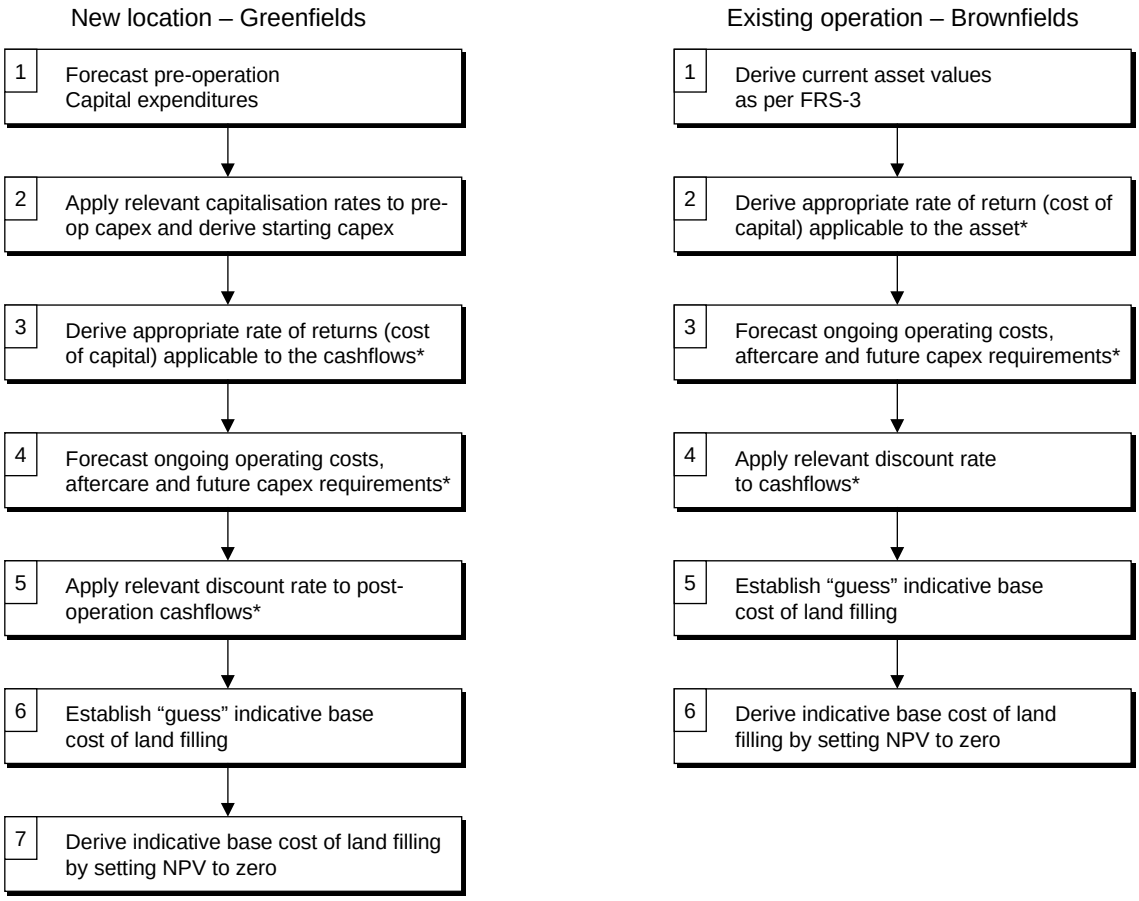


**Figure A3: Financial model algorithm structure**




* On a pre-tax real (present day dollar) basis.

# Appendix B: Landfill FCA Model Input Costs – Default Values

The following tables provide guidance on indicative costs (range, typical and default costs or values) for items scheduled in the model **Cost Input** worksheet. As you may notice, the model already has data in the various input sheets. However, these default values are inserted only to enable the model to generate an IBC value.

Before you take the results of this model beyond an initial drafting stage we strongly advise you to obtain advice on these inputs. The rates provided are for guidance only and are likely to alter according to relevant market and economic parameters as well as site-specific data.

The sources – and therefore the accuracy – of costing information will depend on whether the site is an existing and operating landfill or a planned site, and the degree to which planning, resource consent processes and design have progressed.

Other sources of cost and conversion values that have been used to produce the figures given in the following tables include:

- current site development costs
- operators of landfills of a similar size
- consultants' reports on landfill development
- contractor and supplier estimates and quotes
- tendered contract prices
- construction and contracting cost handbooks and indices.

The following tables are presented in the same order as in the model **Cost Input** worksheet.

## Updating the typical values and ranges in the tip boxes

Periodically the Ministry for the Environment may issue an update to the cost and/or other information contained in the tip boxes. The Updater will consist of an Excel spreadsheet. When the Updater is opened, Excel may ask about virus protection. Select 'Enable Macros'. Answer Yes to the dialogue boxes that follow to select an FCA model file to update. The file must be the same version as the Updater. Once a valid file is selected, the typical values and ranges will be automatically updated and the FCA model saved under the same name.

The date on which the cost data were developed will be shown on the **Instructions** worksheet.

Table B1 presents indicative costs for planning and pre-development activity components. *Note:* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B1: Typical planning and pre-development costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Project management | $20,000–$100,000 | $50,000 |
| Site selection | $100,000–$1,000,000 | $150,000 |
| Consultation | $50,000 + (small site)<br>$150,000+ (large site) | $100,000 |
| Land pre-purchase/pre-leasing arrangements | 5–10% of land value | 7.5% of land value |
| Survey and preliminary design | $30,000–$100,000 | $50,000 |
| Geotechnical and groundwater Investigations | $100,000–$500,000 | $200,000 |
| Other detailed studies (traffic, noise, visual, archaeological, etc.) | $50,000–$250,000 | $100,000 |
| Baseline monitoring | $50,000–$250,000 | $100,000 |
| Resource consent process: | | |
| AEE and consent application | $50,000–$2,000,000 | $200,000 |
| Draft Landfill Management Plan | $10,000–$30,000 | $20,000 |
| Legal | Refer to Guide | – |
| Hearing | Refer to Guide | – |
| Appeal | Refer to Guide | – |
| Land acquisition and associated/set-up costs | $5000–$25,000/ha | $12,500/ha |
| Proceeds from disposal of excess land | 60–70% of per hectare purchase price | 65% of per hectare purchase price |

Table B2 presents indicative costs for base cost activity components. *Note:* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B2: Typical base costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Engineering: | | |
| Detailed design and documentation | 4–7% of capital works costs | 6% of capital works costs |
| Construction management | 5–8% of capital works costs | 6.5% of capital works costs |
| Contractor's P&G | 10–15% of capital works costs | 12.5% of capital works costs |

Table B3 presents indicative costs for development activity components. *Note:* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B3: Typical development costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| *Site access* | | |
| Intersection upgrade | $200,000–$500,000 | – |
| Other roading network upgrades/ contributions | Refer to Guide | – |
| Access road – intersection to footprint | $300,000–$700,000 per km | – |
| Special structures (diversions, bridges, etc.) | Refer to Guide | – |
| *Site amenities and services* | | |
| Site entrance | $15,000–$50,000 | $25,000 |
| Administration building | $25,000–$100,000 | $50,000 |
| Weighbridge and kiosk | $125,000–$225,000 | $150,000 |
| Machinery shed, maintenance facility | $50,000–$150,000 | $100,000 |
| Power and phone | Refer to Guide | – |
| Sewerage | $5000–$12,000 | – |
| Water supply | $5000–$20,000 | – |
| General civil works (sealing, parking, etc) | $20,000–$100,000 | – |
| Washdown facility/wheel-wash | $50,000–$120,000 | $75,000 |
| Fencing | $30–$60/m | $45/m |
| Landscaping | $7500–$20,000/ha | $12,500/ha |
| *Cell construction* | | |
| Sediment control structures and measures | $5000–$25,000 | – |
| Clearing | $1.00–$2.50/$m^2$ | $1.50/$m^2$ |
| Clearing bush | $5.00–$10.00/$m^2$ | $8.00/$m^2$ |
| Perimeter access road | $300–$450/m | $400/m |
| Topsoil: Cut to stockpile | $1.50–$3.00/$m^3$ | $2.00/$m^3$ |
| Unsuitables: Cut to stockpile | $3.50–$12.00/$m^3$ | $8.00/$m^3$ |
| Sub-topsoil: Cut to stockpile | $3.50–$7.50/$m^3$ | $5.50/$m^3$ |
| Low permeability material: | | |
| Cut to stockpile | $3.50–$7.50/$m^3$ | $6.00/$m^3$ |
| Stockpile to liner | $7.50–$10.00/$m^3$ | $9.00/$m^3$ |
| Cut to fill as liner | $7.50–$10.00/$m^3$ | $9.00/$m^3$ |
| Borrow to fill as liner | $7.50–$12.00/$m^3$ from onsite | $10.00/$m^3$ |
| Structural material: | | |
| Cut to stockpile | $3.50–$7.50/$m^3$ | $6.00/$m^3$ |
| Stockpile to fill | $7.50–$10.00/$m^3$ | $8.00/$m^3$ |
| Cut to fill | $7.50–$10.00/$m^3$ | $8.00/$m^3$ |
| Borrow to fill | $7.50–$12.00/$m^3$ from onsite | $9.00/$m^3$ |
| Groundwater control/subsoil drainage | $40–$200/m | $60/m |
| Subgrade preparation | $1.00–$2.00/$m^2$ | $1.50/$m^2$ |
| Specialised subgrade treatment | $7.00–$15.00/$m^2$ | $10.00/$m^2$ |
| Liner supply and installation including QA/QC | FML $10–$16/$m^2$<br>GCL $12–$18/$m^2$<br>CCL as above | $13.00/$m^2$<br>$14.00/$m^2$<br>As above |
| Liner protection layer | $5.00–$10.00/$m^2$ | $7.50/$m^2$ |
| Leachate collection, transmission, and pre-treatment: | | |
| Leachate collection header pipes and fittings | $100.00–$250.00/m | $175.00/m |
| Auxiliary collection pipes and fittings | $40.00–$125.00/m | $75/m |
| Leachate collection sump | $5000–$20,000 | $10,000 |

| | | |
|---|---|---|
| Cleanout ports and manholes | $5000–$10,000 each | $7500 each |
| Automated pump station (pumps, valves, fittings and electrical) | $10,000–$30,000 | $20,000 |
| Leachate collection layer | $5.00–$20.00/m | $12.00/m |
| Leachate pre-treatment facility | Refer to Guide | – |
| Leachate disposal system | Refer to Guide | – |
| *Stormwater management system* | | |
| Major stormwater diversion (e.g. dams, canal, etc) | Refer to Guide | – |
| Open drains | $30–$70/m | $45/m |
| Stabilised drains/ flumes | $75–$325/m | $180/m |
| Piped drains | $50–$450/m | $200/m |
| Stormwater treatment ponds: | | |
| Ponds | $100,000–$1,000,000 | – |
| Instrumentation | $20,000–$150,000 | – |
| *Gas management system* | | |
| Horizontal collectors | $80–$150/m | $120/m |
| Vertical extraction wells | $150–$300/m | $200/m |
| Ring header (below grade) | $350–$450/m | $400/m |
| Laterals to vertical wells (above grade) | $70–$120/m | $90/m |
| Condensate traps | $5000–$10,000 each | $7500 |
| Flare stations: | | |
| Interim | $50,000–$150,000 | Refer to Guide |
| Final | $500,000–$1,000,000 | Refer to Guide |
| *Final cover system* | | |
| Topsoil: | | |
| Stockpile to final cover | $1.5–$3 $m^3$ | $2.00 $m^3$ |
| Import topsoil to final cover | $15–$25/$m^3$ | $20.00/$m^3$ |
| Unsuitables: | | |
| Stockpile to final cover | $3.50–$7.50/$m^3$ | $5.00/$m^3$ |
| Shortfall – make up with sub-topsoil | $3.50–$7.50/$m^3$ | $5.00/$m^3$ |
| Sub-topsoil: | | |
| Stockpile to final cover | $3.50–$7.50/$m^3$ | $5.00/$m^3$ |
| Borrow to final cover | $3.50–$10.00/$m^3$ | – |
| Low permeability material: | | |
| Stockpile to final cover | $6.00–$9.00/$m^3$ | $7.50/$m^3$ |
| Cut to fill as cover | $6.00–$9.00/$m^3$ | $7.50/$m^3$ |
| Borrow to fill as cover | $6.00–$10.00/$m^3$ | $8.00/$m^3$ |
| Geosynthetic layer | $8.00–$14.00/$m^2$ | $12.00/$m^2$ |
| Drainage layer | $8.00–$12.00/$m^2$ | $10.00/$m^2$ |
| Erosion control (vegetation) | $0.50–$1.50/$m^2$ | $1.00/$m^2$ |

Table B4 presents indicative costs for Operation activity components. *Note:* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B4: Typical operation costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Refuse placement | $6–$16/tonne | – |
| Daily cover | $0.25–$0.50/tonne of refuse placed | – |
| Nuisance control (vectors, birds, litter, odour) | $20,000–$80,000/yr | – |
| General maintenance | $4000–$7000/yr | – |
| Salaries, wages and overhead including: on-site management, gate control and fee collection, audit fees, secretarial fees, accounting fees, legal, consultants, insurance, waste acceptance and inspection, and Health and Safety | $100,000–$600,000/yr | – |
| Aftercare levy | Calculated automatically as a sinking fund from aftercare cost estimates input data | – |
| Royalty and host fee | Refer to Guide | – |
| Intermediate cover | $0.25–$0.50/tonne of refuse placed | – |
| Roading (temporary) | $0.50–$1.00/tonne of refuse placed | – |
| Leachate treatment and disposal: | | |
| Trucking offsite prior to treatment system installation | $15.00–$40.00/$m^3$ | – |
| Operation after treatment facility installation | $1.00–$4.00/$m^3$ | – |
| Trade waste charges – untreated leachate | Refer to Guide | – |
| Trade waste charges – treated leachate | Refer to Guide | – |
| Stormwater maintenance | $10,000–$50,000/yr | $20,000/yr |
| Gas control | $300–$750/ha/yr | $500/ha/yr |
| Monitoring – stormwater, groundwater, leachate, landfill gas | $10,000–$50,000/yr | $20,000/yr |
| Environmental compliance | $4000–$50,000/yr | $35,000/yr |
| Bond | Refer to Guide | – |
| Regional council costs | $3000–$15,000/yr | $7500/yr |
| Property rates | Refer to Guide | – |
| Water charges | Refer to Guide | – |
| Electricity | Refer to Guide | – |
| Land leasing | Refer to Guide | – |

Table B5 presents indicative costs for closure activity components. *Note* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B5: Typical closure costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Removal of facilities | $30,000–$150,000 | – |
| Modifications to site stormwater, leachate, landfill gas and other systems | | |
| Final cover | 1–3% of final cover construction cost | 1% of final cover construction cost |
| Landfill gas system | 1–5% of final cover construction cost | 1% of landfill gas system construction cost |
| Leachate system | 1–3% of final cover construction cost | 1.5% of leachate system construction cost |
| On-site surface water control | 1–3% of final cover construction cost | 1.5% of surface water system construction cost |
| Design consultants/third party engineering | 6–10% of closure costs | 7.5% of closure costs |

Post-closure costs include all costs associated with the maintenance and monitoring of a landfill after it has stopped accepting solid waste. Table B6 presents some of the typical individual costs that an owner/operator may incur during aftercare (post-closure care).

**Table B6: Typical average aftercare (post-closure care) costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Administration | $5000–$10,000/yr | $7500/yr |
| Regional council liaison | $7500–$12,500/yr | $10,000/yr |
| Site inspection | $150–$600/ha/yr or $50–100/hr/inspector | $350/ha/yr or $70/hr/inspector |
| Final cover | | |
| Final cover maintenance | $2500–$10,000/ha/yr | $5000/ha/yr |
| Vegetation maintenance | $2500–$7500/ha for revegetation and $500–$1000/ha/yr for mowing | $4000/ha/yr for revegetation and $1000/ha/yr for mowing |
| Leachate management system | | |
| Leachate disposal | $500–$5000/ha/yr ($2–$10/$m^3$) | $5/$m^3$ |
| System maintenance | $500–$1000/ha/yr | $500ha/yr |
| Electricity | $2000–$5000/ha/yr | $2000ha/yr |
| Gas management system | | |
| Maintenance | $500–$3000/ha/yr | $1500ha/yr |
| Replacement | Refer to Guide | – |
| Electricity | $1000–$2000/ha/yr | $1000ha/yr |
| Environmental monitoring system | | |
| Groundwater | $1500–$5000/ha/yr ($1000–$3000/station) | $2000ha/yr |
| Landfill gas (LFG) | $300–2000/ha/yr ($100–200/well/event) | $750ha/yr |
| Leachate | $600–1000ha/yr ($1000–$3000/point/event) | $750ha/yr |
| Stormwater | $600–$1000ha/yr ($600–$1200/point/event) | $600ha/yr |
| Removal of remaining facilities | $20,000–$50,000 | – |
| End of post-closure certification | $30,000–$200,000 | $50,000 |

Table B7 presents indicative costs for contingency activity components. *Note:* actual costs will be site-specific and may vary significantly from those presented in the table.

**Table B7: Typical contingency costs**

| Activity/system | Cost range | Typical/default value |
|---|---|---|
| Pre-development | 15–30% of pre-development cost | 20% of pre-development cost |
| Development | 7.5–20% of development cost | 10% of development cost |
| Operations | | 0% |
| Closure | 7.5–20% of closure cost | 10% of closure cost |
| Aftercare (post-closure care) | 0–15% of aftercare cost | 7.5% of aftercare cost |

# Appendix C: FCA Landfill Model – Description of Costs not Included in the Model

## 1 Site selection costs

Site selection for a new landfill can be a long and involved process, which requires identifying suitable siting criteria, considering a number of possible locations, a number of stages of site investigation and elimination, and extensive consultation.

A comprehensive site selection process is likely to include the following steps:

- desk-top study to identify possible sites
- inspection of possible sites
- various stages of site elimination based on investigations
- consultation
- preliminary assessments of effects on the environment of short-listed sites
- final site selection.

The costs of a landfill site selection process can be substantial. However, a comprehensive site selection process based on sound scientific and engineering principles and involving extensive consultation can reduce the time and cost involved in the resource consent application process.

The site selection process may involve research on a number of potential sites, and that may not create an asset. Normally TLAs or private sector landfill developers consider these costs as general expenditure. In some cases (for example, regional approaches) they may ultimately be included in the final indicated base cost of disposal. For simplicity, only the costs of research and investigations that can be attributed directly to the site finally chosen are included in the FCA model.

## 2 Environmental and community-related costs

There are environmental and community issues relating to landfills that are not direct or indirect financial costs paid by the waste manager. These relate to externalities that occur on a local, national or global scale.

Externalities are costs (or benefits) that are borne by (or accrue to) society in general and which in the past have not generally been accounted for in decisions relating to landfills. They may influence perceptions and decision-making, and therefore require consideration. This guide includes only the financial costs associated with externalities paid by the local authority waste manager. Externalities are identified so that they can be taken into account during the decision-making process.

All landfill sites have the potential to create adverse effects on the environment through:

- discharges to land, groundwater, surface water and air
- effects on local ecology
- community effects.

A wide range of factors contribute to externalities as a result of landfills, including the composition of the waste stream, and the:

- size
- physical characteristics
- age
- location
- design and operation standards

at the landfill site.

New Zealand does not have explicit national standards for the design, construction and operation of landfills (although these may be implemented in future along with other elements of an overall national waste minimisation strategy). Landfill design and operation, while often undertaken in accordance with the CAE *Landfill Guidelines* and accepted current practice, depends on the specific site characteristics, and local and regional environmental and community standards or values.

In order to obtain consents under the RMA from the relevant consenting authority, a landfill must be designed, engineered and monitored to ensure that it will not have significant adverse effects on the surrounding environment. During the resource consent application process it must be demonstrated how the potential effects of a specific site can be avoided, remedied or mitigated.

Because legislation requires waste managers to avoid, remedy or mitigate some effects, some externalities are internalised (taken into account) in the financial costs of landfill development, operation and aftercare through the resource consent process.

The calculation of the cost to society of all externalities associated with landfills is beyond the scope of this guide. However, some externalities are detailed here because they can have a significant effect on the decision-making process and therefore need to be considered by local authority waste managers.

## Discharges to land, groundwater, surface water and air

Landfills are designed and operated to avoid, remedy or mitigate actual and potential effects on the environment. The final decision on the design, operation and monitoring requirements rests with the appropriate consenting authority or the Environment Court.

The cost relating to the effects on the environment of a landfill is considered to be accounted for in the costs of siting, resource consent applications, design, operation and monitoring, as these are the costs relating to the avoidance of actual and potential effects.

## Effects on local ecology

Discharges into the environment can have adverse effects on local terrestrial and aquatic plants and animals. These effects are considered to be accounted for in the costs of siting, resource consent applications, design, operation and monitoring, as these are the costs relating to the avoidance of actual and potential effects.

## Community effects

Siting and developing a landfill can have a number of adverse effects on the local community. In general, people do not like having a landfill sited near to them. The community effects are created by a number of factors including:

- the effects of landfilling practices
- the potential for or perception of a drop in land values
- community disruption.

### The effects of landfilling practices

Historically, landfill sites have not been well sited or operated, which has resulted in adverse effects on site neighbours. Examples are:

- increased traffic volumes and vehicle sizes
- mud on roads
- visual effects due to poor siting and screening
- litter
- noise
- odour
- dust
- vectors and vermin (birds, flies and rats)
- health effects
- landfill gas (LFG).

### Drop in land values

Residents may feel that having a landfill close to them will adversely affect their property values. This issue is very site-specific and, depending on the circumstances, has been demonstrated as being highly variable – from a temporary, short-term reduction in value to a long-term, permanent reduction in property values, where significant impacts or visual amenity loss have occurred.

### Community disruption

The proposal to site a landfill invariably results in objection from the local community. This can lead to a significant amount of community disruption during the siting and consenting process.

Siting procedures ensure that the most appropriate site is selected for a landfill, and a comprehensive public consultation programme can go a long way towards educating the public on the effects of modern landfills and reduce the potential for widespread opposition and community disruption. However, a degree of community disruption can be expected during the siting and consenting processes.

### Cost of community effects

Community effects are partly taken account of in landfill siting, community consultation and resource consent procedures. The costs associated with these activities are included in the full costing model. These costs, however, may not take account of all issues.

One approach, which is adopted overseas, and has been used in New Zealand for some new large landfill sites, is the payment of 'host fees' to the local community affected by the landfill, for appropriate community projects, such as a community hall. Host fees, where they apply, need to be included as a cost in the FCA model.

### Opportunity cost of land

Land used for development of a landfill is not available for other uses until such time as the landfill is closed and rehabilitated. Even then the range of potential uses is limited by the potential for adverse effects on people and the environment. The value of the net benefit forgone by the community in using the land for a landfill, rather than for some alternative use, is the 'opportunity cost' of that land.

However, the value of land when used as a landfill may be higher than for the existing or alternative land uses, in which case opportunity cost does not apply. For this reason, and the fact that the waste manager incurs no cost, community opportunity cost is not included in the FCA model.

## 3 Cost of financial assurances

A financial assurance (see Appendix D), or environmental bond, is a financial provision for the remediation of an environmental accident if a landfill operator goes bankrupt or walks away from the site. It makes money immediately available to a regulatory authority to undertake remedial measures.

Where local authority waste managers are required to provide an environmental bond, this can take the form of a bank guarantee. The annual cost of maintaining a bank guarantee generally ranges from 1% to 3% of the value of the bond. If a bond is required, the cost of its provision is included in the FCA model.

The costs of making provision for a form of financial assurance, other than provision of a bond, should also be included, if required.

# Appendix D: Financial Assurance

Owners or operators of all landfill facilities must demonstrate at the consenting stage that they have sufficient funds to cover the costs associated with closure, post-closure, and corrective action/remediation measures. Financial mechanisms to pay for potential corrective action, should it be determined that a facility poses a threat to the environment or human health, must also be presented at the consenting stage. The cost estimates associated with these requirements must be based on the assumption that a third party will implement the activities.

The following financial assurance mechanisms may be appropriate sources for the required funding.

- **Funds**: held by a reputable third party or trustee until the funds are needed. Payments are made annually into the trust fund. The initial payment must be made before waste acceptance, or before the effective dates for closure and post-closure as specified in the facility's resource consent conditions.
- **Surety bonds**: issued by private firms, which typically require full collateral for the bond, excluding the landfill. A payment or performance surety bond is acceptable for closure and post-closure financial assurance. However, only performance bonds should be acceptable for corrective action. If the surety bond is the main source of financial assurance, then a standby trust fund must also be set up. The bond must be made effective before waste acceptance or before the effective dates for closure and post-closure as specified in the facility's resource consent conditions.
- **Letter of credit**: which must be good for at least one year and irrevocable. The letter of credit must be re-issued at the end of each term. It must also be made effective before waste acceptance or before the effective dates for closure and post-closure as specified in the facility's resource consent conditions.
- **Insurance**: an insurance policy must be issued for face value in the amount of at least the current cost estimate of closure and post-closure. The policy must include a provision to provide the assured funds to a third party, if necessary. The policy must be made effective before waste acceptance or before the effective dates for closure and post-closure as specified in the facility's resource consent conditions.
- **Corporate or local government financial tests and guarantees**: criteria for financial assurance for corporate and government tests and guarantees will be set by central government and/or appropriate regulatory or statutory authorities.
- **Combination of the previously mentioned sources**: any combination of the above-mentioned mechanisms or any other mechanism may be used, as long as they are determined to be independent of each other and acceptable to the appropriate regulatory/statutory authority.

The financial requirements for landfills in the United States and Australia are given below for comparison.

## United States

In the United States, municipal solid waste landfills (MSWLs) are regulated under Subtitle D of the Resource Conservation and Recovery Act (RCRA). The municipal solid waste landfill facility criteria are described in Part 258 of Chapter 40 of the Code of Federal Regulations (40 CFR Part 258). Financial assurance criteria for MSWLs are described in Sub-part G of Part 258.

The following is a brief summary of Sub-part G: Financial Assurance Criteria. It has been extracted from Sub-part G of Part 258.

> *The Part 258, Subpart G, financial assurance criteria require demonstration of responsibility of the costs of closure, post-closure care, and known corrective action. EPA (United States Environmental Protection Agency believe that compliance with these requirements will help ensure responsible planning for future costs. Adequate funds must be available to hire a third party to carry out all necessary closure, post-closure care, and known corrective action activities in the event that the owner and operator declares bankruptcy or lacks the technical expertise to complete the required activities.*
>
> ***Cost estimates***
>
> *The amount of financial assurance, using acceptable financial mechanisms, must equal the cost of a third party conducting these activities. To determine these costs each MSWLF owner and operator must prepare a written, site-specific estimate of the costs of conducting closure/post-closure care and known corrective action.*
>
> ***Closure***
>
> *The owner and operator must calculate a detailed cost estimate for closure based on the largest area of a MSWLF unit that may ever require a final cover during its active life. The cost estimate must equal the expense of closing the area when the extent and manner of operation would make closure most expensive.*
>
> *... the owner and operator must increase both the closure cost estimate and the amount of financial assurance maintained if the closure plan is adjusted or if changing unit conditions (e.g. increases in design capacity) raise the maximum cost of closure. The closure cost estimate and the amount of financial assurance maintained may also be reduced if, as a result of changes in facility conditions (e.g. partial closure of a landfill), the existing cost estimate exceeds the maximum cost of closure during the remaining life of the MSWLF unit. The owner and operator must document evidence supporting such a reduction.*
>
> ***Post-closure care***
>
> *The financial assurance requirements for post-closure are similar to the requirements for closure of MSWLF units. The owner and operator must have a detailed, site-specific written estimate of the cost of hiring a third party to conduct post-closure care for the MSWLF unit. This cost estimate must account for the total costs of conducting post-closure care, including annual and periodic costs described in the post-closure plan. Post-closure care cost estimates must be based on the most expensive costs during the post-closure care period. As with closure cost estimates, changes in facility conditions or the post-closure plan may require the owner and operator to modify the post-closure care cost estimate and the amount of financial assurance.*

***Corrective action***

*... the owner and operator of a MSWLF unit required to undertake corrective action must have a detailed, site-specific written estimate of the cost of hiring a third party to perform corrective action for known releases. The corrective action cost estimate must account for the total expense of activities described in the corrective action plan. Again, the corrective action cost estimate and amount of financial assurance must increase or decrease in response to changes in either the corrective action program or MSWLF unit conditions.*

***Adjustments for inflation***

*Due to changes in inflation and interest rates, cost estimates must be annually adjusted for inflation. Updated cost estimates must account for added inflationary costs to ensure that adequate funds will be available if needed ...*

***Allowable mechanisms***

*The mechanisms used to demonstrate financial assurance must ensure that the funds necessary to meet the costs of closure, post-closure care, and known corrective action will be available when needed. Owners and operators may use any of the following financial mechanisms:*

- *Trust fund*
- *Surety bonds guaranteeing payment or performance*
- *Letter of credit*
- *Insurance*
- *Corporate financial test*
- *Local government financial test*
- *Corporate guarantee*
- *Local government guarantee*
- *State-approved mechanism*
- *State assumption of financial responsibility.*

*In addition, the Agency expects to add financial tests and guarantees as allowable mechanisms for corporations to demonstrate financial assurance. The performance standard requires that any approved financial assurance mechanism satisfy the following criteria:*

- *The amount of funds assured is sufficient to cover the costs of closure, post-closure care, and corrective action for known releases when needed*
- *The funds will be available in a timely fashion when needed*
- *The mechanisms for closure and post-closure care must be established by the owner and operator by the effective date of these requirements or prior to the initial receipt of solid waste, whichever is later. The mechanisms for corrective action must be secured no later than 120 days after the corrective action remedy has been selected, and maintained until the owner and operator are released from financial assurance responsibilities*
- *The mechanisms must be legally valid, binding, and enforceable under state and federal law.*

Two further financial assurance mechanisms, in addition to those listed above, are available (effective 9 April 1997) for local government owners and operators of MSWL facilities. These additional mechanisms – a financial test for use by local government owners and operators, and a provision for local governments that wish to guarantee the costs for an owner or operator – are designed to be self-implementing.

Effective 10 April 1998, two mechanisms were added to those currently available to corporate owners and operators of MSWL facilities. The two mechanisms are a financial test for use by private owners and operators, and a corporate guarantee that allows companies to guarantee the costs for another owner or operator.

## Australia

The following has been extracted from the New South Wales Environmental Protection Authority's *Environmental Guidelines: Solid Waste Landfills* (1996):

> *Financial assurance is a means of ensuring that landfill occupiers adequately plan for emergency closure, site remediation and post-closure care, by providing a specific mechanism to accumulate requisite funding during the life of the landfill. This mechanism encourages development of the necessary long-term financial planning to protect all environmental objectives.*
>
> - *The Landfill Environmental Management Plan (LEMP) should include a well-documented assessment of the potential cost, prepared by an independent consultant, for a third party contractor to undertake each of the following:*
>   - *close down the current operation at any time and remediate the site to a standard acceptable for its planned future use*
>   - *continue post-closure care and monitoring (bearing in mind that the period of after-care is significantly influenced by the design philosophy)*
>   - *complete the required remediation of environmental impacts that may be identified.*
> - *The financial assurance required by the Environment Protection Authority (EPA) will be negotiated in one or more of the following forms:*
>   - *an insurance policy*
>   - *a bank guarantee of funds or letter of credit*
>   - *a bond*
>   - *a third party guarantee*
>   - *a fund established and maintained by a public authority*
>   - *any other form of security that the EPA considers appropriate and specifies in the licence as a condition.*
>
>   *The preferred approach must be nominated in the LEMP.*
> - *The annual report for a landfill ... may nominate any variations for the level at which the financial guarantee is set for the forthcoming years' activity for a particular site based on the current operations and the extent of site activity planned. The nominated variations must be approved by the EPA.*

- *A financial assurance (or any part of it) may be called on by the EPA if the EPA:*
  - *is satisfied that the last licensee has failed to comply with the requirements of the closure plan approved by the EPA, or*
  - *is satisfied that a licensee has contravened any condition of the licence relating to site remediation work, or*
  - *incurs or proposes to incur costs or expenses in taking action that is covered by financial assurance.*
- *The requirement to provide a financial assurance lapses and no longer binds the person who was required to provide it if the EPA is satisfied:*
  - *that the site remediation work has been completed in accordance with a post-closure plan approved by the EPA (as detailed in 29. Closure of Landfill), and*
  - *that further environmental management of the premises is not required.*

*The person may provide the EPA with a certified statement of completion to the effect that site remediation work has been completed and the further environmental management of the premises is not required. If the EPA approves the statement, the requirement for provision of the financial assurance lapses.*

# Appendix E: Typical Example – District Landfill Site

The following illustrates the use of the model for a hypothetical district landfill.

The site is a proposed Greenfields development of a 50,000 tonnes per annum landfill which, for the purpose of this example, will take four years to investigate and obtain consents (the pre-development period). The District Council would prefer the site to operate for at least 20 years. The resource consents will generally be granted for a period not exceeding 35 years. The aftercare period is 30 years.

The project commenced on 1 January 2002 and the target date for commencement of operation is 1 January 2006.

The proposed landfill incorporates several different liner types, and these are outlined below.

This example is used to calculate the required per tonne indicative base cost of disposal (IBC) to cover all costs of the landfill project, including pre-development, development, operation, closure and aftercare.

Furthermore, the District Council wishes to assess the impact on the IBC of reducing waste to landfill. This will enable the council to set realistic waste reduction targets for implementing the district's Waste Strategy. The District Council also wishes to allow for a 1.5% per annum waste growth rate, which will account for long-term demographic projections and per capita waste generation trends.

Finally, the District Council wishes to assess the impact on the IBC of the timing of cell construction (i.e. cell construction staged in equal annual amounts versus cell construction completed in a single year).

Table E1 shows the waste reduction scenarios that have been modelled.

**Table E1: Waste reduction scenarios for a hypothetical district landfill**

| Scenario | Target waste reduction (% over life of facility) |
|---|---|
| 1 | 0 |
| 2 | 10 |
| 3 | 20 |
| 4 | 30 |
| 5 | 50 |

The model input worksheets (**General Input**, **Geometric Input**, and **Cost Input**) have been included below as have the **Project Summary** Output and **Cashflow Chart** Output for the 0% per annum reduction (Scenario 1 with construction staged in equal annual amounts).

Tables E2 and E3 summarise the IBC ($/tonne excluding GST) for the waste reduction scenarios.

**Table E2: IBCs for hypothetical district landfill (Cell Construction Staged in Equal Annual Amounts)**

| Scenario | Waste growth rate for population increase and per capita generation (% p.a.) | Waste reduction over life of facility and equivalent per annum reduction (% / % p.a.) | Net growth rate (% p.a.) | Operating life (years) | Waste: initial base tonnage (tonnes) | Waste in final year (tonnes) | Total tonnage during operating life (tonnes) | IBC ($/tonne) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.5 | 0/0 | 1.5 – 0 = 1.5 | 35 | 50,000 | 82,950 | 2,279,604 | 62.57 |
| 2 | 1.5 | 10/0.6 | 1.5 – 0.6 = 0.9 | 35 | 50,000 | 67,806 | 2,046,277 | 64.72 |
| 3 | 1.5 | 20/1.3 | 1.5 – 1.3 = 0.2 | 35 | 50,000 | 53,515 | 1,810,830 | 67.21 |
| 4 | 1.5 | 30/2.11 | 1.5 – 2.11 = –0.61 | 35 | 50,000 | 40,609 | 1,580,130 | 69.51 |
| 5 | 1.5 | 50/4.36 | 1.5 – 4.36 = –2.86 | 35 | 50,000 | 18,643 | 1,115,057 | 77.88 |

**Table E3: IBCs for hypothetical district landfill (Cell Construction Completed in Single Year)**

| Scenario | Waste growth rate for population increase and per capita generation (% p.a.) | Waste reduction over life of facility and equivalent per annum reduction (% / % p.a.) | Net growth rate (% p.a.) | Operating life (years) | Waste: initial base tonnage (tonnes) | Waste in final year (tonnes) | Total tonnage during operating life (tonnes) | IBC ($/tonne) |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.5 | 0/0 | 1.5 – 0 = 1.5 | 35 | 50,000 | 82,950 | 2,279,604 | 66.02 |
| 2 | 1.5 | 10/0.6 | 1.5 – 0.6 = 0.9 | 35 | 50,000 | 67,806 | 2,046,277 | 68.49 |
| 3 | 1.5 | 20/1.3 | 1.5 – 1.3 = 0.2 | 35 | 50,000 | 53,515 | 1,810,830 | 71.23 |
| 4 | 1.5 | 30/2.11 | 1.5 – 2.11 = –0.61 | 35 | 50,000 | 40,609 | 1,580,130 | 74.06 |
| 5 | 1.5 | 50/4.36 | 1.5 – 4.36 = –2.86 | 35 | 50,000 | 18,643 | 1,115,057 | 83.41 |

Liner Inputs used in the Typical Example

Most of the proposed landfill is to have a liner consisting of 600 mm thickness of compacted clay (with permeability less than $1 \times 10^{-9}$), a 1.5 mm thick textured HDPE FML, a 1000 g/m$^2$ non-woven geotextile liner protection layer and a 300 mm thick 40/20 aggregate leachate collection layer. In parts of cells 1, 2, 5 and 7, the final placed depth of waste is lower and the thickness of the liner protection layer can be reduced to 600 g/m$^2$. In cells 3 and 4, there are steep sidewalls. The liner on these sidewalls is to consist of a GCL, a 1.5 mm thick textured HDPE FML, and a 200 mm thick protection layer of silts and clays. Note that there is no compacted clay component and no leachate collection layer proposed for the sidewall liner. The costs to be used for the various liner components are shown in Table E4.

**Table E4: Costs of liner components for liner types used in Typical Example**

| | |
|---|---|
| Compacted clay liner (cut, on-site borrow or stockpile to fill) | $5.50/m$^3$ |
| Subgrade preparation | |
| Beneath compacted clay liner | $1.00/m$^3$ |
| Beneath GCL | $1.95/m$^3$ |
| Synthetic liner | |
| 1.5 mm thick textured HDPE FML | $15.50/m$^2$ |
| GCL | $16.70/m$^2$ |
| Liner protection layer | |
| 1000 g/m$^2$ non-woven geotextile | $9.20/m$^2$ |
| 600 g/m$^2$ non-woven geotextile | $7.10/m$^2$ |
| 200 mm thick silt & clay layer | $2.60/m$^2$ |
| Leachate Collection layer | |
| 300 mm thick 40/20 aggregate | $12.50/m$^2$ |

Refer to the Model Input worksheets (Geometric Input and Cost Input) included for this typical example to see how the data has been input to the model.

# MfE Landfill Full Cost Accounting Model

## General Input

| | |
|---|---|
| Project Name | **Typical Example - Hypothetical Landfill** |
| Project Location | A District |
| Scenario Number | 1 |
| Scenario Description | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

### SITUATION

- (•) GreenFields Site — Choose this option for a site which has not yet been developed
- ( ) BrownFields Site — Choose this option for a site already in use

### DATES

| | | | |
|---|---|---|---|
| Project Commencement Date | 1/07/2002 | | |
| Operation Commencement Date | 1/07/2006 | ☑ Allow for Appeal | |
| Predevelopment Period (Includes Initial Development Year, Rounded Down) | 4.0 | years | |
| Time of Land Purchase | 2 | nd year of Predevelopment Period | |
| Time of Excess Land Sale | 2 | nd year of Operation | |
| Sunset Date | 1/07/2041 | | |
| Consented Landfill Operating Life | 35.0 | years | |
| Actual Landfill Operating Life (Rounded Up) | 35.0 | years | Closure due to Sunset Date (30/06/41) |
| Aftercare Period | 30 | years | |

### WASTE

( ) Custom Waste Tonnages - See Waste Input Sheet  (•) Generated Waste Tonnages - See Below

| | | | |
|---|---|---|---|
| Annual Waste Tonnage at Start of Operation | | 50,000 | t/year |
| Annual Waste Tonnage Growth Rate | | + 1.5 | % |
| Minimum Allowable Annual Waste Tonnage | Must be greater than | 5,000 | t/year |

**Waste Stream**

| | | |
|---|---|---|
| General Refuse | 100% | of annual waste tonnage |
| Special Refuse | 0% | of annual waste tonnage |
| Cleanfill | 0% | additional to annual waste tonnage |

**Waste Charging**

| | | |
|---|---|---|
| General Refuse | 100% | = IBC |
| Special Refuse | 150% | of IBC |
| Cleanfill | 50% | of IBC |

| | | |
|---|---|---|
| Assumed Compacted Waste Density (Excluding Cover) | 0.80 | t/m³ |
| Target Cover to Waste Ratio (Daily and Intermediate) | 1 : 4 | |
| Volume Utilisation | 1.563 | m³/t |

### FINANCIAL

**Cost of Capital**

| | | | |
|---|---|---|---|
| Planning And Consenting | Stage 1 | 25.0% | |
| Construction | Stage 2 | 25.0% | |
| Operation | Stage 3 | 10.0% | = Internal Rate of Return |
| Aftercare | Stage 4 | 10.0% | |
| Interest Rate (Risk Free Rate plus 0.5%) | | 6.0% | = interest rate on 10 year Govt. Bonds + 0.5% |

(•) Apply Real Annual Movement to IBC over Whole Operating Life  ( ) Ramp IBC from Initial (known) Value to Final (unknown)Value over a Set Period

IBC Real Annual Movement: + 0.0%

*Version 3.1*

# MfE Landfill Full Cost Accounting Model

## Geometric Input

**Typical Example - Hypothetical Landfill**
Scenario No. 1

Volumes in: Mm³
Areas in: Ha

**SITE CONSTANTS**

Leachate Generation

| | | | |
|---|---|---|---|
| ○ Typical for Region | Northland | Active | 2153 m³/ha/annum |
| Location: | | Post Closure | 1617 m³/ha/annum |
| Annual Precipitation: | | | |
| ◉ Custom Values | | Active | 1000 m³/ha/annum |
| | | Post Closure | 600 m³/ha/annum |

| | | | |
|---|---|---|---|
| Assumed Insitu Topsoil Depth | | 0.150 | m |
| Depth of Sub-Topsoil Layer to be Recovered | ☑ Don't Recover from Fill Zone | 0.950 | m |

Liner - Depth of Low Permeability Material in Liner

| | | |
|---|---|---|
| (Default Liner) Liner Type 1 | 0.60 | m |
| Liner Type 2 | 0.60 | m |
| Liner Type 3 | | m |
| Liner Type 4 | | m |
| Liner Type 5 | | m |
| Liner Type 6 | | m |

Only enter depths for liner types which are to be used

| | | |
|---|---|---|
| Final Cap - Depth of Topsoil Layer | 0.100 | m |
| Final Cap - Depth of Unsuitables Layer | | m |
| Final Cap - Depth of Sub-Topsoil Layer | 0.300 | m |
| Final Cap - Depth of Low Permeability Layer | 0.600 | m |

Usually only one or other required

| | | |
|---|---|---|
| Access Road Length | 1.1 | km |
| Length of Boundary Fence | 2500 | m |

| | | | |
|---|---|---|---|
| Leachate Pretreatment Facility | Install in | 8 | th year of Operation |
| Leachate Disposal System | Install in | 8 | th year of Operation |
| Flare Station - Interim | Install | 15% | of way through landfill life |
| Flare Station - Final | Install | 75% | of way through landfill life |

**DEVELOPMENT PROGRAMME**

◉ Cell Construction Staged in Equal Annual Amounts
○ Cell Construction Completed in Single Year

| | Total | | Cell 1 | Cell 2 | Cell 3 | Cell 4 | Cell 5 | Cell 6 | Cell 7 | Cell 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| Net Airspace (excluding Final Cap) | 3.779271 | Mm³ | 0.311568 | 0.425821 | 0.470141 | 0.519074 | 0.573099 | 0.632748 | 0.84682 | 0 |
| Footprint Area | 17.15 | Ha | 2.93 | 2.8 | 1.98 | 1.67 | 2.5 | 2.27 | 3 | 0 |
| Liner Type 2 Area | 4.38 | Ha | 1.03 | 0.91 | | | 0.47 | | 1.97 | |
| LIner Type 3 Area | 1.55 | Ha | | | 0.87 | 0.68 | | | | |
| Liner Type 4 Area | 0 | Ha | | | | | | | | |
| Liner Type 5 Area | 0 | Ha | | | | | | | | |
| Liner Type 6 Area | 0 | Ha | | | | | | | | |
| Disturbed Area | 19.67 | Ha | 3.1 | 3.1 | 2.12 | 1.8 | 3.6 | 2.65 | 3.3 | 0 |
| Area of Fill Zone | 4.2875 | Ha | 0.7325 | 0.7 | 0.495 | 0.4175 | 0.625 | 0.5675 | 0.75 | 0 |
| Area of Liner Type 1 in Fill Zone | 3.8075 | Ha | 0.5 | 0.55 | 0.49 | 0.39 | 0.61 | 0.5675 | 0.7 | 0 |
| Area of Liner Type 2 in Fill Zone | 0.62 | Ha | 0.1 | 0.12 | | | | | 0.4 | |
| Area of Liner Type 3 in Fill Zone | 0.005 | Ha | | | 0.005 | | | | | |
| Area of Liner Type 4 in Fill Zone | 0 | Ha | | | | | | | | |
| Area of Liner Type 5 in Fill Zone | 0 | Ha | | | | | | | | |
| Area of Liner Type 6 in Fill Zone | 0 | Ha | | | | | | | | |
| Area to be Cleared | 29 | Ha | 7.3 | 5.5 | 4.2 | 1.8 | 2.9 | 4 | 3.3 | 0 |
| Area of Bush to be Cleared | 1.04 | Ha | 0 | 0 | 0.18 | 0.675 | 0.185 | 0 | 0 | 0 |
| Area of Specialised Subgrade Treatment | 12 | Ha | 2.3 | 1.5 | 0.7 | 1.8 | 2.5 | 0.6 | 2.6 | 0 |
| Area of Liner Protection Layer | 17.15 | Ha | 2.93 | 2.8 | 1.98 | 1.67 | 2.5 | 2.27 | 3 | 0 |
| Final Cap Area | 17.15 | Ha | 1 | 1.15 | 2 | 2 | 2 | 4 | 5 | 0 |
| Required Cut (E.G. to Basegrade) | 0.3 | Mm³ | 0.0845 | 0.055 | 0.055 | 0.018 | 0.036 | 0.0265 | 0.025 | 0 |
| Useable Liner to be Removed from Cut Zone | 0 | Mm³ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Required Fill (E.G. to Basegrade) | 0.14 | Mm³ | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0 |
| Useable Liner to be Removed from Fill Zone | 0 | Mm³ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unsuitables Volume | 0.2582 | Mm³ | 0.0616 | 0.0446 | 0.009 | 0.0352 | 0.0334 | 0.0112 | 0.0632 | 0 |
| Proportion of Unsuitables in Fill Zone | 100% | | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 0% |
| **Topsoil** | | | | | | | | | | |
| Cut to Stockpile | 0.0295 | Mm³ | 0.0047 | 0.0047 | 0.0032 | 0.0027 | 0.0054 | 0.0040 | 0.0050 | |
| Stockpile to Final Cover | 0.0172 | Mm³ | 0.0010 | 0.0012 | 0.0020 | 0.0020 | 0.0020 | 0.0040 | 0.0050 | |
| Import Topsoil to Final Cover | | Mm³ | | | | | | | | |
| **Unsuitables** | | | | | | | | | | |
| Cut to Stockpile | 0.2582 | Mm³ | 0.0616 | 0.0446 | 0.0090 | 0.0352 | 0.0334 | 0.0112 | 0.0632 | |
| Stockpile to Final Cover | | Mm³ | | | | | | | | |
| Shortfall - make up with Sub-Topsoil | | Mm³ | | | | | | | | |
| **Sub-Topsoil** | | | | | | | | | | |
| Cut to Stockpile | 0.1461 | Mm³ | 0.0225 | 0.0228 | 0.0154 | 0.0131 | 0.0283 | 0.0198 | 0.0242 | |
| Stockpile to Final Cover | 0.0515 | Mm³ | 0.0030 | 0.0035 | 0.0060 | 0.0060 | 0.0060 | 0.0120 | 0.0150 | |
| Borrow to Final Cover | | Mm³ | | | | | | | | |
| **Low Permeability Material** | | | | | | | | | | |
| Cut to Stockpile | | Mm³ | | | | | | | | |
| Stockpile to Liner | | Mm³ | | | | | | | | |
| Stockpile to Final Cover | | Mm³ | | | | | | | | |
| Cut to Fill as Liner | | Mm³ | | | | | | | | |
| Cut to Fill as Final Cover | | Mm³ | | | | | | | | |

# Geometric Input

**Typical Example - Hypothetical Landfill**

Scenario No. 1

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Borrow to Fill as Liner | 0.0936 | Mm³ | 0.0176 | 0.0168 | 0.0067 | 0.0059 | 0.0150 | 0.0136 | 0.0180 | |
| Borrow to Fill as Final Cover | 0.1029 | Mm³ | 0.0060 | 0.0069 | 0.0120 | 0.0120 | 0.0120 | 0.0240 | 0.0300 | |
| **Structural Material** | | | | | | | | | | |
| Cut to Stockpile | 0.0000 | Mm³ | | | | | | | | |
| Stockpile to Fill | | Mm³ | | | | | | | | |
| Stockpile to Daily Cover | | Mm³ | | | | | | | | |
| Cut to Fill | 0.1887 | Mm³ | 0.0716 | 0.0412 | 0.0268 | 0.0103 | 0.0145 | 0.0138 | 0.0105 | |
| Cut to Daily Cover | 0.0192 | Mm³ | | 0.0192 | | | | | | |
| Borrow to Fill | 0.1893 | Mm³ | 0.0075 | 0.0204 | | 0.0432 | 0.0362 | 0.0148 | 0.0673 | |
| Borrow to Daily Cover | 0.8712 | Mm³ | 0.0595 | 0.0860 | 0.1371 | 0.1240 | 0.1335 | 0.1439 | 0.1874 | |
| Length of Perimeter Access Road | 1750 | m | 480 | 400 | 130 | 0 | 280 | 280 | 180 | 0 |
| Subsoil Drainage | 3985 | m | 990 | 800 | 45 | 280 | 1000 | 20 | 850 | 0 |
| Leachate Header Pipework | 2105 | m | 250 | 305 | 340 | 105 | 675 | 280 | 150 | 0 |
| Leachate Collection Pipework | 1600 | m | 320 | 300 | 200 | 170 | 180 | 80 | 350 | 0 |
| Leachate Collection Sumps | 2 | | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Cleanout Port/Manhole | 10 | | 1 | 2 | 1 | 0 | 1 | 2 | 3 | 0 |
| Leachate Pumpout Equipment | 1 | | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater Open Drains | 0 | m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater Stabilised Drains/Flumes | 0 | m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater Piped Drains | 0 | m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gas Horizontal Collection Pipework | 6300 | m | 900 | 900 | 900 | 900 | 900 | 900 | 900 | 0 |
| Gas Vertical Extraction Wells | 2950 | m | 0 | 0 | 590 | 590 | 590 | 590 | 590 | 0 |
| Gas Main Header Pipe | 2851 | m | 0 | 142 | 142 | 142 | 999 | 713 | 713 | 0 |
| Gas Laterals to Vertical Wells | 1675 | m | 0 | 0 | 335 | 335 | 335 | 335 | 335 | 0 |
| Gas Condensate Traps | 30 | | 0 | 5 | 5 | 5 | 5 | 5 | 5 | 0 |
| | | | **Cell 1** | **Cell 2** | **Cell 3** | **Cell 4** | **Cell 5** | **Cell 6** | **Cell 7** | **Cell 8** |

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Typical Example - Hypothetical Landfill**
Scenario No. 1

Note: Leave cost fields blank for any items which are not required

| | | | | |
|---|---|---|---|---|
| **SUNK COSTS** | | | | |
| Sunk Costs | | 300,000 | $ | |
| **PLANNING AND PREDEVELOPMENT** | | | | |
| Project Management | | 160,000 | $ | |
| Site Selection | | 100,000 | $ | |
| Consultation | | 250,000 | $ | |
| Land Pre-Purchase / Pre-Leasing Agreements | | 20,000 | $ | |
| Survey and Preliminary Design | | 125,000 | $ | |
| Geotechnical & Groundwater Investigations | | 200,000 | $ | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | | 200,000 | $ | |
| Baseline Monitoring | | 100,000 | $ | |
| Resource Consent Process | | | | |
| AEE and Consent Application | | 650,000 | $ | |
| Draft Landfill Management Plan | | 20,000 | $ | |
| Legal | | 50,000 | $ | |
| Hearing | | 120,000 | $ | |
| Appeal | | 200,000 | $ | |
| Land Acquisition & Associated/ Set Up Costs | | 1,350,000 | $ | |
| Proceeds from Disposal of Excess Land | | | $ | |
| Custom 1 | | | $ | In year of Project |
| Custom 2 | | | $/yr | Spread over Predevelopment Period |
| **BASE COSTS** | | | | |
| Engineering | | | | |
| Detailed Design and Documentation (%) | | 6.0% | | |
| Construction Management (%) | | 6.5% | | |
| Contractors P & G (%) | | 12.5% | | |
| **DEVELOPMENT** | | | | |
| **Site Access** | | | | |
| Intersection Upgrade | | 350,000 | $ | |
| Other Roading Network Upgrades/ Contributions | | 0 | $ | |
| Access Road - Intersection to Footprint | | 650,000 | $/km | |
| Special Structures : Diversions, Bridges, etc) | | 100,000 | $ | |
| **Site Amenities & Services** | | | | |
| Site Entrance | | 10,000 | $ | |
| Administration Building | | 50,000 | $ | |
| Weighbridge & Kiosk | | 225,000 | $ | |
| Machinery Shed, Maintenance Facility | | 100,000 | $ | |
| Power & Phone | | 30,000 | $ | |
| Sewerage | | 20,000 | $ | |
| Water Supply | | 30,000 | $ | |
| General Civil Works (Sealing, Parking) -Administration | | 55,000 | $ | |
| Washdown Facility/Wheelwash | | 100,000 | $ | |
| Fencing | | 40 | $/m | |
| Landscaping | | | $ | |
| Custom 3 | | | $ | In Initial Development Year |
| **Cell Construction - Earthworks, Liner, Leachate** | | | | |
| Sediment Control Structures and Measures | | | $ | |
| Clearing | | 1.80 | $/m² | |
| Clearing Bush | | 12.00 | $/m² | |
| Perimeter Access Road | | 800.00 | $/m | |
| Topsoil | | | | |
| Cut to Stockpile | | 2.00 | $/m³ | |
| Unsuitables | | | | |
| Cut to Stockpile | | 12.00 | $/m³ | |
| Sub-Topsoil | | | | |
| Cut to Stockpile | | 5.50 | $/m³ | |
| Low Permeability Material | | | | |
| Cut to Stockpile | | 5.50 | $/m³ | |
| Stockpile to Liner | | 5.50 | $/m³ | |
| Cut to Fill as Liner | | 5.50 | $/m³ | |
| Borrow to Fill as Liner | | 13.33 | $/m³ | |
| Structural Material | | | | |
| Cut to Stockpile | | 3.00 | $/m³ | |
| Stockpile to Fill | | 5.00 | $/m³ | |
| Cut to Fill | | 5.00 | $/m³ | |
| Borrow to Fill | | 5.00 | $/m³ | |
| Groundwater Control/ Subsoil Drainage | | 100.00 | $/m | |
| Prepare Subgrade for Laying Liner | Liner Type 1 | 1.00 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | 1.00 | $/m² | |
| | Liner Type 3 | 1.95 | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Specialised Subgrade Treatment | | 22.00 | $/m² | |

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Typical Example - Hypothetical Landfill**
Scenario No. 1

| | | | | |
|---|---|---|---|---|
| Liner Supply & Installation (Synthetic) | Liner Type 1 | 15.50 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | 15.50 | $/m² | |
| | Liner Type 3 | 32.20 | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Liner Protection Layer | Liner Type 1 | 9.20 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | 7.10 | $/m² | |
| | Liner Type 3 | 2.60 | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Leachate Collection and Transmission System | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | | 160.00 | $/m | |
| Auxillary Leachate Collection Pipes (including fittings) | | 60.00 | $/m | |
| Leachate Collection Sump | | 10,000 | $ each | |
| Cleanout Ports/Manholes | | 5,000 | $ each | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | | 48,000 | $ each | |
| Leachate Collection Layer | Liner Type 1 | 12.50 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | 12.50 | $/m² | |
| | Liner Type 3 | | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Leachate Pre-treatment Facility | | 400,000 | $ | |
| Leachate Disposal System | | 147,000 | $ | |

**Stormwater Management System**

| | | |
|---|---|---|
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | $ |
| Open Drains | 50.00 | $/m |
| Stabilised Drains / Flumes | 75.00 | $/m |
| Piped Drains | 150.00 | $/m |
| Stormwater Treatment Ponds | | |
| Ponds | 550,000 | $ |
| Instrumentation | 50,000 | $ |

**Gas Management System**

| | | |
|---|---|---|
| Horizontal Collectors | 100.00 | $/m |
| Vertical Extraction Wells | 200.00 | $/m |
| Ring Header (below grade) | 400.00 | $/m |
| Laterals to vertical wells (above grade) | 70.00 | $/m |
| Condensate Traps | 2,000 | $ each |
| Flare Stations | | |
| Interim | 150,000 | $ |
| Final | 550,000 | $ |

**Final Cover - low permeability barrier layer placement**

| | | |
|---|---|---|
| Topsoil | | |
| Stockpile to Final Cover | 5.00 | $/m³ |
| Import Topsoil to Final Cover | 35.00 | $/m³ |
| Unsuitables | | |
| Stockpile to Final Cover | 6.00 | $/m³ |
| Shortfall - make up with Sub-Topsoil | 6.00 | $/m³ |
| Sub-Topsoil | | |
| Stockpile to Final Cover | 5.60 | $/m³ |
| Borrow to Final Cover | 5.60 | $/m³ |
| Low Permeability Material | | |
| Stockpile to Final Cover | 10.00 | $/m³ |
| Cut to Fill as Cover | 10.00 | $/m³ |
| Borrow to Fill as Cover | 10.00 | $/m³ |
| Geosynthetic layer | | $/m² |
| Drainage layer | 6.00 | $/m² |
| Vegetation | 0.50 | $/m² |

**Other**

| | | | | | |
|---|---|---|---|---|---|
| Custom 4 | | $ | In | | Year of Operation |
| Custom 5 | | $ | In | | Year of Operation |
| Custom 6 | | $/yr | For Cell No. | | |
| Custom 7 | | $/yr | For Cell No. | | |
| Custom 8 | | $/yr | For All Cells | | |
| Custom 9 | | $/yr | For All Cells | | |

**OPERATION**

| **Direct Costs & Indirect Costs** | 20,000 | 50,000 | 75,000 | 100000 | 200000 | 300000 | 500000 | t/yr |
|---|---|---|---|---|---|---|---|---|
| Refuse Placement | 11.00 | 10.50 | 10.00 | 9.00 | 8.00 | 7.00 | 6.00 | $/t |
| Daily Cover | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | $/t |
| Nuisance Control Litter, Odour, Birds, Vector | 20,000 | 30,000 | 40,000 | 50,000 | 60,000 | 70,000 | 80,000 | $/yr |
| General Maintenance | 4,000 | 4,500 | 5,000 | 5,500 | 6,000 | 6,500 | 7,000 | $/yr |
| Salaries, Wages & Overhead | 100,000 | 150,000 | 175,000 | 200,000 | 400,000 | 550,000 | 600,000 | $/yr |
| On-Site Management | | | | | | | | |
| Gate Control & Fee Collection | | | | | | | | |
| Audit Fees | | | | | | | | |

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Typical Example - Hypothetical Landfill**
Scenario No. 1

| | | | |
|---|---|---|---|
| Secretarial Fees | | | |
| Accounting Fees | | | |
| Legal | | | |
| Consultancy | | | |
| Insurance | | | |
| Waste Acceptance and Inspection | | | |
| Health & Safety | | | |
| Aftercare Levy | 0.24 | $/t | Calculates Last |
| Royalty & Host Fee | | $/t | |
| Intermediate Cover | 0.25 | $/t | |
| Roading (Temporary) | 0.75 | $/t | |
| Leachate Tmt & Disposal | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 40.00 | $/m³ | |
| Operation of Disposal System | 1.50 | $/m³ | |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 5.00 | $/m³ | |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | 5.00 | $/m³ | |
| Gas Control | 2,800 | $/ha/yr | Once Interim Flare Installed |
| Stormwater Maintenance | 10,000 | $/yr | |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 20,000 | $/yr | |
| Environmental Compliance | 40,000 | $/yr | |
| Bond | 0 | $/yr | |
| Regional Council Costs | 12,000 | $/yr | |
| Rates | 4,000 | $/yr | |
| Water Charges | | $/yr | |
| Electricity Charges | | $/yr | |
| Land Leasing | | $/yr | |
| Custom 10 | | $/t | |
| Custom 11 | | $/yr | |

**CLOSURE**

**General**

| | | | |
|---|---|---|---|
| Removal of Facilities | 100,000 | $ | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | |
| Final Cover | 1.0% | of construction cost | |
| Landfill Gas Management System | 1.0% | of construction cost | |
| Leachate Management System | 1.5% | of construction cost | |
| Onsite Surface Water Control System | 1.5% | of construction cost | |
| Design Consultants/ Third Party Engineering | 6.0% | of construction cost | |

**AFTERCARE**

| | | | |
|---|---|---|---|
| Administration | 10,000 | $/yr | |
| Regional Council Liaison | 7,500 | $/yr | |
| Site Inspection | 100 | $/ha/yr | |
| Final Cover System | | | |
| Final Cover maintenance | 500 | $/ha/yr | |
| Vegetation maintenance | 2,000 | $/ha/yr | |
| Leachate System maintenance | | | |
| Leachate Disposal | 1.00 | $/m³ | |
| System maintenance | 500 | $/ha/yr | |
| Electricity | 1,000 | $/ha/yr | |
| Gas Management System | | | |
| Maintenance | 500 | $/ha/yr | |
| Replacement | 500 | $/ha/yr | |
| Electricity | 1,000 | $/ha/yr | |
| Environmental Monitoring System | | | |
| Groundwater | 500 | $/ha/yr | |
| Landfill Gas | 500 | $/ha/yr | |
| Leachate | 500 | $/ha/yr | |
| Stormwater | 500 | $/ha/yr | |
| Removal of Remaining Facilities | 50,000 | $ | |
| End of Post Closure Certification | 20,000 | $ | |
| Custom 12 | | $/yr | |
| Custom 13 | | $/ha/yr | |

**CONTINGENCIES**

| | | |
|---|---|---|
| Predevelopment | 25.0% | of predevelopment cost |
| Development | 10.0% | of development cost |
| Operations | 0.0% | of operations cost |
| Closure | 10.0% | of closure cost |
| Aftercare | 5.0% | of aftercare cost |

# MfE Landfill Full Cost Accounting Model

## Summary

| | | | |
|---|---|---|---|
| **DESCRIPTION** | | | |
| Project Name: | **Typical Example - Hypothetical Landfill** | | |
| Project Location: | A District | | |
| Scenario No: | 1 | | |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility | | |
| **DESIGN PLANNING PARAMETERS (From 1 July 2006)** | | | |
| Project Commencement Date | 1 July 2002 | | |
| Operation Commencement Date | 1 July 2006 | | |
| Actual Landfill Operating Life (Rounded Up) | 35 | years | Closure due to Sunset Date (30/06/41) |
| Consented Landfill Operating Life | 35 | years | Sunset Date = 1 July 2041 |
| Aftercare/ Post Closure Period | 30 | years | |
| Number of Phases/Stages/Cells | 7 | | Each cell construction staged in equal annual amounts |
| Annual Waste Tonnage at Start of Operation | 50,000 | t/year | |
| Annual Waste Tonnage Growth Rate | + 1.5 | % | |
| Minimum Allowable Annual Waste Tonnage | 5,000 | t/year | |
| Annual Waste Tonnage at Close of Operation | 82,950 | t/year | |
| Total Tonnes Placed in Landfill | 2,279,604 | t | = 94% of Design Tonnage (2,418,733 t) |
| Average Waste Tonnage | 65,132 | t/year | |
| Target Cover to Waste Ratio (Daily and Intermediate) | 1 : 4 | | |
| Volume Utilisation | 1.56 | m³/t | |
| Actual Footprint Area | 17.15 | Ha | = 100% of Design Footprint Area (17.15 Ha) |
| Waste Volume | 2,849,505 | m³ | |
| Daily And Intermediate Cover | 712,376 | m³ | |
| Net Airspace | 3,561,882 | m³ | = 94% of Design Net Airspace (3,779,271 m³) |
| Final Cover | 171,500 | m³ | |
| Gross Airspace | 3,733,382 | m³ | |
| **FINANCIAL PARAMETERS** | | | |
| **Cost of Capital** | | | |
| Planning And Consenting (Stage 1) | 25% | | |
| Construction (Stage 2) | 25% | | |
| Operation (Stage 3) | 10% | | |
| Aftercare (Stage 4) | 10% | | |
| Interest Rate (Risk Free Rate plus 0.5%) | 6% | | |
| **COSTS SUMMARY** | | | |
| Sunk Costs | $ 300,000 | | |
| Planning / Pre-development | $ 3,545,000 | | |
| Base Costs | $ 6,718,016 | | |
| Development | $ 27,959,380 | | |
| Operation | $ 39,208,164 | | |
| Closure | $ 210,135 | | |
| Contingency on Capital Costs | $ 4,375,003 | | |
| Contingency on Operational Costs | $ 0 | | |
| **Total (excluding Cost of Capital)** | **$ 82,315,698** | | |
| Total Start-up Costs | $ 14,627,666 | | |
| Total Capital Expenditure | $ 43,107,534 | | |
| Total Operational Expenditure | $ 39,208,164 | | |
| Aftercare Fund at Closure | $ 1,654,302 | | Based on Total Footprint Area of 17.15 ha ($175,040/annum + $73,500 in Final Year) |
| Average Whole of Life (AWL) Costs | $ 36.11 | /t | $ 23.11 /m³ of net airspace |
| Net Present Value (NPV) Costs | $ 0.00 | /t | $ 0.00 /m³ of net airspace |
| **INDICATIVE COST OF LANDFILL DISPOSAL** | | | |
| **Indicative Base Cost (IBC) at Start of Operation** | **$ 62.57** | **/t** | $ 40.04 /m³ of net airspace |
| Mark Up | $ 12.51 | | 20% |
| **Indicative Gate Rate at Start of Operation** | **$ 75.08** | | |
| IBC Real Annual Movement | + 0.0% | | (IBC at Close of Operation = $62.57/t) |
| **TOTAL SOLID WASTE MANAGEMENT SYSTEM COSTS** | | | |
| **Other Management System Costs** | | | |
| Refuse Collection Costs (Kerbside, etc) | | | |
| Transfer Station Costs | $ 0 | /t | |
| Freight Costs | $ 0 | /t | |
| Recycling Costs | $ 0 | /t | |
| Greenwaste/Composting Costs | $ 0 | /t | |
| Education/Waste Minimisation Costs | $ 0 | /t | |
| Other Costs | $ 0 | /t | |
| **Total** | $ 0.00 | /t | |
| Landfill Indicative Gate Rate at Start of Operation | $ 75.08 | /t | |
| **Total Solid Waste Management Cost** | **$ 75.08** | **/t** | |

*Version 3.1*

# MfE Landfill Full Cost Accounting Model

## Cashflow Detail

**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Season | | | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
| Year End Date | | 30/06/2002 | 30/06/2003 | 30/06/2004 | 30/06/2005 | 30/06/2006 | 30/06/2007 | 30/06/2008 | 30/06/2009 | 30/06/2010 |
| Year of Operation | | | | | | | 1 | 2 | 3 | 4 |
| **Operating Cell** | | | | | | | **1** | **1** | **1** | **2** |
| Actual Waste Placed (t) | | | | | | | 50,000 | 50,750 | 51,511 | 52,284 |
| **INCOME** | | | | | | | | | | |
| General Refuse | 142,631,982 | | | | | | 3,128,437 | 3,175,364 | 3,222,994 | 3,271,339 |
| Special Refuse | | | | | | | | | | |
| Cleanfill | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | | | | | | **3,128,437** | **3,175,364** | **3,222,994** | **3,271,339** |
| **SUNK COSTS** | | | | | | | | | | |
| Sunk Costs | 300,000 | 300,000 | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | | | | | | | | | | |
| Project Management | 160,000 | | 40,000 | 40,000 | 40,000 | 40,000 | | | | |
| Site Selection | 100,000 | | 100,000 | | | | | | | |
| Consultation | 250,000 | | 83,333 | 83,333 | 83,333 | | | | | |
| Land Pre-Purchase / Pre-Leasing Agreements | 20,000 | | 20,000 | | | | | | | |
| Survey and Preliminary Design | 125,000 | | 125,000 | | | | | | | |
| Geotechnical & Groundwater Investigations | 200,000 | | | 200,000 | | | | | | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | 200,000 | | | 200,000 | | | | | | |
| Baseline Monitoring | 100,000 | | | 33,333 | 33,333 | 33,333 | | | | |
| Resource Consent Process | | | | | | | | | | |
| AEE and Consent Application | 650,000 | | | 650,000 | | | | | | |
| Draft Landfill Management Plan | 20,000 | | | | 20,000 | | | | | |
| Legal | 50,000 | | | 25,000 | 25,000 | | | | | |
| Hearing | 120,000 | | | | 120,000 | | | | | |
| Appeal | 200,000 | | | | 200,000 | | | | | |
| Land Acquisition & Associated/ Set Up Costs | 1,350,000 | | | 1,350,000 | | | | | | |
| Proceeds from Disposal of Excess Land | | | | | | | | | | |
| Custom 1 | | | | | | | | | | |
| Custom 2 | | | | | | | | | | |
| **BASE COSTS** | | | | | | | | | | |
| Engineering | | | | | | | | | | |
| Detailed Design and Documentation (%) | 1,612,324 | | | | 233,721 | 74,757 | 74,757 | 45,531 | 46,479 | 46,671 |
| Construction Management (%) | 1,746,684 | | | | | 253,198 | 80,987 | 80,987 | 49,326 | 50,353 |
| Contractors P & G (%) | 3,359,008 | | | | | 486,919 | 155,744 | 155,744 | 94,857 | 96,832 |
| **DEVELOPMENT** | | | | | | | | | | |
| **Site Access** | | | | | | | | | | |
| Intersection Upgrade | 350,000 | | | | | 350,000 | | | | |
| Other Roading Network Upgrades/ Contributions | | | | | | | | | | |
| Access Road - Intersection to Footprint | 715,000 | | | | | 715,000 | | | | |
| Special Structures : Diversions, Bridges, etc) | 100,000 | | | | | 100,000 | | | | |
| **Site Amenities & Services** | | | | | | | | | | |
| Site Entrance | 10,000 | | | | | 10,000 | | | | |
| Administration Building | 50,000 | | | | | 50,000 | | | | |
| Weighbridge & Kiosk | 225,000 | | | | | 225,000 | | | | |
| Machinery Shed, Maintenance Facility | 100,000 | | | | | 100,000 | | | | |
| Power & Phone | 30,000 | | | | | 30,000 | | | | |
| Sewerage | 20,000 | | | | | 20,000 | | | | |
| Water Supply | 30,000 | | | | | 30,000 | | | | |
| General Civil Works (Sealing, Parking) -Administration | 55,000 | | | | | 55,000 | | | | |
| Washdown Facility/Wheelwash | 100,000 | | | | | 100,000 | | | | |
| Fencing | 100,000 | | | | | 100,000 | | | | |
| Landscaping | | | | | | | | | | |
| Custom 3 | | | | | | | | | | |
| **Cell Construction - Earthworks, Liner, Leachate** | | | | | | | | | | |
| Sediment Control Structures and Measures | | | | | | | | | | |
| Clearing | 522,000 | | | | | 131,400 | | | 99,000 | |
| Clearing Bush | 124,800 | | | | | | | | | |
| Perimeter Access Road | 1,400,000 | | | | | 128,000 | 128,000 | 128,000 | 64,000 | 64,000 |
| Topsoil | | | | | | | | | | |
| Cut to Stockpile | 59,010 | | | | | 3,100 | 3,100 | 3,100 | 1,860 | 1,860 |
| Unsuitables | | | | | | | | | | |
| Cut to Stockpile | 3,098,400 | | | | | 246,400 | 246,400 | 246,400 | 107,040 | 107,040 |
| Sub-Topsoil | | | | | | | | | | |
| Cut to Stockpile | 803,736 | | | | | 41,234 | 41,234 | 41,234 | 25,080 | 25,080 |
| Low Permeability Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Liner | | | | | | | | | | |
| Cut to Fill as Liner | | | | | | | | | | |
| Borrow to Fill as Liner | 1,247,688 | | | | | 78,114 | 78,114 | 78,114 | 44,789 | 44,789 |
| Structural Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Fill | | | | | | | | | | |
| Cut to Fill | 943,675 | | | | | 119,404 | 119,404 | 119,404 | 41,200 | 41,200 |
| Borrow to Fill | 946,656 | | | | | 12,427 | 12,427 | 12,427 | 20,430 | 20,430 |
| Groundwater Control/ Subsoil Drainage | 398,500 | | | | | 33,000 | 33,000 | 33,000 | 16,000 | 16,000 |
| Prepare Subgrade for Laying Liner - Liner Type 1 | 112,200 | | | | | 6,333 | 6,333 | 6,333 | 3,780 | 3,780 |
| Prepare Subgrade for Laying Liner - Liner Type 2 | 43,800 | | | | | 3,433 | 3,433 | 3,433 | 1,820 | 1,820 |
| Prepare Subgrade for Laying Liner - Liner Type 3 | 30,225 | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 4 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 5 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 6 | | | | | | | | | | |
| Specialised Subgrade Treatment | 2,640,000 | | | | | 168,667 | 168,667 | 168,667 | 66,000 | 66,000 |
| Liner Supply & Installation (Synthetic) - Liner Type 1 | 1,739,100 | | | | | 98,167 | 98,167 | 98,167 | 58,590 | 58,590 |
| Liner Supply & Installation (Synthetic) - Liner Type 2 | 678,900 | | | | | 53,217 | 53,217 | 53,217 | 28,210 | 28,210 |
| Liner Supply & Installation (Synthetic) - Liner Type 3 | 499,100 | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 4 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 5 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 6 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 1 | 1,032,240 | | | | | 58,267 | 58,267 | 58,267 | 34,776 | 34,776 |
| Liner Protection Layer - Liner Type 2 | 310,980 | | | | | 24,377 | 24,377 | 24,377 | 12,922 | 12,922 |
| Liner Protection Layer - Liner Type 3 | 40,300 | | | | | | | | | |
| Liner Protection Layer - Liner Type 4 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 5 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Collection and Transmission System | | | | | | | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | 336,800 | | | | | 13,333 | 13,333 | 13,333 | 9,760 | 9,760 |
| Auxillary Leachate Collection Pipes (including fittings) | 96,000 | | | | | 6,400 | 6,400 | 6,400 | 3,600 | 3,600 |
| Leachate Collection Sump | 20,000 | | | | | 10,000 | | | 10,000 | |
| Cleanout Ports/Manholes | 50,000 | | | | | 5,000 | | | 10,000 | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | 48,000 | | | | | 48,000 | | | | |

# MfE Landfill Full Cost Accounting Model

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Season | | | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 |
| Year End Date | | 30/06/2002 | 30/06/2003 | 30/06/2004 | 30/06/2005 | 30/06/2006 | 30/06/2007 | 30/06/2008 | 30/06/2009 | 30/06/2010 |
| Year of Operation | | | | | | | 1 | 2 | 3 | 4 |
| **Operating Cell** | | | | | | | **1** | **1** | **1** | **2** |
| Actual Waste Placed (t) | | | | | | | 50,000 | 50,750 | 51,511 | 52,284 |
| Leachate Collection Layer - Liner Type 1 | 1,402,500 | | | | | 79,167 | 79,167 | 79,167 | 47,250 | 47,250 |
| Leachate Collection Layer - Liner Type 2 | 547,500 | | | | | 42,917 | 42,917 | 42,917 | 22,750 | 22,750 |
| Leachate Collection Layer - Liner Type 3 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 4 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 5 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Pre-treatment Facility | 400,000 | | | | | | | | | |
| Leachate Disposal System | 147,000 | | | | | | | | | |
| **Stormwater Management System** | | | | | | | | | | |
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | | | | | | | | | |
| Open Drains | | | | | | | | | | |
| Stabilised Drains / Flumes | | | | | | | | | | |
| Piped Drains | | | | | | | | | | |
| Stormwater Treatment Ponds | | | | | | | | | | |
| Ponds | 550,000 | | | | | 550,000 | | | | |
| Instrumentation | 50,000 | | | | | 50,000 | | | | |
| **Gas Management System** | | | | | | | | | | |
| Horizontal Collectors | 630,000 | | | | | | 30,000 | 30,000 | 30,000 | 18,000 |
| Vertical Extraction Wells | 590,000 | | | | | | | | | |
| Ring Header (below grade) | 1,140,400 | | | | | | | | | |
| Laterals to vertical wells (above grade) | 117,250 | | | | | | | | | |
| Condensate Traps | 60,000 | | | | | | | | | |
| Flare Stations | | | | | | | | | | |
| Interim | 150,000 | | | | | | | | | |
| Final | 550,000 | | | | | | | | | |
| **Final Cover - low permeability barrier layer placement** | | | | | | | | | | |
| Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 85,750 | | | | | | | | | 5,000 |
| Import Topsoil to Final Cover | | | | | | | | | | |
| Unsuitables | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Shortfall - make up with Sub-Topsoil | | | | | | | | | | |
| Sub-Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 288,120 | | | | | | | | | 16,800 |
| Borrow to Final Cover | | | | | | | | | | |
| Low Permeability Material | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Cut to Fill as Cover | | | | | | | | | | |
| Borrow to Fill as Cover | 1,029,000 | | | | | | | | | 60,000 |
| Geosynthetic layer | | | | | | | | | | |
| Drainage layer | 1,029,000 | | | | | | | | | 60,000 |
| Vegetation | 85,750 | | | | | | | | | 5,000 |
| **Other** | | | | | | | | | | |
| Custom 4 | | | | | | | | | | |
| Custom 5 | | | | | | | | | | |
| Custom 6 | | | | | | | | | | |
| Custom 7 | | | | | | | | | | |
| Custom 8 | | | | | | | | | | |
| Custom 9 | | | | | | | | | | |
| **CLOSURE** | | | | | | | | | | |
| **General** | | | | | | | | | | |
| Removal of Facilities | 100,000 | | | | | | | | | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | | | | | | | | |
| Final Cover | 11,148 | | | | | | | | | |
| Landfill Gas Management System | 32,377 | | | | | | | | | |
| Leachate Management System | 45,717 | | | | | | | | | |
| Onsite Surface Water Control System | 9,000 | | | | | | | | | |
| Design Consultants/ Third Party Engineering | 11,894 | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Predevelopment | 886,250 | | 92,083 | 645,417 | 130,417 | 18,333 | | | | |
| Development | 3,467,740 | | | | 23,372 | 471,023 | 155,744 | 152,822 | 94,952 | 96,851 |
| Closure | 21,014 | | | | | | | | | |
| **TOTAL CAPITAL COST** | **43,107,534** | **300,000** | **460,417** | **3,227,083** | **909,177** | **5,272,920** | **1,713,189** | **1,681,041** | **1,044,471** | **1,065,364** |
| **OPERATION** | | | | | | | | | | |
| **Direct Costs & Indirect Costs** | | | | | | | | | | |
| Refuse Placement | 20,749,079 | | | | | | 493,750 | 498,777 | 503,808 | 508,840 |
| Daily Cover | 569,901 | | | | | | 12,500 | 12,688 | 12,878 | 13,071 |
| Nuisance Control Litter, Odour, Birds, Vector | 1,696,220 | | | | | | 41,250 | 41,719 | 42,195 | 42,677 |
| General Maintenance | 189,811 | | | | | | 5,063 | 5,086 | 5,110 | 5,134 |
| Salaries, Wages & Overhead | 7,323,658 | | | | | | 178,125 | 179,297 | 180,486 | 181,694 |
| Aftercare Levy | 549,228 | | | | | | 12,047 | 12,227 | 12,411 | 12,597 |
| Royalty & Host Fee | | | | | | | | | | |
| Intermediate Cover | 569,901 | | | | | | 12,500 | 12,688 | 12,878 | 13,071 |
| Roading (Temporary) | 1,709,703 | | | | | | 37,500 | 38,063 | 38,633 | 39,213 |
| Leachate Tmt & Disposal | | | | | | | | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 1,156,400 | | | | | | 39,067 | 78,133 | 117,200 | 139,600 |
| Operation of Disposal System | 653,820 | | | | | | | | | |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 144,550 | | | | | | 4,883 | 9,767 | 14,650 | 17,450 |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | | | | | | | | | | |
| Gas Control | 885,892 | | | | | | | | | |
| Stormwater Maintenance | 350,000 | | | | | | 10,000 | 10,000 | 10,000 | 10,000 |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 700,000 | | | | | | 20,000 | 20,000 | 20,000 | 20,000 |
| Environmental Compliance | 1,400,000 | | | | | | 40,000 | 40,000 | 40,000 | 40,000 |
| Bond | | | | | | | | | | |
| Regional Council Costs | 420,000 | | | | | | 12,000 | 12,000 | 12,000 | 12,000 |
| Rates | 140,000 | | | | | | 4,000 | 4,000 | 4,000 | 4,000 |
| Water Charges | | | | | | | | | | |
| Electricity Charges | | | | | | | | | | |
| Land Leasing | | | | | | | | | | |
| Custom 10 | | | | | | | | | | |
| Custom 11 | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Operations | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | | | | | | **922,684** | **974,444** | **1,026,249** | **1,059,347** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **300,000** | **460,417** | **3,227,083** | **909,177** | **5,272,920** | **2,635,873** | **2,655,484** | **2,070,719** | **2,124,711** |
| **NET CASHFLOW** | | **(300,000)** | **(460,417)** | **(3,227,083)** | **(909,177)** | **(5,272,920)** | **492,564** | **519,880** | **1,152,275** | **1,146,628** |

## Cashflow Detail

**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Season | | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
| Year End Date | | 30/06/2011 | 30/06/2012 | 30/06/2013 | 30/06/2014 | 30/06/2015 | 30/06/2016 | 30/06/2017 | 30/06/2018 | 30/06/2019 |
| Year of Operation | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| **Operating Cell** | | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **3** |
| Actual Waste Placed (t) | | 53,068 | 53,864 | 54,672 | 55,492 | 56,325 | 57,169 | 58,027 | 58,897 | 59,781 |
| **INCOME** | | | | | | | | | | |
| General Refuse | 142,631,982 | 3,320,409 | 3,370,215 | 3,420,769 | 3,472,080 | 3,524,161 | 3,577,024 | 3,630,679 | 3,685,139 | 3,740,416 |
| Special Refuse | | | | | | | | | | |
| Cleanfill | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | **3,320,409** | **3,370,215** | **3,420,769** | **3,472,080** | **3,524,161** | **3,577,024** | **3,630,679** | **3,685,139** | **3,740,416** |
| **SUNK COSTS** | | | | | | | | | | |
| Sunk Costs | 300,000 | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | | | | | | | | | | |
| Project Management | 160,000 | | | | | | | | | |
| Site Selection | 100,000 | | | | | | | | | |
| Consultation | 250,000 | | | | | | | | | |
| Land Pre-Purchase / Pre-Leasing Agreements | 20,000 | | | | | | | | | |
| Survey and Preliminary Design | 125,000 | | | | | | | | | |
| Geotechnical & Groundwater Investigations | 200,000 | | | | | | | | | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | 200,000 | | | | | | | | | |
| Baseline Monitoring | 100,000 | | | | | | | | | |
| Resource Consent Process | | | | | | | | | | |
| AEE and Consent Application | 650,000 | | | | | | | | | |
| Draft Landfill Management Plan | 20,000 | | | | | | | | | |
| Legal | 50,000 | | | | | | | | | |
| Hearing | 120,000 | | | | | | | | | |
| Appeal | 200,000 | | | | | | | | | |
| Land Acquisition & Associated/ Set Up Costs | 1,350,000 | | | | | | | | | |
| Proceeds from Disposal of Excess Land | | | | | | | | | | |
| Custom 1 | | | | | | | | | | |
| Custom 2 | | | | | | | | | | |
| **BASE COSTS** | | | | | | | | | | |
| Engineering | | | | | | | | | | |
| Detailed Design and Documentation (%) | 1,612,324 | 37,671 | 37,671 | 58,987 | 27,156 | 17,027 | 17,027 | 17,027 | 17,027 | 37,408 |
| Construction Management (%) | 1,746,684 | 50,561 | 40,811 | 40,811 | 63,903 | 29,419 | 18,446 | 18,446 | 18,446 | 18,446 |
| Contractors P & G (%) | 3,359,008 | 97,232 | 78,482 | 78,482 | 122,890 | 56,575 | 35,473 | 35,473 | 35,473 | 35,473 |
| **DEVELOPMENT** | | | | | | | | | | |
| **Site Access** | | | | | | | | | | |
| Intersection Upgrade | 350,000 | | | | | | | | | |
| Other Roading Network Upgrades/ Contributions | | | | | | | | | | |
| Access Road - Intersection to Footprint | 715,000 | | | | | | | | | |
| Special Structures : Diversions, Bridges, etc) | 100,000 | | | | | | | | | |
| **Site Amenities & Services** | | | | | | | | | | |
| Site Entrance | 10,000 | | | | | | | | | |
| Administration Building | 50,000 | | | | | | | | | |
| Weighbridge & Kiosk | 225,000 | | | | | | | | | |
| Machinery Shed, Maintenance Facility | 100,000 | | | | | | | | | |
| Power & Phone | 30,000 | | | | | | | | | |
| Sewerage | 20,000 | | | | | | | | | |
| Water Supply | 30,000 | | | | | | | | | |
| General Civil Works (Sealing, Parking) -Administration | 55,000 | | | | | | | | | |
| Washdown Facility/Wheelwash | 100,000 | | | | | | | | | |
| Fencing | 100,000 | | | | | | | | | |
| Landscaping | | | | | | | | | | |
| Custom 3 | | | | | | | | | | |
| **Cell Construction - Earthworks, Liner, Leachate** | | | | | | | | | | |
| Sediment Control Structures and Measures | | | | | | | | | | |
| Clearing | 522,000 | | | | 75,600 | | | | | |
| Clearing Bush | 124,800 | | | | 21,600 | | | | | |
| Perimeter Access Road | 1,400,000 | 64,000 | 64,000 | 64,000 | 17,333 | 17,333 | 17,333 | 17,333 | 17,333 | 17,333 |
| Topsoil | | | | | | | | | | |
| Cut to Stockpile | 59,010 | 1,860 | 1,860 | 1,860 | 1,060 | 1,060 | 1,060 | 1,060 | 1,060 | 1,060 |
| Unsuitables | | | | | | | | | | |
| Cut to Stockpile | 3,098,400 | 107,040 | 107,040 | 107,040 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 |
| Sub-Topsoil | | | | | | | | | | |
| Cut to Stockpile | 803,736 | 25,080 | 25,080 | 25,080 | 14,151 | 14,151 | 14,151 | 14,151 | 14,151 | 14,151 |
| Low Permeability Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Liner | | | | | | | | | | |
| Cut to Fill as Liner | | | | | | | | | | |
| Borrow to Fill as Liner | 1,247,688 | 44,789 | 44,789 | 44,789 | 14,796 | 14,796 | 14,796 | 14,796 | 14,796 | 14,796 |
| Structural Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Fill | | | | | | | | | | |
| Cut to Fill | 943,675 | 41,200 | 41,200 | 41,200 | 22,335 | 22,335 | 22,335 | 22,335 | 22,335 | 22,335 |
| Borrow to Fill | 946,656 | 20,430 | 20,430 | 20,430 | | | | | | |
| Groundwater Control/ Subsoil Drainage | 398,500 | 16,000 | 16,000 | 16,000 | 750 | 750 | 750 | 750 | 750 | 750 |
| Prepare Subgrade for Laying Liner - Liner Type 1 | 112,200 | 3,780 | 3,780 | 3,780 | 1,850 | 1,850 | 1,850 | 1,850 | 1,850 | 1,850 |
| Prepare Subgrade for Laying Liner - Liner Type 2 | 43,800 | 1,820 | 1,820 | 1,820 | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 3 | 30,225 | | | | 2,828 | 2,828 | 2,828 | 2,828 | 2,828 | 2,828 |
| Prepare Subgrade for Laying Liner - Liner Type 4 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 5 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 6 | | | | | | | | | | |
| Specialised Subgrade Treatment | 2,640,000 | 66,000 | 66,000 | 66,000 | 25,667 | 25,667 | 25,667 | 25,667 | 25,667 | 25,667 |
| Liner Supply & Installation (Synthetic) - Liner Type 1 | 1,739,100 | 58,590 | 58,590 | 58,590 | 28,675 | 28,675 | 28,675 | 28,675 | 28,675 | 28,675 |
| Liner Supply & Installation (Synthetic) - Liner Type 2 | 678,900 | 28,210 | 28,210 | 28,210 | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 3 | 499,100 | | | | 46,690 | 46,690 | 46,690 | 46,690 | 46,690 | 46,690 |
| Liner Supply & Installation (Synthetic) - Liner Type 4 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 5 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 6 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 1 | 1,032,240 | 34,776 | 34,776 | 34,776 | 17,020 | 17,020 | 17,020 | 17,020 | 17,020 | 17,020 |
| Liner Protection Layer - Liner Type 2 | 310,980 | 12,922 | 12,922 | 12,922 | | | | | | |
| Liner Protection Layer - Liner Type 3 | 40,300 | | | | 3,770 | 3,770 | 3,770 | 3,770 | 3,770 | 3,770 |
| Liner Protection Layer - Liner Type 4 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 5 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Collection and Transmission System | | | | | | | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | 336,800 | 9,760 | 9,760 | 9,760 | 9,067 | 9,067 | 9,067 | 9,067 | 9,067 | 9,067 |
| Auxillary Leachate Collection Pipes (including fittings) | 96,000 | 3,600 | 3,600 | 3,600 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Leachate Collection Sump | 20,000 | | | | | | | | | |
| Cleanout Ports/Manholes | 50,000 | | | | 5,000 | | | | | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | 48,000 | | | | | | | | | |

# MfE Landfill Full Cost Accounting Model

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| Season | | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
| Year End Date | | 30/06/2011 | 30/06/2012 | 30/06/2013 | 30/06/2014 | 30/06/2015 | 30/06/2016 | 30/06/2017 | 30/06/2018 | 30/06/2019 |
| Year of Operation | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| **Operating Cell** | | **2** | **2** | **2** | **2** | **3** | **3** | **3** | **3** | **3** |
| Actual Waste Placed (t) | | 53,068 | 53,864 | 54,672 | 55,492 | 56,325 | 57,169 | 58,027 | 58,897 | 59,781 |
| Leachate Collection Layer - Liner Type 1 | 1,402,500 | 47,250 | 47,250 | 47,250 | 23,125 | 23,125 | 23,125 | 23,125 | 23,125 | 23,125 |
| Leachate Collection Layer - Liner Type 2 | 547,500 | 22,750 | 22,750 | 22,750 | | | | | | |
| Leachate Collection Layer - Liner Type 3 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 4 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 5 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Pre-treatment Facility | 400,000 | | | | 400,000 | | | | | |
| Leachate Disposal System | 147,000 | | | | 147,000 | | | | | |
| **Stormwater Management System** | | | | | | | | | | |
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | | | | | | | | | |
| Open Drains | | | | | | | | | | |
| Stabilised Drains / Flumes | | | | | | | | | | |
| Piped Drains | | | | | | | | | | |
| Stormwater Treatment Ponds | | | | | | | | | | |
| Ponds | 550,000 | | | | | | | | | |
| Instrumentation | 50,000 | | | | | | | | | |
| **Gas Management System** | | | | | | | | | | |
| Horizontal Collectors | 630,000 | 18,000 | 18,000 | 18,000 | 18,000 | 15,000 | 15,000 | 15,000 | 15,000 | 15,000 |
| Vertical Extraction Wells | 590,000 | | | | | 19,667 | 19,667 | 19,667 | 19,667 | 19,667 |
| Ring Header (below grade) | 1,140,400 | | | | 56,800 | | | | | |
| Laterals to vertical wells (above grade) | 117,250 | | | | | | | | | |
| Condensate Traps | 60,000 | | | | 10,000 | | | | | |
| Flare Stations | | | | | | | | | | |
| Interim | 150,000 | 150,000 | | | | | | | | |
| Final | 550,000 | | | | | | | | | |
| **Final Cover - low permeability barrier layer placement** | | | | | | | | | | |
| Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 85,750 | | | | | 5,750 | | | | |
| Import Topsoil to Final Cover | | | | | | | | | | |
| Unsuitables | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Shortfall - make up with Sub-Topsoil | | | | | | | | | | |
| Sub-Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 288,120 | | | | | 19,320 | | | | |
| Borrow to Final Cover | | | | | | | | | | |
| Low Permeability Material | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Cut to Fill as Cover | | | | | | | | | | |
| Borrow to Fill as Cover | 1,029,000 | | | | | 69,000 | | | | |
| Geosynthetic layer | | | | | | | | | | |
| Drainage layer | 1,029,000 | | | | | 69,000 | | | | |
| Vegetation | 85,750 | | | | | 5,750 | | | | |
| **Other** | | | | | | | | | | |
| Custom 4 | | | | | | | | | | |
| Custom 5 | | | | | | | | | | |
| Custom 6 | | | | | | | | | | |
| Custom 7 | | | | | | | | | | |
| Custom 8 | | | | | | | | | | |
| Custom 9 | | | | | | | | | | |
| **CLOSURE** | | | | | | | | | | |
| **General** | | | | | | | | | | |
| Removal of Facilities | 100,000 | | | | | | | | | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | | | | | | | | |
| Final Cover | 11,148 | | | | | | | | | |
| Landfill Gas Management System | 32,377 | | | | | | | | | |
| Leachate Management System | 45,717 | | | | | | | | | |
| Onsite Surface Water Control System | 9,000 | | | | | | | | | |
| Design Consultants/ Third Party Engineering | 11,894 | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Predevelopment | 886,250 | | | | | | | | | |
| Development | 3,467,740 | 96,332 | 78,482 | 80,614 | 119,707 | 55,563 | 35,473 | 35,473 | 35,473 | 37,511 |
| Closure | 21,014 | | | | | | | | | |
| **TOTAL CAPITAL COST** | **43,107,534** | **1,059,653** | **863,303** | **886,750** | **1,316,772** | **611,188** | **390,202** | **390,202** | **390,202** | **412,621** |
| **OPERATION** | | | | | | | | | | |
| **Direct Costs & Indirect Costs** | | | | | | | | | | |
| Refuse Placement | 20,749,079 | 513,872 | 518,900 | 523,923 | 528,937 | 533,941 | 538,932 | 543,905 | 548,860 | 553,792 |
| Daily Cover | 569,901 | 13,267 | 13,466 | 13,668 | 13,873 | 14,081 | 14,292 | 14,507 | 14,724 | 14,945 |
| Nuisance Control Litter, Odour, Birds, Vector | 1,696,220 | 43,168 | 43,665 | 44,170 | 44,683 | 45,203 | 45,731 | 46,267 | 46,811 | 47,363 |
| General Maintenance | 189,811 | 5,158 | 5,183 | 5,209 | 5,234 | 5,260 | 5,287 | 5,313 | 5,341 | 5,368 |
| Salaries, Wages & Overhead | 7,323,658 | 182,919 | 184,163 | 185,425 | 186,707 | 188,007 | 189,327 | 190,667 | 192,027 | 193,408 |
| Aftercare Levy | 549,228 | 12,786 | 12,978 | 13,172 | 13,370 | 13,570 | 13,774 | 13,981 | 14,190 | 14,403 |
| Royalty & Host Fee | | | | | | | | | | |
| Intermediate Cover | 569,901 | 13,267 | 13,466 | 13,668 | 13,873 | 14,081 | 14,292 | 14,507 | 14,724 | 14,945 |
| Roading (Temporary) | 1,709,703 | 39,801 | 40,398 | 41,004 | 41,619 | 42,243 | 42,877 | 43,520 | 44,173 | 44,836 |
| Leachate Tmt & Disposal | | | | | | | | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 1,156,400 | 162,000 | 184,400 | 206,800 | 229,200 | | | | | |
| Operation of Disposal System | 653,820 | | | | | 16,590 | 17,085 | 17,580 | 18,075 | 18,570 |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 144,550 | 20,250 | 23,050 | 25,850 | 28,650 | | | | | |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | | | | | | | | | | |
| Gas Control | 885,892 | | 12,908 | 14,476 | 16,044 | 16,968 | 17,892 | 18,816 | 19,740 | 20,664 |
| Stormwater Maintenance | 350,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 700,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 |
| Environmental Compliance | 1,400,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Bond | | | | | | | | | | |
| Regional Council Costs | 420,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Rates | 140,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Water Charges | | | | | | | | | | |
| Electricity Charges | | | | | | | | | | |
| Land Leasing | | | | | | | | | | |
| Custom 10 | | | | | | | | | | |
| Custom 11 | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Operations | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | **1,092,488** | **1,138,577** | **1,173,365** | **1,208,190** | **975,946** | **985,489** | **995,063** | **1,004,666** | **1,014,294** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **2,152,141** | **2,001,880** | **2,060,115** | **2,524,962** | **1,587,133** | **1,375,692** | **1,385,266** | **1,394,868** | **1,426,915** |
| **NET CASHFLOW** | | **1,168,268** | **1,368,335** | **1,360,653** | **947,118** | **1,937,028** | **2,201,332** | **2,245,413** | **2,290,271** | **2,313,501** |

## Cashflow Detail

**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Season | | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 |
| Year End Date | | 30/06/2020 | 30/06/2021 | 30/06/2022 | 30/06/2023 | 30/06/2024 | 30/06/2025 | 30/06/2026 | 30/06/2027 | 30/06/2028 |
| Year of Operation | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| **Operating Cell** | | **3** | **4** | **4** | **4** | **4** | **4** | **5** | **5** | **5** |
| Actual Waste Placed (t) | | 60,678 | 61,588 | 62,512 | 63,449 | 64,401 | 65,367 | 66,348 | 67,343 | 68,353 |
| **INCOME** | | | | | | | | | | |
| General Refuse | 142,631,982 | 3,796,523 | 3,853,470 | 3,911,272 | 3,969,942 | 4,029,491 | 4,089,933 | 4,151,282 | 4,213,551 | 4,276,755 |
| Special Refuse | | | | | | | | | | |
| Cleanfill | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | **3,796,523** | **3,853,470** | **3,911,272** | **3,969,942** | **4,029,491** | **4,089,933** | **4,151,282** | **4,213,551** | **4,276,755** |
| **SUNK COSTS** | | | | | | | | | | |
| Sunk Costs | 300,000 | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | | | | | | | | | | |
| Project Management | 160,000 | | | | | | | | | |
| Site Selection | 100,000 | | | | | | | | | |
| Consultation | 250,000 | | | | | | | | | |
| Land Pre-Purchase / Pre-Leasing Agreements | 20,000 | | | | | | | | | |
| Survey and Preliminary Design | 125,000 | | | | | | | | | |
| Geotechnical & Groundwater Investigations | 200,000 | | | | | | | | | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | 200,000 | | | | | | | | | |
| Baseline Monitoring | 100,000 | | | | | | | | | |
| Resource Consent Process | | | | | | | | | | |
| AEE and Consent Application | 650,000 | | | | | | | | | |
| Draft Landfill Management Plan | 20,000 | | | | | | | | | |
| Legal | 50,000 | | | | | | | | | |
| Hearing | 120,000 | | | | | | | | | |
| Appeal | 200,000 | | | | | | | | | |
| Land Acquisition & Associated/ Set Up Costs | 1,350,000 | | | | | | | | | |
| Proceeds from Disposal of Excess Land | | | | | | | | | | |
| Custom 1 | | | | | | | | | | |
| Custom 2 | | | | | | | | | | |
| **BASE COSTS** | | | | | | | | | | |
| Engineering | | | | | | | | | | |
| Detailed Design and Documentation (%) | 1,612,324 | 43,221 | 25,605 | 25,605 | 25,605 | 48,175 | 55,612 | 37,996 | 37,996 | 37,996 |
| Construction Management (%) | 1,746,684 | 40,525 | 46,822 | 27,738 | 27,738 | 27,738 | 52,189 | 60,246 | 41,162 | 41,162 |
| Contractors P & G (%) | 3,359,008 | 77,933 | 90,043 | 53,343 | 53,343 | 53,343 | 100,364 | 115,858 | 79,158 | 79,158 |
| **DEVELOPMENT** | | | | | | | | | | |
| **Site Access** | | | | | | | | | | |
| Intersection Upgrade | 350,000 | | | | | | | | | |
| Other Roading Network Upgrades/ Contributions | | | | | | | | | | |
| Access Road - Intersection to Footprint | 715,000 | | | | | | | | | |
| Special Structures : Diversions, Bridges, etc) | 100,000 | | | | | | | | | |
| **Site Amenities & Services** | | | | | | | | | | |
| Site Entrance | 10,000 | | | | | | | | | |
| Administration Building | 50,000 | | | | | | | | | |
| Weighbridge & Kiosk | 225,000 | | | | | | | | | |
| Machinery Shed, Maintenance Facility | 100,000 | | | | | | | | | |
| Power & Phone | 30,000 | | | | | | | | | |
| Sewerage | 20,000 | | | | | | | | | |
| Water Supply | 30,000 | | | | | | | | | |
| General Civil Works (Sealing, Parking) -Administration | 55,000 | | | | | | | | | |
| Washdown Facility/Wheelwash | 100,000 | | | | | | | | | |
| Fencing | 100,000 | | | | | | | | | |
| Landscaping | | | | | | | | | | |
| Custom 3 | | | | | | | | | | |
| **Cell Construction - Earthworks, Liner, Leachate** | | | | | | | | | | |
| Sediment Control Structures and Measures | | | | | | | | | | |
| Clearing | 522,000 | 32,400 | | | | | 52,200 | | | |
| Clearing Bush | 124,800 | 81,000 | | | | | 22,200 | | | |
| Perimeter Access Road | 1,400,000 | | | | | | 44,800 | 44,800 | 44,800 | 44,800 |
| Topsoil | | | | | | | | | | |
| Cut to Stockpile | 59,010 | 1,080 | 1,080 | 1,080 | 1,080 | 1,080 | 2,160 | 2,160 | 2,160 | 2,160 |
| Unsuitables | | | | | | | | | | |
| Cut to Stockpile | 3,098,400 | 84,480 | 84,480 | 84,480 | 84,480 | 84,480 | 80,160 | 80,160 | 80,160 | 80,160 |
| Sub-Topsoil | | | | | | | | | | |
| Cut to Stockpile | 803,736 | 14,447 | 14,447 | 14,447 | 14,447 | 14,447 | 31,089 | 31,089 | 31,089 | 31,089 |
| Low Permeability Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Liner | | | | | | | | | | |
| Cut to Fill as Liner | | | | | | | | | | |
| Borrow to Fill as Liner | 1,247,688 | 15,836 | 15,836 | 15,836 | 15,836 | 15,836 | 39,990 | 39,990 | 39,990 | 39,990 |
| Structural Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Fill | | | | | | | | | | |
| Cut to Fill | 943,675 | 10,308 | 10,308 | 10,308 | 10,308 | 10,308 | 14,525 | 14,525 | 14,525 | 14,525 |
| Borrow to Fill | 946,656 | 43,179 | 43,179 | 43,179 | 43,179 | 43,179 | 36,153 | 36,153 | 36,153 | 36,153 |
| Groundwater Control/ Subsoil Drainage | 398,500 | 5,600 | 5,600 | 5,600 | 5,600 | 5,600 | 20,000 | 20,000 | 20,000 | 20,000 |
| Prepare Subgrade for Laying Liner - Liner Type 1 | 112,200 | 1,980 | 1,980 | 1,980 | 1,980 | 1,980 | 4,060 | 4,060 | 4,060 | 4,060 |
| Prepare Subgrade for Laying Liner - Liner Type 2 | 43,800 | | | | | | 940 | 940 | 940 | 940 |
| Prepare Subgrade for Laying Liner - Liner Type 3 | 30,225 | 2,652 | 2,652 | 2,652 | 2,652 | 2,652 | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 4 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 5 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 6 | | | | | | | | | | |
| Specialised Subgrade Treatment | 2,640,000 | 79,200 | 79,200 | 79,200 | 79,200 | 79,200 | 110,000 | 110,000 | 110,000 | 110,000 |
| Liner Supply & Installation (Synthetic) - Liner Type 1 | 1,739,100 | 30,690 | 30,690 | 30,690 | 30,690 | 30,690 | 62,930 | 62,930 | 62,930 | 62,930 |
| Liner Supply & Installation (Synthetic) - Liner Type 2 | 678,900 | | | | | | 14,570 | 14,570 | 14,570 | 14,570 |
| Liner Supply & Installation (Synthetic) - Liner Type 3 | 499,100 | 43,792 | 43,792 | 43,792 | 43,792 | 43,792 | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 4 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 5 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 6 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 1 | 1,032,240 | 18,216 | 18,216 | 18,216 | 18,216 | 18,216 | 37,352 | 37,352 | 37,352 | 37,352 |
| Liner Protection Layer - Liner Type 2 | 310,980 | | | | | | 6,674 | 6,674 | 6,674 | 6,674 |
| Liner Protection Layer - Liner Type 3 | 40,300 | 3,536 | 3,536 | 3,536 | 3,536 | 3,536 | | | | |
| Liner Protection Layer - Liner Type 4 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 5 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Collection and Transmission System | | | | | | | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | 336,800 | 3,360 | 3,360 | 3,360 | 3,360 | 3,360 | 21,600 | 21,600 | 21,600 | 21,600 |
| Auxillary Leachate Collection Pipes (including fittings) | 96,000 | 2,040 | 2,040 | 2,040 | 2,040 | 2,040 | 2,160 | 2,160 | 2,160 | 2,160 |
| Leachate Collection Sump | 20,000 | | | | | | | | | |
| Cleanout Ports/Manholes | 50,000 | | | | | | 5,000 | | | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | 48,000 | | | | | | | | | |

# MfE Landfill Full Cost Accounting Model

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| Season | | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 |
| Year End Date | | 30/06/2020 | 30/06/2021 | 30/06/2022 | 30/06/2023 | 30/06/2024 | 30/06/2025 | 30/06/2026 | 30/06/2027 | 30/06/2028 |
| Year of Operation | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| **Operating Cell** | | **3** | **4** | **4** | **4** | **4** | **4** | **5** | **5** | **5** |
| Actual Waste Placed (t) | | 60,678 | 61,588 | 62,512 | 63,449 | 64,401 | 65,367 | 66,348 | 67,343 | 68,353 |
| Leachate Collection Layer - Liner Type 1 | 1,402,500 | 24,750 | 24,750 | 24,750 | 24,750 | 24,750 | 50,750 | 50,750 | 50,750 | 50,750 |
| Leachate Collection Layer - Liner Type 2 | 547,500 | | | | | | 11,750 | 11,750 | 11,750 | 11,750 |
| Leachate Collection Layer - Liner Type 3 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 4 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 5 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Pre-treatment Facility | 400,000 | | | | | | | | | |
| Leachate Disposal System | 147,000 | | | | | | | | | |
| **Stormwater Management System** | | | | | | | | | | |
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | | | | | | | | | |
| Open Drains | | | | | | | | | | |
| Stabilised Drains / Flumes | | | | | | | | | | |
| Piped Drains | | | | | | | | | | |
| Stormwater Treatment Ponds | | | | | | | | | | |
| Ponds | 550,000 | | | | | | | | | |
| Instrumentation | 50,000 | | | | | | | | | |
| **Gas Management System** | | | | | | | | | | |
| Horizontal Collectors | 630,000 | 15,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 |
| Vertical Extraction Wells | 590,000 | 19,667 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 |
| Ring Header (below grade) | 1,140,400 | 56,800 | | | | | 56,800 | | | |
| Laterals to vertical wells (above grade) | 117,250 | 23,450 | | | | | 23,450 | | | |
| Condensate Traps | 60,000 | 10,000 | | | | | 10,000 | | | |
| Flare Stations | | | | | | | | | | |
| Interim | 150,000 | | | | | | | | | |
| Final | 550,000 | | | | | | | | | |
| **Final Cover - low permeability barrier layer placement** | | | | | | | | | | |
| Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 85,750 | | 10,000 | | | | | 10,000 | | |
| Import Topsoil to Final Cover | | | | | | | | | | |
| Unsuitables | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Shortfall - make up with Sub-Topsoil | | | | | | | | | | |
| Sub-Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 288,120 | | 33,600 | | | | | 33,600 | | |
| Borrow to Final Cover | | | | | | | | | | |
| Low Permeability Material | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Cut to Fill as Cover | | | | | | | | | | |
| Borrow to Fill as Cover | 1,029,000 | | 120,000 | | | | | 120,000 | | |
| Geosynthetic layer | | | | | | | | | | |
| Drainage layer | 1,029,000 | | 120,000 | | | | | 120,000 | | |
| Vegetation | 85,750 | | 10,000 | | | | | 10,000 | | |
| **Other** | | | | | | | | | | |
| Custom 4 | | | | | | | | | | |
| Custom 5 | | | | | | | | | | |
| Custom 6 | | | | | | | | | | |
| Custom 7 | | | | | | | | | | |
| Custom 8 | | | | | | | | | | |
| Custom 9 | | | | | | | | | | |
| **CLOSURE** | | | | | | | | | | |
| **General** | | | | | | | | | | |
| Removal of Facilities | 100,000 | | | | | | | | | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | | | | | | | | |
| Final Cover | 11,148 | | | | | | | | | |
| Landfill Gas Management System | 32,377 | | | | | | | | | |
| Leachate Management System | 45,717 | | | | | | | | | |
| Onsite Surface Water Control System | 9,000 | | | | | | | | | |
| Design Consultants/ Third Party Engineering | 11,894 | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Predevelopment | 886,250 | | | | | | | | | |
| Development | 3,467,740 | 78,514 | 88,282 | 53,343 | 53,343 | 55,600 | 101,108 | 114,096 | 79,158 | 79,158 |
| Closure | 21,014 | | | | | | | | | |
| **TOTAL CAPITAL COST** | **43,107,534** | **863,655** | **971,097** | **586,775** | **586,775** | **611,602** | **1,112,185** | **1,255,058** | **870,736** | **870,736** |
| **OPERATION** | | | | | | | | | | |
| **Direct Costs & Indirect Costs** | | | | | | | | | | |
| Refuse Placement | 20,749,079 | 558,698 | 563,575 | 568,420 | 573,227 | 579,206 | 586,907 | 594,694 | 602,567 | 610,527 |
| Daily Cover | 569,901 | 15,169 | 15,397 | 15,628 | 15,862 | 16,100 | 16,342 | 16,587 | 16,836 | 17,088 |
| Nuisance Control Litter, Odour, Birds, Vector | 1,696,220 | 47,924 | 48,492 | 49,070 | 49,656 | 50,063 | 50,214 | 50,367 | 50,522 | 50,680 |
| General Maintenance | 189,811 | 5,396 | 5,425 | 5,453 | 5,483 | 5,503 | 5,511 | 5,518 | 5,526 | 5,534 |
| Salaries, Wages & Overhead | 7,323,658 | 194,809 | 196,231 | 197,674 | 199,139 | 201,253 | 204,272 | 207,336 | 210,446 | 213,603 |
| Aftercare Levy | 549,228 | 14,619 | 14,838 | 15,061 | 15,287 | 15,516 | 15,749 | 15,985 | 16,225 | 16,468 |
| Royalty & Host Fee | | | | | | | | | | |
| Intermediate Cover | 569,901 | 15,169 | 15,397 | 15,628 | 15,862 | 16,100 | 16,342 | 16,587 | 16,836 | 17,088 |
| Roading (Temporary) | 1,709,703 | 45,508 | 46,191 | 46,884 | 47,587 | 48,301 | 49,025 | 49,761 | 50,507 | 51,265 |
| Leachate Tmt & Disposal | | | | | | | | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 1,156,400 | | | | | | | | | |
| Operation of Disposal System | 653,820 | 19,065 | 19,566 | 20,067 | 20,568 | 21,069 | 21,570 | 22,320 | 23,070 | 23,820 |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 144,550 | | | | | | | | | |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | | | | | | | | | | |
| Gas Control | 885,892 | 21,588 | 22,523 | 23,458 | 24,394 | 25,329 | 26,264 | 27,664 | 29,064 | 30,464 |
| Stormwater Maintenance | 350,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 700,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 |
| Environmental Compliance | 1,400,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Bond | | | | | | | | | | |
| Regional Council Costs | 420,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Rates | 140,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Water Charges | | | | | | | | | | |
| Electricity Charges | | | | | | | | | | |
| Land Leasing | | | | | | | | | | |
| Custom 10 | | | | | | | | | | |
| Custom 11 | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Operations | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | **1,023,946** | **1,033,636** | **1,043,343** | **1,053,066** | **1,064,440** | **1,078,195** | **1,092,819** | **1,107,599** | **1,122,537** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **1,887,601** | **2,004,733** | **1,630,118** | **1,639,841** | **1,676,042** | **2,190,380** | **2,347,877** | **1,978,335** | **1,993,273** |
| **NET CASHFLOW** | | **1,908,922** | **1,848,738** | **2,281,154** | **2,330,101** | **2,353,449** | **1,899,553** | **1,803,405** | **2,235,216** | **2,283,481** |

## Cashflow Detail

**DESCRIPTION**

Project Name: **Typical Example - Hypothetical Landfill**
Project Location: A District
Scenario No: 1
Scenario Description: 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| Season | | 2028/29 | 2029/30 | 2030/31 | 2031/32 | 2032/33 | 2033/34 | 2034/35 | 2035/36 | 2036/37 |
| Year End Date | | 30/06/2029 | 30/06/2030 | 30/06/2031 | 30/06/2032 | 30/06/2033 | 30/06/2034 | 30/06/2035 | 30/06/2036 | 30/06/2037 |
| Year of Operation | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| **Operating Cell** | | **5** | **5** | **6** | **6** | **6** | **6** | **6** | **7** | **7** |
| Actual Waste Placed (t) | | 69,378 | 70,419 | 71,475 | 72,547 | 73,635 | 74,740 | 75,861 | 76,999 | 78,154 |
| **INCOME** | | | | | | | | | | |
| General Refuse | 142,631,982 | 4,340,906 | 4,406,019 | 4,472,110 | 4,539,191 | 4,607,279 | 4,676,388 | 4,746,534 | 4,817,732 | 4,889,998 |
| Special Refuse | | | | | | | | | | |
| Cleanfill | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | **4,340,906** | **4,406,019** | **4,472,110** | **4,539,191** | **4,607,279** | **4,676,388** | **4,746,534** | **4,817,732** | **4,889,998** |
| **SUNK COSTS** | | | | | | | | | | |
| Sunk Costs | 300,000 | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | | | | | | | | | | |
| Project Management | 160,000 | | | | | | | | | |
| Site Selection | 100,000 | | | | | | | | | |
| Consultation | 250,000 | | | | | | | | | |
| Land Pre-Purchase / Pre-Leasing Agreements | 20,000 | | | | | | | | | |
| Survey and Preliminary Design | 125,000 | | | | | | | | | |
| Geotechnical & Groundwater Investigations | 200,000 | | | | | | | | | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | 200,000 | | | | | | | | | |
| Baseline Monitoring | 100,000 | | | | | | | | | |
| Resource Consent Process | | | | | | | | | | |
| AEE and Consent Application | 650,000 | | | | | | | | | |
| Draft Landfill Management Plan | 20,000 | | | | | | | | | |
| Legal | 50,000 | | | | | | | | | |
| Hearing | 120,000 | | | | | | | | | |
| Appeal | 200,000 | | | | | | | | | |
| Land Acquisition & Associated/ Set Up Costs | 1,350,000 | | | | | | | | | |
| Proceeds from Disposal of Excess Land | | | | | | | | | | |
| Custom 1 | | | | | | | | | | |
| Custom 2 | | | | | | | | | | |
| **BASE COSTS** | | | | | | | | | | |
| Engineering | | | | | | | | | | |
| Detailed Design and Documentation (%) | 1,612,324 | 55,607 | 42,320 | 57,704 | 24,704 | 24,704 | 60,886 | 72,119 | 36,887 | 36,887 |
| Construction Management (%) | 1,746,684 | 41,162 | 60,241 | 45,847 | 62,513 | 26,763 | 26,763 | 65,960 | 78,129 | 39,961 |
| Contractors P & G (%) | 3,359,008 | 79,158 | 115,848 | 88,167 | 120,217 | 51,467 | 51,467 | 126,847 | 150,249 | 76,849 |
| **DEVELOPMENT** | | | | | | | | | | |
| **Site Access** | | | | | | | | | | |
| Intersection Upgrade | 350,000 | | | | | | | | | |
| Other Roading Network Upgrades/ Contributions | | | | | | | | | | |
| Access Road - Intersection to Footprint | 715,000 | | | | | | | | | |
| Special Structures : Diversions, Bridges, etc) | 100,000 | | | | | | | | | |
| **Site Amenities & Services** | | | | | | | | | | |
| Site Entrance | 10,000 | | | | | | | | | |
| Administration Building | 50,000 | | | | | | | | | |
| Weighbridge & Kiosk | 225,000 | | | | | | | | | |
| Machinery Shed, Maintenance Facility | 100,000 | | | | | | | | | |
| Power & Phone | 30,000 | | | | | | | | | |
| Sewerage | 20,000 | | | | | | | | | |
| Water Supply | 30,000 | | | | | | | | | |
| General Civil Works (Sealing, Parking) -Administration | 55,000 | | | | | | | | | |
| Washdown Facility/Wheelwash | 100,000 | | | | | | | | | |
| Fencing | 100,000 | | | | | | | | | |
| Landscaping | | | | | | | | | | |
| Custom 3 | | | | | | | | | | |
| **Cell Construction - Earthworks, Liner, Leachate** | | | | | | | | | | |
| Sediment Control Structures and Measures | | | | | | | | | | |
| Clearing | 522,000 | | 72,000 | | | | | 59,400 | | |
| Clearing Bush | 124,800 | | | | | | | | | |
| Perimeter Access Road | 1,400,000 | 44,800 | 44,800 | 44,800 | 44,800 | 44,800 | 44,800 | 24,000 | 24,000 | 24,000 |
| Topsoil | | | | | | | | | | |
| Cut to Stockpile | 59,010 | 2,160 | 1,590 | 1,590 | 1,590 | 1,590 | 1,590 | 1,650 | 1,650 | 1,650 |
| Unsuitables | | | | | | | | | | |
| Cut to Stockpile | 3,098,400 | 80,160 | 26,880 | 26,880 | 26,880 | 26,880 | 26,880 | 126,400 | 126,400 | 126,400 |
| Sub-Topsoil | | | | | | | | | | |
| Cut to Stockpile | 803,736 | 31,089 | 21,762 | 21,762 | 21,762 | 21,762 | 21,762 | 22,206 | 22,206 | 22,206 |
| Low Permeability Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Liner | | | | | | | | | | |
| Cut to Fill as Liner | | | | | | | | | | |
| Borrow to Fill as Liner | 1,247,688 | 39,990 | 36,311 | 36,311 | 36,311 | 36,311 | 36,311 | 39,990 | 39,990 | 39,990 |
| Structural Material | | | | | | | | | | |
| Cut to Stockpile | | | | | | | | | | |
| Stockpile to Fill | | | | | | | | | | |
| Cut to Fill | 943,675 | 14,525 | 13,808 | 13,808 | 13,808 | 13,808 | 13,808 | 8,708 | 8,708 | 8,708 |
| Borrow to Fill | 946,656 | 36,153 | 14,839 | 14,839 | 14,839 | 14,839 | 14,839 | 56,063 | 56,063 | 56,063 |
| Groundwater Control/ Subsoil Drainage | 398,500 | 20,000 | 400 | 400 | 400 | 400 | 400 | 14,167 | 14,167 | 14,167 |
| Prepare Subgrade for Laying Liner - Liner Type 1 | 112,200 | 4,060 | 4,540 | 4,540 | 4,540 | 4,540 | 4,540 | 1,717 | 1,717 | 1,717 |
| Prepare Subgrade for Laying Liner - Liner Type 2 | 43,800 | 940 | | | | | | 3,283 | 3,283 | 3,283 |
| Prepare Subgrade for Laying Liner - Liner Type 3 | 30,225 | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 4 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 5 | | | | | | | | | | |
| Prepare Subgrade for Laying Liner - Liner Type 6 | | | | | | | | | | |
| Specialised Subgrade Treatment | 2,640,000 | 110,000 | 26,400 | 26,400 | 26,400 | 26,400 | 26,400 | 95,333 | 95,333 | 95,333 |
| Liner Supply & Installation (Synthetic) - Liner Type 1 | 1,739,100 | 62,930 | 70,370 | 70,370 | 70,370 | 70,370 | 70,370 | 26,608 | 26,608 | 26,608 |
| Liner Supply & Installation (Synthetic) - Liner Type 2 | 678,900 | 14,570 | | | | | | 50,892 | 50,892 | 50,892 |
| Liner Supply & Installation (Synthetic) - Liner Type 3 | 499,100 | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 4 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 5 | | | | | | | | | | |
| Liner Supply & Installation (Synthetic) - Liner Type 6 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 1 | 1,032,240 | 37,352 | 41,768 | 41,768 | 41,768 | 41,768 | 41,768 | 15,793 | 15,793 | 15,793 |
| Liner Protection Layer - Liner Type 2 | 310,980 | 6,674 | | | | | | 23,312 | 23,312 | 23,312 |
| Liner Protection Layer - Liner Type 3 | 40,300 | | | | | | | | | |
| Liner Protection Layer - Liner Type 4 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 5 | | | | | | | | | | |
| Liner Protection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Collection and Transmission System | | | | | | | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | 336,800 | 21,600 | 8,960 | 8,960 | 8,960 | 8,960 | 8,960 | 4,000 | 4,000 | 4,000 |
| Auxillary Leachate Collection Pipes (including fittings) | 96,000 | 2,160 | 960 | 960 | 960 | 960 | 960 | 3,500 | 3,500 | 3,500 |
| Leachate Collection Sump | 20,000 | | | | | | | | | |
| Cleanout Ports/Manholes | 50,000 | | 10,000 | | | | | 15,000 | | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | 48,000 | | | | | | | | | |

# MfE Landfill Full Cost Accounting Model

| | Total | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 |
| Season | | 2028/29 | 2029/30 | 2030/31 | 2031/32 | 2032/33 | 2033/34 | 2034/35 | 2035/36 | 2036/37 |
| Year End Date | | 30/06/2029 | 30/06/2030 | 30/06/2031 | 30/06/2032 | 30/06/2033 | 30/06/2034 | 30/06/2035 | 30/06/2036 | 30/06/2037 |
| Year of Operation | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| **Operating Cell** | | **5** | **5** | **6** | **6** | **6** | **6** | **6** | **7** | **7** |
| Actual Waste Placed (t) | | 69,378 | 70,419 | 71,475 | 72,547 | 73,635 | 74,740 | 75,861 | 76,999 | 78,154 |
| Leachate Collection Layer - Liner Type 1 | 1,402,500 | 50,750 | 56,750 | 56,750 | 56,750 | 56,750 | 56,750 | 21,458 | 21,458 | 21,458 |
| Leachate Collection Layer - Liner Type 2 | 547,500 | 11,750 | | | | | | 41,042 | 41,042 | 41,042 |
| Leachate Collection Layer - Liner Type 3 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 4 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 5 | | | | | | | | | | |
| Leachate Collection Layer - Liner Type 6 | | | | | | | | | | |
| Leachate Pre-treatment Facility | 400,000 | | | | | | | | | |
| Leachate Disposal System | 147,000 | | | | | | | | | |
| **Stormwater Management System** | | | | | | | | | | |
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | | | | | | | | | |
| Open Drains | | | | | | | | | | |
| Stabilised Drains / Flumes | | | | | | | | | | |
| Piped Drains | | | | | | | | | | |
| Stormwater Treatment Ponds | | | | | | | | | | |
| Ponds | 550,000 | | | | | | | | | |
| Instrumentation | 50,000 | | | | | | | | | |
| **Gas Management System** | | | | | | | | | | |
| Horizontal Collectors | 630,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 18,000 | 15,000 | 15,000 |
| Vertical Extraction Wells | 590,000 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 23,600 | 19,667 | 19,667 |
| Ring Header (below grade) | 1,140,400 | | 399,600 | | | | | 285,200 | | |
| Laterals to vertical wells (above grade) | 117,250 | | 23,450 | | | | | 23,450 | | |
| Condensate Traps | 60,000 | | 10,000 | | | | | 10,000 | | |
| Flare Stations | | | | | | | | | | |
| Interim | 150,000 | | | | | | | | | |
| Final | 550,000 | | | | 550,000 | | | | | |
| **Final Cover - low permeability barrier layer placement** | | | | | | | | | | |
| Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 85,750 | | | 10,000 | | | | | 20,000 | |
| Import Topsoil to Final Cover | | | | | | | | | | |
| Unsuitables | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Shortfall - make up with Sub-Topsoil | | | | | | | | | | |
| Sub-Topsoil | | | | | | | | | | |
| Stockpile to Final Cover | 288,120 | | | 33,600 | | | | | 67,200 | |
| Borrow to Final Cover | | | | | | | | | | |
| Low Permeability Material | | | | | | | | | | |
| Stockpile to Final Cover | | | | | | | | | | |
| Cut to Fill as Cover | | | | | | | | | | |
| Borrow to Fill as Cover | 1,029,000 | | | 120,000 | | | | | 240,000 | |
| Geosynthetic layer | | | | | | | | | | |
| Drainage layer | 1,029,000 | | | 120,000 | | | | | 240,000 | |
| Vegetation | 85,750 | | | 10,000 | | | | | 20,000 | |
| **Other** | | | | | | | | | | |
| Custom 4 | | | | | | | | | | |
| Custom 5 | | | | | | | | | | |
| Custom 6 | | | | | | | | | | |
| Custom 7 | | | | | | | | | | |
| Custom 8 | | | | | | | | | | |
| Custom 9 | | | | | | | | | | |
| **CLOSURE** | | | | | | | | | | |
| **General** | | | | | | | | | | |
| Removal of Facilities | 100,000 | | | | | | | | | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | | | | | | | | |
| Final Cover | 11,148 | | | | | | | | | |
| Landfill Gas Management System | 32,377 | | | | | | | | | |
| Leachate Management System | 45,717 | | | | | | | | | |
| Onsite Surface Water Control System | 9,000 | | | | | | | | | |
| Design Consultants/ Third Party Engineering | 11,894 | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Predevelopment | 886,250 | | | | | | | | | |
| Development | 3,467,740 | 80,919 | 114,520 | 89,706 | 116,917 | 51,467 | 55,085 | 127,970 | 146,725 | 76,849 |
| Closure | 21,014 | | | | | | | | | |
| **TOTAL CAPITAL COST** | **43,107,534** | **890,108** | **1,259,717** | **986,761** | **1,286,089** | **566,139** | **605,939** | **1,407,668** | **1,613,979** | **845,335** |
| **OPERATION** | | | | | | | | | | |
| **Direct Costs & Indirect Costs** | | | | | | | | | | |
| Refuse Placement | 20,749,079 | 618,574 | 626,707 | 634,928 | 643,237 | 651,633 | 660,118 | 668,691 | 677,352 | 686,102 |
| Daily Cover | 569,901 | 17,345 | 17,605 | 17,869 | 18,137 | 18,409 | 18,685 | 18,965 | 19,250 | 19,539 |
| Nuisance Control Litter, Odour, Birds, Vector | 1,696,220 | 50,840 | 51,003 | 51,168 | 51,336 | 51,506 | 51,678 | 51,853 | 52,031 | 52,212 |
| General Maintenance | 189,811 | 5,542 | 5,550 | 5,558 | 5,567 | 5,575 | 5,584 | 5,593 | 5,602 | 5,611 |
| Salaries, Wages & Overhead | 7,323,658 | 216,807 | 220,059 | 223,360 | 226,710 | 230,111 | 233,563 | 237,066 | 240,622 | 244,231 |
| Aftercare Levy | 549,228 | 16,715 | 16,966 | 17,221 | 17,479 | 17,741 | 18,007 | 18,277 | 18,551 | 18,830 |
| Royalty & Host Fee | | | | | | | | | | |
| Intermediate Cover | 569,901 | 17,345 | 17,605 | 17,869 | 18,137 | 18,409 | 18,685 | 18,965 | 19,250 | 19,539 |
| Roading (Temporary) | 1,709,703 | 52,034 | 52,814 | 53,606 | 54,410 | 55,227 | 56,055 | 56,896 | 57,749 | 58,616 |
| Leachate Tmt & Disposal | | | | | | | | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 1,156,400 | | | | | | | | | |
| Operation of Disposal System | 653,820 | 24,570 | 25,320 | 26,001 | 26,682 | 27,363 | 28,044 | 28,725 | 29,475 | 30,225 |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 144,550 | | | | | | | | | |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | | | | | | | | | | |
| Gas Control | 885,892 | 31,864 | 33,264 | 34,535 | 35,806 | 37,078 | 38,349 | 39,620 | 41,020 | 42,420 |
| Stormwater Maintenance | 350,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 700,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 | 20,000 |
| Environmental Compliance | 1,400,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 | 40,000 |
| Bond | | | | | | | | | | |
| Regional Council Costs | 420,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Rates | 140,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Water Charges | | | | | | | | | | |
| Electricity Charges | | | | | | | | | | |
| Land Leasing | | | | | | | | | | |
| Custom 10 | | | | | | | | | | |
| Custom 11 | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | |
| Operations | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | **1,137,635** | **1,152,893** | **1,168,115** | **1,183,501** | **1,199,051** | **1,214,767** | **1,230,651** | **1,246,902** | **1,263,323** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **2,027,743** | **2,412,610** | **2,154,876** | **2,469,589** | **1,765,190** | **1,820,706** | **2,638,319** | **2,860,881** | **2,108,657** |
| **NET CASHFLOW** | | **2,313,163** | **1,993,410** | **2,317,234** | **2,069,602** | **2,842,090** | **2,855,682** | **2,108,215** | **1,956,851** | **2,781,341** |

# MfE Landfill Full Cost Accounting Model

## Cashflow Summary

**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Season | | | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
| Year End Date | | 30/06/2002 | 30/06/2003 | 30/06/2004 | 30/06/2005 | 30/06/2006 | 30/06/2007 | 30/06/2008 | 30/06/2009 | 30/06/2010 | 30/06/2011 | 30/06/2012 | 30/06/2013 | 30/06/2014 | 30/06/2015 | 30/06/2016 |
| Year of Operation | | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| **Operating Cell** | | | | | | | **1** | **1** | **1** | **2** | **2** | **2** | **2** | **2** | **3** | **3** |
| Actual Waste Placed (t) | | | | | | | 50,000 | 50,750 | 51,511 | 52,284 | 53,068 | 53,864 | 54,672 | 55,492 | 56,325 | 57,169 |
| **INCOME** | | | | | | | | | | | | | | | | |
| General Refuse | 142,631,982 | | | | | | 3,128,437 | 3,175,364 | 3,222,994 | 3,271,339 | 3,320,409 | 3,370,215 | 3,420,769 | 3,472,080 | 3,524,161 | 3,577,024 |
| Special Refuse | | | | | | | | | | | | | | | | |
| Cleanfill | | | | | | | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | | | | | | **3,128,437** | **3,175,364** | **3,222,994** | **3,271,339** | **3,320,409** | **3,370,215** | **3,420,769** | **3,472,080** | **3,524,161** | **3,577,024** |
| **SUNK COSTS** | 300,000 | 300,000 | | | | | | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | 3,545,000 | | 368,333 | 2,581,667 | 521,667 | 73,333 | | | | | | | | | | |
| **BASE COSTS** | 6,718,016 | | | | 233,721 | 814,875 | 311,489 | 282,263 | 190,662 | 193,856 | 185,464 | 156,964 | 178,280 | 213,948 | 103,022 | 70,946 |
| **DEVELOPMENT** | | | | | | | | | | | | | | | | |
| Site Access | 1,165,000 | | | | | 1,165,000 | | | | | | | | | | |
| Site Amenities & Services | 720,000 | | | | | 720,000 | | | | | | | | | | |
| Cell Construction - Earthworks, Liner, Leachate | 19,719,110 | | | | | 1,410,356 | 1,215,956 | 1,215,956 | 728,857 | 609,857 | 609,857 | 609,857 | 609,857 | 898,317 | 249,117 | 249,117 |
| Stormwater Management System | 600,000 | | | | | 600,000 | | | | | | | | | | |
| Gas Management System | 3,237,650 | | | | | | 30,000 | 30,000 | 30,000 | 18,000 | 168,000 | 18,000 | 18,000 | 84,800 | 34,667 | 34,667 |
| Final Cover - low permeability barrier layer placement | 2,517,620 | | | | | | | | | 146,800 | | | | | 168,820 | |
| Other | | | | | | | | | | | | | | | | |
| **CLOSURE** | 210,135 | | | | | | | | | | | | | | | |
| **CONTINGENCIES** | 4,375,003 | | 92,083 | 645,417 | 153,789 | 489,356 | 155,744 | 152,822 | 94,952 | 96,851 | 96,332 | 78,482 | 80,614 | 119,707 | 55,563 | 35,473 |
| **TOTAL CAPITAL COST** | **43,107,534** | **300,000** | **460,417** | **3,227,083** | **909,177** | **5,272,920** | **1,713,189** | **1,681,041** | **1,044,471** | **1,065,364** | **1,059,653** | **863,303** | **886,750** | **1,316,772** | **611,188** | **390,202** |
| **OPERATION** | | | | | | | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | | | | | | **922,684** | **974,444** | **1,026,249** | **1,059,347** | **1,092,488** | **1,138,577** | **1,173,365** | **1,208,190** | **975,946** | **985,489** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **300,000** | **460,417** | **3,227,083** | **909,177** | **5,272,920** | **2,635,873** | **2,655,484** | **2,070,719** | **2,124,711** | **2,152,141** | **2,001,880** | **2,060,115** | **2,524,962** | **1,587,133** | **1,375,692** |
| **NET CASHFLOW** | | **(300,000)** | **(460,417)** | **(3,227,083)** | **(909,177)** | **(5,272,920)** | **492,564** | **519,880** | **1,152,275** | **1,146,628** | **1,168,268** | **1,368,335** | **1,360,653** | **947,118** | **1,937,028** | **2,201,332** |

# MfE Landfill Full Cost Accounting Model

## Cashflow Summary

**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| Season | | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | 2021/22 | 2022/23 | 2023/24 | 2024/25 | 2025/26 | 2026/27 | 2027/28 | 2028/29 | 2029/30 | 2030/31 |
| Year End Date | | 30/06/2017 | 30/06/2018 | 30/06/2019 | 30/06/2020 | 30/06/2021 | 30/06/2022 | 30/06/2023 | 30/06/2024 | 30/06/2025 | 30/06/2026 | 30/06/2027 | 30/06/2028 | 30/06/2029 | 30/06/2030 | 30/06/2031 |
| Year of Operation | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| **Operating Cell** | | **3** | **3** | **3** | **3** | **4** | **4** | **4** | **4** | **4** | **5** | **5** | **5** | **5** | **5** | **6** |
| Actual Waste Placed (t) | | 58,027 | 58,897 | 59,781 | 60,678 | 61,588 | 62,512 | 63,449 | 64,401 | 65,367 | 66,348 | 67,343 | 68,353 | 69,378 | 70,419 | 71,475 |
| **INCOME** | | | | | | | | | | | | | | | | |
| General Refuse | 142,631,982 | 3,630,679 | 3,685,139 | 3,740,416 | 3,796,523 | 3,853,470 | 3,911,272 | 3,969,942 | 4,029,491 | 4,089,933 | 4,151,282 | 4,213,551 | 4,276,755 | 4,340,906 | 4,406,019 | 4,472,110 |
| Special Refuse | | | | | | | | | | | | | | | | |
| Cleanfill | | | | | | | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | **3,630,679** | **3,685,139** | **3,740,416** | **3,796,523** | **3,853,470** | **3,911,272** | **3,969,942** | **4,029,491** | **4,089,933** | **4,151,282** | **4,213,551** | **4,276,755** | **4,340,906** | **4,406,019** | **4,472,110** |
| **SUNK COSTS** | 300,000 | | | | | | | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | 3,545,000 | | | | | | | | | | | | | | | |
| **BASE COSTS** | 6,718,016 | 70,946 | 70,946 | 91,327 | 161,679 | 162,470 | 106,686 | 106,686 | 129,256 | 208,165 | 214,100 | 158,316 | 158,316 | 175,927 | 218,410 | 191,718 |
| **DEVELOPMENT** | | | | | | | | | | | | | | | | |
| Site Access | 1,165,000 | | | | | | | | | | | | | | | |
| Site Amenities & Services | 720,000 | | | | | | | | | | | | | | | |
| Cell Construction - Earthworks, Liner, Leachate | 19,719,110 | 249,117 | 249,117 | 249,117 | 498,545 | 385,145 | 385,145 | 385,145 | 385,145 | 671,062 | 591,662 | 591,662 | 591,662 | 591,662 | 452,137 | 370,137 |
| Stormwater Management System | 600,000 | | | | | | | | | | | | | | | |
| Gas Management System | 3,237,650 | 34,667 | 34,667 | 34,667 | 124,917 | 41,600 | 41,600 | 41,600 | 41,600 | 131,850 | 41,600 | 41,600 | 41,600 | 41,600 | 474,650 | 41,600 |
| Final Cover - low permeability barrier layer placement | 2,517,620 | | | | | 293,600 | | | | | 293,600 | | | | | 293,600 |
| Other | | | | | | | | | | | | | | | | |
| **CLOSURE** | 210,135 | | | | | | | | | | | | | | | |
| **CONTINGENCIES** | 4,375,003 | 35,473 | 35,473 | 37,511 | 78,514 | 88,282 | 53,343 | 53,343 | 55,600 | 101,108 | 114,096 | 79,158 | 79,158 | 80,919 | 114,520 | 89,706 |
| **TOTAL CAPITAL COST** | **43,107,534** | **390,202** | **390,202** | **412,621** | **863,655** | **971,097** | **586,775** | **586,775** | **611,602** | **1,112,185** | **1,255,058** | **870,736** | **870,736** | **890,108** | **1,259,717** | **986,761** |
| **OPERATION** | | | | | | | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | **995,063** | **1,004,666** | **1,014,294** | **1,023,946** | **1,033,636** | **1,043,343** | **1,053,066** | **1,064,440** | **1,078,195** | **1,092,819** | **1,107,599** | **1,122,537** | **1,137,635** | **1,152,893** | **1,168,115** |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **1,385,266** | **1,394,868** | **1,426,915** | **1,887,601** | **2,004,733** | **1,630,118** | **1,639,841** | **1,676,042** | **2,190,380** | **2,347,877** | **1,978,335** | **1,993,273** | **2,027,743** | **2,412,610** | **2,154,876** |
| **NET CASHFLOW** | | **2,245,413** | **2,290,271** | **2,313,501** | **1,908,922** | **1,848,738** | **2,281,154** | **2,330,101** | **2,353,449** | **1,899,553** | **1,803,405** | **2,235,216** | **2,283,481** | **2,313,163** | **1,993,410** | **2,317,234** |

## Cashflow Summary

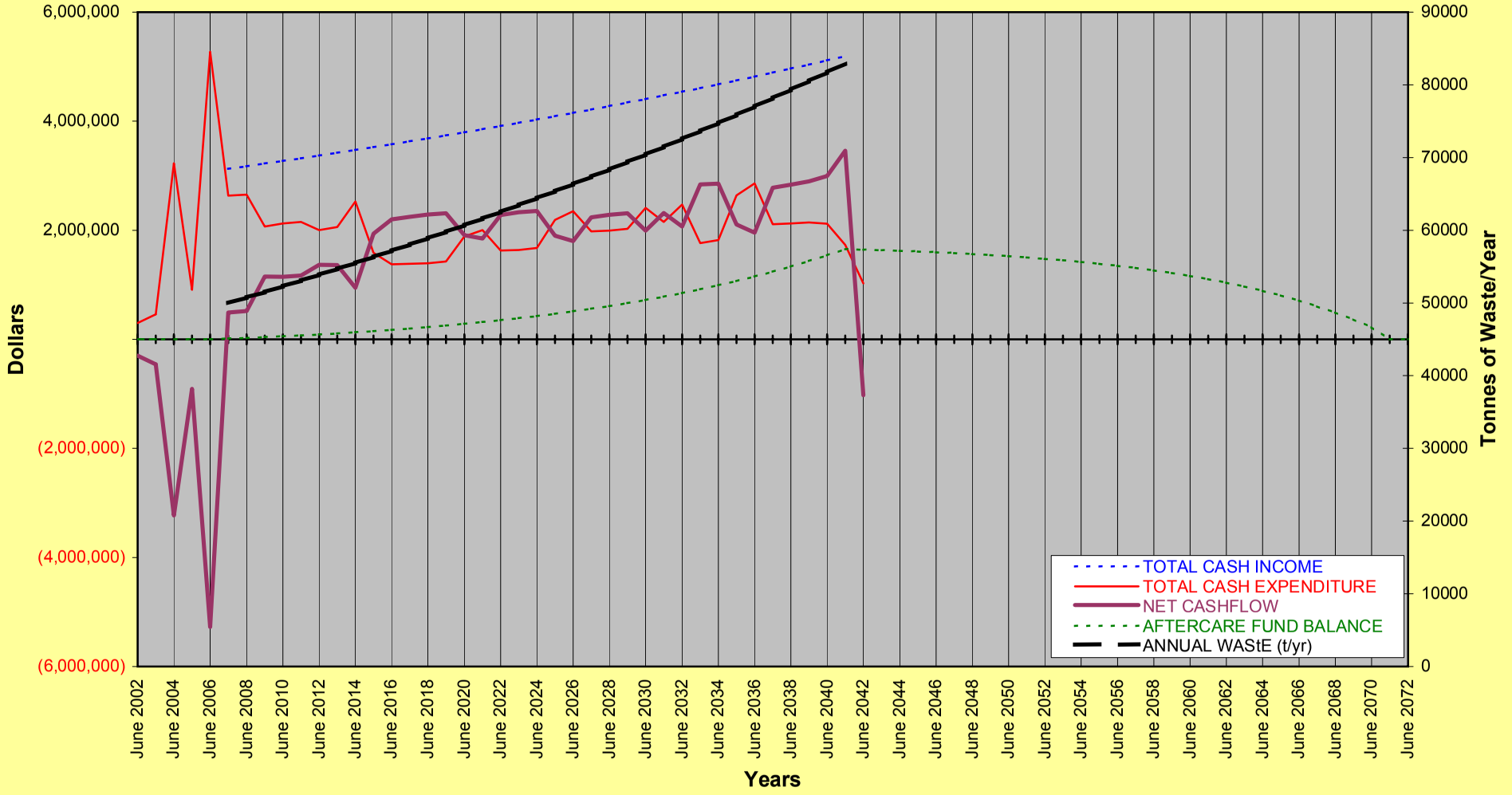
**DESCRIPTION**

| | |
|---|---|
| Project Name: | **Typical Example - Hypothetical Landfill** |
| Project Location: | A District |
| Scenario No: | 1 |
| Scenario Description: | 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility |

| | Total | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year No. | | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Season | | 2031/32 | 2032/33 | 2033/34 | 2034/35 | 2035/36 | 2036/37 | 2037/38 | 2038/39 | 2039/40 | 2040/41 | 2041/42 |
| Year End Date | | 30/06/2032 | 30/06/2033 | 30/06/2034 | 30/06/2035 | 30/06/2036 | 30/06/2037 | 30/06/2038 | 30/06/2039 | 30/06/2040 | 30/06/2041 | 30/06/2042 |
| Year of Operation | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 |
| **Operating Cell** | | **6** | **6** | **6** | **6** | **7** | **7** | **7** | **7** | **7** | **7** | |
| Actual Waste Placed (t) | | 72,547 | 73,635 | 74,740 | 75,861 | 76,999 | 78,154 | 79,326 | 80,516 | 81,724 | 82,950 | |
| **INCOME** | | | | | | | | | | | | |
| General Refuse | 142,631,982 | 4,539,191 | 4,607,279 | 4,676,388 | 4,746,534 | 4,817,732 | 4,889,998 | 4,963,348 | 5,037,798 | 5,113,365 | 5,190,066 | |
| Special Refuse | | | | | | | | | | | | |
| Cleanfill | | | | | | | | | | | | |
| **TOTAL CASH INCOME** | **142,631,982** | **4,539,191** | **4,607,279** | **4,676,388** | **4,746,534** | **4,817,732** | **4,889,998** | **4,963,348** | **5,037,798** | **5,113,365** | **5,190,066** | |
| **SUNK COSTS** | 300,000 | | | | | | | | | | | |
| **PLANNING AND PREDEVELOPMENT** | 3,545,000 | | | | | | | | | | | |
| **BASE COSTS** | 6,718,016 | 207,434 | 102,934 | 139,116 | 264,926 | 265,265 | 153,697 | 153,697 | 153,697 | 116,810 | | |
| **DEVELOPMENT** | | | | | | | | | | | | |
| Site Access | 1,165,000 | | | | | | | | | | | |
| Site Amenities & Services | 720,000 | | | | | | | | | | | |
| Cell Construction - Earthworks, Liner, Leachate | 19,719,110 | 370,137 | 370,137 | 370,137 | 654,522 | 580,122 | 580,122 | 580,122 | 580,122 | 580,122 | | |
| Stormwater Management System | 600,000 | | | | | | | | | | | |
| Gas Management System | 3,237,650 | 591,600 | 41,600 | 41,600 | 360,250 | 34,667 | 34,667 | 34,667 | 34,667 | 34,667 | 353,317 | |
| Final Cover - low permeability barrier layer placement | 2,517,620 | | | | | 587,200 | | | | | | 734,000 |
| Other | | | | | | | | | | | | |
| **CLOSURE** | 210,135 | | | | | | | | | | 11,894 | 198,241 |
| **CONTINGENCIES** | 4,375,003 | 116,917 | 51,467 | 55,085 | 127,970 | 146,725 | 76,849 | 76,849 | 76,849 | 73,160 | 36,521 | 93,224 |
| **TOTAL CAPITAL COST** | **43,107,534** | **1,286,089** | **566,139** | **605,939** | **1,407,668** | **1,613,979** | **845,335** | **845,335** | **845,335** | **804,758** | **401,732** | **1,025,465** |
| **OPERATION** | | | | | | | | | | | | |
| **CONTINGENCIES** | | | | | | | | | | | | |
| **TOTAL OPERATING COST** | **39,208,164** | **1,183,501** | **1,199,051** | **1,214,767** | **1,230,651** | **1,246,902** | **1,263,323** | **1,279,915** | **1,296,679** | **1,313,618** | **1,330,732** | |
| **TOTAL CASH EXPENDITURE** | **82,315,698** | **2,469,589** | **1,765,190** | **1,820,706** | **2,638,319** | **2,860,881** | **2,108,657** | **2,125,249** | **2,142,014** | **2,118,377** | **1,732,465** | **1,025,465** |
| **NET CASHFLOW** | | **2,069,602** | **2,842,090** | **2,855,682** | **2,108,215** | **1,956,851** | **2,781,341** | **2,838,099** | **2,895,784** | **2,994,989** | **3,457,601** | **(1,025,465)** |

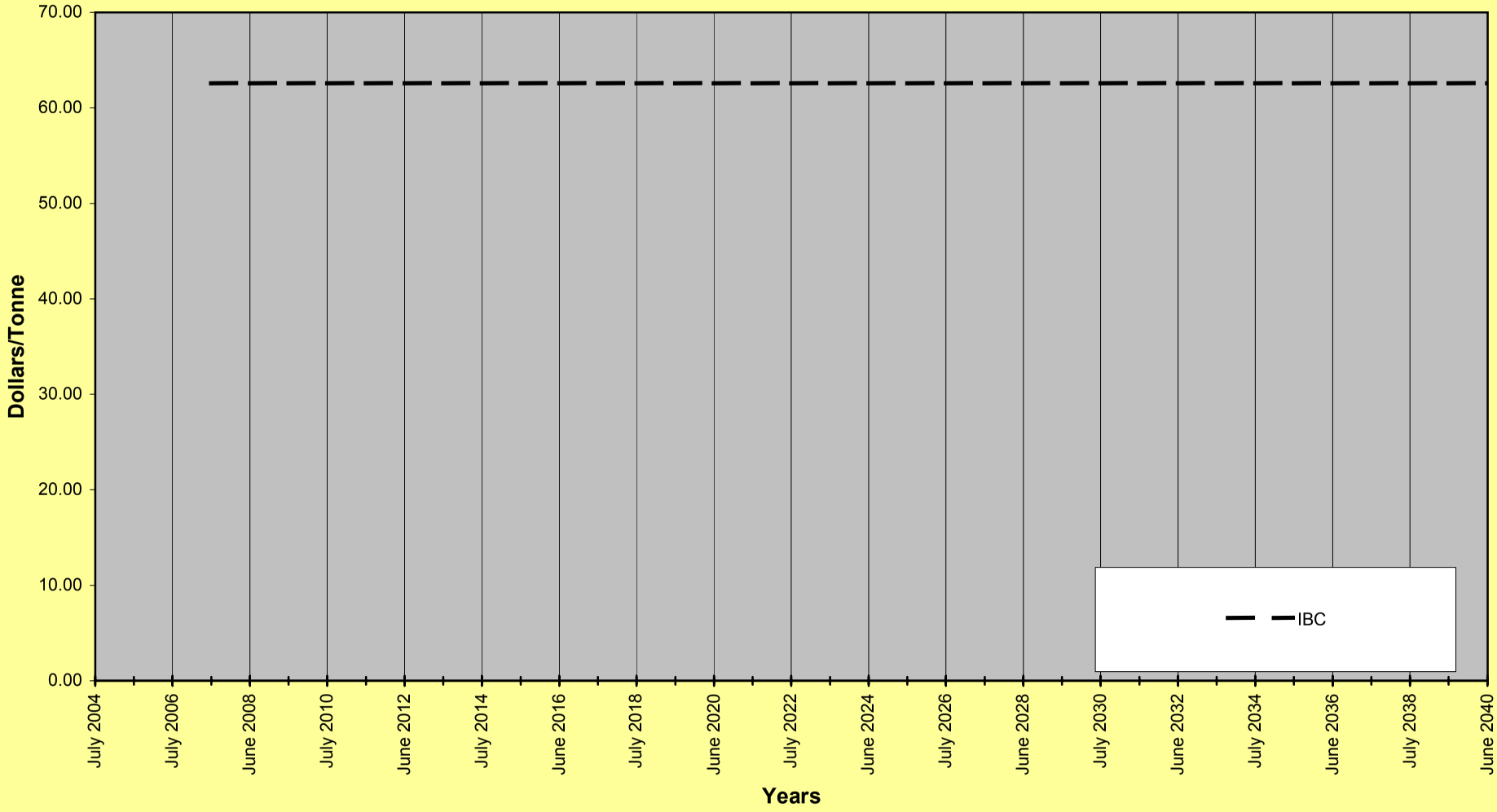
# Cashflow Chart

Scenario No. 1 - 50,000 tonnes per annum, 1.5% per annum growth - 0% waste reduction over life of facility



# IBC Chart

Scenario No. 1 - Typical



# Appendix F: Landfill FCA Model – Blank Copies of Worksheets

# MfE Landfill Full Cost Accounting Model

## General Input

| | |
|---|---|
| Project Name | **Project Name** |
| Project Location | Landfill Location |
| Scenario Number | 1 |
| Scenario Description | Typical |

### SITUATION

- ○ GreenFields Site — Choose this option for a site which has not yet been developed
- ◉ BrownFields Site — Choose this option for a site already in use

### DATES

| | | | |
|---|---|---|---|
| Project Commencement Date | 1/07/2000 | | ☑ Allow for Appeal |
| Commencement Date of Operation in New Airspace | 1/07/2001 | | |
| Assumed Life of Residual Airspace (Rounded Down) | 1.0 | years | |
| Time of Land Purchase | N/A | | |
| Time of Excess Land Sale | N/A | | |
| Sunset Date | 1/07/2039 | | |
| Consented Landfill Operating Life | 39.0 | years | |
| Actual Landfill Operating Life (Rounded Up) | 39.0 | years | Closure due to Sunset Date (30/06/39) |
| Aftercare Period | 30 | years | |

### WASTE

◉ Custom Waste Tonnages - See Waste Input Sheet ○ Generated Waste Tonnages - See Below

Tonnage Units: t/year | %

Minimum Allowable Annual Waste Tonnage — Must be greater than 5,000 t/year

**Waste Stream**

| | | |
|---|---|---|
| General Refuse | 100% | of annual waste tonnage |
| Special Refuse | 0% | of annual waste tonnage |
| Cleanfill | 0% | additional to annual waste tonnage |

**Waste Charging**

| | | |
|---|---|---|
| General Refuse | 100% | = IBC |
| Special Refuse | 150% | of IBC |
| Cleanfill | 50% | of IBC |

| | | |
|---|---|---|
| Assumed Compacted Waste Density (Excluding Cover) | 0.90 | t/m³ |
| Target Cover to Waste Ratio (Daily and Intermediate) | 1 : 4.5 | |
| Volume Utilisation | 1.358 | m³/t |

### FINANCIAL

**Cost of Capital**

| | | | |
|---|---|---|---|
| Planning And Consenting | Stage 1 | N/A | |
| Construction | Stage 2 | N/A | |
| Operation | Stage 3 | 10.0% | = Internal Rate of Return |
| Aftercare | Stage 4 | 10.0% | |

Interest Rate (Risk Free Rate plus 0.5%) — 6.0% — = interest rate on 10 year Govt. Bonds + 0.5%

◉ Apply Real Annual Movement to IBC over Whole Operating Life ○ Ramp IBC from Initial (known) Value to Final (unknown)Value over a Set Period

IBC Real Annual Movement + 0.0%

*Version 3.1*

# MfE Landfill Full Cost Accounting Model

## BrownFields Input

**Project Name**
Scenario No. 1

Volumes in Mm³ | Same as
Areas in Ha | Geometric Input

### EXISTING CONDITIONS

| | | |
|---|---|---|
| Residual Constructed Airspace as at 30 June 2000 | 0.3 | Mm³ |
| Life of Residual Airspace | 1.1 | years |
| Footprint of Existing Landfill | 5 | Ha |

Continuing Development is to be
- ○ Overlay
- ◉ Extension to Footprint

- ☐ Existing Flare Station
- ☐ Existing Leachate Pretreatment
- ☐ Existing Leachate Disposal

### WORKS TO BE COMPLETED DURING RESIDUAL LIFE

| | | |
|---|---|---|
| Stormwater Open Drains | 100 | m |
| Stormwater Stabilised Drains/Flumes | 20 | m |
| Stormwater Piped Drains | 25 | m |
| Gas Horizontal Collection Pipework | 600 | m |
| Gas Vertical Extraction Wells | 25 | m |
| Gas Main Header Pipe | 50 | m |
| Gas Laterals to Vertical Wells | 30 | m |
| Gas Condensate Traps | 2 | |
| Area of Final Cap to be Completed on Residual Airspace | 1 | Ha |

### STOCKPILES

| | | |
|---|---|---|
| Volume of Existing Topsoil Stockpile | 0.001 | Mm³ |
| Volume of Existing Unsuitables Stockpile | 0.0015 | Mm³ |
| Volume of Existing Sub-Topsoil Stockpile | 0.0005 | Mm³ |
| Volume of Existing Low Permeability Material Stockpile | 0.0002 | Mm³ |
| Volume of Existing Structural Material Stockpile | 0.001 | Mm³ |

### FINANCIAL

| | | |
|---|---|---|
| Value of Aftercare Fund as at 30 June 2000 | $ 10,000 | |

# Custom Waste Input

**Project Name**
Scenario No. 1

Tonnage Units t/year (Same as General Input)

| Year of Operation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Season | 2004/05 | 2005/06 | 2006/07 | 2007/08 | 2008/09 | 2009/10 | 2010/11 | 2011/12 |
| Year End Date | 30/06/2005 | 30/06/2006 | 30/06/2007 | 30/06/2008 | 30/06/2009 | 30/06/2010 | 30/06/2011 | 30/06/2012 |
| Annual Waste (t) | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 | 200,000 |
| Cumulative Waste (t) | 200,000 | 400,000 | 600,000 | 800,000 | 1,000,000 | 1,200,000 | 1,400,000 | 1,600,000 |

# MfE Landfill Full Cost Accounting Model

## Geometric Input

**Project Name**
Scenario No. 1

Volumes in Mm³
Areas in Ha

**SITE CONSTANTS**

Leachate Generation

| | | | |
|---|---|---|---|
| ○ Typical for Region | Auckland | Active | 1147 m³/ha/annum |
| Location: | | Post Closure | 999 m³/ha/annum |
| Annual Precipitation: | | | |
| ◉ Custom Values | | Active | 1000 m³/ha/annum |
| | | Post Closure | 800 m³/ha/annum |

| | | | |
|---|---|---|---|
| Assumed Insitu Topsoil Depth | | | 0.150 m |
| Depth of Sub-Topsoil Layer to be Recovered | ☑ Don't Recover from Fill Zone | | m |
| Liner - Depth of Low Permeability Material in Liner | | (Default Liner) Liner Type 1 | 0.90 m |
| | | Liner Type 2 | m |
| | | Liner Type 3 | m |
| | | Liner Type 4 | m |
| | | Liner Type 5 | m |
| | | Liner Type 6 | m |
| Final Cap - Depth of Topsoil Layer | | | 0.150 m |
| Final Cap - Depth of Unsuitables Layer | | | 0.300 m |
| Final Cap - Depth of Sub-Topsoil Layer | | | m |
| Final Cap - Depth of Low Permeability Layer | | | 0.600 m |
| Access Road Length | | | 2 km |
| Length of Boundary Fence | | | 5000 m |
| Leachate Pretreatment Facility | | Install in | 4 th year of Operation |
| Leachate Disposal System | | Install in | 4 th year of Operation |
| Flare Station - Interim | | Install | 25% of way through landfill life |
| Flare Station - Final | | Install | 75% of way through landfill life |

Only enter depths for liner types which are to be used

Usually only one or other required

**DEVELOPMENT PROGRAMME**

○ Cell Construction Staged in Equal Annual Amounts
◉ Cell Construction Completed in Single Year

| | Total | Cell 1 | Cell 2 | Cell 3 | Cell 4 | Cell 5 | Cell 6 | Cell 7 | Cell 8 | Cell 9 | Cell 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Net Airspace (excluding Final Cap) | 11.05 Mm³ | 1 | 0.75 | 0.6 | 1.3 | 1.9 | 0.6 | 3.5 | 1.4 | 0 | 0 |
| Footprint Area | 37 Ha | 6.4 | 5.5 | 4.4 | 3.3 | 4.4 | 4 | 5.9 | 3.1 | 0 | 0 |
| Liner Type 2 Area | 0 Ha | | | | | | | | | | |
| LIner Type 3 Area | 0 Ha | | | | | | | | | | |
| Liner Type 4 Area | 0 Ha | | | | | | | | | | |
| Liner Type 5 Area | 0 Ha | | | | | | | | | | |
| Liner Type 6 Area | 0 Ha | | | | | | | | | | |
| Disturbed Area | 51.8 Ha | 17.5 | 6.5 | 5.2 | 2.9 | 6.1 | 3.4 | 9.5 | 0.7 | 0 | 0 |
| Area of Fill Zone | 15.1 Ha | 7.7 | 1.5 | 1.9 | 1.6 | 0.5 | 0.7 | 0.9 | 0.3 | 0 | 0 |
| Area of Liner Type 1 in Fill Zone | 12.4 Ha | 5 | 1.5 | 1.9 | 1.6 | 0.5 | 0.7 | 0.9 | 0.3 | | |
| Area of Liner Type 2 in Fill Zone | 0 Ha | | | | | | | | | | |
| Area of Liner Type 3 in Fill Zone | 0 Ha | | | | | | | | | | |
| Area of Liner Type 4 in Fill Zone | 0 Ha | | | | | | | | | | |
| Area of Liner Type 5 in Fill Zone | 0 Ha | | | | | | | | | | |
| Area of Liner Type 6 in Fill Zone | 0 Ha | | | | | | | | | | |
| Area to be Cleared | 54 Ha | 18 | 7 | 6 | 3 | 6 | 4 | 9 | 1 | 0 | 0 |
| Area of Bush to be Cleared | 10 Ha | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| Area of Specialised Subgrade Treatment | 37 Ha | 6.4 | 5.5 | 4.4 | 3.3 | 4.4 | 4 | 5.9 | 3.1 | 0 | 0 |
| Area of Liner Protection Layer | 37 Ha | 6.4 | 5.5 | 4.4 | 3.3 | 4.4 | 4 | 5.9 | 3.1 | 0 | 0 |
| Final Cap Area | 38.6 Ha | 2.6 | 1.8 | 3.1 | 4.7 | 3.1 | 1.7 | 10.4 | 11.2 | 0 | 0 |
| Required Cut (E.G. to Basegrade) | 2.8 Mm³ | 0.5 | 0.4 | 0.2 | 0.2 | 0.6 | 0.1 | 0.5 | 0.3 | 0 | 0 |
| Useable Liner to be Removed from Cut Zone | 1.22 Mm³ | 0.2 | 0.2 | 0.1 | 0.1 | 0.3 | 0.02 | 0.2 | 0.1 | 0 | 0 |
| Required Fill (E.G. to Basegrade) | 0.85 Mm³ | 0.4 | 0.1 | 0.1 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0 | 0 |
| Useable Liner to be Removed from Fill Zone | 0 Mm³ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Unsuitables Volume | 0.26 Mm³ | 0.07 | 0.05 | 0.03 | 0.02 | 0.04 | 0.04 | 0.01 | 0 | 0 | 0 |
| Proportion of Unsuitables in Fill Zone | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 67% | 0% | 0% |
| **Topsoil** | | | | | | | | | | | |
| Cut to Stockpile | 0.0777 Mm³ | 0.0263 | 0.0098 | 0.0078 | 0.0044 | 0.0092 | 0.0051 | 0.0143 | 0.0011 | | |
| Stockpile to Final Cover | 0.0555 Mm³ | 0.0039 | 0.0027 | 0.0047 | 0.0071 | 0.0047 | 0.0026 | 0.0156 | 0.0144 | | |
| Import Topsoil to Final Cover | Mm³ | | | | | | | | | | |
| **Unsuitables** | | | | | | | | | | | |
| Cut to Stockpile | 0.2600 Mm³ | 0.0700 | 0.0500 | 0.0300 | 0.0200 | 0.0400 | 0.0400 | 0.0100 | | | |
| Stockpile to Final Cover | 0.1110 Mm³ | 0.0078 | 0.0054 | 0.0093 | 0.0141 | 0.0093 | 0.0051 | 0.0312 | 0.0288 | | |
| Shortfall - make up with Sub-Topsoil | Mm³ | | | | | | | | | | |
| **Sub-Topsoil** | | | | | | | | | | | |
| Cut to Stockpile | Mm³ | | | | | | | | | | |
| Stockpile to Final Cover | Mm³ | | | | | | | | | | |
| Borrow to Final Cover | Mm³ | | | | | | | | | | |
| **Low Permeability Material** | | | | | | | | | | | |
| Cut to Stockpile | 0.7512 Mm³ | 0.1364 | 0.1349 | 0.0496 | 0.0517 | 0.2322 | | 0.1367 | 0.0097 | | |
| Stockpile to Liner | 0.0160 Mm³ | | | | | | 0.0160 | | | | |
| Stockpile to Final Cover | 0.0762 Mm³ | | | | | 0.0186 | | | 0.0576 | | |
| Cut to Fill as Liner | 0.3170 Mm³ | 0.0576 | 0.0495 | 0.0396 | 0.0297 | 0.0396 | 0.0200 | 0.0531 | 0.0279 | | |
| Cut to Fill as Final Cover | 0.1458 Mm³ | 0.0156 | 0.0108 | 0.0186 | 0.0282 | | 0.0102 | 0.0624 | | | |
| Borrow to Fill as Liner | Mm³ | | | | | | | | | | |
| Borrow to Fill as Final Cover | Mm³ | | | | | | | | | | |
| **Structural Material** | | | | | | | | | | | |
| Cut to Stockpile | 0.1581 Mm³ | | | | | | | 0.1581 | | | |
| Stockpile to Fill | 0.0010 Mm³ | 0.0010 | | | | | | | | | |
| Stockpile to Daily Cover | 0.1581 Mm³ | | | | | | | 0.1581 | | | |
| Cut to Fill | 0.7714 Mm³ | 0.2503 | 0.1221 | 0.1058 | 0.0513 | 0.0729 | 0.0714 | 0.0499 | 0.0478 | | |
| Cut to Daily Cover | 0.7058 Mm³ | 0.0898 | 0.0018 | 0.0554 | 0.2405 | 0.0209 | 0.1207 | 0.1769 | | | |
| Borrow to Fill | 0.1620 Mm³ | 0.1620 | | | | | | | | | |
| Borrow to Daily Cover | 1.4233 Mm³ | 0.0850 | 0.1793 | 0.0654 | 0.0613 | 0.4016 | | 0.4496 | 0.1811 | | |

1) Area of Liner Type 1 = Footprint less area of Liner Types 2,3,4,5, & 6.
2) Each liner area defines the area of clay, synthetic liner, liner protection, and leachate collection for that liner type.

These include the area both inside and outside of the footprint

These are for the area of each type of liner which is to be placed in the zone where fill is required to achieve basegrade levels

# MfE Landfill Full Cost Accounting Model

## Geometric Input

**Project Name**
Scenario No. 1

| | | Cell 1 | Cell 2 | Cell 3 | Cell 4 | Cell 5 | Cell 6 | Cell 7 | Cell 8 | Cell 9 | Cell 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Length of Perimeter Access Road | 2250 m | 450 | 1300 | 0 | 0 | 0 | 250 | 250 | 0 | 0 | 0 |
| Subsoil Drainage | 0 m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Header Pipework | 1200 m | 340 | 300 | 260 | 300 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Collection Pipework | 1550 m | 700 | 270 | 260 | 320 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Collection Sumps | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Cleanout Port/Manhole | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Leachate Pumpout Equipment | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater Open Drains | 2300 m | 500 | 1200 | 0 | 0 | 0 | 300 | 300 | 0 | 0 | 0 |
| Stormwater Stabilised Drains/Flumes | 0 m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Stormwater Piped Drains | 0 m | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gas Horizontal Collection Pipework | 9380 m | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 1340 | 0 | 0 | 0 |
| Gas Vertical Extraction Wells | 2950 m | 0 | 0 | 590 | 590 | 590 | 590 | 590 | 0 | 0 | 0 |
| Gas Main Header Pipe | 2851 m | 0 | 142 | 142 | 142 | 999 | 713 | 713 | 0 | 0 | 0 |
| Gas Laterals to Vertical Wells | 1675 m | 0 | 0 | 335 | 335 | 335 | 335 | 335 | 0 | 0 | 0 |
| Gas Condensate Traps | 35 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 0 | 0 | 0 |

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Project Name**
Scenario No. 1

Note: Leave cost fields blank for any items which are not required

| | | | |
|---|---|---|---|
| **ASSET VALUE** | | | |
| Asset Value (derived in accordance with FRS-3) | | | $ |
| **PLANNING AND PREDEVELOPMENT** | | | |
| Project Management | | | |
| Site Selection | | | |
| Consultation | | | |
| Land Pre-Purchase / Pre-Leasing Agreements | | | |
| Survey and Preliminary Design | | | |
| Geotechnical & Groundwater Investigations | | | |
| Other Detailed Studies (I.e. Noise, Traffic, Visual, etc) | | | |
| Baseline Monitoring | | | |
| Resource Consent Process | | | |
| AEE and Consent Application | | | |
| Draft Landfill Management Plan | | | |
| Legal | | | |
| Hearing | | | |
| Appeal | | | |
| Land Acquisition & Associated/ Set Up Costs | | | |
| Proceeds from Disposal of Excess Land | | | |
| Custom 1 | | | |
| Custom 2 | | | |
| **BASE COSTS** | | | |
| Engineering | | | |
| Detailed Design and Documentation (%) | | 6.0% | |
| Construction Management (%) | | 6.5% | |
| Contractors P & G (%) | | 12.5% | |
| **DEVELOPMENT** | | | |
| **Site Access** | | | |
| Intersection Upgrade | | | |
| Other Roading Network Upgrades/ Contributions | | | |
| Access Road - Intersection to Footprint | | | |
| Special Structures : Diversions, Bridges, etc) | | | |
| **Site Amenities & Services** | | | |
| Site Entrance | | | |
| Administration Building | | | |
| Weighbridge & Kiosk | | | |
| Machinery Shed, Maintenance Facility | | | |
| Power & Phone | | | |
| Sewerage | | | |
| Water Supply | | | |
| General Civil Works (Sealing, Parking) -Administration | | | |
| Washdown Facility/Wheelwash | | | |
| Fencing | | | |
| Landscaping | | | |
| Custom 3 | | | |
| **Cell Construction - Earthworks, Liner, Leachate** | | | |
| Sediment Control Structures and Measures | | 10,000 | $ |
| Clearing | | 1.50 | $/m² |
| Clearing Bush | | 8.00 | $/m² |
| Perimeter Access Road | | 400.00 | $/m |
| Topsoil | | | |
| Cut to Stockpile | | 2.00 | $/m³ |
| Unsuitables | | | |
| Cut to Stockpile | | 8.00 | $/m³ |
| Sub-Topsoil | | | |
| Cut to Stockpile | | 5.50 | $/m³ |
| Low Permeability Material | | | |
| Cut to Stockpile | | 6.00 | $/m³ |
| Stockpile to Liner | | 9.00 | $/m³ |
| Cut to Fill as Liner | | 9.00 | $/m³ |
| Borrow to Fill as Liner | | 10.00 | $/m³ |
| Structural Material | | | |
| Cut to Stockpile | | 6.00 | $/m³ |
| Stockpile to Fill | | 8.00 | $/m³ |
| Cut to Fill | | 8.00 | $/m³ |
| Borrow to Fill | | 9.00 | $/m³ |
| Groundwater Control/ Subsoil Drainage | | 60.00 | $/m |
| Prepare Subgrade for Laying Liner | Liner Type 1 | 1.50 | $/m² |
| | Liner Type 2 | | $/m² |
| | Liner Type 3 | | $/m² |
| | Liner Type 4 | | $/m² |
| | Liner Type 5 | | $/m² |
| | Liner Type 6 | | $/m² |
| Specialised Subgrade Treatment | | 10.00 | $/m² |

Leave cost blank for any liner type to which this feature does not apply

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Project Name**
Scenario No. 1

| | | | | |
|---|---|---|---|---|
| Liner Supply & Installation (Synthetic) | Liner Type 1 | | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | | $/m² | |
| | Liner Type 3 | | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Liner Protection Layer | Liner Type 1 | 7.50 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | | $/m² | |
| | Liner Type 3 | | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Leachate Collection and Transmission System | | | | |
| Leachate Collection Header Pipes (including fittings and filter fabric) | | 175.00 | $/m | |
| Auxillary Leachate Collection Pipes (including fittings) | | 75.00 | $/m | |
| Leachate Collection Sump | | 10,000 | $ each | |
| Cleanout Ports/Manholes | | 7,500 | $ each | |
| Automated Pump Station (pumps, valves, fittings, and electrical) | | 20,000 | $ each | |
| Leachate Collection Layer | Liner Type 1 | 12.00 | $/m² | Leave cost blank for any liner type to which this feature does not apply |
| | Liner Type 2 | | $/m² | |
| | Liner Type 3 | | $/m² | |
| | Liner Type 4 | | $/m² | |
| | Liner Type 5 | | $/m² | |
| | Liner Type 6 | | $/m² | |
| Leachate Pre-treatment Facility | | 500,000 | $ | |
| Leachate Disposal System | | 100,000 | $ | |

**Stormwater Management System**

| | | |
|---|---|---|
| Major Stormwater Diversion (E.g. Dams, Canal, etc) | | $ |
| Open Drains | 45.00 | $/m |
| Stabilised Drains / Flumes | 180.00 | $/m |
| Piped Drains | 200.00 | $/m |
| Stormwater Treatment Ponds | | |
| Ponds | 800,000 | $ |
| Instrumentation | 50,000 | $ |

**Gas Management System**

| | | |
|---|---|---|
| Horizontal Collectors | 120.00 | $/m |
| Vertical Extraction Wells | 200.00 | $/m |
| Ring Header (below grade) | 400.00 | $/m |
| Laterals to vertical wells (above grade) | 90.00 | $/m |
| Condensate Traps | 7,500 | $ each |
| Flare Stations | | |
| Interim | 75,000 | $ |
| Final | 750,000 | $ |

**Final Cover - low permeability barrier layer placement**

| | | |
|---|---|---|
| Topsoil | | |
| Stockpile to Final Cover | 2.00 | $/m³ |
| Import Topsoil to Final Cover | 20.00 | $/m³ |
| Unsuitables | | |
| Stockpile to Final Cover | 5.00 | $/m³ |
| Shortfall - make up with Sub-Topsoil | 5.00 | $/m³ |
| Sub-Topsoil | | |
| Stockpile to Final Cover | 5.60 | $/m³ |
| Borrow to Final Cover | 7.00 | $/m³ |
| Low Permeability Material | | |
| Stockpile to Final Cover | 7.50 | $/m³ |
| Cut to Fill as Cover | 7.50 | $/m³ |
| Borrow to Fill as Cover | 8.00 | $/m³ |
| Geosynthetic layer | 12.00 | $/m² |
| Drainage layer | 10.00 | $/m² |
| Vegetation | 1.00 | $/m² |

**Other**

| | | | | | |
|---|---|---|---|---|---|
| Custom 4 | | $ | In | | Year of Operation |
| Custom 5 | | $ | In | | Year of Operation |
| Custom 6 | | $ | For Cell No. | | |
| Custom 7 | | $/yr | For Cell No. | | |
| Custom 8 | | $/cell | For All Cells | | |
| Custom 9 | | $/yr | For All Cells | | |

**OPERATION**

| **Direct Costs & Indirect Costs** | 20,000 | 50,000 | 75,000 | 100000 | 200000 | 300000 | 500000 | t/yr |
|---|---|---|---|---|---|---|---|---|
| Refuse Placement | 16.00 | 14.50 | 13.50 | 12.00 | 9.00 | 7.00 | 6.00 | $/t |
| Daily Cover | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | $/t |
| Nuisance Control Litter, Odour, Birds, Vector | 20,000 | 30,000 | 40,000 | 50,000 | 60,000 | 70,000 | 80,000 | $/yr |
| General Maintenance | 4,000 | 4,500 | 5,000 | 5,500 | 6,000 | 6,500 | 7,000 | $/yr |
| Salaries, Wages & Overhead | 100,000 | 150,000 | 175,000 | 200,000 | 400,000 | 550,000 | 600,000 | $/yr |
| On-Site Management | | | | | | | | |
| Gate Control & Fee Collection | | | | | | | | |
| Audit Fees | | | | | | | | |

# MfE Landfill Full Cost Accounting Model

## Cost Input

**Project Name**
Scenario No. 1

| | | | |
|---|---|---|---|
| Secretarial Fees | | | |
| Accounting Fees | | | |
| Legal | | | |
| Consultancy | | | |
| Insurance | | | |
| Waste Acceptance and Inspection | | | |
| Health & Safety | | | |
| Aftercare Levy | 0.36 | $/t | Calculates Last |
| Royalty & Host Fee | | $/t | |
| Intermediate Cover | 0.35 | $/t | |
| Roading (Temporary) | 0.75 | $/t | |
| Leachate Tmt & Disposal | | | |
| Trucking Off Site (Prior to Disposal System Installation) | 30.00 | $/m³ | |
| Operation of Disposal System | 3.00 | $/m³ | |
| Trade Waste Charge - Untreated Leachate (For Trucked Leachate) | 2.00 | $/m³ | |
| Trade Waste Charge - Treated Leachate (For Trucked Leachate) | 1.00 | $/m³ | |
| Gas Control | 500 | $/ha/yr | Once Interim Flare Installed |
| Stormwater Maintenance | 20,000 | $/yr | |
| Monitoring - Stormwater, Groundwater, Leachate, Landfill Gas, Local Ecology | 20,000 | $/yr | |
| Environmental Compliance | 35,000 | $/yr | |
| Bond | 0 | $/yr | |
| Regional Council Costs | 7,500 | $/yr | |
| Rates | | $/yr | |
| Water Charges | | $/yr | |
| Electricity Charges | 2,000 | $/yr | |
| Land Leasing | | $/yr | |
| Custom 10 | | $/t | |
| Custom 11 | | $/yr | |

**CLOSURE**

**General**

| | | | |
|---|---|---|---|
| Removal of Facilities | 50,000 | $ | |
| Modifications to site stormwater, leachate, landfill gas and other systems | | | |
| Final Cover | 1.0% | of construction cost | |
| Landfill Gas Management System | 1.0% | of construction cost | |
| Leachate Management System | 1.5% | of construction cost | |
| Onsite Surface Water Control System | 1.5% | of construction cost | |
| Design Consultants/ Third Party Engineering | 7.5% | of construction cost | |

**AFTERCARE**

| | | | |
|---|---|---|---|
| Administration | 7,500 | $/yr | |
| Regional Council Liaison | 10,000 | $/yr | |
| Site Inspection | 350 | $/ha/yr | |
| Final Cover System | | | |
| Final Cover maintenance | 5,000 | $/ha/yr | |
| Vegetation maintenance | 3,500 | $/ha/yr | |
| Leachate System maintenance | | | |
| Leachate Disposal | 5.00 | $/m³ | |
| System maintenance | 500 | $/ha/yr | |
| Electricity | 2,000 | $/ha/yr | |
| Gas Management System | | | |
| Maintenance | 1,500 | $/ha/yr | |
| Replacement | | $/ha/yr | |
| Electricity | 1,000 | $/ha/yr | |
| Environmental Monitoring System | | | |
| Groundwater | 2,000 | $/ha/yr | |
| Landfill Gas | 750 | $/ha/yr | |
| Leachate | 750 | $/ha/yr | |
| Stormwater | 600 | $/ha/yr | |
| Removal of Remaining Facilities | 35,000 | $ | |
| End of Post Closure Certification | 50,000 | $ | |
| Custom 12 | | $/yr | |
| Custom 13 | | $/ha/yr | |

**CONTINGENCIES**

| | | |
|---|---|---|
| Predevelopment | 20.0% | of predevelopment cost |
| Development | 10.0% | of development cost |
| Operations | 0.0% | of operations cost |
| Closure | 10.0% | of closure cost |
| Aftercare | 7.5% | of aftercare cost |