A Guide to the Management of Cleanfills

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1 Introduction

1.1 Background

The number of cleanfills in New Zealand has been rapidly increasing over the past 10 years or so. One of the main reasons for this is the introduction or substantial increase of landfill charges. This has created the need for lower-cost alternatives to dispose of wastes that are considered harmless to the environment.

Cleanfills are intended to accept only inert wastes. However, over time the term 'cleanfill' has been stretched and modified. Many cleanfills now mistakenly accept a multitude of construction and demolition waste, contaminated soils, green waste and many other materials that can result in an adverse effect on the environment.

A number of councils have decided that if cleanfills only accept inert wastes they do not require resource consents. They have described cleanfills that meet particular criteria as a permitted activity in their district or regional plans, and focus on erosion and sediment control issues. This may be acceptable where appropriate waste acceptance criteria and siting constraints for cleanfills have been established and are stringently enforced. Some councils, however, have not set waste acceptance criteria or siting guidelines, or have set inappropriate criteria, and often do not adequately monitor or audit the cleanfill operations.

Some cleanfills have been operating illegally, either without consents or breaching consent conditions or rules in a district or regional plan. This practice does not appear to have received the level of attention necessary to avoid unacceptable effects because cleanfills traditionally have not been considered to have any effect on the environment. This is often due to a lack of resources in some regions and the need to prioritise compliance efforts.

The Ministry for the Environment believes a lack of guidance for cleanfill operators and environmental managers has contributed to the poor operation and management of cleanfills in New Zealand. This *Guide* has been prepared to assist councils and cleanfill operators by providing a national definition for cleanfills, defining appropriate waste acceptance criteria, and advising best practice methods for managing cleanfills. The Guide encourages well-run, low-risk cleanfill sites.

1.2 The waste management hierarchy

Before *any* waste is disposed of, careful consideration should be given to minimising or eliminating the waste stream in accordance with the waste management hierarchy. This hierarchy, ranked in terms of decreasing preference, is:

i prevention or reduction

ii reuse

iii recycling or materials/energy recovery

iv final disposal in a safe manner.

Waste minimisation is particularly relevant in the context of cleanfills, where the primary source of waste is from the construction and demolition industry. Nearly all construction and demolition waste can be recycled or reused. Selective demolition or 'de-construction' of structures and good management of construction sites will result in a sorted, uncontaminated and potentially valuable resource rather than a waste product.

However, there can be economic and environmental costs associated with waste minimisation, and these need to be weighed against the benefits of any proposed waste minimisation efforts.

1.3 Objectives

The objectives of this Guide are to:

- clarify and define the term 'cleanfill'
- outline general waste acceptance criteria for cleanfills, and explain why certain other wastes should be excluded
- provide information to councils for determining consent requirements for cleanfills
- provide guidelines for locating and determining the feasibility of a new cleanfill site
- define methods for effectively managing cleanfill sites to minimise adverse environmental effects
- raise awareness of the risks associated with poorly managed cleanfills
- provide information to assist councils and operators with the upgrading of existing cleanfill operations and, where necessary, determine the need for closure of unsatisfactory cleanfill operations
- help councils and industry to re-define landfills that have been incorrectly labelled as cleanfills.

1.4 Scope

The main environmental objectives for cleanfills are to ensure that there is no site contamination and no leachate generation from the deposited waste. Identification and enforcement of appropriate waste acceptance criteria are the main means of achieving these objectives, so these are the main focus of the Guide. However, the operation of a cleanfill can cause other potentially adverse environmental effects, especially those relating to erosion and sediment control.

The Guide describes potential effects from cleanfills and methods for avoiding or minimising these effects.

The scope of this Guide is restricted to environmental issues associated with the establishment, operation and closure of cleanfills. Commercial and engineering considerations – which may be significant for many cleanfills – are discussed in passing, but guidance is only suggested for these issues where they are of environmental significance.

This Guide does not eliminate the necessity for the detailed development of site-specific consent conditions or specific clauses for regional or district plans. Sections of the Guide are not intended to be copied verbatim, or adopted without consideration of their suitability on a case-by-case basis. Relevant sections can, however, be used as a guide for preparing specific conditions or clauses.

1.5 Who should use the Guide?

The Guide is intended as a practical handbook for use by local government, cleanfill operators and environmental managers. The Guide could be used by:

- city, district and regional council officers:
  - to establish appropriate district and regional plan provisions for cleanfills
  - for monitoring cleanfill operations
- city, district and regional council consent officers for processing consent applications for cleanfills
- cleanfill operators:
  - when establishing a cleanfill
  - to determine what waste can be accepted at a cleanfill
  - to establish appropriate operating procedures
- city, district and regional council officers for monitoring cleanfill operations
- city, district and regional council officers *and* cleanfill operators to reclassify existing operations as 'cleanfilling' or 'landfilling'
- waste generators and transporters to determine whether their waste should be going to a cleanfill or a landfill.

1.6 How to use the Guide

The Guide provides an overview of the requirements for cleanfills in New Zealand. It is loosely divided into two sections. Chapters 1 to 4 define cleanfills, the waste acceptance criteria and the regulatory setting. Chapters 5 to 8 provide guidelines for establishing and operating cleanfills.

Detailed information is provided on waste acceptance for cleanfills, since this is the primary purpose of the Guide. However, where detailed information is readily available elsewhere on related aspects of cleanfill management, the reader is referred to those other more detailed documents. This is particularly the case for details on erosion and sediment control (Chapter 7), and for testing contaminated soils, sampling methods and acceptability criteria if contaminant concentrations greater than background are to be allowed in resource consents (section 4.4).

This document is a guide and is not intended to be interpreted as a mandatory standard or a set of regulations. A practical approach must be taken when applying the suggestions made, as not all suggestions will apply in all cases. In particular, the scale of the operation must be taken into account when applying the guidelines.

Appendix A provides a checklist on how to use this Guide when considering the establishment of a cleanfill.

1.7 Relationship with other guides

1.7.1 Landfill Management Programme

This Guide is one of a series of guidelines prepared by or sponsored by the Ministry for the Environment under the Landfill Management Programme. Cleanfills are a form of landfill, and there are many practices and issues that are common to both. Reference is made to other documents as appropriate.

Related guidelines produced by the Ministry for the Environment include:

- *Landfill Guidelines*, Centre for Advanced Engineering, University of Canterbury, 2000 (partly funded by the Ministry for the Environment)
- *A Guide for the Management of Closing and Closed Landfills in New Zealand*. Ministry for the Environment, 2001
- *A Guide to Landfill Consent Conditions*. Ministry for the Environment, 2001
- *Landfill Acceptance Criteria for Wastes with Hazardous Properties: Issues and Options.* Ministry for the Environment, 2001
- *Landfill Full Cost Accounting Guide*. Ministry for the Environment, to be released March/April 2002
- *Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand*. Ministry for the Environment, 1998
- *Health and Environmental Guidelines for Selected Timber Treatment Chemicals*. Ministry for the Environment, 1997
- *Guideline for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand*. Ministry for the Environment, June 1999.

1.7.2 Landfill waste acceptance criteria and landfill classification

During April 2001 the Ministry for the Environment released an issues and options paper entitled *Landfill acceptance criteria for wastes with hazardous properties*. This document recommends the development of a nationally consistent approach to landfill waste acceptance criteria and presents three options. The preferred option involves the development of a landfill classification system combined with prescriptive lists defining what wastes are able to be disposed in the differing landfill classes.

The report asks whether any future landfill classification system should be extended to include cleanfill sites. The Ministry will consider comments made on this proposal by submitters during the ongoing analysis of landfill classification and waste acceptance criteria.

2 What is a Cleanfill?

2.1 Cleanfilling versus other landfill types

2.1.1 Landfilling

The term 'landfill' or 'sanitary waste landfill', applied to municipal solid waste landfills, is widely used in today's society and is generally well understood. The *Landfill Guidelines* (CAE, 2000) simply define a landfill as 'a waste disposal site used for the controlled deposit of solid wastes into or onto land'.

Municipal solid waste accepted at landfills comprises any non-hazardous,[1] solid and degradable waste from a combination of residential, commercial and industrial sources. It includes putrescible waste and garden waste. This type of material placed in a landfill will degrade, producing leachate and landfill gas over an extended period.

The principal environmental performance objectives for a landfill are protecting groundwater and surface water from leachate contamination, and protecting people and the environment from the adverse effects of landfill gas. These objectives have a major influence on the siting, design and operation of a landfill. The key features of landfills that address these objectives are:

- selecting a site with favourable geological and hydrogeological conditions to minimise the impact of any leachate that may escape from the site
- a base liner and leachate collection system to protect ground and surface water
- appropriate treatment and disposal for collected leachate
- appropriate gas control and monitoring system
- operating the landfill to control effects associated with litter, dust, odour, noise and vermin
- site capping and rehabilitation
- environmental monitoring.

[1] Municipal solid waste may contain a small percentage of hazardous waste, such as paints and domestic cleaners, included with the general waste stream.

2.1.2 Cleanfilling

In contrast, cleanfills are promoted as low-cost alternatives to landfills for "inert" waste that will have potentially no adverse environmental effect, or only minor effects. The cleanfill site selection process can be less stringent. There is no need for the construction of liners, leachate collection systems or gas control systems, and the required environmental monitoring can be reduced. The result is a significant reduction in the cost of establishing and operating a cleanfill compared to a landfill.

The material deposited in a cleanfill will typically be from construction and demolition activities, and will generally comprise soil, rock, concrete, bricks and similar inert material. However, not all construction and demolition waste can be considered to be inert and suitable for cleanfilling.

Criteria limiting the waste that can be accepted provide the primary environmental control for a cleanfill. For this control to be effective, waste acceptance must be extensively monitored and the criteria enforced during the operational period of the cleanfill.

Cleanfills can, however, present an attractive option to irresponsible waste generators seeking to dispose of non-cleanfill waste at a low cost. Particular vigilance is required by operators and consent authorities enforcing waste acceptance control to ensure that this does not happen.

2.2 Cleanfill definition

Cleanfill material is material that does not undergo any physical, chemical, or biological transformations that will cause adverse environmental effects or health effects once it is placed in a cleanfill. Cleanfill material has no potentially hazardous content and must not be contaminated by or mixed with any other non-cleanfill material.

Cleanfill material and cleanfills are defined as follows.

Cleanfill material

Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:

- combustible, putrescible, degradable or leachable components
- hazardous substances
- products or materials derived from hazardous waste treatment, hazardous waste stabilisation or hazardous waste disposal practices
- materials that may present a risk to human or animal health such as medical and veterinary waste, asbestos or radioactive substances
- liquid waste.

Cleanfill

A cleanfill is any landfill that accepts only cleanfill material as defined above.

2.3 Purpose of cleanfilling

There are a number of reasons for establishing cleanfills.

- A landowner or developer may have a "hole" that needs to be filled in order to further utilise or develop a property. In this case, the owner is looking for a low-cost source of fill material. Such a "hole" could be a natural depression or gully, a disused quarry, or excavation resulting from mining or construction activities. Quarries may have requirements or expectations for reinstatement, and cleanfilling is a sensible way of achieving these.
- A property owner or developer may have surplus material from a construction or demolition project. The owner could dispose of this material at a suitable location on its own site or on a suitable site nearby. The objective is the low-cost appropriate disposal of the surplus material.
- A local council may promote the establishment of a cleanfill to reduce the volume of waste discharged to its municipal solid waste landfill to extend its operating life.
- An operator may set up a commercial operation for the disposal of cleanfill.
- A developer may wish to fill an area of land for a subdivision development.

The common factor in all of these is the type of material used for the fill operation.

2.4 End use

In all the above cases the opportunity exists for the beneficial use of the land on which the cleanfill has been constructed to provide an additional financial return for the cleanfill operation. It is not uncommon for a building, a more extensive development, or a residential or commercial subdivision to be constructed on a completed cleanfill site. However, this is extremely uncommon on a municipal solid waste landfill site, where it presents particular technical challenges.

Where such development is anticipated, the quality control of fill placement is important to achieve a suitable 'engineered fill'. In this situation the operator may place additional controls on the acceptance of waste in relation to the nature and size of individual waste items and the standard to which the fill is compacted and tested. Such additional controls for acceptance and placement to achieve an engineered fill for future development of the site are beyond the scope of this Guide. Operators proposing such an end use should seek professional engineering advice.

Development on a cleanfill site raises the possibility of subsequent excavation on the site for construction of buildings or structures as part of the original development or for further development in the future. The original developer may have no control over future activities on the site, so it is important that any waste deposited in a cleanfill will not present a risk to human health if excavated or subsequently exposed.

Where no future development on the site is proposed, the site may be treated simply as a 'cleanfill landfill' with no particular engineering fill controls. The site could be capped and grassed and used for rural activities, passive recreation, open yard-type commercial uses or other similar uses. Any future development on the site may need to be restricted and would be subject to engineering investigations and design. In this case, the status of the site would need

to be recorded by the council on the site file for the subject property or other appropriate database. This information would then be available for a Land Information Memorandum (LIM).

2.5 Do I have a cleanfill?

The fill material placed in a cleanfill can be predominantly soil. In some cases there may be little difference between cleanfilling and an earthworks construction operation. This raises the question: When does an earthworks fill operation become a cleanfill, and when does a cleanfill become an earthworks operation?

For the purposes of this Guide the question is not important. What is important is the criteria for establishing the type of waste that can be accepted for placement in all fill operations.

The key considerations are as follows.

- If any material is being placed onto or into land then this operation will be potentially either a cleanfill or a landfill.
- If the material clearly complies with the definition of cleanfill then the operation will be a cleanfill.
- If the fill contains materials specifically excluded from the definition of cleanfill (for example, general demolition products, green waste or municipal solid waste) then it is a landfill.
- If virgin natural materials are being moved from one part of a site to elsewhere on the same or contiguous site, then this would be considered an earthworks operation.

For practical administrative purposes, city, district and regional councils need to allow for small-scale cleanfilling to occur as a permitted activity. Such cleanfills should still be subject to the principles outlined in this Guide, particularly for waste acceptance and the control of erosion and sediment discharges. Councils should establish appropriate criteria to define a small-scale cleanfill, and these would typically relate to the volume of filling, the area of exposed earth surfaces, and/or the sensitivity of the fill site or adjacent environment. Such criteria have already been established for many cities, districts and regions, and developers/operators need to find out the criteria applying in the area in which they operate.

3 Regulatory and Legislative Setting

3.1 Introduction

The Resource Management Act 1991 (RMA) is the primary statute for the management of New Zealand's environment. As there is no legislation dealing specifically with cleanfills, activities associated with their establishment and operation are controlled through the RMA.

This chapter provides an overview of the key RMA requirements for councils and cleanfill site operators and owners during the life-cycle of a cleanfill. It does not purport to be exhaustive, and if in doubt professional legal advice should be sought.

3.1.1 Purpose and principles of the RMA (Part II)

The overriding purpose of the RMA is to 'promote the sustainable management of natural and physical resources'.

'Sustainable management' is defined in section 5 as:

> *... managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while –*
>
> *sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generation; and*
>
> *safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
>
> *avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

In achieving the purpose of sustainable management, all persons exercising powers and functions under the Act (for example, councils, consent authorities, requiring authorities, central government) have a statutory duty to:

- recognise and provide for the "Matters of National Importance" (section 6)
- have particular regard to "Other Matters" (section 7)
- take into account the "Principles of the Treaty of Waitangi" (section 8).

The focus of the RMA is on managing the environmental effects of activities rather than the activities themselves. It requires the integrated management of natural and physical resources. Individual effects cannot be looked at in isolation from the wider environment.

Part II, and in particular section 5, are paramount considerations for local authorities when assessing applications for cleanfill activities under section 104 of the RMA. Part II must also be considered by local authorities when developing objectives, policies and rules for inclusion in district and regional plans that relate to the establishment and operation of cleanfills.

3.1.2 Administration of the RMA (Parts IV and V)

Under the RMA a system of responsibilities and powers for central and local government is developed to ensure that the purpose and principles of the Act are being carried out.

Central government provides a national overview and monitoring role, with some areas of direct responsibility (for example, call-in powers for matters of national significance). Central government establishes the regulations and empowering Acts that the regional, district and city councils use. Central government can also set technical standards (for example, water quality standards, waste acceptance criteria) and issue policy statements on matters of national significance.

Currently there are no national standards defining cleanfills and cleanfill waste acceptance criteria.

Regional council functions include the preparation, implementation and review of objectives, polices and methods to achieve the integrated management of the natural and physical resources of a region. The regional council has direct responsibility (via rules in the regional plan and conditions on resource consents) to control activities affecting the coastal environment, discharges of contaminants, water quality and soil conservation.

City and district council functions include the preparation, implementation and review of objectives, polices and methods to achieve the integrated management of the natural and physical resources in a city or district. City and district councils have direct responsibility (via rules in the district plan and conditions on resource consents) to control uses of land and the effects of those uses, including noise, design standards, access and traffic.

Regional, district and city councils have the ability under Parts 1 and 2 of the Second Schedule of the RMA to make provision in regional and district plans to control the establishment and environmental effects of cleanfill activities.

3.2 Resource consents required

Part 3 of the RMA sets out the duties and restrictions relating to different types of resource use. Resource consents are required where the activity contravenes the duties and restrictions set out in Part 3, and where a regional or district plan requires that resource consents be sought. The resource consents likely to be required for a cleanfill operation are identified below.

3.2.1 Land (section 9)

A land-use consent will be required to establish a cleanfill operation unless cleanfill activities are expressly provided for in the district plan. A consent may also be required from the regional council for earthworks activities exceeding permitted thresholds in the regional plan (section 9(3)).

3.2.2 Discharge of contaminants (section 15)

Materials and substances disposed of as cleanfill fall within the RMA definition of a 'contaminant' because they have the *potential* to change the physical, chemical or biological condition of the land or water onto or into which they are discharged (section 2).

A discharge permit is required under section 15 for the disposal of cleanfill materials to land and to water unless these activities are expressly provided for in a district or regional plan or by an existing use right. If the materials being disposed of will leach into the receiving environment, these materials are unlikely to be accepted at a cleanfill (see section 2.2 this document).

A discharge to air permit may be required under section 15(1)(c) if the cleanfill produces dust and/or odour. However, odour is unlikely at a cleanfill where materials deposited comply with the waste acceptance criteria of this Guide (see section 2.2).

3.2.3 Water (section 14)

A water permit from the regional council may be required for the following activities occurring on a cleanfill site:

- collection, control or diversion of stormwater
- diversion or damming of watercourses or groundwater
- taking of water or groundwater (for example, for dust control).

3.2.4 Rivers and lake beds (section 13)

The disposal of cleanfill material in streams or lakes for activities such as streambank protection works or reclamations will require consent unless these activities are expressly provided for in the regional plan.

3.2.5 Coastal marine area (section 12)

The disposal of cleanfill materials or discharge of waters from the cleanfill directly into the coastal marine area and intertidal zone for activities such as coastal protection works or reclamations will require a coastal permit unless these activities are expressly provided for in the regional coastal plan. Approval from the Minister of Conservation will be required in instances where the activity or discharge is restricted.

3.2.6 Noise (section 16)

There is a duty on every occupier of land (including the coastal marine area) to adopt the best practicable option to ensure noise does not exceed a reasonable level. Noise limits are typically provided as rules in a district plan.

3.2.7 Who issues consents?

The regulatory authority responsible for the each different type of consent is shown in Table 3.1.

Table 3.1: Regulatory authority resource consent responsibilities

Authority	Consent type	Purpose
Regional council or unitary authority	Discharge permits	Discharge of contaminants to: • land • water • air
	Water permit	The taking, use, damming or diverting of water.
	Land-use consent	Excavation or filling of the land; installation of bores and culverts.
	Coastal permit	If the site is in a coastal marine area.
District or city council, or unitary authority	Land-use consent	Use of land for purposes of a landfill.
	Subdivision consent	This may be necessary if the project involves any creation of new allotments, amalgamation of titles, vesting of roads or reserves, or partition of the land into different ownerships.
Minister of Conservation	Coastal permit	Restricted coastal activities.

3.3 Status of activities

3.3.1 Designations and existing use rights

In addition to the types of consent above, designations and existing use rights are also treated as a form of resource consent.

Designations operate like a rule in a district plan. They can only be initiated by a requiring authority (for example, a local authority or network utility operator). They provide land-use consent for the activity and allow the requiring authority to do anything in accordance with the designation. They have the advantage of providing long-term certainty, and they operate independently of rules in a district plan. Many cleanfill sites owned and operated by local authorities have been established by designation.

Existing use rights allow lawfully established activities to continue (even if subsequent legislative changes mean they now contravene a rule in a plan), provided the effects of the use are the same or similar in character, intensity or scale to those that existed prior to the rule becoming operative or the proposed plan notified. If they meet the criteria for existing use rights, existing cleanfills can remain as of right provided the scale and/or the effects do not change.

Operators and owners of cleanfills that were established before the RMA and that are still operating need to ensure that the cleanfills are authorised either through existing use rights or, in the case of local authorities, by designation. Any significant changes to the cleanfill operation, such as site expansion or changes to the types of materials accepted, are likely to require new resource consents.

3.3.2 Status of activities

Activities are classified under the RMA into five categories.

Permitted activities are recognised as being compatible with the environmental outcome sought by the regional or district plan. No resource consent is required, but permitted activities are subject to performance criteria in the plan.

Controlled activities may have a minor adverse effect on the environment. Consent must be granted, but subject to conditions in accordance with criteria set out in the regional or district plan.

Discretionary activities (including limited/restricted discretionary activities) are allowed at the discretion of the consent authority. The scope of matters that may be considered are wide ranging, unless the plan specifically restricts the scope of the consent authority's discretion. There is a general presumption that there is potential for adverse effects to be created by discretionary activities.

Non-complying activities are not provided for by the plan. There is a presumption that the activity will have an adverse effect on the environment unless it can be demonstrated otherwise.

Prohibited activities are expressly prohibited in the plan and no resource consent can be granted.

3.3.3 Activity status of cleanfills

Some district and regional plans (for example, Far North District Proposed Plan, Rotorua District Plan) treat cleanfilling operations as a permitted activity. These activities are subject to compliance with a range of performance criteria, including quantities, nature of materials and location. Other plans (for example, Northland Proposed Regional Water and Soil Plan, Otago Regional Plan: Waste) make specific provision for cleanfilling as either permitted or controlled activities. Again, these are subject to compliance with a range of performance criteria.

Regional, district and city councils may wish to consider incorporating the Ministry for the Environment's cleanfill waste acceptance criteria described in this Guide into their plans, either as performance criteria or as the basis for establishing resource consent conditions. This will provide a greater degree of certainty and control over what materials can be disposed of in cleanfills.

3.4 Resource consent applications

3.4.1 Application

Applications for resource consent are made under section 88 of the RMA. Section 88 requires that an assessment of environmental effects (AEE) be provided for each application. The scope of the assessment should correspond with the scale and significance of the actual and potential environmental effects.

The Fourth Schedule of the RMA sets out the matters that are required to be addressed in an AEE. When preparing an AEE to establish a cleanfill operation, applicants need to consider a wide range of potential off-site effects and mitigation measures, including:

- effects on neighbours (social, noise, dust, traffic)
- visual impacts
- measures to control discharges
- effects on the existing natural environment (for example, site clearance and vegetation removal and rehabilitation)
- site location (proximity to water courses, erodability, significance of site to tangata whenua).

3.4.2 Notification

Section 93 of the RMA requires the consent authority to notify affected parties. Proposals can proceed on a non-notified basis only if one of the following conditions is met (section 94).

- The activity is controlled and the plan expressly permits the consideration of the activity without the need to obtain the written approval of affected persons.
- The activity is a limited discretionary activity and the plan expressly permits the consideration of the activity without the need to obtain the written approval of affected persons.
- The activity is discretionary or non–complying, but the consent authority is satisfied that the adverse effects on the environment will be minor and the written approval has been obtained from every person deemed by the consent authority to be adversely affected (unless it is unreasonable to obtain such approval).

3.4.3 Consent conditions

Section 104 of the RMA sets out the matters a consent authority must consider when assessing an application for a resource consent. The assessment is subject to Part II matters, and other considerations such as the actual and potential effects on the environment of allowing the activity and compliance with relevant regional and district plans.

Conditions may be imposed on resource consents under section 108. The types of issues that need to be covered by consent conditions for activities associated with cleanfilling are summarised in Table 3.2 below.

3.4.4 Term of a consent

The maximum life of a consent is 35 years, except for land-use, subdivision and reclamation consents, which are unlimited. If no period is specified then the default consent period is five years. A consent lapses after two years if it is not exercised. If existing use rights apply, the use must not have discontinued for a continuous period of more than 12 months.

Table 3.2: Examples of issues to be covered by consent conditions for cleanfills

Type of consent	Types of conditions
Land use (section 9)	• Site location (e.g. proximity to waterways, coast, residential areas, areas of significance to tangata whenua) • Hours of operation • Traffic and access • Noise • Visual and landscape mitigation • Earthworks controls • Sediment and erosion control • Site rehabilitation
Discharge to land (section 15) (e.g. disposal of waste materials to ground)	• Quantity of fill to be placed • Waste acceptance criteria • Monitoring • Site security/fencing • Location of material
Discharge to water (section 15) (e.g. discharge of site stormwater)	• Location of discharge • Quantity of discharge • Quality of discharge • Design, integrity and maintenance of structures • Monitoring and reporting
Discharge to air (section 15) (e.g. odour, dust)	• Separation distances from adjacent sites • Operational practices to minimise dust/odour • Complaints procedures
Works in watercourse (section 13) (e.g. stream protection works or reclamations)	• Suitability of material (waste acceptance criteria) • Quantities • Protection of stream ecology (e.g. provision for fish passage) • Protection of stream hydrology and hydraulics

Type of consent	Types of conditions
Water permit (section 14 (e.g. diversion or damming of watercourses)	• Location of dams, diversion or takes • Quantity of take • Design and integrity of structures
General conditions (section 108)	• Preparation and implementation of management plans • Cultural considerations/protocols • Site rehabilitation • Bond

3.5 Enforcement

Part XII of the RMA deals with offences and enforcement. The most common forms of enforcement are through abatement notices, enforcement orders and infringement notices.

Abatement notices are issued by local authorities requiring any person to stop or not start anything that:

- contravenes or is likely to contravene the RMA, a rule in a plan, or a resource consent; or
- is, or is likely to be, noxious, dangerous, offensive, or objectionable to such an extent as to have an adverse effect on the environment.

Enforcement orders are issued by the Environment Court requiring any person to stop or not start anything that:

- contravenes or is likely to contravene the RMA, a rule in a plan, a resource consent, designation, existing use right; or
- is, or is likely to be noxious, dangerous, offensive, or objectionable to such an extent as to have an adverse effect on the environment.

Abatement notices and enforcement orders can also be issued to require a person to do something to achieve compliance with the RMA, rules in a plan or resource consent. This includes avoiding, remedying or mitigating adverse effects caused by that person.

Interim enforcement orders can be issued in emergency situations to prevent imminent adverse effects occurring.

Retrospective enforcement orders can be issued under section 314(4) of the RMA requiring a person responsible for historical site contamination to rehabilitate the site. Similar orders can be issued under section 314(da) to owners or occupiers of a contaminated site, even though they may not have been responsible for its contamination. The Environment Court has held that retrospective enforcement orders are limited to contamination that occurred after the RMA came into force.

Infringement notices under section 343c can be issued by enforcement officers to deal immediately with minor offences. 'Instant' fines of up to $1000 may be imposed.

3.6 Offences

3.6.1 Offence provisions

Offences are set out in section 338(1) of the RMA. They relate to breaches of sections 9 to 15 of the Act, and to any enforcement order or abatement notice.

Section 338 offences are based on strict liability, which means that it is not necessary to prove intent to commit the offence. Section 341(2) provides limited defences such as reasonable action in an emergency situation, or unforeseeable act beyond the defendant's control. In each case remedial action following the incident is required.

3.6.2 Corporate liability and liability for acts of agents

Principals and employers are liable for the acts of agents and employees (RMA section 340). A defence of due diligence is available only if the principal did not know and could not reasonably have been expected to have known of the committing of the offence, or that all reasonable steps were taken to prevent the committing of the offence.

Owners and managers of cleanfill operations need to be aware of their potential liability arising from the acts or omissions of employees. There are a number of ways to reduce exposure to liability, including:

- employee environmental training
- conducting regular site environmental audits and monitoring
- implementation of environmental management systems
- contingency measures on-site for unforeseen events or emergencies
- waste declaration documentation or licences/contracts for regular users.

3.6.3 Penalties

The maximum penalties under the RMA are a fine of $200,000, or a prison sentence of up to two years. Fines of up to $10,000 per day are imposed for continuing offences.

Examples of penalties imposed for breaches of the RMA, which are relevant to cleanfills, are provided below.

- *Machinery Movers Ltd* v *Auckland Regional Council (1994) 1 NZLR 2 NZRMA.* A fine of $25,000 (excluding costs) was imposed for the discharge of chemical contaminants to land in circumstances where they were likely to enter water, causing damage to wildlife. The discharge was intentional, but the employees were unaware of the toxicity of the contaminants.
- *Canterbury RC* v *Timaru DC 23/19/96.* A fine of $2500 was imposed when effluent was discharged into a stream as a result of unforeseen failure of pumps and the actions of poorly trained employees.

- *Northland RC* v *Acacia Park Ltd 16/6/97.* A fine of $8500 was imposed for the deposition of waste material not on the consented area (on top of a plateau), but rather on the slope itself. Run-off from the waste caused serious pollution in a tributary of the Whangarei Harbour.
- *Bay of Plenty RC* v *Waimea Consultancy Ltd 27/9/99*. Fines of $20,000 (consultancy) and $8500 (consent holder) were imposed for dust nuisance relating to earthworks for a subdivision.
- *Auckland RC* v *Interclean Industrial Services Ltd 27/7/99.* Fines of $15,000 were imposed for the discharge of contaminants to land; in this case, the stock-piled waste material exceeded the holding capacity of the bund.
- *Auckland Regional Council and Manukau City Council* v *AA Wholesale Hire Ltd, 1995*. Fines of $37,000 were imposed.

3.6.4 Other remedies

Common law remedies (such as nuisance, negligence and trespass) and other legislation (Health Act 1956 and Building Act 1991) continue to be available, either instead of or in addition to the RMA, but these remedies have very rarely been used since the introduction of the RMA.

3.7 How to find out more

The following documents have been produced by the Ministry for the Environment:

- *Guide to Landfill Consent Conditions*. Ministry for the Environment, Wellington, 2001
- *Resource Management Act Practice and Performance: A Guide to the Resource Management Act*. Ministry for the Environment, Wellington, 1998
- *Your Guide to the Resource Management Act: An essential reference for people affected by or interested in the Act*. Ministry for the Environment, Wellington, 1999.

For further guidance, see:

- www.mfe.govt.nz.

4 Waste Acceptance Criteria

4.1 General criteria for cleanfill material

Determining if a particular waste is acceptable in a cleanfill requires an assessment of how the waste will behave when it is placed, and the potential effects of the waste on the environment. Only waste complying with the definition of cleanfill in section 2.2 should be accepted at a cleanfill.

In accordance with that definition, the following general types of waste are ***UNACCEPTABLE*** in a cleanfill.

Leachable waste

Leachate is formed when water passes through wastes that are soluble or contain soluble parts. Combustion and/or degradation can lead to soluble compounds being formed from insoluble ones. The water leaches soluble contaminants from the waste, forming a leachate. Leachate contaminants may include metals, nitrogen, organic compounds (such as pesticides and herbicides), and many other contaminants that may be present in waste.

Leachate will migrate into the soil and can contaminate soil and/or groundwater. This can create a public health risk if the groundwater is used for water supply. Leachate may also find its way to surface water, causing pollution and posing a risk to stream ecology as well as to public health.

Degradable waste

Some wastes (for example, green wastes) break down over time due to chemical or biological action. This can result in compounds becoming soluble and leaching into the environment. Chemical reactions can occur when the waste comes in contact with water (rust, for instance). Biological degradation can release gases that may be toxic, environmentally detrimental, odorous or flammable.

Putrescible waste

This is a sub-set of degradable waste, the waste typically being readily degradable and having already started the decay process, resulting in odours. Putrescible waste is able to support disease vectors such as flies, rats and birds, so special control of putrescible waste is needed to limit public health risks.

Combustible waste

Combustible materials within a cleanfill pose a fire risk. Fire may release gases that may be highly toxic and pose a risk to people and the environment. Combustion may also create soluble compounds that are leachable. Fire itself may spread outside the cleanfill and present a physical danger to people and property in the vicinity.

Unsafe if excavated

Some substances may have little effect when buried in a cleanfill, but could pose a significant risk to people and/or the environment if excavated.

These risks may be in the form of chemical hazards or health hazards (for example, used needles, asbestos) or bulky or sharp objects placed near the cleanfill surface that may protrude through the cleanfill cap.

Hazardous substances

Hazardous wastes pose a present or future threat to people or the environment as a result of one or more of the following characteristics:

- explosiveness
- flammability
- capacity to oxidise
- corrosiveness
- toxicity
- eco-toxicity.

Liquid wastes

Liquid wastes by their very nature can potentially seep directly into the environment and are therefore unacceptable.

Materials that do not exhibit any of these properties are acceptable in cleanfills.

4.2 Acceptable cleanfill material

4.2.1 Acceptable materials

Table 4.1 lists materials that are acceptable for disposal in cleanfills. The reasons for acceptance of these materials are described in the table.

For regional plans it is expected that the discharge of materials listed in Table 4.1 could be considered as a permitted activity for cleanfills. For district plans the placement of these materials could be expected to be permitted in areas where the plan provides for cleanfilling activities.

Table 4.1: Cleanfills – acceptable materials

Material	Discussion
Asphalt (cured)	Weathered (cured) asphalt is acceptable: After asphalt has been exposed to the elements for some time, the initial oily surface will have gone and the asphalt is considered inert.
Bricks	Inert – will undergo no degradation.
Ceramics	Inert.
Concrete – un-reinforced	Inert material. Ensure that other attached material is removed.
Concrete –reinforced	Steel reinforcing bars will degrade. However, bars fully encased in intact concrete will be protected from corrosion by the concrete. Reinforced concrete is thus acceptable provided protruding reinforcing steel is cut off at the concrete face.
Fibre cement building products	Inert material comprising cellulose fibre, Portland cement and sand. Care needs to be taken that the product does not contain asbestos, which is unacceptable.
Glass	Inert, and poses little threat to the environment. May pose a safety risk if placed near the surface in public areas, or if later excavated. The safety risk on excavation should become immediately apparent, so glass is considered acceptable provided it is not placed immediately adjacent to the finished surface.
Road sub-base	Inert.
Soils, rock, gravel, sand, clay, etc	Acceptable if free of contamination (see 4.3.2 for definition of contaminated soil in this context).
Tiles (clay, concrete or ceramic)	Inert.

4.2.2 Conditionally acceptable materials

Materials other than those listed in Table 4.1 may comply with the definition of cleanfill. In some cases, additional evidence may be required to prove that particular materials comply with the definition and are acceptable. In other cases controls may need to be placed on the quantity of certain materials placed in the cleanfill, or their position within the cleanfill, to ensure that the properties of the material in place comply with the definition.

Where materials of this nature are proposed to be deposited, the cleanfill should not be allowed as a permitted activity and a resource consent will be required. Requirements for the acceptance or placement of certain materials can then be described by the conditions of the consent and appropriate management plans and monitoring established. It is not expected that a cleanfill operator should make decisions on the acceptability of these types of materials, unless specifically provided for in a consent.

Common materials that fall into this category and the reasons for any limitations or conditions are described below. Other materials not described below may fall into this general category and it may be possible for the waste generator or cleanfill operator to demonstrate to council compliance with the definition of cleanfill. However, as noted above, the cleanfill operator should not accept or place this material without consent approval from the appropriate authority.

Cement (dry) and cement wastes

Such material will have a high pH and may react with other materials in the cleanfill, resulting in unacceptable leachate. Acceptance should be conditional on the actual composition and properties of the cement waste and other wastes likely to be deposited adjacent to it.

Limitation may need to be placed on the total quantity deposited, location within the cleanfill and/or limitations on other wastes that can be accepted.

Dredging spoil

Dredging spoil from harbours, rivers and estuaries can be highly variable in contaminant content, ranging from 'virgin material' to highly contaminated with hazardous substances. It may also have a high organic content, which would be unacceptable. Such material would need to be tested for suitability as cleanfill relative to background contaminant concentrations (see section 4.4).

Glass fibres (including Pink Bats)

While similar to glass, the fibrous nature of this material means that it may pose a safety risk before this is apparent. This material may be acceptable with conditions placed on the end use of the site or the location of the material in the cleanfill (for example, to be placed a specified depth beneath the surface).

Mine tailings/spoil

This material could be highly variable in content and would need to be tested to determine its acceptability (see section 4.4).

Plasterboard (gib/drywall)

Plasterboard is manufactured from gypsum (calcium sulphate). American studies have indicated that the degradation of plasterboard can result in elevated sulphate levels in underlying groundwater. Gypsum can also release hydrogen sulphide (a toxic and odorous gas) under moist, anaerobic conditions.

This material may be acceptable with restrictions placed on the total quantity of material in the cleanfill. The quality and use of underlying groundwater systems should be taken into account.

Plastic and polystyrene

Plastics are typically inert. Small quantities of building plastics such as pipes and plastic sheeting amongst a matrix of cleanfill material are acceptable. A large quantity of plastic on its own or with other combustible material may present a fire hazard.

Combustion products from plastics generally comprise lower aromatics, which provide a potential leachate hazard.

Plastics used in domestic or industrial situations, for example, are unacceptable as they are typically used as containers and may be contaminated with other materials.

Restrictions would need to be placed on the total quantity of plastics and/or other types of materials that can be placed with the plastics to control the risk of combustion.

Low-level contaminated soils, rock, gravel, sand, clay, etc.

Soils etc. with low levels of contaminants may be acceptable if the consent authority is satisfied that the material meets the definition of cleanfill. Consent conditions would specify the maximum levels of contaminants permitted and the frequency and scope of testing required to demonstrate compliance (see sections 4.3.2 and 4.4.).

Timber (natural)

This refers to natural timbers comprising tree trunks, branches (over 80 mm diameter) and roots. Although degradable, such material will take a long time to decompose and will not cause significant leachate. There may be issues associated with potential subsidence after decomposition has taken place. Restrictions should be placed on the total quantity of this type of material in the cleanfill, and care must be taken that such timber is generally dispersed throughout other cleanfill material.

Tyres

Tyres may present a fire hazard in large quantities. Small quantities of tyres may be acceptable if dispersed amongst other non-combustible materials.

4.3 Unacceptable cleanfill materials

4.3.1 Unacceptable waste

Table 4.2 lists common materials, especially construction and demolition waste, that are considered unacceptable for disposal at a cleanfill. Such material should be disposed of at a landfill authorised to accept that material. The reasons for exclusion are discussed in the table.

The table includes materials that have traditionally been inappropriately disposed of to cleanfills. This list is not exhaustive and there will be other materials that are unacceptable. If a substance or waste is not included in this table this *does not* imply acceptance. Generally, if the waste is not listed in Table 4.1, or it exhibits any of the properties that make it unacceptable as cleanfill as described in section 4.1, then the waste cannot be disposed of to cleanfill.

The classification of specific materials not listed in these tables could be confirmed through the appropriate regional council or through the resource consent process.

Table 4.2: Unacceptable waste

Material	Discussion
Abrasive blasting sand/agents	May contain metals, paint and other contaminants.
Asbestos (including asbestos sheeting)	Potentially hazardous. Although an inert compound, future excavation could cause significant health effects.
Asphalt (new)	New asphalt or asphalt that has been ground or pulverised may release oily substances that could leach into the environment.
Bark	Degradable; leaches tannins.
Cables	Metal cables will degrade (see Metals).
Car bodies	Contain metals, oils, plastics, asbestos and other potential contaminants.
Carpet	Degradable. May also contain formaldehyde residue from flooring.
Cesspit/stormwater sump cleanings	Contain various metal contaminants and organics.
Containers	To avoid any potential confusion, all containers are considered unacceptable. Containers may degrade or be punctured, releasing their contents or the remnants of their contents. The containers themselves may be detrimental to the environment (see plastics and metal).
Cork tiles	Degradable.
Corrugated iron	Degradable steel and zinc.
Electrical equipment and insulation	For example, fluorescent light tubes could contain PCBs (also see Plastics).
Formica	Generally stable (it is a melamine-formaldehyde polymer), but may be bonded with urea formaldehyde. This is water soluble and may leach formaldehyde compounds into groundwater. Often attached to particleboard.
Foundry sand	Contains metals.
Greenwaste (e.g. grass clippings, tree trimmings)	Will degrade and release contaminants such as ammonia and nitrates into the soil and groundwater, and may generate gases such as methane and carbon dioxide. The resulting leachate may mobilise other contaminants in the fill.
Hardboard	Degradable; contains phenol resorcinol formaldehyde.

Material	Discussion
Household waste	Typically contains large amounts of putrescible and degradable waste that will degrade and cause odour problems, and create soluble compounds causing leachate. Also contains some hazardous components.
MDF (medium-density fibreboard – customwood)	Degradable; may use urea formaldehyde as a bonding agent. This is water soluble and may leach formaldehyde compounds into groundwater (see Particleboard). Some modern MDF boards use phenol formaldehydes and other resins that may be acceptable, but the board itself is unacceptable.
Medical and veterinary waste	Unsafe if excavated (health hazard); may generate leachate.
Metals	For example, structural steel, roofing, window frames, building components, etc; degradable, can leach into the ground or groundwater. Soluble metals may be toxic depending on the concentration.
Paint	Hazardous waste. Liquid paints may contain significant quantities of volatile organic carbon compounds. These will contaminate soils and groundwater, causing detrimental effects to the environment (e.g. killing aquatic life) and human health. Some paints contain metals. Water-based paints contain preservatives and biocides which may include mercury, or other compounds that can cause dermatological problems.
Painted materials	Lead-based paint is hazardous and must be taken to a hazardous waste facility. Once paint has dried, the potential for contaminants in the paint to migrate through the soil is minimised, so all dried paint other than lead-based is relatively inert. However, to avoid any doubt all painted materials should be rejected.
Paper and cardboard	Paper and cardboard are degradable and present a fire hazard.
Particleboard (chipboard)	Contains urea formaldehyde as a bonding agent. This is water soluble and may leach formaldehyde compounds into the groundwater. Formaldehyde is known to cause many adverse health reactions and has been classified as a “probable human carcinogen” by the USEPA.
Plywood – structural / external grade	Uses phenol resorcinol formaldehyde as a bonding agent. This is not water-soluble and is relatively inert. However, the board itself is degradable and the difference between internal and external grade may not be apparent to the cleanfill operator.
Plywood – internal grade	Uses urea formaldehyde glue as a bonding agent. This is water-soluble and may leach formaldehyde compounds into groundwater (see Particleboard).
Road sweepings	Contain various metal contaminants and organics.
Sawdust	Degradable and could contain timber treatment chemicals.
Tar	Can contain a variety of compounds, many of which have been found to be carcinogenic. Many of the compounds do not bind to soil and can migrate directly to groundwater; potential for groundwater contamination with hydrocarbon compounds.
Timber (processed)	All sawn, gauged or dressed timber is considered unacceptable, as the cleanfill operator will not be able to determine easily if it is treated or untreated. Chemicals used for timber treatment can leach out and contaminate soils and groundwater. The chemicals used include copper-chrome-arsenic (CCA), light organic solvent preservatives (LOSP), creosote, boron and pentachlorophenol (PCP). These can all have a detrimental effect on human health and the environment.
Wood chips	Degradable.

Note: If a substance or waste is not included in this table it does not imply it is suitable for acceptance at a cleanfill.

4.3.2 Sources of unacceptable waste

There are a number of sources of waste that are considered unacceptable for disposal in cleanfills.

Waste that has been rejected from a landfill

If a waste fails to meet the acceptance criteria for a landfill then it could not be expected to meet any criteria for acceptance at a cleanfill and must be rejected. This holds regardless of any subsequent testing that may be undertaken in accordance with this Guide.

Any waste that is or has been classified as hazardous

This includes hazardous wastes that have been treated, stabilised or encapsulated to remove or contain the hazardous properties, and any products or materials derived from hazardous waste treatment or hazardous waste stabilisation processes. The idea is that there should be no risk associated with the disposal of any material to a cleanfill.

Contaminated soils

In relation to cleanfills, contaminated soils are defined as:

> *... all soils with contaminant concentrations greater than natural background levels at the cleanfill site.*

All natural soils or contaminated soils with concentrations of contaminants below background levels can be accepted at a cleanfill.

Soils with contaminant concentrations greater than background levels should only be accepted at a cleanfill if specifically allowed by a resource consent or by a rule in the regional plan applicable to the area in which the cleanfill is operating. Such soils would not strictly comply with the definition of cleanfill described in Chapter 2, and should only be considered for acceptance in a cleanfill if the consent authority was satisfied that the effects would be minor.

Soils with naturally high contaminant concentrations are considered to be contaminated soils when the natural contaminant concentrations exceed natural background concentrations at the cleanfill. This situation could occur when soils from one area are transported to a cleanfill in another area.

Background concentrations at the cleanfill site should be checked against any regional or district council requirements to avoid issues arising where council limits are lower than natural background levels. In all cases, local requirements take precedence over the provisions of this Guide.

4.3.3 Mixed materials and small quantities

Materials that would otherwise have been acceptable in a cleanfill will become unacceptable if contaminated with or mixed with unacceptable material. Examples of this may be spilt oil or paint in soil, vegetation or unacceptable building products mixed with soil, or mixed demolition waste (for example, roofing iron or flashings mixed with bricks).

Demolition waste must be thoroughly sorted to minimise the risks of contaminating acceptable cleanfill waste with unacceptable waste. Selective demolition or de-construction can minimise cleanfill contamination by keeping the demolition waste separate as demolition progresses. Material from a selective demolition site would be more readily accepted at cleanfills compared with mixed demolition waste.

Any mixed waste arriving at a cleanfill site should be rejected or thoroughly inspected to ensure that it contains no unacceptable materials.

There has been a trend in the past for some councils to allow small quantities of green waste and metals to be mixed with other materials accepted at cleanfills. A nominal percentage for this type of material has sometimes been specified in regional or district plans or in consent conditions. This approach has often been abused, and used as a justification for allowing larger quantities of such unacceptable waste to be deposited than was ever intended.

The approach taken in this Guide is that *no* amount of unacceptable waste is permitted. However, regional council officers must act *reasonably* when enforcing consents or permitted activities. For example, the occasional small piece of steel or timber attached to concrete, or trace amounts of vegetation mixed with soil, are unlikely to have significant environmental effects and would be allowed at the discretion of the enforcement officer. On the other hand, the operator must reject loads that contain any unacceptable waste or remove any unacceptable materials that can readily be sorted. A cleanfill where any unacceptable waste has been deposited would be subject to the enforcement provisions of the RMA.

4.4 Testing

4.4.1 Materials to be tested

Materials acceptable at cleanfills are clearly defined in section 4.2 so that there can be no possible confusion for waste producers, those responsible for accepting the waste, or those enforcing waste acceptance. However, there will be instances where it will be necessary to prove that a particular material is suitable for disposal in a cleanfill. Examples include:

- dredging spoil
- soils or other materials where it is suspected that there may have been some contamination but the extent of contamination is unknown
- a by-product from an industrial process
- soils or other material originating from an industrial site or other land use which is typically associated with site contamination (see section 8.3.3.).

For acceptance at a cleanfill it must be demonstrated that the concentration of contaminants does not exceed background concentrations in soils at the cleanfill site.

4.4.2 Testing required

In all of the above cases the material may be acceptable if it can be demonstrated that it meets the criteria for cleanfills. Testing will be required to determine acceptability or otherwise, and should be targeted at determining the concentration of contaminants in the fill material for comparison with site background levels.

Site conditions

With this approach in mind, it is recommended that cleanfill operators/owners determine site background levels before commencing to operate a cleanfill. Alternatively, soils on the cleanfill site or from adjacent land could be tested to determine background levels should the need arise. To determine background concentrations, a site-specific sampling programme should be developed which should include, as a minimum, three soil samples.

Organic compounds (for example, total petroleum hydrocarbons, semi-volatile and volatile organic compounds) should not be present on the cleanfill site, so it should not be necessary to test for these. Testing should therefore focus on heavy metals and would typically be expected to include:

- arsenic
- boron
- cadmium
- chromium
- copper
- cobalt
- lead
- mercury
- nickel
- tin
- zinc.

Cleanfill contamination

The frequency and scope of testing required for the fill material itself will depend on the nature and consistency of the material, and will need to be determined in consultation with, and agreed by, the consent authority in the area the cleanfill is operating. For example, a consistent by-product of an industrial process may require initial testing to verify the absence of contaminants in the waste and may then require no further testing, or low-frequency testing to verify that there have been no changes to the process. Dredging spoil showing no contamination in initial testing may require only a low frequency of subsequent testing, whereas dredging spoil or soil from a contaminated site showing substantial variation in results during initial testing may require extensive ongoing testing. This may include testing every truck load, and possibly more than one sample per truck load. Typically, material that requires this level of testing would not be

considered acceptable as cleanfill and the cost of testing would make cleanfilling unattractive to the waste generator.

As a minimum, at least one sample per 1000 m^3 of fill material should be taken and analysed.

Initially at least, testing should screen for a wide range of contaminants. For repeat, long-term, consistent wastes, selected parameters may be appropriate if approved in writing by the appropriate consent authority. Testing should include the heavy metals listed above, plus screens for:

- total petroleum hydrocarbons (TPH)
- semi-volatile organic compounds (SVOCs)
- volatile organic compounds (VOCs)
- polyaromatic hydrocarbons (PAHs).

Other contaminants may be required to be tested depending on the source of the waste.

The test results are then compared against the background site concentrations previously determined. If any parameters exceed background concentrations, the material should not be accepted at the cleanfill.

As noted previously, the detection of TPH, SVOCs, VOCs and PAHs would preclude the waste from disposal at a cleanfill.

4.4.3 Alternative testing criteria

Through the regional plan process or as a condition of a specific resource consent for a cleanfill, regional councils may wish to allow low levels of contaminants, (greater than background levels) in soils deposited in cleanfills. When determining acceptable limits, regional councils need to consider safe contaminant levels for the intended future use of the land, the potential for contaminants to leach from the soil, and the potential adverse effect of the resulting leachate on the environment.

Typically, testing would be targeted at determining the concentration of the contaminant in the soil and the leachability of that contaminant. Common leachability tests used include the USEPA TCLP (Toxicity Characteristic Leaching Procedure) and the ASLP (AS4439).

A number of publications are available that detail acceptable contaminant levels, sampling and testing procedures for different applications. These documents should be referred to when setting acceptable contaminant levels for individual cleanfills if this approach is taken. Publications from the Ministry for the Environment include:

- *Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand*. Ministry for the Environment, Wellington, 1998
- *Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand*. Ministry for the Environment, Wellington, 1999
- *Health and Environmental Guidelines for Selected Timber Treatment Chemicals*. Ministry for the Environment, Wellington, 1997.

Other publications include:

- *Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites*. Australian and New Zealand Environment and Conservation Council & National Health and Medical Research Council, 1992
- New South Wales Environmental Protection Authority. 1999. *Environmental Guidelines: Assessment, Classification & Management of Liquid & Non-Liquid Wastes*, New South Wales Environmental Protection Authority, Sydney
- Western Australia Department of Environmental Protection. *Guidelines for Acceptance of Solid Waste to Landfill*. Western Australia Department of Environmental Protection, Pollution Prevention Division, Perth, Western Australia.

4.5 How to determine acceptable cleanfill materials

Figure 4.1 presents the general approach required for determining if materials are acceptable at a cleanfill. This approach assumes that a cleanfill has already been established as a permitted activity or has the appropriate resource consents.

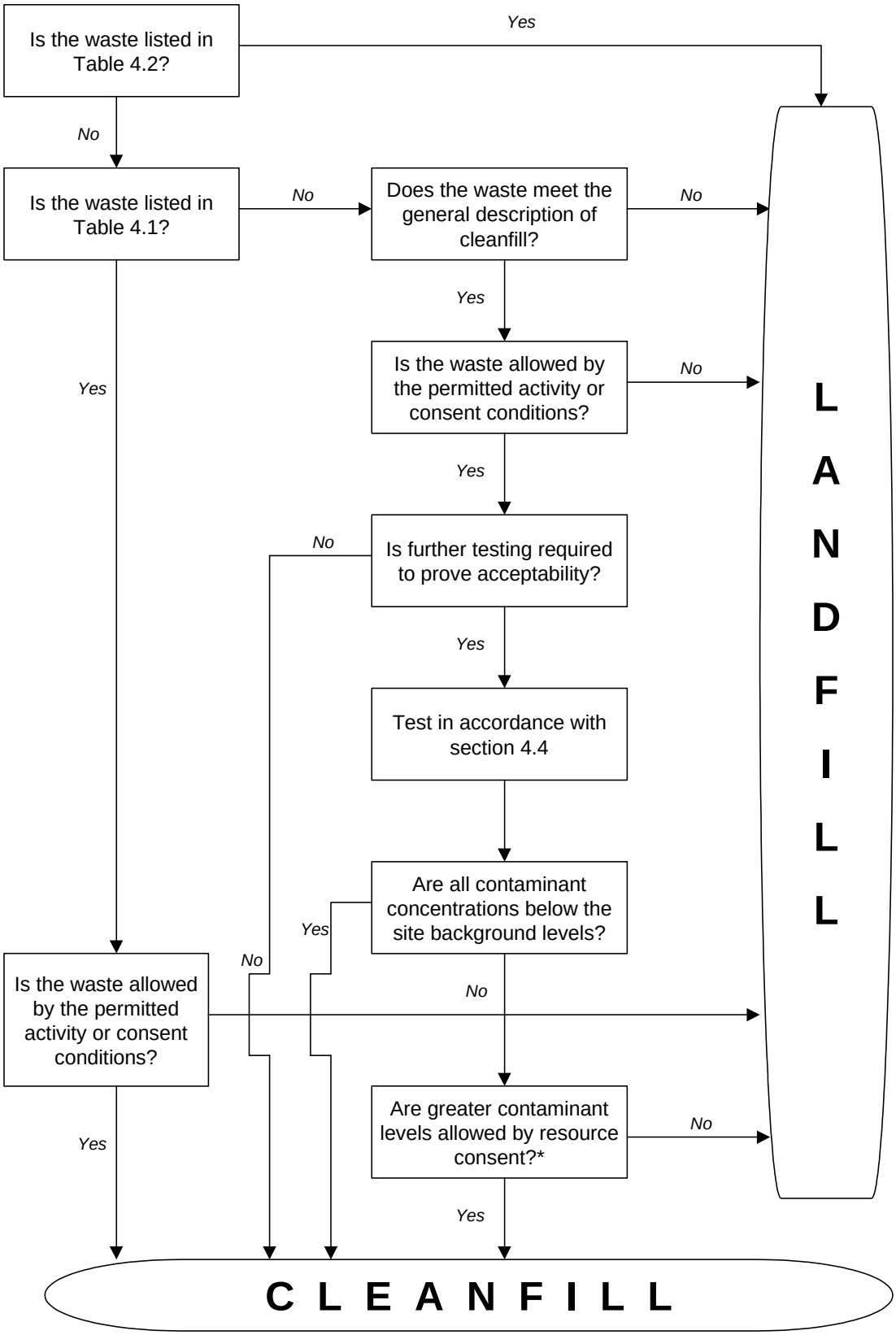
The first step is to compare the material against Table 4.1. If the material is listed on this table and is not specifically excluded by the conditions for the permitted activity or resource consent conditions, the waste can be cleanfilled.

If the material is not listed in Table 4.1 it should be compared against the materials described in section 4.2.2. If falling within this category and acceptance of the waste is specifically allowed by resource consents or conditions of the permitted activity, then the waste may be cleanfilled. Testing may be required to determine acceptability.

If listed as unacceptable in Table 4.2 the waste cannot go to any cleanfill. If the waste has been rejected for acceptance at a landfill it cannot go to a cleanfill.

If any action described in the methodology is deemed too difficult or not cost effective to complete, the waste must be disposed of in a landfill or hazardous waste facility as applicable.

Figure 4.1: Methodology for determining acceptability of waste as cleanfill



* Further testing may be required.

4.6 Waste acceptance control

Once waste acceptance criteria have been established for a particular site, region or district it is important that they are enforced. Documentation should be provided for all loads entering a cleanfill and an appropriate inspection regime instituted (see section 8.3).

The documentation required and load inspections should be fully described in the cleanfill management plan (see section 8.1).

Where specific resource consents are required for a cleanfill, it would be appropriate for the details of the documentation, inspections and reporting to be described by consent conditions. Where a cleanfill is operated as a permitted activity it is expected that documentation would be provided as described in this Guide.

Random inspections by regional or district council field staff are required to monitor whether the waste acceptance criteria are being adhered to.

4.7 Existing cleanfills

There are a number of existing or closed sites that have previously been described as cleanfills but which may not meet the criteria described in this Guide.

Regulatory authorities and owners responsible for such sites need to inspect the sites and review records of the type of waste that has been accepted and, if necessary, reclassify the site as a landfill. Where any doubt exists, site investigations may be required to determine the nature of wastes deposited. Such investigations may include bore holes, test pits, or both. Sufficient coverage is required to provide confidence in the results obtained.

The finding of any material on-site that does not meet the waste acceptance criteria may change the status of the facility from a cleanfill to a landfill. The owner would need to determine potential environmental effects due to the presence of this material in the cleanfill and apply to the regional council for appropriate resource consents. This may require the installation of specific environmental protection works (for example, leachate extraction) and additional environmental monitoring. Alternatively, the material may be able to be removed to reinstate the cleanfill status of the site.

Refer to the *Landfill Guidelines* (CAE, 2000) or *A Guide for The Management of Closing and Closed Landfills in New Zealand* (Ministry for the Environment, 2001a) to determine requirements for currently operating or closed landfills.

5 Cleanfill Siting

5.1 Cleanfill siting philosophy

The primary environmental control on a cleanfill development is the waste acceptance criteria. If these criteria are adhered to and other appropriate environmental management practices are implemented, the potential for adverse environmental effects should be minimal.

Because of this, site selection for a cleanfill would tend to be based predominantly on commercial considerations relating to:

- proximity to the source of the waste
- opportunity for subsequent site development
- land ownership or land purchase cost
- cost of cleanfill development, for example, suitable topography, geological stability.

The environmental effects of a cleanfill need to be considered. The procedure described below sets out a methodical approach to this process.

In many cases the site would be pre-selected, for example, in the case where a property owner wishes to fill a hole on a property, where a site has been purchased for its development potential or where an owner wants to dispose of cleanfill waste on its own site. While in these cases a rigorous site selection process as described in this chapter may not be relevant, the effects of establishing a cleanfill on the site need to be considered against the criteria described.

The information contained in this chapter is only applicable if the waste acceptance criteria are adhered to. If proposed fill material does not fit these criteria refer to the *Landfill Guidelines* (CAE, 2000).

5.2 Site selection process

The cleanfill site should be located to minimise impacts on the local community and the environment.

Appropriate site selection can result in more efficient and effective site management and savings in development and operating costs.

This process is not definitive. The underlying reason for developing the cleanfill and the proposed end-use of the cleanfill may impact on the site selection process. Site specific characteristics may also result in some factors being given a greater weighting than others.

5.2.1 Initial site selection

A number of potential sites should be identified from a desk-top study considering the following criteria:

- distance from cleanfill sources to site
- access routes to site (road and rail) and distance from major routes
- local authority limitations on truck movements on secondary roads
- ownership and availability
- size of site
- geological stability
- flood paths
- compatibility with surrounding land use
- heritage/Maori cultural sites
- ecology.

Transport costs to these potential sites may be used as the basis for a preliminary economic assessment.

Both local and regional councils can assist when determining siting restrictions. These bodies often have large resource databases available detailing heritage and cultural sites, waterways, soil types and the like.

A walk over survey should be undertaken of the sites identified by the desk-top study. The sites should be assessed against the criteria listed above and any significant constraints with respect to surface hydrology, stability, topography or environmental issues identified.

There are a number of environmental factors that would make a site unacceptable for development as a cleanfill. Such "fatal flaws" include but may not be limited to:

- destruction or impact on existing wetlands
- construction within a flood plain or watercourse
- sites of cultural or archaeological significance
- severe or unmanageable instability
- steep sites.

Identification of any of these factors or other potentially significant adverse effects during this initial survey would typically eliminate a site from further consideration.

5.2.2 Non-technical investigations

Non technical issues include social, cultural and amenity values. The following factors should be determined for each site:

- location and type of nearest neighbours (e.g. school, isolated dwelling)
- potential for nuisance associated with noise, dust, traffic and visual effects
- sites of cultural significance including natural waters, marae, ancestral land, waahi tapu and other taonga
- sites of historic significance.

Any sites identified as unsuitable due to the potential for significant adverse effects relating to these factors would typically be eliminated.

5.2.3 Detailed technical investigations

Results from the desk-top study, site walk-over, preliminary economic assessment and non-technical investigations can be used to rank the suitability of the sites. This ranking is preliminary only and will be affected by design and operations issues and community values.

A short-list of preferred sites can progress to detailed technical and economic investigations.

The detailed technical investigation must be designed on a site-specific basis but should address the criteria listed in section 5.3.

5.2.4 Economic assessment

The economic assessment should include all real, definable and measurable costs paid for by the cleanfill operator. The type of costs to be identified include:

- land costs
- planning and resource consent costs
- development costs, including design and construction
- operation costs, including management, administration and overhead costs
- environmental controls and maintenance (silt ponds, temporary grass cover, etc.)
- monitoring
- closure, site rehabilitation and after-care costs.

Information on full costings of landfill options is provided in the *Landfill Full Cost Accounting Guide* (Ministry for the Environment, to be released March/April 2002).

5.3 Cleanfill siting criteria

Construction and operation of a cleanfill site could lead to a range of positive, neutral and adverse effects. Often these effects are difficult to quantify. Assessment of the relative importance of the various effects can become subjective, particularly for social and community issues. However, assessment of non-technical and environmental issues must be given equal importance to engineering cost–benefit analyses to ensure a balanced decision is made.

It is important that an appropriate level of care is applied to the site selection process. This is pivotal to the whole project. Once the site is selected and the cleanfill established, the resulting effects will remain for the life of the project.

A coarse screening matrix is a common method for evaluating effects. Each site can be assessed against a range of criteria, agreed in advance with interested parties and given a relative score. A ranking system can be used where the scores indicate the degree of benefit or disbenefit. The scores from each criterion are totalled for each site to rank the site. The site with the highest score is the most preferred.

Certain factors can be considered to be so critical that any options that fail the criteria can be eliminated.

The following criteria should be considered when identifying and assessing potential cleanfill sites.

5.3.1 Locality

- The distance to the nearest residential, commercial or industrial development.
- How a cleanfill would fit in with the existing land use and landform.
- The direct impact on dwellings in and adjacent to the proposed site in terms of removal, relocation and physical disturbance.
- The availability of separation distances or ‘buffer zones’ between the cleanfill and the nearest dwellings or special purpose areas (such as schools) to preserve the amenity of the surrounding area.

5.3.2 Land use

- An assessment of the extent to which the location of the cleanfill will impact on, or take out of production, land of high value for industrial, commercial, agricultural, horticultural or silvicultural purposes.
- Statutory planning constraints, including zoning and land designated for a special purpose.

5.3.3 Property issues

- The potential land area available for the site.
- If the potential site is on one lot or many.
- The number of land owners affected.

5.3.4 Site soils

- Potential sediment management issues, particularly in relation to highly erodible soils, slope, and proximity of watercourses.
- Any existing contamination or discharges on the site.
- The availability of on-site materials for capping, if this is required.
- Areas for stockpiling stripped topsoil.

5.3.5 Site stability

- The proximity to
  - active geological faults
  - area of geothermal activity
  - area of highly soluble rocks, sinks and caverns
  - landslide-prone areas
  - steeply sloping land
  - springs/high groundwater levels
  - stream banks and flood plains

  and the effect these are likely to have on the cleanfill development.

5.3.6 Surface water

- The proximity of waterbodies, including rivers, streams, wetlands, estuaries, marshes and springs.
- The necessity to divert water courses or provide culverts through the cleanfill site.
- The potential to pollute water supply catchments or water bodies, including those used for drinking water or aquaculture.
- The potential to cause or contribute to significant degradation of natural wetlands.
- The proximity to sensitive aquatic ecosystems and potential effects on these.
- The location with respect to flood plains that could be affected by a major flood event (for example, 1 in 100-year).

5.3.7 Topography

- The ability of existing topographical features to assist in minimising environmental effects such as noise and visual effects.
- The effect of site slopes on stormwater control, site stability and operation of the cleanfill.
- The suitability of the topography for cleanfill development (for example, site not too steep for filling on, suitable for staged development of the cleanfill, access available throughout the life of the cleanfill without requiring major civil works, etc.).

5.3.8 Access and traffic

- The distance from main traffic routes.
- The standard and capacity of the road access to the site (this should include an evaluation of the type and number of vehicles likely to access the cleanfill site and the existing traffic along the route).
- Whether the cleanfill traffic can avoid residential areas.
- Road safety considerations at the cleanfill entrance.
- Any existing (district plan) limitations on heavy traffic movements.
- Dust from access roads.

5.3.9 Environmental

- The effect on sensitive or significant natural features, including wetlands, inter-tidal areas, areas of native bush, recognised wildlife habitats, national, regional and local parks, reserve lands.
- The effect of the cleanfill on sites of historical or cultural significance, or known archaeological features.
- The effect on habitat areas of protected, threatened or endangered species.
- Potential for environmental enhancement.

5.3.10 Community issues

- Nuisance associated with noise, dust, traffic and visual effects on both the immediate area and the wider visual catchment.
- Protection of local amenity values.
- Cultural and heritage issues.
- Loss of property value.
- The end use of the site.
- Community social impacts.
- Maori issues, archaeological sites, etc.

6 Cleanfill Design

6.1 Design philosophy

For a landfill, the degree of environmental protection is strongly influenced by the quality of the landfill design.

For a cleanfill, the primary environmental controls are the waste acceptance criteria, so design of the cleanfill is not specifically directed towards refuse and leachate containment. Landfill features such as leachate collection, removal and treatment, low-permeability liners, gas management, cover and capping issues are not relevant to the design of cleanfills because of the inert nature of the waste. However, erosion and sediment control are very important. Cleanfill design should be based on sound engineering principles and should be specific to the particular cleanfill site.

Factors influencing the design of cleanfills are summarised briefly below.

6.2 Design considerations

6.2.1 End use

The reason for developing the cleanfill and the proposed end use of the site will have a major influence on the design of the cleanfill in terms of:

- required footprint (the extent of the cleanfill area)
- staging of development
- nature of material to be accepted (for example, size, compactability, strength), and subsequent stability implications
- final landform / visual integration
- specific capping requirements.

6.2.2 Site characterisation

Sufficient investigations are required to characterise the site to allow for the design of the cleanfill. Investigations will include:

- site topography, to determine layout, staging, fill volumes, etc.
- geotechnical investigations sufficient to determine the stability of the site before and after filling, and for the design of any structures
- the presence and location of any services on the site (such as buried or overhead power or telephone cables, water, sewer or gas pipes)

- identification of any areas to be protected (watercourses, wetlands, archaeological sites, vegetation, steep slopes, etc.)
- background analysis of surface and groundwater quality for future reference in relation to potential effects of the cleanfill
- background analysis of site soil contaminant concentrations for future waste acceptance control.

6.2.3 Site access

Access to a cleanfill site will normally be limited to commercial vehicles. Access considerations include:

- the standard of construction of all roads leading to the site (in some cases the upgrading of roads and bridges may be required)
- location of the entrance off the road to provide for safe entry and exit of vehicles – this may involve discussions with and the approval of the authority controlling the road (the district/city council or Transit New Zealand); construction of turning lanes, slip lanes or similar may be required depending on the road usage and expected cleanfill traffic volumes
- access within the site to provide for the efficient and safe movement of vehicles to the fill area
- appropriate security to restrict access (see sections 8.3 and 8.5).

6.2.4 Site facilities

The extent of the facilities required will depend on site-specific conditions such as the size of the cleanfill, the reason for operating the cleanfill, and agreed charging and waste control methods. Site facilities required may include:

- a weighbridge for charging and cleanfill control
- a charging booth for collecting dockets and controlling entrance to the cleanfill (waste acceptance control)
- staff facilities, including office, lunchroom and toilets
- site services, including power, telephone, water supply and sewage disposal
- wheel-wash facilities to prevent soil and debris being deposited on local roads
- fencing and gate (lockable) to control access to the cleanfill
- landscaping to help reduce visual effects and control dust.

6.2.5 Erosion and sediment control

Aspects to be considered for design include:

- development of an overall erosion and sediment control plan (see Chapter 7)
- planning of staged development of the site to minimise the area of exposed surfaces
- determining requirements for stormwater treatment devices throughout the life of the project and ensuring adequate space is available on-site for these at appropriate locations
- location of clean water cut-off measures such as drains, bunds or similar
- a rehabilitation and stabilisation plan.

Details of erosion and sediment control are provided in Chapter 7.

6.2.6 Fill volumes and staging

To calculate maximum fill volumes and potential staging, the following must be determined:

- overall footprint and final land form
- available fill volume
- staging of the development of the cleanfill throughout its life.

6.2.7 Engineering considerations

Specific engineering design may be required for the following:

- site preparation, such as stripping of vegetation, and benching of slopes to ensure stability of the placed fill
- stockpile locations (topsoil or other fill)
- determining temporary and final fill slopes to provide an acceptable factor of safety for stability
- specific compaction requirements for the fill, to ensure stability of the placed fill or to produce an ‘engineered fill’ for subsequent subdivision or development of the site
- starter bunds or any other earth structures that may be required for stability or containment of the fill, erosion and sediment control, etc.
- stormwater channels, pipes and specific erosion and sediment control works
- stormwater ponds and stormwater discharge structures
- stream diversions
- groundwater control (for example, groundwater cut-off drains, groundwater pumping).

7 Erosion and Sediment Control

7.1 Introduction

After waste acceptance criteria for a cleanfill have been set and appropriate waste acceptance controls established, the next most significant environmental issue is erosion and sediment control. A review of regional and district plans shows that this aspect of cleanfill operation has typically been given high prominence, and factors relating to erosion and sediment control usually determine whether or not specific resource consents are required for a site.

It is not the intention of this Guide to provide a comprehensive manual of practice for erosion and sediment control. These are important for all earthwork projects, of which cleanfills are only a sub-set, and appropriate guidelines are established in many parts of the country (although there are no national guidelines). So the issues associated with this aspect of cleanfill operation and management are described in general terms only, and procedures provided for addressing them. For specific erosion and sediment control guidelines, and details of acceptable solutions, see, for example, *Auckland Regional Council Erosion and Sediment Control Guidelines for Land Disturbing Activities* (Auckland Regional Council, 1999), or relevant guidelines prepared by the appropriate local regional council.

7.2 Effects of sediment discharge

Possible environmental effects associated with sediment release are well documented, and include:

- smothering of aquatic life by a build-up of sediment in the stream bed
- alteration of habitats (for example, by destroying spawning grounds)
- abrasive action against aquatic life (for example, increasing susceptibility to disease)
- scouring of algae (a major food supply for stream life) from rocks in the stream bed
- changes to predator–prey relationships due to increased turbidity (cloudiness) in the water, stopping animals feeding because they cannot see their prey
- changes to temperature due to increases in turbidity affecting heat absorption
- reduced primary productivity due to increases in turbidity stopping light penetrating the water, slowing down photosynthetic activity and subsequent plant and algae growth
- accumulation of pollutants transported by sediments (for example, lead, hydrocarbons, agricultural nutrients and toxic substances)
- blockage of water flows, increasing susceptibility to flooding and consequent damage to property
- effects on consumable water for irrigation, stock and domestic water supplies (for example, clogging of pumps, filters and sprinkler nozzles and increasing treatment requirements and cost)
- reduced aesthetic quality of water bodies.

The importance of adequate erosion and sediment control is shown by the potential significance of these adverse environmental effects.

7.3 Key measures

A cleanfill is typically a long-duration activity lasting several years. By comparison, an earthworks project may be limited to a single construction season of a few months to a year. For this reason, erosion and sediment control requirements for a cleanfill are more closely aligned to those for a landfill or quarry activity. The focus should be on providing robust, permanent sediment control measures with smaller temporary works and erosion controls to augment the key treatment devices.

The key principles of effective erosion and sediment control are:

1 protection of sensitive areas (avoidance)
2 diversion of 'clean' water (erosion control)
3 minimising the area of exposed earth surfaces (erosion control)
4 breaking up the site into small lengths and areas (erosion control)
5 collection and treatment of sediment-laden water (sediment control)
6 maintenance and inspection of erosion and sediment control devices.

Effective erosion control is critical to overall discharge management, as this minimises the volume of sediment the sediment control devices need to treat.

Effective erosion and sediment control will result in a drier site, which increases the ability to work the site and will potentially increase profitability for the owner/operator.

The key measures listed above are now explained in more detail.

7.3.1 Protection of sensitive areas

Areas prone to erosion (such as those with sensitive soils, poor vegetation cover and steep slopes) require specific protection against erosion. Areas of specific ecological value may also require specific protection against the effects of sedimentation. Protection in this sense would generally be accomplished by avoiding any works in these areas, installing diversion drains around the area, and possibly fencing to restrict access.

7.3.2 Diversion of clean water

The term 'clean water' is used to describe stormwater running off stabilised and vegetated surfaces and free of sediment. Diversion of clean water around the working area will reduce erosion and hydraulic loads on treatment devices. Diverted clean water would typically be discharged separately without treatment. Clean water drains should be relocated to maximise the clean water diversion as revegetation progresses.

7.3.3 Minimising exposed areas

The most effective erosion control is to minimise the area of disturbance. Careful planning of the cleanfill operation in terms of access and open fill areas is required to minimise the area of exposed earth at any one time. Fill sites should be progressively developed, and completed areas or areas that will not be worked for some time should be stabilised (revegetated) as soon as practical.

Immediate stabilisation may be required in some areas. Mulch may be applied where the need for stabilisation is temporary. If permanent, mulching and seeding may be appropriate.

7.3.4 Breaking up the site into small areas

Small areas and lengths draining to individual or intermediate treatment devices will reduce flows and therefore reduce erosion potential. Management of the site will assist in reducing the load on down-gradient devices and subsequently improve overall efficiency.

7.3.5 Collection and treatment of dirty water

Specific drainage should be provided to collect all water running off exposed surfaces for treatment prior to discharge. Drainage should be maintained in good condition and relocated as required as further surfaces are progressively exposed. Sediment control measures (for example, sediment ponds and silt fences) must be regularly maintained and cleaned out to ensure maximum efficiency.

7.4 Design approach

The following sets out a general approach to the design of erosion and sediment control systems.

- Ascertain the erosion and sediment control requirements specified for the region and district or city in which the cleanfill is located. Some councils will specify a 'best practical option' approach, whereas others will nominate discharge standards or prescribe particular solutions. The different nature of soils in different regions may require different solutions.
- If a resource consent has been obtained, the conditions of the consent will contain a number of specific requirements that will affect likely impact on the design. Alternatively, the design approach could be developed in advance of application for resource consent and agreed through the consent process.
- Prepare a specific design in accordance with the key measures described above that meets local requirements and consent conditions.
- For all but minor operations, it is expected that a sediment retention pond(s) will be required. For cleanfill operations it is recommended that ponds with a minimum volume of 3% of the contributing catchment area be provided unless local requirements are greater (3 m^3 of storage for every 100 m^2 of contributing catchment). Diversion of clean

flows will help to reduce pond size. Ponds should not be constructed 'on line' or within a watercourse.

- Where discharge standards are specified, consideration may need to be given to flocculation, as such standards are usually very low. The design of the flocculation system should allow for flow-proportional dosing of the flocculant and good mixing at the pond inlet prior to the quiescent zone. Consideration should be given to the potential effects of carry-over of the flocculent into the stream, and the benefit of flocculation compared with any potential adverse effects.
- Use local guidelines for determining specific design requirements. Where local guidelines are not available, consider using the *Auckland Regional Council Erosion and Sediment Control Guidelines for Land Disturbing Activities* (Auckland Regional Council, 1999 TP90) as a best practice measure. The use of this or alternative guidelines should be discussed and agreed with the consent authority prior to implementation. This guideline may not be appropriate on its own where a specific discharge standard is required.
- Determine the need for, and details of, other measures such as contour drains, hay bales, check weirs and silt fences in accordance with the agreed guideline. Note that hay bales and silt fences are generally inappropriate as the sole means of sediment control.
- Allow adequate space on-site for all sediment control measures required over the life of the cleanfill.

7.5 Resource consents and monitoring

Most regional councils specify trigger criteria (for example, exposed area and/or fill volume) which determine whether cleanfilling will be considered a permitted activity. Exceedance of the triggers requires resource consents. Where such trigger criteria are not set, all cleanfill operations in those regions will require resource consents for stormwater/sediment discharges.

Matters that need to be considered in determining appropriate resource consent conditions include, but are not necessarily limited to:

- understanding the receiving environment
- the sensitivity of the receiving environment
- the duration of the proposed operation, in terms of total operating life and operating patterns (for example, whether the operation is seasonal only)
- the availability of performance data for specific erosion and sediment control devices in local conditions or similar soils
- established regional standards (if any)
- consideration of whether the established regional best practical option (BPO) is appropriate, or whether a better BPO is required
- whether other parties, including tangata whenua, will be adversely affected
- whether consent conditions have been adequately defined and are achievable.

(See *A Guide to Landfill Consent Conditions* (Ministry for the Environment, 2001b) for further information.)

Sometimes it may be appropriate for resource consents to specify an absolute suspended solids or turbidity standard for the discharge from the site. In many cases, however, stream turbidity increases substantially during a storm event. A more appropriate standard may be, for example, that the discharge concentration should not be greater than 10% above background levels in the stream at the time of discharge. Often it would be more appropriate to specify a means of compliance with appropriate maintenance requirements and best practice measures to ensure the prescribed facilities continue to function as intended.

Monitoring requirements in consent conditions need to be carefully considered, and should fit the scale and size of the operation. When setting monitoring conditions, the consent authority should be mindful of the costs and benefits of carrying out the monitoring. In most cases monitoring would be limited to confirming that the appropriate devices have been installed, that they are functioning effectively during rainfall events, and that they are being maintained. Where a specific discharge standard is specified, this must be related to the size of the storm event, the expected stream conditions during that event, and the point during the storm at which the standard applies. Monitoring would then be undertaken accordingly. However, any such 'quantitative' monitoring should be linked back to adverse effects, so a focus on device installation and maintenance may give a better outcome.

8 Operation and Management

8.1 Cleanfill management plan

Every cleanfill facility must have a site-specific management plan. This plan should cover all operational and management aspects of the cleanfill, including:

- resource consent requirements
- site management
- cleanfill design
- waste acceptance criteria
- waste acceptance controls and procedures
- daily operating procedures
- environmental controls and monitoring
- emergency procedures
- reporting requirements.

A suggested table of contents for a cleanfill management plan is provided in Appendix B.
A site operating record should also be maintained for the site, containing:

- load inspection records
- monitoring, testing or sampling documentation relating to waste acceptance and any discharges from the site (for consent compliance and good site management).
- training procedures.

8.2 Personnel

8.2.1 Staffing

The staffing level required will vary for each cleanfill facility depending on the size and type of operation. Staffing levels should be sufficient to enable all daily operating procedures to be carried out in accordance with the cleanfill management plan. At small and/or remote sites it may not be economical or necessary for a permanent staff presence. At such sites, special measures will be required to ensure security of the site, to control waste acceptance and for charging for waste deposited. Such special measures may include electronic access for licensed users of the site (see section 8.3.2).

8.2.2 Training

All management and operation staff must be familiar with the cleanfill facility's operation, including the waste acceptance criteria, requirements of the management plan, any resource consent conditions and the status of site activities.

As a minimum, specific staff training should be provided to all existing and new staff to cover:

- identification of acceptable and unacceptable waste, load inspections and testing procedures, required documentation and record keeping for operation staff
- the principles of erosion and sediment control and any site-specific requirements
- testing and sampling procedures for any staff undertaking monitoring
- appropriate training for staff using earthmoving machinery
- site safety practices and emergency procedures for all staff.

In some regions training is provided for erosion and sediment control. This is recommended for key personnel.

Refresher training should be performed on an annual basis. Documentation of all training should be maintained in a site operations record.

8.2.3 Health and safety

Cleanfill operations must be performed in accordance with the Health and Safety in Employment Act 1992 administered by the Department of Labour (Occupational Safety and Health – OSH). This differs from most other aspects of this Guide, which fall under the RMA and are administered by regional councils and local authorities. This section provides a general overview of applicable health and safety requirements, but does not purport to be a comprehensive and up-to-date representation of OSH requirements. Site operators must determine and comply with all the requirements of OSH.

The cleanfill operator should establish and maintain a site safety management system that ensures the safety of all persons on the site in accordance with the Health and Safety in Employment Act 1992 (HSEA). The site safety management system will apply to all employees, subcontractors and visitors to the cleanfill.

Normally the operator will have responsibility for control of the place of work, as defined in the HSEA, clause 16, and all separate contractors would be required to co-ordinate their safety management systems with that of the operator, where applicable.

The safety management system should ensure compliance with the HSEA and should include, but not be limited to:

- an up-to-date register of all hazards
- safety procedures relevant to the site
- contractors' safety policy, training procedures and recent safety records

- requirements for appropriate safety equipment, including specialised equipment for specific tasks
- requirements for safety meetings, as frequently as is necessary
- evacuation and emergency procedures.

The operator should:

- provide first aid facilities, and personnel with relevant first aid training, as required by the relevant laws
- develop a procedure that complies with the HSEA and any other relevant legislation for identifying, assessing, eliminating, isolating and minimising hazards that are or may exist on the site
- conduct site-wide safety audits and safety reviews as frequently as required to ensure the safety of all persons on the site
- establish and maintain a register of hazards for the site in which the operator should record any identified hazard, the date it was identified and any steps taken to eliminate, mitigate, mark or isolate the hazard.

Refer to the local Occupational Safety and Health office, Department of Labour, for further information.

8.3 Material acceptance

8.3.1 Documentation

Cleanfill operators should maintain adequate documentation of materials accepted at the cleanfill. The purpose of this documentation is to:

- ensure that users of the cleanfill fully understand the waste acceptance criteria and signify acceptance and compliance with this
- assist the operator in tracing any non-complying materials if found at a later date
- provide evidence to the consent authority of the type of waste received at the cleanfill
- include any specific documentation that may be required by consent conditions.

Information to be provided should include:

- date of waste acceptance
- contractor's name
- description of the waste type
- verification that the waste type complies with the cleanfill acceptance criteria
- source of waste
- quantity of waste
- any noticeable characteristics of the waste
- details of specific waste disposal agreements

- sign-off by the contractor
- check by the operator.

For all loads that arrive at the site, the waste generator/contractor must provide the above information and sign a declaration that the load to be disposed meets the waste acceptance criteria. The waste acceptance criteria applicable to that site should be printed in full or summarised on the form, together with any other specific requirements for the cleanfill site.

Appendix C gives an example of a cleanfill declaration form that could be provided by the operator for completion by the waste disposer.

8.3.2 Waste disposal agreements

Where specific contractors regularly use the cleanfill, the individual load declaration may be replaced with a formal agreement between the cleanfill operator and the contractors, or with a 'licence' to use the facility. The agreement/licence should state that the contractor will only dispose of waste that meets the waste acceptance criteria. Penalties could be imposed under the contract if the contractor fails to comply with the waste acceptance criteria.

When the site is not continuously staffed, consideration could be given to providing licensed users with electronic access to the site – by swipe card, key pad or similar. This would provide good site security, record the users of the site, and provide a means for invoicing, either by the truck-load or by tonnage if connected to a weigh bridge.

8.3.3 Inspections

The cleanfill operator should collect the documentation for all loads entering the site and visually verify that the material description matches the actual load. If there is any doubt, the load should be tipped from the truck away from the tip face for inspection. Alternatively, the load should be immediately rejected.

Any mixed waste arriving at the site should be rejected or thoroughly inspected to ensure that it contains no unacceptable materials. Any material with a solvent or pungent smell indicates the waste is likely to contain contaminants above background levels. This waste should be rejected.

The origin of the waste can also indicate the potential for non-compliance with the acceptance criteria. Particular sites may have contaminated soil or waste due to the work that is generally carried out on these sites. If the origin of waste is from any of these sites, the load should be rejected or accepted only if testing has shown compliance. Specific industries and land uses that have been associated with site contamination are listed below:

- acid/alkali formulation
- agricultural/horticultural activities
- airports
- asbestos production and disposal
- chemical manufacture and formulation
- defence works
- drum reconditioning works

- dry-cleaning establishments
- electrical manufacturing (transformers)
- electroplating and heat treatment premises
- engine works
- explosive industry
- gas works
- iron and steel works
- landfill sites
- metal treatment
- mining and extractive industries
- oil production and storage
- paint formulation and manufacture
- pesticide manufacture and formulation
- pharmaceutical manufacture and formulation
- power stations
- railway yards
- scrap yards
- sediments from harbours, rivers and streams
- service stations
- sheep and cattle dips
- smelting and refining
- tanning and associated trades
- waste storage and treatment
- wood preservation.

The cleanfill operator should inspect incoming loads at random to check that only cleanfill that meets the waste acceptance criteria is being disposed. Where the site is not manned, this can be done retrospectively. Where a number of contractors have access to a site it may be difficult to determine which contractor has been responsible for breaching the waste acceptance criteria. Operators and/or consent holders must be aware of the risks associated with unsupervised access, as ultimately they carry the liability for what is placed in the cleanfill. There may be significant costs and potential safety hazards associated with removing non-cleanfill material from the cleanfill once dumped.

8.4 Fill placement and control

The width of the working face should be kept as small as possible to minimise exposed cleanfill surfaces. Sufficient room must be maintained for vehicles to unload and manoeuvre safely.

Vegetation should only be stripped immediately prior to filling, and should be re-established as soon as practical. Vegetation should be established in any area that will not be worked on for a period of three months or more.

There will be specific requirements for fill placement and control where an engineered fill is required for further development of the site, including:

- material type
- layer thickness
- compaction standards
- maximum size and specific handling requirements for bulky objects.

8.5 Access

The cleanfill site should be secured to prevent unauthorised access and illegal dumping of wastes. The level of security should be determined on a site-specific basis, but may include the use of gates and fences, and natural barriers such as trees, berms, ditches and embankments.

All vehicles entering the site should report to the reception office, or equivalent, before proceeding to the waste reception or working areas of the cleanfill.

A sign-post should be located at the entrance to the cleanfill with the following information:

- cleanfill name
- owner and operator
- contact details, including after-hours emergency contacts
- description of waste accepted at the site
- description of prohibited waste
- the requirement for a waste acceptance agreement prior to disposal at the site.

A cleanfill site requires appropriate roading access to the reception facilities, working face, and facilities such as stormwater control systems for cleanfill users and for construction traffic.

Permanent access roads should ideally be sealed to a good standard to control dust.

Internal access roads should be aligned with easy gradients. Where possible, these should follow perimeter routes on good foundations to minimise reconstruction and relocation as filling progresses. Any access roads that will be used for more than six months should ideally be metalled or sealed (see section 8.7). Any access required across the fill material should be constructed from heavy road metal.

8.6 Water control

Stormwater must be controlled to prevent erosion and excessive sediment discharge to waterways (see Chapter 6).

Surface water from outside the cleanfill area should be diverted around the active area. This can be achieved by constructing berms and swales to redirect the water to stormwater control structures or other surface water-bodies. Surface water within the cleanfill area should be treated to remove sediment.

A regular preventative maintenance programme for the stormwater control systems should be undertaken, including:

- regular inspection of drainage and treatment systems
- cleaning of sumps and culverts
- dredging of silt ponds and disposal of dredged material in a secure manner
- servicing of pumps
- reinstatement of eroded areas.

Maintenance records should be kept to help demonstrate consent compliance. The effectiveness of the erosion and sediment control systems should be continually assessed and new drainage and treatment devices installed as required.

The groundwater level will need to be maintained below active fill areas. This could be achieved by pumping from wells around the fill area, or by constructing groundwater cut-off drains. Such wells or drains provide a convenient point for collecting groundwater samples to confirm that no contamination is occurring.

8.7 Nuisance control

8.7.1 Dust

Dust generated at cleanfill sites must be minimised to reduce pollutants leaving the site as airborne dust, reduce stormwater sediment loads and protect local amenity.

Dust will be generated on-site from:

- disturbance of dried soils on access roads from traffic and wind movements
- earthworks, such as placing of the fill material and final cover
- filling and compacting of dust-generating waste.

To minimise dust generation, permanent access roads should be sealed to a good standard and cleaned with mechanical road sweepers as required. Unsealed roads should be sprayed with a water cart or irrigation system during dry periods.

Dust-type waste should be dampened down with water by the waste generator prior to disposal.

8.7.2 Noise

Excessive noise from a cleanfill site can impact significantly on the local amenity value and neighbours. Determining appropriate noise limits for the site will depend on adjacent land use, existing background noise and the nature of the noise.

Noise from the site should be managed so that it is not generally noticeable above the prevailing background noise and does not exceed the appropriate noise levels for the locality and land use.

Noise minimisation measures may include:

- buffer zones around the site
- acoustic barriers, including planting
- preventative maintenance of mechanical equipment and the fitting of silencers and mufflers, where appropriate
- restricting the hours of operation to match adjacent land uses.

8.7.3 Fires

The potential for fires at cleanfill sites is much less than at landfill sites. However, as a general rule, there should be a prohibition on all forms of deliberate burning. Fire-fighting equipment should be maintained on-site and all staff trained in the use of the equipment and the correct procedures in the event of a fire. For cleanfills within forestry areas, special conditions (for example, spark arrestors) may be required, as may the need to obtain a special permit from the local fire authority.

8.8 Closure and aftercare

On completion of the cleanfill disposal operations, closure works should be undertaken as soon as practicable. These works will include construction of any remaining sections of the final cover system and revegetation of the surface. It is expected that the reinstatement work will be undertaken progressively immediately on completion of intermediate areas.

The final cover requirements for the cleanfill will depend on the type of fill material used and the proposed end use of the site. Closely compacted cleanfill material may not require any cover other than topsoil. However, some cleanfill material (such as large blocks of concrete) may require substantial soil cover depending on the proposed end use of the site. If the site is to be further developed, cover details will be determined as part of the engineered fill requirements.

The cover and revegetation should promote sound land management and conservation, prevent hazards and protect amenity. Specific requirements may be specified in the land-use consent for the site.

8.9 Recycling and other activities

Recycling on either a small or a large scale is almost inevitable on many cleanfill sites, unless all unacceptable waste is rejected at the gate. Where mixed loads are accepted they must be sorted and unacceptable materials – which are often recyclable – must be immediately removed from the site or stored on a separate part of the site for later removal.

The owner/operator must ensure that all necessary consents are obtained for the activities undertaken on-site and check with the regional and city/district council to determine if recycling is an acceptable on-site practice. Additional consents may be required for recycling activities (for example, composting of organic material may require air discharge consents (odour) and discharge of contaminant consents (leachate).

The following guidelines are suggested for mixed-waste reception and recycling activities.

- All mixed waste should be deposited on an identified area of the site, well clear of the tip face, for subsequent sorting. Separation from the tip face is important to avoid possible confusion and disposal of unacceptable waste with cleanfill.
- Unacceptable waste should not be deposited at the tip face for later separation.
- A separate drainage system should be provided around the recycling area to allow run-off from this area to be monitored.
- Mixed waste should be sorted on the day of arrival to ensure no hazardous or other wastes that may leach into the environment are present.
- All separated organic material should be promptly removed from the site unless appropriate consents have been obtained.
- Under no circumstances should hazardous or potentially hazardous waste ever be accepted at a cleanfill site for separation or recycling.

Appendix A: Checklist for Establishing a Cleanfill

The steps to work through when considering establishing a cleanfill are as follows.

- Undertake an appropriate site selection process and assess the effects of establishing a cleanfill on the identified site (see Chapter 5). ☐
- Identify erosion and sediment control requirements for the cleanfill operation. In many cases resource consents will be required only for this aspect of the operation. In most regions the area of exposed earth determines if a consent is required. The effects of erosion can be controlled by limiting the area of exposed earth and installing appropriate sediment control and treatment devices (see Chapter 7). ☐
- Identify appropriate waste acceptance criteria and methods to enforce these criteria (see Chapter 4). ☐
- Identify potential end uses for the site and determine if the cleanfill operation is compatible with the proposed end use. The final land shape and any requirement for capping and finishing the cleanfill will be determined by the proposed end use of the site. ☐
- Determine the need for any additional waste acceptance or fill control measures required by the proposed end use. Seek professional engineering advice on achieving an engineered fill for further site development. ☐
- Determine if the proposed cleanfill is a permitted activity in the relevant district or regional plan, and satisfies the requirements for the permitted activity status. If not, apply for resource consents from the district or city council and regional council (see Chapter 3). ☐
- Prepare a Cleanfill Management Plan to address all potential effects from the operation of the cleanfill (see Chapter 8). ☐

Appendix B: Cleanfill Management Plan: Outline Table of Contents

Introduction

Project description
Purpose
Approvals
Staging
Management plan status

Management

Site owner and operator
Management structure
Right of access
Operating hours
Staff requirements
Training
Health and safety

Design and operation

Site preparation
Signage
Screens
Fencing
Traffic management
Final landform
Final cover requirements

Waste acceptance

Acceptable wastes
Prohibited wastes
Testing requirements
Waste acceptance control
Documentation and record keeping

Erosion and sediment control

Objectives
Design approach
Erosion and sediment control measures
Resource consent requirements and monitoring

Fill compaction (if required)

Objectives
Compaction requirements
Monitoring

Control of nuisances

Dust control
Wheel washing and road cleaning
Noise management
Litter control

Monitoring

Waste acceptance
Stormwater
Groundwater
Reporting

Complaints response

Appendix C: Sample Cleanfill Waste Acceptance Declaration

General

Contractor: ..... Date:.....

Details of waste disposal agreement: .....

Physical characteristics of waste

Type of waste: .....

Other minor waste types included:.....

Is waste listed in Acceptable Materials Table for this cleanfill? (i.e. Table 4.1 plus any additional materials allowed by a resource consent for the cleanfill) ☐ Yes ☐ No

Is waste listed in Unacceptable Materials Table for this cleanfill? (i.e. Table 4.2 excluding materials allowed by a resource consent) ☐ Yes ☐ No

Origin of waste: .....

Process generating the waste:.....

Quantity of waste: ..... m^3

Any waste characteristic tests available? ☐ Yes ☐ No

Any noticeable characteristics of the waste (smell, colour, consistency, etc)? If yes, please specify: ..... ☐ Yes ☐ No

.....

Has waste been rejected at a landfill? ☐ Yes ☐ No

Is further testing required to prove acceptability? ☐ Yes ☐ No

Contractor sign off: .....

Operator to complete

Load inspected? ☐ Yes ☐ No

Waste description:.....

Signature: .....

(Refer to waste acceptance criteria printed on the reverse of this form.)

Appendix D: Waste Acceptance Criteria from Other Organisations

New South Wales Environmental Protection Authority

Non-liquid waste types that are classified in Schedule 1 Part 3 of the Operations Act as inert waste

Waste type or stream

Virgin excavated natural material (e.g. clay, gravel, sand, soil and rock) that is not mixed with any other waste and that:

(a) has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and that does not contain sulphidic ores or soils, or

(b) consists of excavated natural materials that meet such criteria as may be approved by the EPA.

Building and demolition waste (eg bricks, concrete, paper, plastics, glass, metal and timber (1), being material resulting from the demolition, erection, construction, refurbishment or alteration of buildings or from the construction, repair or alteration of infrastructure-type development such as roads, bridges, dams, tunnels, railways and airports, and which:

(a) is not mixed with any other type of waste, and

(b) does not contain any asbestos waste.

Asphalt waste (eg resulting from road construction and water proofing works).

Biosolids categorised as Unrestricted Use, or as Restricted Use 1, in accordance with the criteria set out in the Biosolids Guidelines.

Used, rejected or unwanted tyres (including shredded tyres or tyre pieces).

Office and packaging waste (eg paper, plastics, glass, metal and timber) that is not mixed with any other type of waste.

Note:

1) Includes treated timber such as copper chrome arsenate (CCA), high temperature creosote (HTC), pigmented emulsified creosote (PEC) and light organic solvent preservative (LSOP) treated timber.

Treated timber and biosolids need to be disposed in a solid waste landfill due to disposal restrictions.

Western Australia Department of Environmental Protection

Clean Fill: *Waste material which consist of rocks or soil arising from the excavation of largely undisturbed material and that does not contain harmful contaminants.*

Examples:

Virgin excavated natural material (e.g. clay, gravel, sand, soil and rock), or such material that is mixed with:

- *waste that has been excavated from areas that are not contaminated, as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals and does not contain sulfidic ores or soils, or*
- *waste that consists of excavated natural materials that meet such criteria as approved by the Director Pollution Prevention Division.*

Inert Wastes: *Wastes that are largely non-biodegradable, non-flammable and not chemically reactive. Inert wastes are subdivided into two separate classes:*

- *Type 1 – Inert Wastes are sourced from waste streams as listed below and contain contaminants in concentrations less than the specified criteria.*
- *Type 2 – Wastes consisting of non-biodegradable organic materials such as tyres and plastics, which are flammable and require special management to reduce the potential for fires.*
- *Type 3 – Waste material from DEP approved secondary waste treatment plants, subject to appropriate assessment and approval of that waste and the specified landfill.*

Examples of Type 1 inert wastes:

Building and demolition waste (e.g. bricks, concrete, paper, plastics, glass, metal and timber), being material resulting from the demolition, erection, construction, refurbishment or alteration of buildings or from the construction, repair or alteration of infrastructure-type development such as roads, bridges, dams, tunnels, railways, and airports, and which:

- *is not mixed with any other type of waste, and*
- *does not contain any asbestos.*

Asphalt waste (e.g. resulting from road construction and waterproofing works).

Biosolids categorised for unrestricted use.

Casting sand (that does not contain leachable components which would require disposal in a higher class of landfill).

Examples of Type 2 inert wastes:

Used, rejected or unwanted tyres (including shredded tyres or tyre pieces).

Pennsylvania Department of Environmental Protection

Fill is ... uncontaminated and non water-soluble material that can be moved and used as fill material. Although fill material may contain certain contaminants, these contaminants are present in the fill at de minimis levels which DEP considers protective of public health.

Fill material is usually generated by a variety of construction and development projects and generally includes soil, rock, stone, and gravel. In addition to these materials, waste materials including fly ash, bottom ash, boiler ash, steel slag, and various foundry sands may also be beneficially used in a variety of ways such as construction material.

Different guidelines have been established for soil containing metals that exceed the values listed in Table 1. If a spill or release has not affected the soil but the soil contains metals that exceed the guidelines listed in Table 1, you can choose to have the soil further tested. For example, a test can be performed in order to compare the level of metals present in the soil at the excavation site and the level of metals present in the soil from the site where the soil will be moved. If both sites contain soil with comparable levels of metals, you will not need to obtain a permit to move and use the soil; however, if the levels are not comparable, you must comply with DEP regulations in order to move and use the soil material.

North Dakota Department of Health

33-20-05.1-02. Performance and design criteria.

2. Disposal of the following solid waste into inert waste landfills is prohibited: agricultural waste, asbestos waste, municipal waste, commercial waste, industrial waste, special waste, regulated infectious waste, liquid solid waste, hazardous waste, and radioactive waste.

Washington State Department of Ecology

CHAPTER 173–304 WAC MINIMUM FUNCTIONAL STANDARDS FOR SOLID WASTE HANDLING

173-304-100 (19) "Demolition waste" means solid waste, largely inert waste, resulting from the demolition or razing of buildings, roads and other man-made structures. Demolition waste consists of, but is not limited to, concrete, brick, bituminous concrete, wood and masonry, composition roofing and roofing paper, steel, and minor amounts of other metals like copper. Plaster (i.e., sheet rock or plaster board) or any other material, other than wood, that is likely to produce gases or a leachate during the decomposition process and asbestos wastes are not considered to be demolition waste for the purposes of this regulation.

Glossary

Borehole	A hole sunk into the ground by drilling for abstraction of water or for observation purposes. A borehole may be lined with suitable casing and screened at appropriate depths.
Catchment	The area from which water drains to a specified point (e.g. to a reservoir, river, lake, borehole).
Cleanfill	A cleanfill is any landfill that accepts only cleanfill material.
Cleanfill material	Material that when buried will have no adverse effect on people or the environment; includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of: • combustible, putrescible, degradable or leachable components • hazardous substances • products or materials derived from hazardous waste treatment, hazardous waste stabilisation or hazardous waste disposal practices • materials that may present a risk to human health • liquid waste.
Closed landfill	Any landfill that no longer accepts waste for disposal.
Contaminant	Any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substance, energy or heat: • when discharged into water, changes or is likely to change, the physical, chemical or biological condition of water; or • when discharged onto or into land or into air, changes or is likely to change, the physical, chemical or biological condition of the land or air onto or into which it is discharged.
Contaminated site	A site at which (not naturally occurring) hazardous substances are present in concentrations above background levels and in a state such that they may pose or may be likely to pose an immediate or long-term hazard to human health or the environment.
Down-gradient	In the direction of decreasing water level (in groundwater this is following the *hydraulic gradient*).
Effluent	A liquid waste.
Groundwater	All water that is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
Hydraulic gradient	The change in total head (of water) with distance in a given direction; the direction is that which yields a maximum rate of decrease in head.
Hydrology	The study of water at ground surface.

Inert waste	Waste that when deposited at a landfill under normal conditions does not undergo any significant physical, chemical or biological reactions or cause environmental pollution.
Landfill	A waste-disposal site used for the controlled deposit of solid wastes onto or into land.
Landfill gas	Gas generated as a result of decomposition processes or biodegradable materials deposited in a landfill. It consists principally of methane and carbon dioxide, but includes minor amounts of other components.
Leachate	Liquid that has percolated through or emerged from solid waste, and that contains dissolved and/or suspended liquids and/or solids and/or gases.
Monitoring	In this context, a continuous or regular periodic check to determine the ongoing nature of the potential hazard, conditions along environmental pathways and environmental impacts of landfill operations to ensure that the landfill is performing according to design. The general definition of monitoring includes measurements undertaken both for compliance purposes and to assess landfill performance.
Permeability	A measure of the rate at which a fluid will move through a medium. The permeability of a medium is independent of the properties of the fluid.
Receptor	A resource (including humans) that may be affected by a contaminant, via a pathway.
Risk	A quantitative or qualitative combination of the probability of a defined hazard causing an adverse consequence at a receptor, and the magnitude of that consequence.
Run-off	Rain or melted snow that drains from the land surface.
Surface water	Any accumulation of water on the ground surface, including puddles, ponds, lakes, wetlands, drains, ditches, springs, seepages, streams and rivers.
SVOC	Semi-volatile organic compound.
Toxicity	The adverse effects caused by a toxin (poison) that, when introduced into or absorbed by a living organism, destroys life or injures health. Acute toxicity means the effects that occur a short time after exposure to the toxin; chronic toxicity means the effects that occur either after prolonged exposure or an extended period after initial exposure.
TPH	Total petroleum hydrocarbons.
VOC	Volatile organic compound.
Waste	Any material – whether it is liquid, solid or a contained gas – that is unwanted and unvalued, and is discarded or discharged by its holder.

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