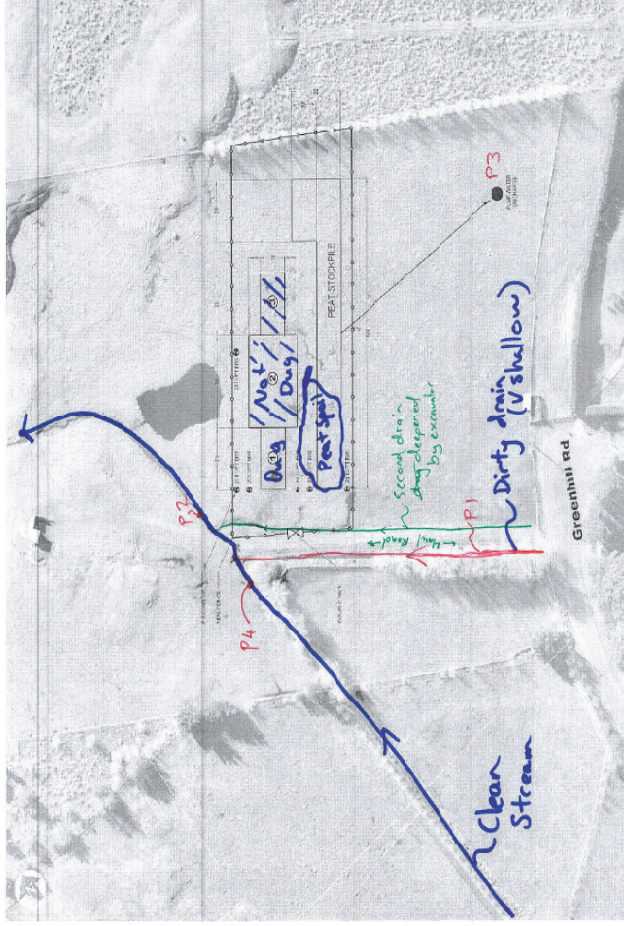


Appendix H.N
Peat Replacement Trial

Peat Trial Sample Results

Sample #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
NTU	91	10.6	129	12.7	720	34	15.9	58	11	78	23	10.1	136	18.7	10.6	520	10.5	23	13.5	240	11.4
pH Units	6.8	7.1	6.8	7.1	6.5	6.9	7.1	6.9	7.1	6.4	6.9	7.1	6.6	7	7.1	6.3	7	6.9	7.1	6.7	7.2
g/m3	200	11	340	12	950	83	13	90	8	103	29	7	210	18	5	910	10	27	9	290	6

Sample Locations



Sample #	Date of Sample	Time of Sample	General Activity
1	30/05/2011	11:56	Immediately after commencement
2	30/05/2011	11:56	Immediately after commencement
3	30/05/2011	13:44	Pumping during Digging
4	30/05/2011	13:44	Pumping during Digging
5	30/05/2011	13:44	Pumping during Digging
6	30/05/2011	14:30	Infiltration from Base of Pit Noted - No pumping
7	30/05/2011	14:30	Infiltration from Base of Pit Noted - No pumping
8	31/05/2011	8:00	Pre Pumping Pit Water
9	31/05/2011	8:00	Pumping Pit Water
10	31/05/2011	8:00	Pumping
11	31/05/2011	9:00	Pumping
12	31/05/2011	9:00	Pumping
13	31/05/2011	9:00	Pumping
14	31/05/2011	12:30	Following Sand Placement in Pit - Pumping
15	31/05/2011	12:30	Following Sand Placement in Pit - Pumping
16	31/05/2011	12:30	Following Sand Placement in Pit - Pumping
17	31/05/2011	12:30	Following Sand Placement in Pit - Pumping
18	31/05/2011	16:00	Pumping off
19	31/05/2011	16:00	Pumping off
20	31/05/2011	16:00	Pumping off
21	31/05/2011	16:00	Pumping off

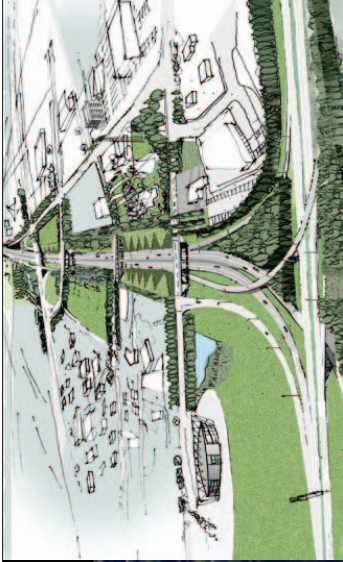
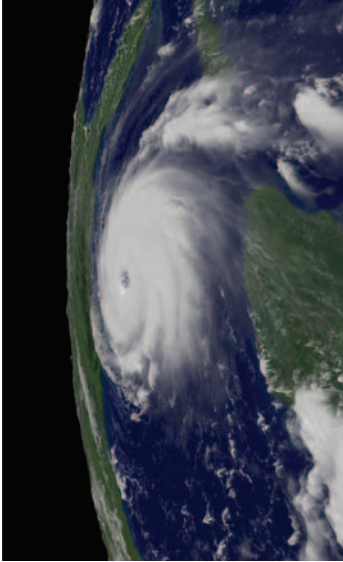
Appendix H.O
NZTA Environmental Plan

ENVIRONMENTAL PLAN

IMPROVING ENVIRONMENTAL SUSTAINABILITY AND PUBLIC HEALTH IN NEW ZEALAND

VERSION 2

JUNE 2008



ENVIRONMENTAL POLICY

[Return to Table of contents](#) →

Transit New Zealand is committed to:

- being socially and environmentally responsible; and
- improving the contribution of state highways to the environmental and social well being of New Zealand by:

Protecting and enhancing the environment where appropriate

Managing the state highway network provides opportunities to protect and enhance the natural and physical environment. Transit manages these opportunities, where appropriate, for the benefit of current and future generations. Transit has a role in improving quality of life, particularly in urban areas, and aims to do this in partnership with others.

Avoiding adverse effects to the extent reasonable in the circumstances

Constructing and operating state highways can impose adverse effects on communities and the environment. Transit avoids these effects to the extent reasonable in the circumstances. Adverse environmental effects that cannot be reasonably avoided are mitigated by low-impact and, preferably, multi-purpose measures; statutory compliance is a minimum requirement. Working in partnership with others to encourage multi-modal travel and reduce demand for private motor vehicle travel helps reduce adverse effects.

Using and managing resources efficiently

Materials and energy are key components of Transit's business and these resources are used in a manner that recognises supply limitations and lifecycle costs. Particular emphasis is given to reusing and recycling resources. Transit recognises the multiple benefits of using energy efficiently and aims to ensure state highways contribute to improving the energy efficiency of the transport sector and help reduce New Zealand's greenhouse gas emissions.

Considering environmental issues early

Environmental management is most effective when environmental constraints and opportunities are considered early in network planning, design and maintenance. Transit recognises it is also cost effective to consider environmental issues early, alongside other key objectives such as safety, economic development and integrated planning.

Contributing to sustainable outcomes by working with others

Many elements of a sustainable land transport system are beyond Transit's direct control. In these situations Transit aims to influence sustainable outcomes by working with central government, local government, communities, Māori and transport providers.

Continually improving environmental performance

Achieving sound social and environmental outcomes is an integral part of Transit's business. While compliance with legal obligations is inherent in Transit's business, learning from experience, including that of consultants and contractors, is necessary for continual improvement. Transit encourages new ways of improving environmental sustainability and public health.

Signed in the presence of the Transit New Zealand Board, 3 November 2004.

David Stubbs

David Stubbs

Chairperson

Rick van Barneveld

Rick van Barneveld

Chief Executive

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

OBJECTIVES

- ES1** Ensure construction and maintenance activities avoid, remedy or mitigate effects of soil erosion, sediment run-off and sediment deposition.
- ES2** Identify areas susceptible to erosion and sediment deposition and implement erosion and sediment control measures appropriate to each situation with particular emphasis on high-risk areas.
- ES3** Use bio-engineering and low-impact design practices where practicable.

EFFECTS

Adverse impacts include soil slips and landslides where significant amounts of sediment enter waterways resulting in deterioration and destruction of flora, fauna, aesthetic features, structures and water quality.

The two main drivers of erosion are water and wind.

Water: Water plays a major role in erosion by displacing and transporting soil. In general, there is an increased potential for water erosion where the land slope is greater than 2%.

Water erosion types include:

1. Raindrop erosion: the breaking-up of the soil surface through the direct impact of raindrops. The extent of raindrop erosion is directly related to soil surface cover and the size, velocity and direction of raindrops, and is essentially the start of the erosion process.
2. Sheet erosion: the uniform removal of soil without the development of visible water channels. It is the least apparent of the erosion types.
3. Rill erosion: soil removal through the cutting of many small but conspicuous channels.
4. Gully erosion: the consequence of water cutting down into the soil along the line of flow. Gullies – the result of concentrated flows – develop more quickly in places characterised by furrows and vehicle ruts.
5. Tunnel erosion: occurs in soils with sub-layers with a tendency to transport flowing water more readily than their surface layer.
6. Channel erosion: when the volume and velocity of water in stream systems results in scouring and undercutting of stream banks and beds.

Wind: Wind can move sediment grains over long distances when they are air-borne. Sediments also can be blown along expanses of land, such as beaches, mudflats, unvegetated cropland or construction areas. Obstructions can reduce the wind's erosive capacity; hence windblown sediment is often deposited at these locations.

Windborne dust can pose a significant hazard on the state highway network by reducing visibility.



Lime application (Photo taken by G Ridley, Waitakere, Auckland)

The three key factors that influence the erosion process are climate, soil characteristics (soil texture, organic matter, permeability and structure) and topography. These factors need to be considered when implementing risk assessment, mitigation and control measures; with particular attention being paid to:

- vegetation cover removal;
- control measures during earthworks;
- roading project design;
- unstable or exposed soil;

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

- stockpile location of soil and other debris including haul road location;
 - earth damaged by vehicle passage;
 - works carried out during rainy seasons and other wet periods;
 - works in areas sensitive to erosion (friable soils, high rainfall, coastal environments);
 - local environments characterised by high water flows and subject to high rainfall;
 - steep slopes;
 - long slope lengths; and
 - storms featuring heavy or abnormal rainfall, both forecast and not forecast.
- Because erosion and sediment deposition has a detrimental effect on the environment and safe sustainable use of the state highway network, control measures should be planned and implemented early in any project that is likely to cause erosion or sediment deposition.

TRANSIT'S ROLE



Silt fence construction (Photo in Auckland region – compliments AFC)

With careful planning and design, adverse effects of sediment discharges resulting from construction and maintenance activities can be avoided or minimised.

- Transit ensures that the above objectives are key in minimising adverse effects of road construction and maintenance. This involves forming partnerships with interested parties – government agencies, consulting and engineering firms, specialist advice and contracting firms. Transit's intention is to lead in the:
- promotion and use of appropriate design methods;
 - development and application of practices that minimise risk of erosion and sediment deposition;
 - implementation of erosion and sediment control measures;
 - identification of risk and problem areas;
 - use of best-practice methods unique to each situation to ensure effectiveness;
 - early identification of new projects that have a higher risk of erosion;
 - identification of and support for new techniques and methodologies including research and implementation as appropriate;
 - consultation with council authorities to ascertain problem areas and agree upon solutions; and
 - protection of sensitive receiving environments.

PERFORMANCE INDICATOR

None at this time.

EXAMPLES OF CURRENT PRACTICE

There are 10 core best-practice principles for erosion and sediment control to be applied in all projects.

1. **Minimise disturbance:** some areas of a site should not be disturbed and others should have the impacts on them minimised as much as possible. Projects should avoid working on areas that are steep, wet, have fragile soils, vegetation or are conservation areas.
2. **Stage construction:** to limit erosion, project sites should use only the areas needed for the immediate activity and construction staging where the site has earthworks undertaken in small units over time, followed by progressive re-vegetation.
3. **Protect steep slopes:** steep slopes should be avoided, but if necessary, divert run-off from slope and ensure that erosion control measures are put in place immediately the activity is finished.
4. **Protect watercourses:** preserve riparian margins around watercourses – a vegetative barrier should be maintained and appropriate erosion and sediment control measures implemented around water bodies to minimise contamination.
5. **Stabilise exposed areas rapidly:** it is important to stabilise each area with vegetation or other appropriate measures after they have been disturbed. Mulch is a material that provides instant stabilisation.
6. **Install perimeter controls:** placed around the project, these prevent clean offsite run-off contamination.
7. **Sediment retention measures:** when installed, will capture and minimise the impacts of any sediment run-off where present.

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

8. Get registered: consult with erosion experts or attain qualifications on erosion and sedimentation, allowing savings on project time and money, as well as facilitating early identification of potential problems. An appropriately qualified and trained contractor enhances achievement of the above objectives.
9. Ensure plan evolution: the project plan should evolve as the relevant variables do. Factors such as weather, changes to grade and altered drainage can require changes to planned erosion and sediment control practices.
10. Assess and adjust: monitor, assess and maintain effective control measures by facilitating adaptation to storm events or changes in project plans.

Transit promotes the use of vegetation as an effective erosion and sediment control measure because it is a low-impact bioengineering alternative. The use of vegetation to manage erosion and to achieve slope stabilisation serves these key functions:

- retain sediment, keeping it out of receiving environments;
- provide permanent slope stabilisation and erosion control with its root structures minimising slip risk; and
- create an aesthetically pleasing roadside environment.

Use of vegetation in erosion and sediment control is an efficient use of capital compared to traditional construction-based alternatives, and can also save staff time, maintenance costs mitigating against future road closures and remedial work.

To effectively utilise vegetative options for erosion and sediment control careful planning and consideration is needed as:

- vegetative options should complement the natural biodiversity of the surrounding area, especially when working in or adjacent to Department of Conservation (DOC) land;
- selection of native species endemic to the area is important because of the impact on the natural character, the species native to the area and plants' ability to flourish in the environment; and
- plants should be locally-sourced and chosen after consultation with experts such as tangata whenua and local DOC personnel.



Sediment retention pond (Photo in Auckland region – compliments ARC)



Orewa Interchange construction, ALPUFT B2 Northern Motorway Extension

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

IMPLEMENTATION PLAN

TRANSIT ACTIVITIES	METHODS	TOOLKIT
<p>National Office Initiatives</p>	<p>Risk Assessment Identify areas of high risk on a national basis with respect to future proposed projects based on extent and nature of construction works and the values of the receiving environments.</p> <p>Specifications Develop specifications for implementation and maintenance of erosion and sediment control measures, including details of resource consent proforma relating to earthworks activities.</p> <p>Education/Advocacy Undertake educational initiatives with Transit-employed contractors and consultants to upskill at all levels. Collaborate and form partnerships with the various external providers, research organisations and councils to promote good practice and to further explore technical options and advancements.</p>	<p>Soil Conservation Technical Handbook http://www.nzarm.org.nz/SoilConserv%20Pt%20A.pdf</p> <p>Goldman, Steven J, Jackson, K and Bursztynsky, T: Erosion and Sediment Control Handbook, 1986</p> <p>Fundamentals of Urban Runoff Management: Technical and Institutional Issues http://www.nzarm.org.nz/SoilConserv%20Pt%20A.pdf</p>
<p>Plan</p>	<p>Local Authorities' Erosion and Sediment Control Guidelines Detailing each local authority's erosion and sediment control guidelines and extracting key elements from international experience.</p> <p>Collaborative Regional Planning Work with councils to develop regional and district plans that meet the needs of Transit to ensure that consideration is given to practical and achievable requirements for erosion and sediment control for all projects including maintenance works.</p>	<p>Erosion and Sediment Control Guideline 2007 for Canterbury http://www.ecan.govt.nz/NR/rdonlyres/30C25E34-6844-4498-84B9-AE31BD133EAC/0/FullErosionandSedimentControlGuideline.pdf</p> <p>Erosion and Sediment Control for the Auckland Regional Council (TP90) http://www.arc.govt.nz/albany/fms/main/Documents/Plans/Technical%20publications/51-100/TP90%20Erosion%20and%20sediment%20control%20guidelines%20for%20land%20disturbing%20activities%20in%20the%20Auckland%20Region%20Part%20A%201-4%20-%201999.pdf</p> <p>Erosion and Sediment Control Guidelines for the Wellington Region http://www.gw.govt.nz/council-reports/pdfs%5Creportdocs%5C2002_514_2_Attach.pdf</p>

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

TRANSIT ACTIVITIES	METHODS	TOOLKIT
<p>Plan</p>	<p>Consent Conditions</p> <p>Ensure that resource consent conditions are appropriate and have considered:</p> <ul style="list-style-type: none"> • potential effects; • cost effectiveness; and • practicality and achievability. 	<p>Earthworks- Erosion and Sediment Control for Environment Waikato http://www.ew.govt.nz/Environmental-information/Land-and-soil/Erosion/Earthworks---Erosion-and-Sediment-Control/</p> <p>Preparing the Erosion and Sedimentation Control Plan http://www.dlr.enr.state.nc.us/images/Sediment_design_manual_June2006/ChapterFour_20060614.PDF</p> <p>Preparing the Erosion and Sedimentation Control Plan – North Carolina Department of Environment and Natural Resources a useful guideline on how to plan erosion and sediment control measures</p>
<p>Design</p>	<p>Control Selection</p> <p>Seek expert advice and research available literature as necessary to design and advise on appropriate selection of control measures.</p> <p>Follow the 10 basic principles and place emphasis on the prevention of sediment-generation in the first instance. The less sediment we generate the less we have to capture before it leaves our site.</p> <p>Ongoing Advancements</p> <p>Collaborate and form partnerships with the councils and private landowners to continually enhance the erosion and sediment control measures while looking for innovative ways of implementation and maintenance.</p> <p>Risk Assessment</p> <p>Develop a risk matrix for each specific project to allow clear interpretation of the areas where the highest risk exists and how this can be managed to minimise the risk.</p>	<p>Erosion and Sediment Control Using New Zealand Native Plants http://icm.landcareresearch.co.nz/knowledgebase/publications/public/NZHT_Chris_Phillips_natives.pdf</p> <p>West Virginia Department of Transportation Division of Highways: Erosion and Sediment Control Manual http://www.wvdot.com/engineering/files/EROSION/Erosion2003.pdf</p>

2.4 EROSION AND SEDIMENT CONTROL

[Return to Table of contents](#) →

TRANSIT ACTIVITIES	METHODS	TOOLKIT
<p>Build</p>	<p>Key Contacts Develop a list of key suppliers and key contacts for your region. Develop partnerships with these parties to secure availability as required.</p> <p>Consent Compliance Comply with all resource consent conditions and continue to work with all authorities to understand and ensure compliance.</p> <p>Incident Reporting and Checklists Develop incident reporting and checklists for the various projects to assist with achieving compliance and appropriate objectives and outcomes. Check against the objectives for erosion and sediment control and adjust as necessary.</p> <p>Collaboration Ongoing partnership building with councils and key stakeholders.</p>	<p>Tennessee Erosion and Sediment Control Handbook http://www.state.tn.us/environment/wpc/sed/sed_ero_controlhandbook/eschandbook.pdf</p> <p>Advice and Guidance on Range of Consenting and Compliance Issues http://www.qualityplanning.org.nz</p>
<p>Maintain and Operate</p>	<p>Only on completion of the construction activity can the erosion and /or sediment control measure be removed. They are short-term measures only and are not designed for long-term placement. Utilise rapid stabilisation techniques to allow for removal of the control measures and to eliminate future sedimentation issues.</p>	

Appendix H.P
Permit to Pump System

Project:

JSEA N°:

Permit N°

Permit Request

Name of Contractor/Subcontractor:

Person in Charge of Work: Position:

Description of proposed work:

Area/Location of proposed work:

Volume of water to be pumped (estimated) :m³

Any impurities other than sediment? : (e.g. contaminated groundwater, contact with fresh cement, concrete dust, fuels, oils, chemicals?)
.....

Receiving area of pump discharge: (attach additional information as required)
.....

Planned controls to be in place during pumping: (attached additional information as required)
.....

Estimated duration of pumping:hrs Proposed commencement date and time:/...../.....am/pm

Permit to Work - Pumping

Approval is subject to the following conditions/procedures/precautions (include any additional safety and environmental requirements):

Environmental Procedure ENV-10 Waste Concrete and Grout

Environmental Procedure ENV-11 Dewatering Discharge
.....
.....

Time period during which pumping is to be undertaken :

From (Time): Day: Date:/...../.....

To (Time): Day: Date:/...../.....

Authorised by Environmental Manager (Signature): Date:/...../.....

If appropriate, request a briefing from the Environmental Manager prior to commencement of work

This Permit to Pump becomes invalid and must be returned to the Environmental Manager if the scope of work or the work area changes or unauthorised discharges to waterways occur.

Receipt of Permit

As the Person In Charge of Work I understand that I am responsible for informing the personnel under my control of the content and limits of this Permit.

I confirm that the specified environmental requirements have been taken and authorise this Permit to go into effect.

Name:Signature:Date:/...../.....

Permit Closeout

As the Person In Charge of Work I confirm that pumping activities described in this Permit have now been completed

Name:Signature:Date:/...../.....

Return closed out Permit to the Environmental Manager

Appendix H.Q
Fletcher Environmental Toolkit

THIS LAND IS MY LAND

As a company, and as individuals, we take pride in our beautiful country, however New Zealand's natural beauty is not something we can take for granted. As engineers we have a huge impact on the environment.

We strive to ensure that the impact of our interventions on the environment is minimal, and the mark we leave is positive.

Fletcher Construction prides itself in the way it approaches environmental management. We have had many successes in the past but must not become complacent. It is up to each of us to look after our environment and ensure it is protected for future generations.

Let's be proud of what we leave behind.



Graham Darlow
GENERAL MANAGER – ENGINEERING



Peter Neven
GENERAL MANAGER – BUILDING



Alan Brown
GENERAL MANAGER – SOUTH PACIFIC

Environmental Toolkit

The Environmental Toolkit will help you to manage the environmental and community risks inherent in our day-to-day work. It addresses issues that commonly arise on-site and offers practical solutions.

It covers typical environmental considerations, such as erosion and sediment control, management of fuels, oils and chemicals, control of concrete wastes and grout slurries and contaminated soils. Community issues are also an important concern and the Toolkit addresses noise, dust and heritage sites.

“The Toolkit addresses issues that commonly arise on-site and offers practical solutions.”

The Toolkit also provides a series of linked posters. You should use the contents of this Toolkit, together with the posters, to promote environmental and community awareness among staff and subcontractors. Environmental and community issues should be incorporated into daily briefings and toolbox talks. Ensuring staff buy into environmental management will result in better project outcomes.

The disc at the back of the manual contains further, more detailed, information, such as full copies of Council sediment control guidelines, environmental fact sheets, as well as printable copies of the posters in the Toolkit.

It is important that this document is not seen as replacing contract specifications, project environmental management plans, resource consents and other specific documentation that is relevant to your site. This documentation should always be referred to when undertaking construction works.

ENVIRONMENTAL MANAGEMENT MANUAL

The Environmental Management Manual is used to establish specific project environmental management plans. The manual meets the requirements of the internationally recognised standard AS/NZS ISO-14001. It contains a number of standard forms and procedures commonly used onsite. A copy of the manual is held on every project site and can be referenced as required.



Stuart Chapman
ENVIRONMENTAL MANAGER – ENGINEERING
THE FLETCHER CONSTRUCTION COMPANY LIMITED

TAB
Earthwork Controls

Earthwork Controls

Earthworks operations often generate large volumes of sediment – unless appropriately controlled this will wash into receiving environments. Sediment smothers the bottom of streams and harbours, and can kill stream life or shellfish. It is crucial that we control sediment runoff from construction sites to prevent ongoing damage to the local environment.



Above: *Sediment plume entering receiving environment.*

Sites requirements for sediment management will vary from project to project. The actual requirements will depend on the Project Specifications, local Council rules and Resource Consents. Large project sites often have specific **Erosion and Sediment Control Plans (ESCP's)** for the different areas where earthworks are carried out.

“**The best way to prevent sediment discharging from a site is to minimise exposure to rainfall in earthworks areas.**”

Earthwork Controls continued

The best way to prevent sediment discharging from a site is to minimise exposure to rainfall in earthworks areas. This means considering how you can best minimise areas being open at any one time, or carry out temporary stabilisation as the work progresses. Planning is critical to ensure an understanding of the practical staging limitations and workability is obtained.

Preventing sediment from being generated in the first instance is achieved through erosion control techniques. The prevention of sediment leaving your construction site, once the sediment is generated is referred to as sediment control.

The earthwork controls section of this toolkit contains basic information on typical erosion and sediment controls used on project sites.

This toolkit does not replace the use of specific Regional Erosion and Sediment Control Guidelines. Refer to these documents for full sets of technical drawings.



Picture: Catastrophic effect of sediment discharge.

TAB Erosion Control Techniques

AUCKLAND REGION	Auckland Regional Council – ‘Erosion and Sediment Control Guidelines for Land Disturbing Activities’ – Technical Publication 90 (1990)
WAIKATO / BOP REGION	Environment Waikato – ‘Erosion and Sediment Control Guidelines for Soil Disturbing Activities’
WELLINGTON REGION	Greater Wellington Regional Council – ‘Erosion and Sediment Control Guidelines for the Wellington Region’
TARANAKI REGION	‘Guidelines for Earthworks in the Taranaki Region’
BAY OF PLENTY REGION	‘Erosion and Sediment Control Guidelines for Land Disturbing Activities’

Electronic copies are provided on the disc at the back of this toolkit, or refer to Fletcher Construction’s Environmental Manager, Head Office for areas outside these regions.

Erosion Control

Stabilisation is one of the best ways to limit the potential for sediment run off. Stabilisation is often required by Councils to limit exposed areas.

Once works cease within an earthworks area (temporarily or permanently) the area can be stabilised in one of the following ways:

ROCK COVER

The simple placement of a clean "low fine" rock to a depth of 100mm over exposed areas will provide immediate erosion protection. Rock cover can be used on areas such as access roads (discussed later in this toolkit) and larger earthworks areas. With forward planning the placement of this rock cover can be undertaken between earthworks completion and commencing operations on, for example, building of structures or roads.

CONVENTIONAL GRASSING



Placement of a minimum of 100mm of topsoil followed by planting and establishment of temporary or permanent grass will provide erosion control. **Placement of topsoil alone is not considered to provide erosion control** – a period of 4 to 6 weeks (dependent upon climatic conditions) is usually required prior to achieving a stabilised surface when grass is established (80% strike recommended). As such, any sediment controls should generally be left in place until the grass establishes.

Seed bed preparation is critical to achieve a good grass cover. Use of correct seed mix is critical. If not specified in the Construction Specifications then discussion with the local seed supplier will determine the most appropriate species and application rates. Fertiliser and watering may also be required.

Picture: Erosion stabilised grassed batter.

Erosion Control continued

HYDROSEEDING

Hydro-seeding is the application of seed, fertiliser and paper or wood pulp in a slurry to the earthwork area. It is designed to help establish vegetation quickly and is an appropriate stabilisation technique in critical areas such as steep slopes and batters. Topsoiling is not usually necessary. Irrigation of the hydroseeded area may be required if the area is not mulched. A water cart may be one option to consider.

Sediment controls should always remain in place until grass strikes (80% strike is needed).



Picture: Hydroseeding demonstration.

MULCHING

Mulch (straw or hay) can also be applied to provide instant stabilisation. This is normally applied with a seed and fertiliser mix which enables grass growth after the straw and hay has rotted away. It is also used to raise and maintain the ground temperature in winter months to allow for more effective germination of seed. Mulch is usually applied by a contractor using a specialised machine however small areas can be hand mulched. When applied mulch should provide a full ground cover and no areas of bare earth should be visible.

Bark chip can also be used as a temporary or permanent mulch. Seed is often added to mulch to provide a vegetative cover.



Picture: Straw mulch being applied for instant stabilisation of a temporary batter.



Picture: Hand mulching associated with Berm Work.

The Appendix attached to this toolkit provides a list of mulching & hydroseeding contractors.

Erosion Control continued

GEOTEXTILES

Geotextiles can provide instant protection against erosion. Products include non-woven polyester fabrics such as 'bidim', however there are many products available and each product has a specific purpose. It is important that you speak to the geotextile supplier about what products are best suited for the conditions.

When utilising geotextiles ensure the fabric is adequately pinned to earth using soil pins at spacings of no more than a 500mm grid pattern. A minimum of 150mm overlap must be left between geotextile rolls at all points.

For small stockpiles you could consider covering with sheet polythene material. However geotextile is usually a better product to work with and is more durable.



Picture: Temporary batter protected with geotextile.

The Appendix attached to this toolkit provides a list of geotextile suppliers.

CLEANWATER DIVERSIONS



By preventing clean water entering the construction zone we help protect our work areas and reduce the size of the sediment controls we have to build to treat dirty water.

Clean water diversions are formed as either **bunds** or **channels**. They must be correctly installed and maintained regularly to ensure they work correctly.

Picture: Diversion bund diverting clean water away from the construction area.

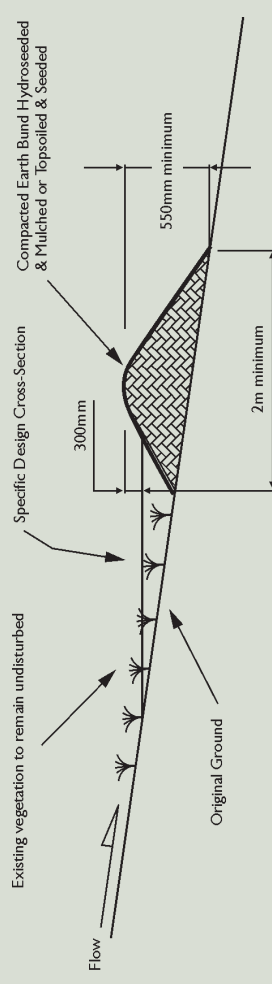
Design

The location of cleanwater diversions should be carefully thought out in advance of construction – if not established in the right place, they may be damaged by construction equipment.

For most operations, cleanwater diversions should be at least 550mm high (either bund height, channel depth or a combination of both). Cleanwater diversions must be well compacted and stabilised (typically grassed) to prevent them eroding following heavy rain.

Once the slope of the cleanwater diversion starts to exceed approximately 2-5% it must be stabilised with a heavy geotextile fabric (e.g. bidim) or low fine rock aggregate to prevent it eroding.

For small sites, other materials such as sand bags can be used to act as cleanwater diversions.



Picture: Cross section of typical clean water diversion bund.

Erosion Control continued

CLEANWATER DIVERSIONS continued



Picture: Clean water diversion channel stabilised with geofabric.



Picture: Hot-mix bund directing clean water to cesspit.

The outfall of clean water diversion channels should be protected to prevent scour. Geotextile fabric or rock aggregate is often used. Where possible, the clean water diversion should discharge directly into the existing stormwater system.

On hard stand areas (e.g. carriage ways), smaller clean water bunds can be used to prevent clean road runoff entering an earthworks site. These bunds are usually constructed with hot-mix asphalt. It is important to ensure these types of bunds do not cause potential back flooding of roads.

Maintenance

Diversion channels need regular maintenance, including:

- ▶ Inspection during and after heavy rainfall for any scour or breaches.
- ▶ Check the outlet has not scoured out, and if necessary remove any dirt and re-establish the outlet.

STABILISED CONSTRUCTION ENTRANCES

The establishment of a Stabilised Construction Entrance is often required at entry and exit points on construction sites. These are designed to prevent the access points from becoming sediment sources and will also help with dust minimisation. Entrances should be designed to be a minimum of 4 m in width and 10m in length.

For short term projects, where machine size is generally less than 2 tonnes, design is based on a minimum of 150mm depth of clean, well graded 65mm aggregate, placed and compacted.

Where larger machines are to be used, the depth of aggregate should be increased to 400mm.

For long term projects you may consider applying 40mm of asphalted concrete to provide a hard wearing surface.



Picture: Stabilised Construction Entrance.

Erosion Control continued

STABILISED CONSTRUCTION ENTRANCES continued

In some cases the Stabilised Construction Entrances will develop, or lead, into a fully-formed access road. For example, where access is required for large plant equipment over the winter period.

Access roads need to be regularly cleaned of any dirt clods that fall from trucks and other plant to prevent them becoming a source of sediment. Good road design and ongoing maintenance reduces the need for wheel washing as trucks leave the site.



Picture: Well constructed access track.

WHEEL WASHES

In addition to Stabilised Construction Entrances there are times when wheel wash facilities must be installed as a condition of Local Council approvals and good construction practice. The design for these varies tremendously and if you are required to install a wheel wash for the first time you should talk to a senior engineer, or contact Fletcher Construction's Environmental Manager.

Two examples are illustrated below:

Example 1:

This wheel wash facility was necessary to wash truck tyres prior to exiting the site. A cattle grate formed the wash down area, with dirty water directed to a small treatment pond that removes sediment prior to discharge. The pond design is similar to a Decanting Earth Bund covered under *Sediment Controls* section.

This wheel wash is manually operated using a water blaster connected to mains water or an on-site water tank.



Picture: Wheel wash – cattle grate.

Example 2:

This wheel wash was designed for significant truck movements in and out of a long-term site. A reinforced concrete design was selected to provide additional strength. The system is manually operated, with the discharge passed through a Decanting Earth Bund.



Picture: Wheel wash – concrete pad.

Cattle grate / stops can be sourced from rural equipment suppliers. Wooden protection should be placed over metal grates to prevent damage from track mounted machines. It is important to ensure the wheel wash is monitored to ensure it is being used correctly and maintenance performed. Do not allow operators to waterblast the undercarriage, as this will discharge to the on-site sediment controls which are not designed to treat oily waste.

Erosion Control continued

Silt Fences: our last defence

Proper installation is the key to effective treatment.

Install silt fences in areas where dirty water runoff needs treatment.

Check during and after heavy rainfall.

Maintain your fences regularly.



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TAB
Sediment Control Techniques

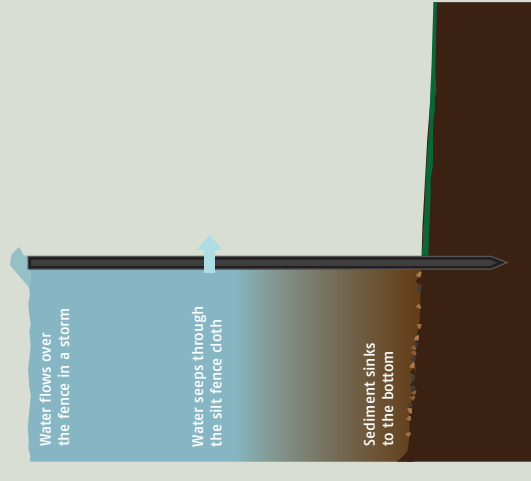
Sediment Control Techniques



SILT FENCES

A silt fence creates a boundary between the construction site (dirty area) and the surrounding environment (clean area).

They are used to detain sheet flows from small areas to promote removal of sediment from the dirty water runoff.



Silt Fences are not filters! Their purpose is to hold back dirty water and allow the sediment to settle out. The water then can slowly seep through the cloth or flow over the top of the fence.

There are two types of silt fence:

- ▶ Silt Fences
- ▶ Super Silt Fence

Super Silt Fences are more durable and can take a larger and steeper catchment area. They are useful in environmentally sensitive areas.

- The Super Silt Fence is 400mm higher than the Silt fence
- The Super Silt Fence has a wire chain link mesh supporting the silt cloth for added support and protection
- The Super Silt Fence has a double thickness of geotextile.



Sediment Control Techniques continued

SILT FENCES continued



Picture: Silt fence – not level.

Design

- Install silt fences level across the slope (ie following the land contours) so that water can build up over the whole length of the fence and not concentrate in one area. Failure to do this may result in bypass or failure of the silt fence.
- Use returns projecting upslope at either end of the silt fence to prevent dirty water outflanking the fence.
- Tension the wire every 50 metres.

The length and grade of a batter slope determines whether or not a silt fence can be used successfully. Use the table below for guidance:

SLOPE STEEPNESS %	SLOPE LENGTH (m) (MAXIMUM)	SPACING OF RETURNS (m)
< 2%	N/A	Unlimited
2–10%	40	60
10–20%	30	50
20–33%	20	40
33–50%	15	30
> 50%	6	20

Source: ARC TP90 for standard silt fence

For example: If a batter has a slope of 30% and a length (top of batter to bottom of batter) of 40m, then a silt fence is not appropriate and another control device will need to be used.

A list of silt cloth (geotextile) suppliers is provided in the Appendix of this Toolkit.

A3 fold-out goes here



Picture: Silt fence return – minimum 1m upslope.

Sediment Control Techniques continued



INSTALLATION

The wire on the silt fence must be tensioned. Any joints in fabric must have a minimum 2m overlap; or use a wooden batten and screws to joint the cloth. Minimise the number of joints required.



Ensure that returns are installed at both ends of the silt fence. In this photo the water will run along the silt fence and around the end and then into the stormwater system. The water has not been treated!

BACK OF A3 FOLD OUT DIAGRAM



Unlike this photo, silt fences must be trenched in and the ground must be compacted otherwise there is the potential for uncontrolled discharge.



Correct silt fence joint.

Silt fence joints need to be secure, otherwise they are a weak point in the barrier. They should be for the full width of the Silt Fence material and be trenched into the ground.

Sediment Control Techniques continued



This photo shows uncontrolled discharge caused by poor trenching.



MAINTENANCE

Maintenance is essential to keep the required dimensions of the silt fence. Excess material must not build up on the fence. Remove it regularly to ensure silt fence continues to work at full height.



This fence will provide no silt control for the surrounding area, as it has not been maintained.

Holes in the silt fences (including small holes) allow the water to flow straight through the fence, which makes the fence ineffective.

Patch any holes with new cloth.



Inappropriate use of Gorilla Filler

Limit the use of products such as 'Gorilla Filler' for repairing small tears in silt fence material. It should not be used to repair large rips or tears (rule of thumb – nothing larger than a 50 cent piece). Also, do not use Gorilla Filler as a seal for silt fence fabric joints. Gorilla Filler does not have the same properties, or achieve the same objectives, as the original material.

Silt Fences: our last defence

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Maintain your fences regularly.

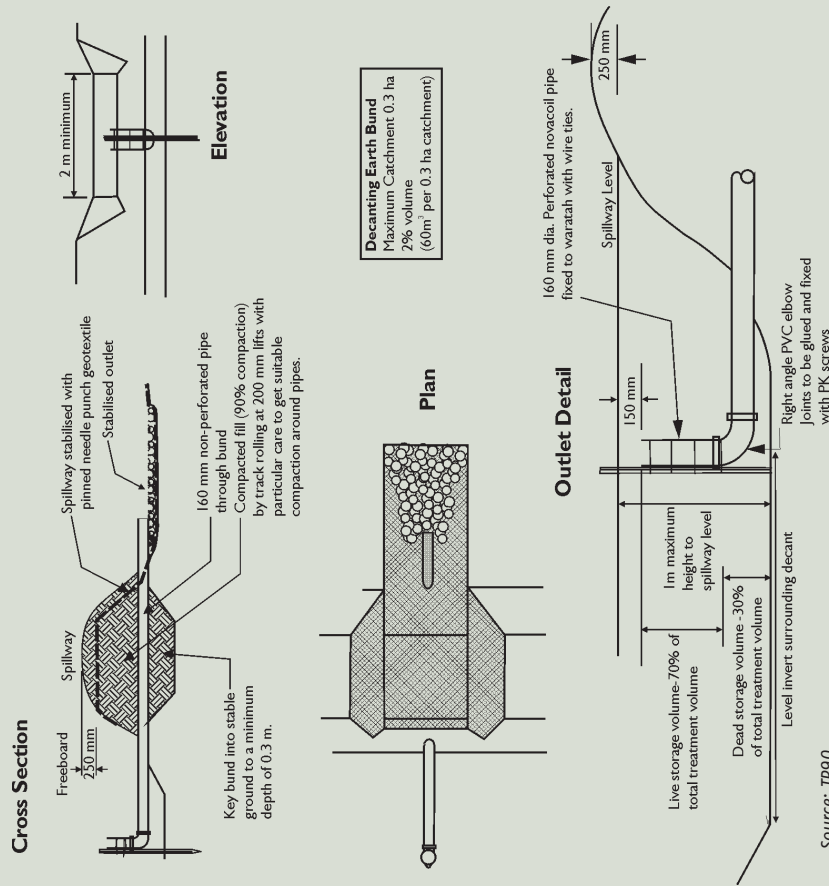


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Decanting Earth Bunds

The purpose of a Decanting Earth Bund is to create an area for dirty water to pond. This allows for the sediment in the water to settle out. The clean water is then discharged to the environment. Note this section explains the basics of a Decanting Earth Bund. You should also read the technical details contained in the Erosion and Sediment Controls Guidelines in the CD at the back of the toolkit.

Decanting Earth Bunds are suited for area catchments up to a maximum area of 3000 m². For larger areas alternative controls will be required, for example sediment retention ponds.



Source: TP90

THE REQUIRED VOLUME OF A DECANT

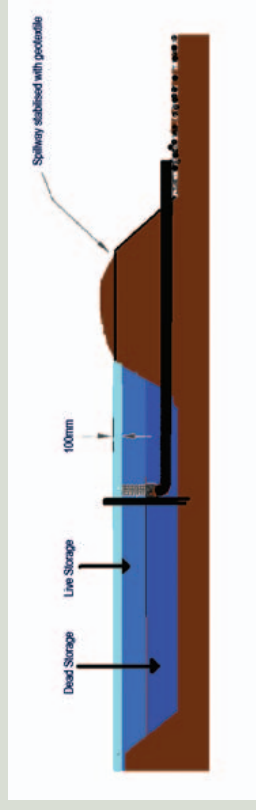
Decants must be sized so that storage of the decant is 2% of the catchment area. For example a 2000m² catchment area requires a 40 m³ decant (2000x0.02) and a 3000m² catchment requires a 60m³ decant (3000x0.02). A good rule of thumb is that a 20ft shipping container has a volume of approximately 33m³.

The storage in the decant consists of the dead storage and the live storage. This is split into 1/3 dead storage and 2/3 live storage. (Note these ratios can change between regions – check the relevant guideline contained in the CD for any regional differences).

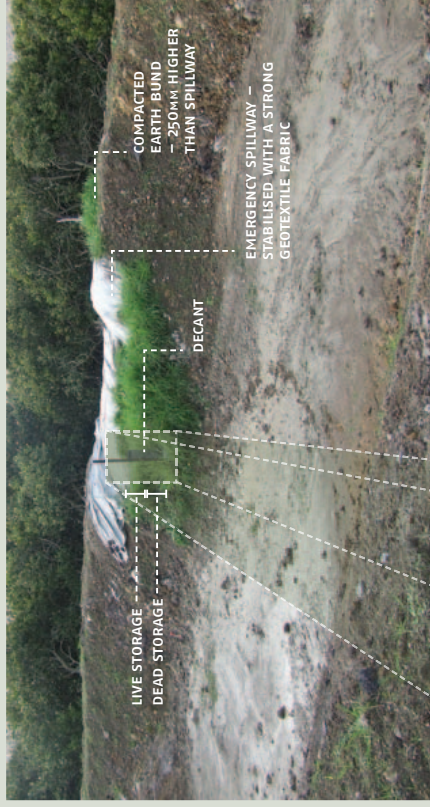
$$\text{Total Storage} = 1/3 \times (\text{Dead Storage}) + 2/3 \times (\text{Live Storage})$$

Example:

CATCHMENT SIZE	2000 m ²	3000 m ²	FORMULA
Total Required Storage in Decant	40 m ³	60 m ³	= (Catchment Size) x 0.02
Dead Storage	13 m ³	20 m ³	= (Total Storage) x 1/3
Live Storage	27 m ³	40 m ³	= (Total Storage) x 2/3



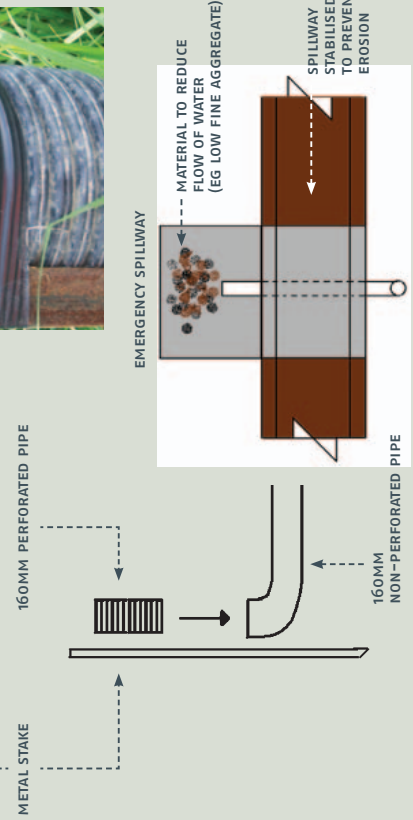
Decanting Earth Bunds continued



Connect the perforated pipe to the non-perforated pipe to the non-perforated pipe securely with glue or tape. This is a common failure in these systems!



Connect the metal stake to the pipe.



OTHER KEY CONSTRUCTION POINTS

- ▶ The entry point of dirty water into the bund should be the opposite end to the decent to maximise settlement
- ▶ Make sure the bund is well compacted in 200mm lifts, especially around the outlet pipe
- ▶ Glue the perforated PVC section to the PVC upturn to prevent it failing
- ▶ Only the top portion of the decant is perforated.
- ▶ Make sure the top of the perforated pipe is 100mm lower than the emergency spillway.
- ▶ Always inspect the bund before, during and after heavy rainfall
- ▶ Maintenance – Make sure you have a secure location for disposal where it won't run-off into the environment! Muck out the bund regularly to ensure dead storage is maintained.

MATERIALS

- ▶ 160mm diameter PVC pipe
- ▶ 160mm diameter perforated novacoli pipe
- ▶ Strong woven low permeability geotextile fabric (e.g. bidim A19)
- ▶ Metal stake (waratahs)
- ▶ Soil pins



Picture: Decanting Earth Bund.

Sediment Retention Ponds

Sediment retention ponds are temporary ponds used to filter sediment-laden water in a way that allows for sediment to settle out prior to its discharge. They are generally used at sites with an exposed earthworks area greater than 3,000m² (0.3 hectares), up to a maximum of five hectares.



Picture: Typical sediment retention pond.

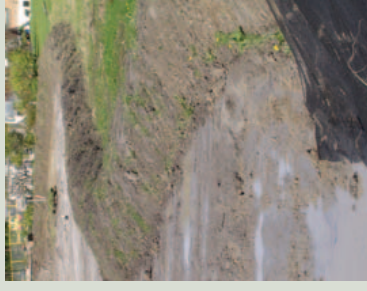
Full details for pond design and construction can be found in the “Regional Erosion and Sediment Control Guidelines” found on the CD at the back of this Toolkit. These structures are significant, costly, and require specific construction design. They need to be sited and installed with care. Ponds can be further treated by way of chemical addition (for example, poly-alum-chloride, or ‘PAC’), a chemical treatment process that aids in the settlement of dispersive clay particles.

If you are responsible for the construction of a sediment retention pond for the first time, please first liaise with a senior project engineer or contact Fletcher Construction’s Environmental Manager for further advice.



Picture: Sediment Retention Pond decant detail.

Dirty Water Diversions



Dirty water diversions work by diverting dirty water to a sediment treatment device (for example a decanting earth bund or sediment retention pond) for treatment prior to discharge to the environment.

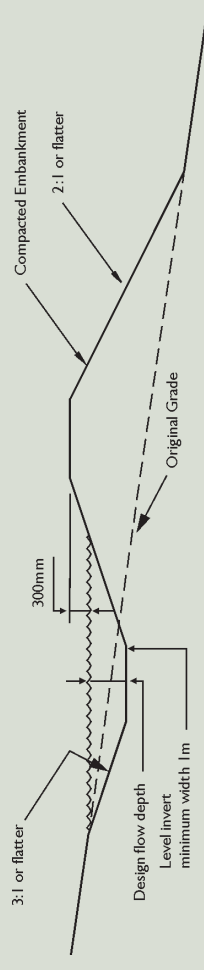
Dirty water diversions can be in the form of a non erodible bunds or channels. They must be correctly installed and maintained regularly to ensure they work correctly.

Picture: Typical dirty water diversion bund.

Design

Diversions are typically 550mm high (either bund height, channel depth or a combination of both). Bunds formed with clay must be well compacted. It is not usually necessary to stabilise dirty water diversions with grass or geofabric cloth (as for clean water diversions) unless the gradient starts to exceed approximately 2–5% as erosion may become an issue.

It is often necessary to re-establish dirty water diversions at the end of each working day due to movements of earthwork equipment in an area. If so, make sure this is critical this work is programmed into the daily schedule of works.



Source: TP90.

Picture: Cross section of typical dirty water diversion bund.

Dewatering – Trenches and Piles

Before discharging dirty water from trenching or piling operations to the environment, treatment is first required to settle out sediment and avoid potential environmental damage.

Options to consider when treating sediment-laden water include:

- ▶ Wherever possible, let dirty water settle out in the excavation first and then pump it from a suspended pump inlet hose (i.e. don't let the inlet sit in the bottom of the excavation and 'suck up' sludge). Ideally, place the intake in a perforated cage suspended above the deepest point. Monitor the discharge regularly to ensure it is clean.
- ▶ Around urban areas consider pumping dirty water directly to the sewer. This usually requires pre-treatment to settle the heavier grit material. A permit from the local council will also be required. Contact the Environmental Manager for further advice.
- ▶ Discharge pumped water to a decanting earth bund or sediment retention pond. Ensure these systems are able to handle the flow, and take care not to overload the treatment system with large volumes of water all at once. Pump to the inlet of the device and ensure you stop pumping once the dead storage volume is full to allow settlement to occur.
- ▶ If there is a large flat area of grass that is a minimum of 50 metres back from natural water and / or the stormwater system, then discharge dirty water over the grass to filter out the sediment. The discharge needs to be dispersed with no concentrated flow-paths developing. A T-Bar junction with various discharge points or a level spreader can assist in this regard. This is only suitable for small volumes of water. All water must filter into the ground or evaporate.
- ▶ Discharging behind a silt fence is not ideal as these are not designed to deal with concentrated flows from pumping dirty water. If this is your only option then place hose at least 15 metres back from super silt fence, and ensure the discharge is well dispersed. The hose must be moved regularly and the super silt fence monitored to make sure it is intact and not being undercut. Remove accumulated sediment from behind super silt fence when it reaches half the height of the fabric. To achieve a dispersed flow run the end of the hose into a perforated novacoil section to help spread the flow over a wider section of silt fence.

“ Poor dewatering practices are common on construction sites.
Make sure you have a plan.”



Picture: Checking clarity in settling tank.



Picture: Settling tank.

- ▶ Set up a dewatering system (such as a water tank or sealed shipping container) to act as a settling device. Allow settlement and then pump out clean water using a suspended pump inlet. Monitor discharge to make sure it is clean.
- ▶ Chemically treating the water before discharging is only preferable when no other options exist. Contact the Environmental Manager before carrying out chemical treatment.
- ▶ Recycle water wherever possible (eg use for dust suppression or earthworks conditioning).

Always monitor the discharge to ensure it is clean before it reaches natural water or the stormwater system. If not, stop the operation and reconsider your options.

Note: Haybales are not effective in removing sediment from dewatering activities.

Dewatering – Trenches and Piles continued

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Other Sediment Controls

CESSPIT PROTECTION

Cesspit protection is an important aspect at all construction sites, however at no time should cesspit protection be relied upon as the primary control device. There are many alternative forms of cesspit protection. Common methods include silt fences surrounds and sand socks. Silt fence surrounds can be used where they can be trenched or secured around cesspits.

Sand socks only trap small amounts of sediment and heavier materials and are useful on small earthwork sites. They need to be cleaned out with a shovel regularly (or following heavy rainfall). Do not use as your only sediment control device. Cesspit protection is only useful as short-term control or for very small areas of localised works. If not used properly they can be totally ineffective or result in surface flooding of roads.

Geofabric cloth under the grate is not recommended. It can cause surface flooding of roads and is difficult to maintain.



Completed Silt Fence protecting manhole.

Maccaferri sand sock protecting a cesspit.

A list of cesspit protection suppliers is provided in the Appendix of this toolkit.

ROAD SWEEPING



Road-sweeping is a commonly used method to remove obvious sediment deposition on road surfaces. While the objective should always be to prevent this happening in the first instance, sweeping is an effective remedy. You should specify the use of a suction sweeper – not a rotary broom.

Picture: Suction Sweeper

Road sweeping is primarily used to remove dust and dirt from carriageways. It is not always effective at removing heavier material which may need to be manually shovelled up.

A list of contractors for road sweeping is provided in the Appendix of this Toolkit.

Other Sediment Controls continued

INVESTIGATION BORES

Investigation bores are often the first activity in a new area and are programmed before any formal erosion and sediment controls have been installed. Water is used in lubrication and some spoil is generated from the borehole. Where long-term sediment control measures have not been installed it may be necessary to install temporary controls.

Recycling of drilling water should always be carried out, even if there is an adequate supply of clean water. Care should be taken when emptying the recirculation water tank.

When considering options, a review of long-term erosion and sediment control should be undertaken. In some cases installation of the final controls could be the best option.

If installation of final controls is not possible other options must be considered. These may include:

- ▶ Silt fences
- ▶ Bunds (eg. sandbags)

Silt Fence

A semi-circle of silt fence is created below the work area (at least three, preferably four wattatahs in length). The silt fence must be trenched in so that no collected material can seep beneath the geotextile.

The silt fence should remain in place long enough to allow liquids to soak away leaving the solids contained. Solids should be mucked away before the fence is removed.

Bunds

A semi-circle bund created with either sandbags or other cohesive material is created on the downslope of the work area to contain any run-off from the work site. If the slope is steep the sandbags should be secured with wattatahs. In some cases the bunded area can be lined with geotextile to provide additional treatment.

As above, the bund should remain in place until liquids have soaked away and remaining sediments can be safely removed.

Other Considerations

During winter periods when the ground is soft, site access should be considered. Exposed areas should be reinstated with mulch and grass seed following completion of drilling.

TAB

Environmental Controls

Concrete Waste and Grout Slurries



Picture: Fish kill resulting from grout waste entering a small stream.

Being highly caustic, the lime contained in concrete and grout is extremely dangerous if it escapes in a liquid form to freshwater environments.

Any un-reacted slurry entering streams or creeks, either directly or via the stormwater system, quickly kills any fish or other aquatic life present. Be aware that stormwater lines and sewer lines are two different systems with stormwater drainage eventually discharging to streams and harbours.

The following operations require management systems to capture wastes:

- ▶ Concreting and grouting in and around natural waterways
- ▶ Concrete and grout pump washout
- ▶ Concrete truck-chute wash
- ▶ Slurry from tremie pours
- ▶ Concrete slurry from concrete cutters
- ▶ Lime or cement stabilisation of subgrade or subbase

When using cement and / or grout products in and around natural waterways, be careful to ensure that controls are in place to capture any excess slurry. Traditional sediment control devices, eg. silt fences and sediment retention ponds, do not treat lime waste.

Options for control include:

- ▶ Ask if the concrete trucks can wash down at their own yards, where they should have proper facilities to wash their equipment.
- ▶ Pump left over concrete from the concrete pump back into the last concrete truck (make them wait until finished pumping last load).



Picture: Timber-lined washout area.



Picture: Concrete washout area.

Concrete Waste and Grout Slurries continued



Picture: Polythene lined washout area. Cover when not in use to prevent it filling with rainwater.



Picture: Concrete washout area. A copy of the sign is available on the CD.

If washout must happen on-site, then:

- ▶ On hard-stand areas use a low skip bin (lined with polythene if necessary to prevent leakage) to capture the washout slurry. Arrange to have the slurry collected by vacuum “sucker” truck on a regular basis, or pump it to a flat grassy area where it can soak away (monitor to ensure no run-off to the stormwater system). Cover bins with polythene when not in use to eliminate rainwater.
- ▶ If pumping onto grass the area must be a minimum of 50 metres from receiving environments such as streams (and stormwater drainage lines) and must be pumped in a dispersed fashion so as not to create concentrated flow-paths.
- ▶ Dig a soak pit, a minimum of 50 metres away from any streams or storm-water system to provide an area for trucks to wash out chutes. This should not be used as an excess concrete dump site. Make sure drivers know where the washout facility is located and that it is used. Allow the slurry to soak away. The pit must be maintained on a regular basis by removing hardened concrete offsite or disposing on-site as fill. Do not allow slurry to overflow and run into the stormwater or receiving environments as it is still considered dangerous to aquatic life.

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Lime Drying of Soils

Lime drying of soils can cause potential environmental issues. Any overland runoff from lime-drying needs to be controlled and treated before discharging to the environment. Un-reacted lime washing to freshwater environments can result in fish kills. Lime dust can also be a major issue if it blows off-site.

- ▶ Take care to avoid lime spills when transferring lime to spreading machine.
- ▶ Avoid spreading lime outside the area to be hoed so the lime mixes with the soil.
- ▶ Ensure correct application rates so lime reacts quickly with soil. Areas should be well compacted.
- ▶ Lift decants on sediment retention pond or other sediment control devices and monitor pH of water prior to discharge (generally, safe pH is considered between the pH range of 6 – 9) or contact the Environmental Manager for advice.
- ▶ As much as possible, divert clean water away from the treatment area using clean water diversion bunds.
- ▶ Do not apply lime in windy conditions where it may blow off-site.
- ▶ Don't stockpile lime on-site.



Picture: Lime drying.

Fuel, Oils and Chemicals

Fuel, oils and construction chemicals such as formolins and concrete additives must be managed on our sites. Spills can have a serious effect on the environment. Once in water these products can quickly kill fish, birds, shellfish and other aquatic life. Spills to land can cause residual contamination issues, which are costly to resolve.

Every site needs to have a plan in place for dealing with fuels, oils and chemicals. Site workers need to be briefed as to what the plan is, where spill kits are located and how to safely deal with any spills.

It is mandatory for a Spill Response Plan to be posted in smoko sheds and site huts (use the "React Fast to Spills" poster on the CD). It must be communicated to staff and subcontractors. Complete the contact details at the bottom of the plan.

Bulk fuels and chemicals must be secured outside of work hours.

One contracting firm in Auckland was fined \$55,000 for not securing their fuel supplies – vandals broke into the site and tipped over 3,000 litres of diesel into a local creek. Killing fish and ducks. The judge noted that while the spill was not deliberately done by the contractors, they were careless in not properly securing their bulk fuel supplies overnight.

Wherever possible, refuelling is to be carried out well back from any streams or the harbour or any stormwater drain. Areas should be identified in advance of works.

In the case of a significant spill (which is considered a spill that can not be immediately cleaned up by staff on site) to the stormwater system or waterway you must immediately advise the Project Manager so the correct authorities can be contacted.



Locate bulk drums within a bund. A roof prevents the bund from filling with rainwater which may get contaminated. Alternately store in a container.



Oil Spill kits are to be located at work sites. A cover distinguishes it from a rubbish bin!

Selected suppliers of oil spill equipment are detailed in the Appendix of this toolkit.

Fuel, Oils and Chemicals continued

DISPOSAL OF CONTAMINATED MATERIAL

Always collect any used spill equipment and ensure it is correctly disposed.

Small amounts of contaminated spill equipment or earth can be placed in a heavy duty plastic bag and then into the general refuse container.

Large amounts of oil contaminated waste material should be collected by a specialist waste disposal company.

Make sure you replace the contents of the spill kit.

LIQUID WASTES

Vacuum "sucker" trucks are used to remove liquid wastes or large spills.

They can also be utilised to remove excess concrete slurry.

Make sure you have a list of local contractors that can be called to site at short notice to deal with any spills.

Cesspits are often good collection points for spills; however they must first be blocked off.



Picture: Liquid waste removal.

Selected contractors available to undertake this work are listed in the Appendix of this toolkit.

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Fuel, Oil and Chemical Spills continued

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Contaminated Soils

This section contains information on how to identify and manage potentially contaminated soils and groundwater to protect the environment and yourselves. For specific worker safety requirements you must also refer to Health & Safety Manual, FCE-015 "Hazardous Materials".

When working on earthwork sites (especially around urban areas, roads and rail) there is always the possibility of encountering previously unknown fill, which may (or may not) contain potentially contaminated materials. It is important that where contamination is encountered that our works proceed in a way that avoids these contaminants impacting the wider environment or people's health.

While not all contamination is obvious, some more common indicators of potential soil contamination include:

- ▶ Obvious waste material, e.g. car bodies, construction debris, drums, green waste, household rubbish etc
- ▶ Fibrous material e.g. asbestos
- ▶ Oil stained soils or rainbow sheen in ground or surface water
- ▶ Soil mounds or excavations that do not match the natural land
- ▶ Unnatural staining or colouring of soils
- ▶ Unusual odours e.g. 'oily', 'metallic' or 'rotten cabbage'
- ▶ Gas bubbles in pooled ground or surface water
- ▶ Dead or stressed vegetation for no obvious reason



Picture: Contaminated ground water as a result of historical dumping practices – leachate must be pumped to sewer.

When working in urban areas or where contamination may otherwise be suspected, the team should be adequately briefed at the start of groundbreaking activities on what indicators to keep an eye out for. This may include additional personal safety equipment and/or specialist gas detecting equipment.

If indicators are found, then works should cease in the area until it can be examined by the Engineer's Representative, Environmental Manager or specialist contaminated sites consultant. You may need to temporarily secure the excavation or backfill the excavation if it presents a risk to the public due to odours, and work elsewhere until the site has been properly assessed.

Unforeseen ground contamination is typically dealt with as a Contract Variation. Please make sure your site diary notes reflect any contamination encountered, time delays, additional plant costs etc.

Continued works, in-situ remediation or offsite disposal of suspect materials may first require laboratory testing to occur. It is important that potentially contaminated fill material is kept separate from "clean" fill material. Heavy fines can occur for disposing contaminated material incorrectly. Refer to the Environmental Manager for potential options if in doubt.



Picture: Old fill site located within new road alignment.

“ If indicators are found, then works should cease in the area until it can be examined. ”

Contaminated Soils continued

To confirm if material is contaminated or not, environmental testing is often carried out by specialist consultants. Refer to Fletcher Construction Environmental Manager for advice if you are involved with aspects of testing.

In many cases it is necessary to pump water that has come into contact with contaminated soils. Ground or surface water that has come into contact with contaminated soils cannot be pumped to the stormwater system or sediment retention devices without first being tested and confirmed as clean. Where ever possible, clean water runoff should be diverted around contaminated soils.

“ ...water that has come into contact with contaminated soils cannot be pumped to the stormwater system or sediment retention devices without first being tested and confirmed as clean. ”

In urban areas it may be possible to obtain a permit from the local Council to pump contaminated water to the sewer. Contact the Fletcher Construction Environmental Manager for advice.

Construction Waste Recycling

WHY IT'S AN ISSUE

Percentages from Fletcher Construction Sites

- ▶ C & D waste may represent up to 50% of all waste generated in New Zealand, 20% of all waste going to landfill and 80% of all waste going to clean-fill.
- ▶ Work on Fletcher Construction sites indicates that somewhere between 20% and 70% of materials going to landfill can normally be diverted from waste skips to recycling
- ▶ Most significant opportunities are for untreated wood, metal, concrete, plastics, plasterboard and demolition materials. Office based activities and smoko sheds can also make significant recycling commitments by diverting paper, card, cans, bottles and organic waste.

TYPES OF CONSTRUCTION WASTE THAT CAN BE RECYCLED – WHERE IT GOES:

MATERIAL TYPE	USED FOR / COMES FROM	RECYCLED FOR
Untreated timber	Boxing, temporary formwork	Chipped for mulch, firewood
Plywood, chipboard	Formwork	Very limited recycling. Look to reuse onsite as much as possible
Treated timber	Permanent works	Very limited recycling, look to reuse onsite as much as possible
Concrete	Demolition of structures	Onsite fill, temporary haul road construction, offsite cleanfill
Steel	Pile casing and rebar offcuts, damaged waratahs	New metal products
Plasterboard	Commercial and residential building offcuts	An additive used in compost operations and as a soil conditioner
Hard plastics	HDPE and PVC offcuts, used fluoro safety fencing, milk bottles etc	Chipped and used for manufacturing new plastic products e.g. pot plant holders and plastic buckets
Soft plastics	Packaging, silt fences, tarpaulins etc	Recycled into plastic bags and other soft plastic products
Office recycling	Cardboard, polystyrene packing, cans and bottles, paper, organic waste	Variety of new uses Local councils often provide a curbside recycling service for these products Consider a worm farm for lunch room wastes

Construction Waste Recycling continued

SETTING UP SITE RECYCLING

Recycling is best set-up during project start-up. When requesting waste bins from a waste provider, check what types of recycling bins can be provided onsite. Co-ordinate efforts with the site superintendent in terms of likely bin locations and room for additional recycling bins.

Ask for prices from more than one waste provider (see contacts list in supplier section at rear of toolkit for some of the large companies operating in NZ). Recycling opportunities may be limited outside of the major urban areas, however it is worth checking with waste providers and local councils about what services are available

Waste service providers should be able to provide the project with monthly statistics on volumes and weights of waste generated each month and the relative percentages that have been recycled.

Different work stages tend to generate different materials and volumes of waste. Focus on key work areas that generate waste. Consider timeframes e.g. periodic 'clean-ups' at the end of a work stage are a good time to get in extra timber, metal or plastic recycling bins.

If possible, coordinate bin ordering through a single person so that the right bins are ordered at the right time.

Education of staff and control of subcontractors is vital to avoid bin cross contamination. Cover waste and recycling at weekly toolbox talks. Involve subcontractors when setting up sub-contracts.

The Environmental Toolkit contains site office and construction waste recycling posters and skip bin signs – get copies from the CD at the back of the toolkit.

Signs should be attached to plywood and hooked over the bin so they can be easily transferred.

Smaller RECYCLING IS A LOAD OF RUBBISH

The infographic illustrates waste categories and corresponding bin types:

- Structures:** Represented by an icon of a building.
- Drainage:** Represented by an icon of a pipe.
- Lunch bins:** Represented by an icon of a bottle and a cup.
- Social events:** Represented by an icon of a bottle and a glass.
- Civil construction:** Represented by an icon of a crane.

1. USE BRAIN (represented by a brain icon):

- Flexible plastics only
- Hard plastics only
- Untreated timber only
- Scrap steel only
- Landfill waste only

2. USE BIN (represented by a bin icon):

- Flexible plastics only
- Hard plastics only
- Untreated timber only
- Scrap steel only
- Landfill waste only

Logos for **LION BRANDS LIGHTLY**, **LAND PRIDE**, and **Fletcher Construction** are visible at the bottom.

Wildlife on Sites

Wildlife in urban environments can be surprisingly diverse. Likewise, construction sites can support a variety of animals and birds including pukeko, ducks, gulls, shorebirds, skinks, and numerous freshwater fish.

Wildlife in New Zealand is protected under the Wildlife Act, 1953. The Act protects all wildlife from injury, farming, breeding or selling. Species able to be hunted within specified season are listed within the Act. It should be noted that the Act declares terrestrial and freshwater invertebrates as animals and therefore subject to the provisions in the Act e.g. insects like the weta and freshwater crayfish (koura).

SICK OR INJURED ANIMALS

Occasionally sick or injured animals might be found on site. The "patient" should be carefully caught (an old blanket or coat is helpful to "net" the animal) and placed in a cardboard box. Keeping the animal in the dark will help keep it calm, however make sure if you are sealing the box that sufficient air flow is available. Injured animals will be distressed, so it is important to protect yourself when handling them. If in doubt, contact the local vet or other wildlife expert to capture the animal.

Injured birds can often be delivered to the local bird rescue centre. Your local branch can be found on the following website: <http://www.birdrescue.org.nz/>

Other animals should be taken to the local SPCA or veterinary clinic. Always ring ahead before bringing in an animal so that the centre can prepare for its arrival.



FRESHWATER FISH

Prior to any works within waterways an attempt should be made to relocate native freshwater fauna. Species likely to be encountered include:

- ▶ Shortfin & longfinned eel
- ▶ Kokopu (native trout)
- ▶ Common bully, mullet and other estuarine species
- ▶ Pest species such as mosquito fish and carp

Contact your Environmental Manager for advice; however, in most cases contracting a freshwater ecology consultant to undertake the clearance is advisable (refer contacts in the back). Upon advice of experts, pest species such as carp should be destroyed.



Wildlife on Sites continued

Depending on the size of the waterway, trapping and netting will take approximately 1-2 weeks. In some cases electric fishing may be appropriate which can clear and area in a matter of hours although repeat sweeps may be required.

“ Do not underestimate the potential for a waterway to support life. Even overgrown roadside drains and swales can support an abundance of eels and other freshwater critters.”

THREATENED AND ENDANGERED SPECIES

Some sites may be associated with endangered or threatened species. In such situations there is an obligation to ensure, and where possible enhance the survival of such species.

In most cases projects will be aware of such situations before starting work and can therefore ensure breeding and other habitat requirements are incorporated into the programme and work planning.

Ongoing consultation should be undertaken with the Environmental Manager and/or consulting ecologist and all site staff briefed on the restrictions. Providing updates to site staff on the status of the species and management will better ensure buy-in to conservation programmes.

ENJOY IT!

Wildlife on site should be enjoyed and staff should be encouraged to get involved, whether it's catching and relocating eels or building wildlife refuges.

Further, conservation projects are a great opportunity to involve the public. Ring up your local school and ask whether they would like to assist in releasing wildlife captured prior to works starting or plant trees in rehabilitation areas.

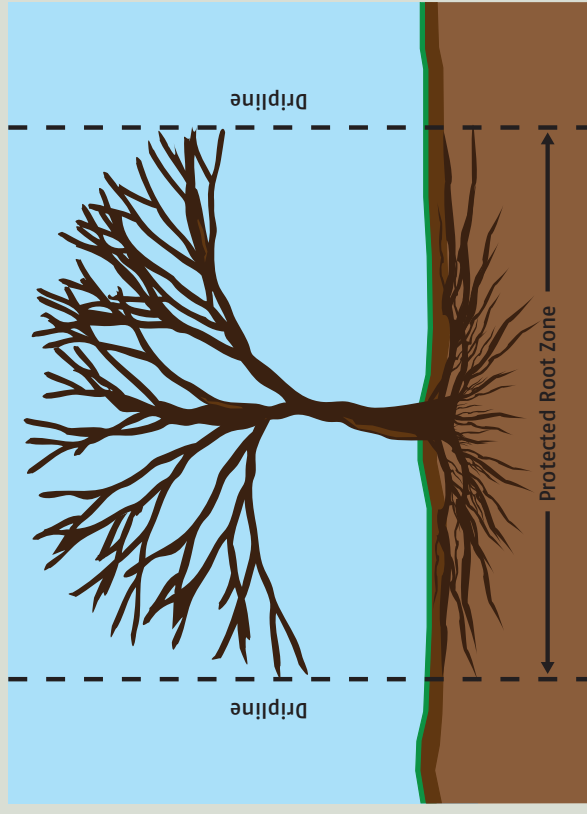


Relocating skinks prior to tree clearance.

Tree Management

Notable trees may be protected under local council plans. In many regions trees greater than 8-10 metres in height are afforded automatic protection and will require a resource consent to fell or prune.

Prior to works trees should be identified and protected where required. Materials and plant should not be stored within the root zone of protected trees. The root zone can be defined by the drip line of the tree in most cases.



Before clearing, relocation should be considered for healthy specimens. In some cases the costs of relocation may be off set by the cost of buying in specimen trees during the landscaping phase.



Tree spade in action.



Northern Busway Project site.

“ It is best to read the weather forecast
before praying for rain.”

MARK TWAIN

TAB
Community Liaison

General Community Consideration

Good community relationships are about communicating with people that may be affected by the project. It is critical to our company that we deal with our neighbours in a professional manner at all times. It is all about acting in a proactive manner is try to identify and deal with issues before they create constraints and delays to the project.

Typical issues include:

- ▶ Night works
- ▶ Work on or close to property boundaries
- ▶ Work immediately outside adjoining properties
- ▶ Starting works in new areas
- ▶ Harbour works
- ▶ Connecting into, or interrupting services

These areas are discussed in more detail below, together with some practical solutions that may help.

On smaller projects community liaison may be fairly simple. Those managing the project may be able to communicate with all those people affected directly and keep them updated on the project. Larger projects on the other hand may require a greater level of consideration to ensure maximum benefit to the project.

Prior to undertaking any external liaison you must confirm with the Project Manager as to what communication is permitted by the Client. In many cases it is only the Client who can directly liaise with external parties. This section does not include information on traffic management requirements as this usually requires a project-specific management plan.



General Community Consideration continued

WHY SHOULD WE COMMUNICATE WITH EXTERNAL PARTIES?

In construction there are always time constraints and pressure to get the project finished within the project deadline. Any delays to the project will cost money and damage our reputation. Community liaison can make the difference between success and failure.

By informing and managing the community you are likely to be more in control and improve their levels of satisfaction.

For example – if you develop a good relationship with an adjoining resident, they are much more likely to ring you with an issue rather than talk to the Client, local authorities or media.

Fletcher Construction policy is that you are not permitted to speak directly to any media where it can be construed you are speaking on behalf of the Company. Refer any media approaches to your Project Manager.

Community liaison is all about basic common sense and consideration for others. It is not hard to keep those affected parties around your work site informed of the works and your programme. The more they feel like they are being considered the more accepting that they will usually be to your work, and the less likely they are to try to delay to project. So while it may seem that having to put time and effort into liaison may use up valuable start-up resources, not putting in this effort is likely to hinder the project at a later date.

Community liaison can make the difference between success and failure. 》

WHO ARE OUR COMMUNITY?

On every project affected parties are likely to change. When considering who is potentially affected, it is useful to brainstorm with the team and list every person that you think may be affected by your project. This may include:

- ▶ adjoining residents
- ▶ local businesses and industries
- ▶ local schools, hospitals and retirement villages
- ▶ motorists and other vehicles users of the road (buses, trucks)
- ▶ pedestrians and cyclists
- ▶ local councils
- ▶ local interest groups e.g., sports clubs, harbour users, conservation groups
- ▶ Tangata Whenua (Maori groups)

The more time you spend identifying the potentially affected people at the start of a project, the easier it will be for you to manage their expectations.

Additionally, as a project expands in site area or the construction activities change (ie. tree clearance to piling activities) then people may be affected differently and additional consideration may need to be given.

CONTRACT AND LEGAL REQUIREMENTS

Some contracts require Fletcher Construction to take a lead role in community liaison. Others limit our involvement with external parties. You must ensure you know what applies to your project. If you are unsure check with the Project Manager.

Where Fletcher Construction is not directly involved with external parties, we still have a requirement to keep our Clients advised so that they can provide accurate and up to date information to affected parties.

There may be a legal requirements manage communication with external parties. For example where land has been purchased from an adjoining resident, there may be a Land Access Agreement in place that has conditions within it.

Most major projects also have resource consent conditions that relate to consultation requirements, noise levels and work hours. These details should be known by everyone working on the project

If you are not aware of these conditions, make sure you ask the Project Manager.

Situations where liaison is normally required

The community should be kept advised of project progress. When work starts in a new area, land owners and occupiers should be advised of the start date, estimated duration, and general activities to be expected.

NIGHT WORKS

People living within approximately 100 m of the work area should generally be given advance notice of any night works that will be visible or audible. They should be made aware of the timing of the works, what activities to expect and any mitigation measures to be undertaken by the construction team.

Tip:

Make sure you keep your promises with regards to finish times so that your credibility is maintained!

WORK ON OR CLOSE TO PROPERTY BOUNDARIES

People should be given advance notice of any works on or close to their property boundary. Where it is necessary to work on the residents side of the boundary permission must be obtained in advance regardless of whether a Land Access Agreement is in place. Where an agreement is in place, this often specifies the length of time required for notification.

Tip:

Land Access Agreements are signed between the Client and landowner. They can usually be found in the Project Specification documentation. If you are having trouble locating this information talk to your Project Manager.

General Community Consideration continued

DISRUPTIVE ACTIVITIES DURING DAYTIME

Noisy activities such as pile driving or blasting may require advance notice to residents. Refer to the section on noise control measures.

Activities such as blasting or vibratory rolling can cause vibration issues.

Activities that may cause vibration include piling, vibrating rollers, graders, truck movements or tracking excavators.

Good communication with neighbours is often required so they are aware of these activities.

Building condition surveys or vibration monitoring may be required. Contact the Environmental Manager for further information.

WORK IMMEDIATELY OUTSIDE PROPERTY

People should be advised of any work being carried out on the road or footpath in front of their property or business, and any changes to access should be detailed. Where pedestrian or vehicle access to a business will be affected it may be necessary to provide additional signage for customers.

Tip:

The more time you can give people the better – for example they may need to plan their business communications around any disruptions that may occur.

“By informing and managing the community you are more likely to be in control and improve their satisfaction.”

Liaison Methods

The methods below relate to general stakeholder liaison. Additional liaison requirements may be specified within the Project Specifications.

MAIL DROPS AND LETTERS

Mail drops are useful for advising a group of neighbours on activities where personal contact is not necessary. They provide a general update on the works as well as details of the work that may affect them. They should generally advise:

- ▶ date work is expected to start & duration
- ▶ hours of work
- ▶ activities to be expected (eg. truck movements, concrete breaking)
- ▶ how neighbours will be affected (eg. new road layout, work close to boundary)
- ▶ mitigation measures (eg. restricted work hours, noise containers)
- ▶ date mail drop delivered

Distribution should be at least one, preferably two or more full days, prior to the start of works.

PERSONAL CONTACT

Personal contact with outside parties should be coordinated by the Project Manager.

If you are approached by a member of the public please be courteous. It may be necessary that the Client (or someone else on the project) follows up a query or question. Please ensure that the details are passed on to the correct person as a matter of priority.

If someone is abusive towards you ensure your own safety first. Report any serious incidents to the Project Manager as soon as possible.

It is often necessary to personally advise people of any works that are close to their property boundary, immediately outside their property or affecting their property access by phone. If necessary this may be followed by a letter or meeting on site to discuss issues of concern.

Meetings on site may be useful to fully explain the details of construction works that affect people. Generally the Project manager should be involved with these types of meetings.

All personal contact with external parties should be recorded.



General Community Consideration continued

Dealing with Complaints and Enquiries

General complaints and enquiries regarding construction should be answered directly where information is available. If the query cannot be answered immediately a return phone call by a member of the project management team should occur. Advise the caller that the Project Engineer or Manager will call them – and follow this up to make sure it happens!

It is important for all Fletchers employees and subcontractor to deal with the public in a polite and friendly manner. Keep in mind that you are representing the Fletcher brand and company.

While complaints are often negative, you can also think of them as a tool to monitor hotspot or areas that need additional resources and / or management.

Registers must be kept of all complaints and enquiries.

"If you travel on the Northern Motorway, you will now see the effects of the busway construction upon the school. All of the trees on the motorway boundary have been removed so that the contractor can begin to lay the large drains that are necessary. **Fletchers, who are responsible for the construction of the busway, have been excellent to deal with and they have gone out of their way** to try to save eleven of the pinoaks that were formerly on the boundary adjacent to the soccer fields and cricket pitch. They have also undertaken to paint out graffiti on the board boundary fences as soon as it appears..."

EXCERPT FROM A LETTER FROM ALISON GERNHOEFER, PRINCIPAL, WESTLAKE GIRLS HIGH SCHOOL

Specific Community Issues

Dust and noise complaints are often the most regular complaints on construction sites. The toolkit outlines some methods that are used to manage these issues and reduce the effects on our neighbours. Heritage and archaeological finds are also covered.

Dust Control Measures

Dust around a construction site can create health issues not only for our workers but also our neighbours especially when works occur close to hospitals, retirement villages, schools or residents that suffer from asthma.

Dust is also a nuisance to neighbours due to issues such as dust on laundry, houses and cars. In extreme cases, it can also be a danger to motorists and other road users.

The risk that dust may cause depends on factors like location of the neighbours and prevailing wind direction and strength. It will also depend on the weather conditions. For example after a dry period, dust volumes are likely to be high.

“ It is much easier to control dust through good upfront planning rather than try to control it once it becomes a problem. ”

On large earthwork sites, a water cart may need to be continuously on site. Other more expensive methods such as dust suppressants or windbreaks can potentially be used – talk to the Environmental Manager first

NOTE: The use of waste oil to dampen dust is not permitted on any Fletcher Construction site.

This section does not specifically cover the worker safety. For worker safety requirements refer to the Health and Safety manual guideline FCE-017 "General Safe Practices for Employees".

Specific Community Issues continued

To mitigate the effect of dust on neighbours the following mitigation measures should be considered:

- ▶ Consider types of works, prevalent wind direction and location of public to work zones when planning the work.
- ▶ Stabilise haul roads with low fine aggregate or pave heavily trafficked areas with millings or asphalt.
- ▶ Keep haul roads clean by removing split material regularly. This prevents material being ground into fine particles and potentially becoming a source of dust.
- ▶ Re-vegetate exposed surfaces as soon as possible.
- ▶ Limit vehicle speeds on haul roads to 10–15 km/hr.
- ▶ Minimise drop heights from loaders. Clean up any spills from mechanical loading operations.
- ▶ Locate stockpiles away from boundaries where they adjoin residential areas.
- ▶ Cover stockpiles with polythene or geotextile.
- ▶ Cover trucks with tarpaulins or use enclosed bins.
- ▶ Wet down haul roads and unpaved areas during dry / windy periods using a water cart
- ▶ Use rollers / compactors to seal surfaces.
- ▶ Regularly sweep public roads adjacent to site entrances.
- ▶ Use wheel washes to remove entrained dirt from vehicles or plant prior to exit.

Silt Fences: our last defence

Proper installation is the key to effective treatment.

Install silt fences in areas where dirty water runoff needs treatment.

Check during and after heavy rainfall.

Maintain your fences regularly.



THIS LAND IS
MY LAND

Fletcher
CONSTRUCTION

PRIDE OF PLACE : www.fletcherconstruction.co.nz

Specific Community Issues continued

Noise Control Measures

As well as being a potential Health and Safety issue to workers, noise can also create major disturbance to neighbours and we should consider the affect of noise on neighbours when planning works.

On most projects permitted off-site noise levels are controlled by the local Council. It is therefore important to consider what sort of area you are working in and what rules apply. Noise limits vary depending on the time of day and the work being carried out. Residential noise levels are likely to be lower than noise levels in an industrial areas. Also, permitted noise levels will generally be higher during the day than at nights and weekends in residential areas. The opposite is often true for commercial / industrial areas.

Each project is likely to have different standards. Please check with the Project Manager on your project to see what noise restrictions are on your project. Night and weekend works may require special approval from the local Council.

This section does not specifically cover the worker safety. For worker safety requirements refer to the Health and Safety manual guideline FCE-001 "Hearing Protection".

PLANNING NOISE CONTROL

Noise control levels need to be considered when working in sensitive locations such as close to residential areas or schools.

Planning considerations include:

- ▶ General hours of work – depending on your location schedule the noisiest activities for periods when neighbours are not present.
- ▶ What types of equipment are to be used and the location of the works. Can alternate quieter or more modern equipment be sourced?
- ▶ Keep neighbours informed as to what is happening on-site. They may be more tolerant to a short term increase in noise levels if you keep them informed and stick to your promises in terms of work hours.
- ▶ Construct any screens, fences or bunds that are required under the contract prior to commencing work.
- ▶ Seek advice from the Environmental Manager or specialist noise consultants on how to best manage activities. Specialist noise consultants are listed in the Contacts section of the toolkit.
- ▶ Noise monitoring should also be regularly carried out to ensure that the noise levels occurring on site do not exceed those permitted. Contact the Environmental Manager for advice if you are planning on doing this yourself. Head Office has a noise meter that can be borrowed for short term periods.
- ▶ Brief the team prior to works starting – they need to know what's going on. Keep them up to date through daily briefings and toolbox meetings.

The following information can be used to help predict and manage construction noise. If you need a noise meter or further help with noise issues contact the Environmental Manager.

Plant	Sound Power Level at source (dBA)	Est. Noise Level @ 20m (dBA)	Est. Noise Level @ 50m (dBA)	Est. Noise Level @ 100m (dBA)
Scraper	118	84	76	70
Bulldozer	116	82	74	68
Hydraulic excavator	116	82	74	68
Dump truck	114	80	72	66
Roller	106	72	64	58
SP compactor	100	66	58	52
Grader	116	82	74	68
Loader	117	83	75	69
Bored piles	119	95	88	82
Driven timber piles	118	95	88	82
Driven concrete piles	110	94	87	81
Mixed general construction, (trucks, small power equipment)	-	70-75	67-72	57-62

Actual sound measures taken from a project site:

Plant	Plant Est. Noise Level at 10 m (dBA)
Concrete pump	77
Concrete truck	70
Crane (50 tonne)	80
Delivery truck	75
Directional drill rig	75
Generator	67
Hand tools	70
Hiab truck	75
Labourers	65
Plate compactor	80
Saw cutting	85
Six wheel truck	75
Slip forming machine	75

Predicting noise when multiple noise sources are involved is more complicated. Contact the Environmental Manager for advice.

Specific Community Issues continued

Each site will have its own noise characteristics. To determine how noise might impact offsite, this table can be used to help assess possible noise reduction factors:

Control by	Noise reduction possible in practice, dBA
Distance	Approximately 6 dBA for each doubling of distance.
	For example if a house was located at the following distances from a site:
	20 m – reduce by 6 dBA
	40 m – reduce by 12 dBA
	60 m – reduce by 18 dBA
	100 m – reduce by 20 dBA
200 m – reduce by 30 dBA	
Screening (e.g. shield or barrier)	Reduce by 7 to 10 dBA
Partial screening (e.g. vegetation)	Reduce by 5 dBA
Enclosure (e.g. sound box)	Reduce by 15 to 30 dBA
Silencing (e.g., noise baffles)	Reduce by 5 to 10 dBA



Picture: Lifting pre-cast beams at night required careful planning for noise.

PRACTICAL NOISE MITIGATION MEASURES	
Excavators	<ul style="list-style-type: none"> ▶ If you need to clean the excavator bucket then use a spade – avoid shaking it! ▶ Empty contents of buckets from a low height ▶ Hire new machines ▶ Grease tracks regularly ▶ Use wheeled excavators if possible ▶ Avoid un-necessary movements
Trucks / vehicles	<ul style="list-style-type: none"> ▶ Close tailgates and doors carefully to avoid slamming ▶ Surround tail gate with lagging material ▶ Tip away from nearest residents when unloading rock and other 'noisy' loads ▶ Avoid sounding the horn – consider other methods ▶ Reduce speed and revs as far as practical ▶ Avoid dragging equipment around on the ground ▶ Place sand bedding layer in tray or HDPE liner if loading rock or other 'noisy' loads
General power tools	<ul style="list-style-type: none"> ▶ Avoid dropping tools or dragging on ground ▶ Use noise muffled equipment – check with hire centres ▶ Use hydraulic saws or wire cutters instead of other types of power saws ▶ Use armouwall barriers to screen noisy tools ▶ Place a layer of felt or rubber between steel and tool ▶ Use a rubber mallet if possible, don't strike bare steel with tools ▶ Keep saws sharp, use a damp blade.
Lifting Equipment	<ul style="list-style-type: none"> ▶ Use straps rather than chains – avoid steel on steel ▶ Muffle engine bay
Other measures	<ul style="list-style-type: none"> ▶ Fully brief the team before commencing works ▶ Install noise barriers early in project ▶ Use a site shed or hut to screen power tools ▶ Can alternate designs be carried out to reduce noise? ▶ Where possible complete noisy works during daylight hours ▶ Communicate over the radio/phone – don't shout or swear ▶ Good housekeeping is essential for night works as visibility is reduced. Be sure to be tidy as you go. ▶ Limit, or ban, music being played on-site – especially at night ▶ Turn off reversing alarms – BUT first consult with the Health and Safety Manager

Specific Community Issues continued

Silt Fences: our last defence

Proper installation is the key to effective treatment.

Install silt fences in areas where dirty water runoff needs treatment.

Check during and after heavy rainfall.

Maintain your fences regularly.



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Heritage and Archaeological Sites

In New Zealand an archaeological site is a place associated with pre-1900 human activity. Sites may include, for example:

- ▶ Maori pa – often found on cliffs, headlands or ridges. Remains can be seen in the soils and from lines or walls of loose stones or stone mounds, fire pits, terraces and storage pits.
- ▶ Midden – rubbish dumps, often contain shells, bones, artefacts, charcoal or oven stones.
- ▶ Shipwrecks (pre-1900's).
- ▶ Other rubbish dumps pre 1900's containing bricks, bottles, clothing etc.
- ▶ Old building foundations from pre-1900 construction period.
- ▶ Any bones that may be of human origin.

If you come across a possible heritage site during excavations you should stop works in the area, protect that area and report the situation to the Project Manager.

To continue works, the project team may need to obtain a permit to modify or destroy the site. Permits are obtained from the Historic Places Trust (HPT). This may require an archaeologist or a heritage consultant to visit to the site in order to catalogue what is present before it is modified or destroyed.

If you uncover any suspected heritage site please keep good notes in your site diary. Record time of stopping and time advised to client's rep. Unexpected finds are normally treated as a Contract Variation.

Historic Places and consultant contact details are included in Contacts section of this toolkit.



Specific Community Issues continued

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Construction Vibration

Construction activities can generate vibrations that are noticeable to humans as a nuisance and in some cases cause damage to adjacent property or services.

It is important that these effects are managed to ensure risks are minimised as far as practical.

Factors that influence vibration and its potential to cause unwanted effects vary for each site. They include ground conditions, type and duration of the equipment being used and proximity and type of adjacent buildings. Depending on these conditions, vibration effects may be felt at up to several hundred metres away and sometimes several kilometres from the work site.

Acceptable vibration standards are normally specified in the Contract or Resource Consents for the project, and these levels should be reviewed prior to undertaking any activities that may potentially cause issues.

The typical standard used in NZ is the German Standard "DIN-4150 Part 3 – Structural vibration in buildings – effects on structures". The compliance level is measured in terms of the velocity of the ground and the limit varies between 2 mm/s and 20 mm/s depending on the type of structure at risk and the frequency of the operation. Note that vibration is felt by humans at much lower levels, typically at around 0.5 to 2.0 mm/sec. Movement at these levels is likely to cause complaints from neighbours but rarely will any damage arise at these levels. When assessing complaints, care must be taken to ensure that cracks and gaps are not the result of seasonal shrinkage and swelling of both the building under investigation and the ground it is situated on. Without proper investigation, vibration from construction works often takes the blame for these effects.

Typical works that may cause vibration:

- Vibratory rollers
- Demolition activities (e.g. dropping large items)
- Driven or vibro piles
- Pneumatic breakers
- Explosives
- Heavy machinery (e.g. dump trucks and excavators tracking close to property boundaries)



Construction Vibration continued

Mitigation to reduce the risk of vibration complaints and/or damage include:

- ▶ Contracting a building inspection firm to undertake an independent pre-work baseline structure survey. This will normally require you to liaise with the property owner to obtain their permission to enter the property for the survey. It may take a number of weeks to arrange so planning should begin early.
- ▶ Notify residents of impending work and duration well in advance of the work.
- ▶ Monitor vibration levels during construction works to assess levels against applicable standards. Monitoring should be performed on the closest dwellings if possible, rather than in the ground at or near the boundary.
- ▶ Review equipment being used to undertake the work and if necessary change work methodologies where possible e.g. bored instead of driven piles and avoid using vibro rollers close to buildings.
- ▶ Review pile driving frequencies and speeds, and adjust if required.
- ▶ Implement specialist vibration control measures e.g. vibration isolation pads under stationary plant, cut-off trenches etc. Contact Environmental Manager for more information.



Vibration monitoring equipment PHOTOS: GEOTECHNICS LTD

TAB Appendices

Key Contacts and Suppliers

*This list provides a starting point for you. It is not exhaustive and it is **not** a preferred suppliers list, and suppliers are not necessarily loaded into Fletcher's accounting system.*

FLETCHER CONSTRUCTION ENVIRONMENTAL CONTACTS AS AT MARCH 2011

- ▶ Environmental Manager – Head Office
Stuart Chapman. Phone 09 525 4953 or 021 768 091
- ▶ Environmental Managers – Projects
Rachel Blake. Phone 027 221 4699
Kylie Eltham. Phone 027 201 6383
Elyse LaFace. Phone 027 613 1440
Karsten Stevenson. Phone 0274 528 308

MULCHING CONTRACTORS

- ▶ Stable Earth – North Island.
Based in Auckland. Phone 09 411 8837 / 027 250 9419
- ▶ Rural Supply Technologies – All of NZ.
Based in Palmerston North. Phone 06 355 3625
- ▶ Evergreen Soil Conservation – North Island
Based in Rotorua. Phone 07 345 9985
- ▶ Erosion Control Co Ltd – North Island.
Based in Auckland. Ph/fax 09 426 8292
- ▶ EcoTec Hydroseeding – Upper North Island.
Phone 07 548 1414
- ▶ Creating Turf Ltd – Upper North Island (will do small areas)
Based in Auckland. Phone 09 473 3676 or 021 245 6789
- ▶ Exler Turf Ltd – North Island
Based in Auckland. Phone 0274 935 198
- ▶ Treescape (mulching only) – Auckland. Phone 09 414 1310
- ▶ Mulchman (bark chip). Phone 0800 006655
- ▶ Mulchit (bark and compost blowing). Phone 021 175 8163

SPECIALIST SEDIMENT CONTROL CONSULTANTS

- ▶ Mike McConnell, McConnell Consulting Ltd – phone 0274 838 923
- ▶ Graeme Ridley, Ridley Dunphy Ltd – phone 0275 800 584
- ▶ Campbell Stewart – Southern Skies – phone 021 837 824

Key Contacts and Suppliers continued

GEOTEXTILE SUPPLIERS*

- ▶ Maccaferri NZ Ltd
Auckland: Phone 09 634 6495
Christchurch: Phone 03 349 5600
- ▶ R. J. Reid NZ Ltd
Auckland: Phone 09 426 0606
- ▶ Permathene Ltd
Auckland: Phone 0800 888 333
- ▶ Geotech Systems Ltd
Tauranga: Phone 0800 436 8324
- ▶ Rural Supply Technologies Ltd, Palmerston North: Phone 06 355 3625
- ▶ Dalton International – Auckland
Phone 09 263 3142

or see Yellow Pages under “Erosion Control”.

* Includes silt fence material, dewatering and cesspit protection devices.

CONTRACTORS FOR ROAD SWEEPING

- ▶ Porters Roadsweping (Auckland) – phone 09 298 4571
- ▶ Fulton Hogan (Auckland division) – phone 0274 849 095

or see Yellow–Pages under “Contractors – Sweeping”

SUPPLIERS OF OIL SPILL EQUIPMENT

- ▶ Process Lubricants Ltd
4/42 Elice Rd, Glenfield, Auckland. Phone 09 444 5444.
Discount for Fletcher companies, technical support available. Will also run toolbox talks to discuss how to use the kits with staff.
- ▶ Environmental Safety Products & Services Ltd
24 hour availability. Phone Grant on 09 827 7003, 021 941 306
Discount for Fletcher companies, technical support and emergency call-out available, will also run toolbox talks to discuss how to use the kits with staff.
- ▶ NZ Safety Ltd (limited technical support with purchase)
Normal business discounts apply. 0800 697 23389
- ▶ Seaview Safety & Supplies Ltd (limited technical support)
Wellington: Phone 04 576 0381
- ▶ Spillsorb Products. Phone Andrew 0274 791 393
- ▶ Dalton International – Auckland. Phone 09 263 3142
- ▶ Spill Stop Limited – Auckland. Phone 09 444 8901

LIQUID AND SPECIALIST WASTE DISPOSAL PROVIDERS

- ▶ Transpacific Technical Services – NZ wide
Auckland – phone 09 274 7963
- ▶ Chemwaste Industries Ltd
Auckland – phone 09 634 6777
Wellington – phone 04 568 3784
Christchurch – phone 03 384 5435
- ▶ Interclean
Auckland – phone 09 273 7570
- ▶ JJ Richards
Hamilton – phone 07 834 1010

or refer to “Waste Disposal” in the Yellow Pages directory – ensure the company you use is certified to treat and dispose liquid wastes; refer list provided on CD.

SOIL AND WATER TESTING

- ▶ Watercare Laboratory Services. Auckland – phone 09 539 7600
- ▶ Hills Laboratories. Hamilton – phone 07 858 2000
- ▶ Dowdell & Associates – asbestos testing. Auckland – phone 09 526 0246

RECYCLING SERVICES

- ▶ Transpacific Waste Management – NZ wide. Phone 09 527 1300
- ▶ Absolute Waste Services – construction waste recycling. Phone 0800 227 658
- ▶ Paper Reclaim Ltd – office paper, cardboard, glass, plastics, cans recycling bins. Penrose, Auckland, phone 09 571 0242.
- ▶ Salter’s Cartage – bulk waste oil collection over Upper North Island. Based in Wiri, Auckland. Phone 09 278 6563
- ▶ Sims Pacific Metals – scrap steel. Phone 09 276 1809

SPECIALIST NOISE AND VIBRATION CONSULTANTS

- ▶ JP Styles Acoustics & Vibration – Auckland. Phone 09 308 9015
- ▶ Marshall Day & Associates:
Auckland – phone 09 379 7822
Wellington – phone 04 499 3016
Christchurch – phone 03 365 8455
- ▶ Hegley Acoustic Consultants:
Auckland – phone 09 520 5358
- ▶ Malcolm Hunt Associates:
Wellington – phone 04 472 5689
- ▶ Machinery Monitoring Services (sell noise monitoring meters)
Phone 09 623 3147
- ▶ Geotechnics Ltd (vibration testing)
Nationwide – phone 09 356 3510

Otherwise, check in the Yellow Pages under “Noise Consultants”.

HERITAGE

- ▶ Russell Foster & Associates – Auckland. Phone 09 630 1041
- ▶ Archaeology BOP – Whakatane. Phone 07 307 9455
- ▶ Clough & Associates – Auckland. Phone 09 814 1946
- ▶ Historic Places Trust:
Northern Region – 09 307 8896
Central Region – 04 801 5088
Southern Region – 03 377 3968

DILAPIDATION SURVEYORS

- ▶ Dainty Alderton Consulting Engineers – Auckland
Phone 09 835 1747
- ▶ Tonkin & Taylor – Auckland
Phone 09 355 6000

ARBORISTS AND TREE RELOCATIONS

- ▶ Arb-Solutions – consulting arborists
Nationwide – phone 0800 508 508
- ▶ Natural Habitats – tree trimming removal
Phone 09 970 3488
- ▶ Treescape – transplanting, treespade
Auckland – phone 09 259 0572
- ▶ Treetransplant – tree spade
Bay of Plenty – phone 07 579 2069

Environmental Hazard Identification (Generic)

ACTIVITY (ASPECT)	POTENTIAL ENVIRONMENTAL HAZARD (IMPACT)	POSSIBLE CONTROL MEASURES (AVOID, REMEDY OR MITIGATE)
Archaeological sites	Potential destruction of protected archaeological sites	Stop works in immediate area and notify Engineer to contract for further instructions.
Concrete cutting	Discharge to waterways - potential fish kills.	Capture slurry and dispose to pit, skip bin or offsite. Do not allow to enter natural water or stormwater system.
Construction waste	Potential nuisance, odour or vermin	Keep site tidy by reinforcing message to workers. Ensure rubbish bins are located on site and emptied regularly. Consider recycling options for scrap steel, waste timber, office waste (e.g. paper, cans etc).
Contaminated groundwater	Contaminated water discharges to waterways or the stormwater system	Consider how to deal with contaminated water before discharging. Pump to a designated area or to the sewer (with Council approval).
Dirt on roads	Safety and nuisance to travelling public, runoff to stormwater system	Prevent dirt from getting onto roads. Keep vehicles to metalled areas on site. Use wheel wash where required. Use sweeper truck to regularly remove from roads.
Discharge of abrasive blast media to air, ground or water	Potential nuisance to neighbours, contamination of ground or waterways	Consider methods to reduce nuisance such as best type of blast media, containment systems, wind strength and direction. Determine if used media can be collected and reused.
Dust	Health hazard and potential nuisance to neighbours	Minimise unsealed areas. Keep trucks to stabilised areas. Use salvaged base course or millings to provide temporary stabilisation. Limit speed of traffic on unsealed areas. Use a water-cart to regularly dampen trafficked surfaces.
Erosion control and sediment runoff	Sediment discharges to waterways or the storm-water system, dirt on roads.	Minimise open areas to reduce the potential for run-off. For open areas use sediment control measures such as those detailed in the best practice guidelines prepared by individual Councils.
Exposed aggregate / acid washing	Potential for fish kills from lime or acids	Direct runoff to unsealed areas where can soak away. Pump to sewer (with Council approval). Create a sump arrange vacuum sucker truck to remove offsite.
Noise	Potential for nuisance to property owners	Consider location relative to other properties and types of machines on-site. Implement practical measures to reduce noise, for example time of work, shielding, silencers or mufflers, worker behaviour. Do not rattle excavator buckets to clean (use spade). Where possible, locate noisy operations away (or shielded) from neighbours (e.g. unloading / loading, formwork fabrication etc)

Environmental Hazard Identification (Generic) *continued*

ACTIVITY (ASPECT)	POTENTIAL ENVIRONMENTAL HAZARD (IMPACT)	POSSIBLE CONTROL MEASURES (AVOID, REMEDY OR MITIGATE)
Oil and fuel spills	Contamination of land & waterways.	Take precautions to prevent spills occurring in the first place e.g. regular equipment checks. Have a stock of spill clean-up equipment onsite in case of spill. Use drip trays under leaky machines.
Paving works	Discharge of bitumen to stormwater system	Ensure stormwater cesspits are appropriately covered.
Pile spoil	Sediment discharges to stormwater system	Ensure sediment controls in place around any pile stockpiles (e.g. silt fences). For marine piling works collect spoil in skip bins and transport ashore for appropriate disposal where practicable.
Pump and chute washouts	Contamination of waterways or the storm-water system with cement waste resulting in potential fish kills.	Provide suitable wash-down areas that are controlled. Use a pit or a bin to capture waste. Site pit/bin well away from water or storm-water drains.
Pumping dirty water from excavations	Sediment discharges to waterways or the stormwater system	Consider how to treat dirty water before discharging. Pump via a sediment control measure such as a pond or run dirty water through a silt fence. Suspend intake from top of water column to minimise risk of pumping dirty water.
Refuelling	Potential for spills of diesel or petrol during refuelling operation	Consider best location to refuel, generally away from waterways and stormwater systems. Operators to remain with refuelling equipment throughout operation. Ensure spill equipment close to hand.
Soil Contamination	Potential runoff from contaminated sites to waterways or stormwater systems	Temporarily cease works in area and advise the Engineer to the Contract. Seek advice from Environmental Manager or Specialist Contaminated sites consultant. Dispose contaminated soils to approved landfill.
Vegetation removal	Potential for removal of protected trees	Prior to works check with Council to determine rules for tree removal and/or trimming. Consult with arborist if required. Clearly mark vegetation to be removed to prevent unnecessary damage. Only remove minimum necessary to safely carry out the works.
Vibration	Potential for nuisance to property owners, damage to adjacent structures and foundations	Consider site location relative to other properties and works being carried out. Consider liaison with property owners (as contract permits). Consider need for property assessments prior to works. Seek expert advice.
Wastewater from site	Wastewater discharge to ground or water	Capture wastes using septic or portable tank, use vacuum sucker truck to remove. Use Portaloos. Connect to the sewer (with Council approval).
Working in watercourses (e.g. culvert works)	Potential sediment discharges during works	Plan methodology in advance of works taking into account specific Council requirements (ensure you have necessary resource consents). Divert watercourse through stabilised bypass to enable works to be carried out 'in the dry'. Seek advice from Environmental Manager or specialist environmental consultancy in advance of works.

Environmental policy.

Fletcher Construction recognises the significance and sensitivity of the environment.

We will:

Manage responsibly

Manage our business in an environmentally responsible manner and provide leadership in our industry.

Set & review objectives

Set and review measurable environmental objectives and targets.

Continue to innovate

Continuously seek practical and innovative ways to reduce our footprint with a commitment to continual improvement.

Promote awareness

Foster a culture of environmental awareness to promote sustainable work practices – including material selection and methodologies.

Implement initiatives

Implement initiatives to reduce, reuse and recycle waste, and prevent pollution.

Comply with requirements

Comply with applicable legal and other requirements related to the environmental aspects of our work.



Mark Blims
Chief Executive - Infrastructure
Fletcher Building Ltd



Greg Pritchard
General Manager
Building



Graham Darlow
General Manager
Engineering



Alan Brown
General Manager
South Pacific



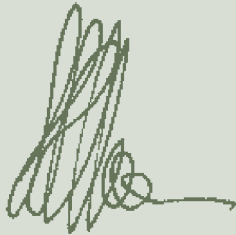
THE FLETCHER CONSTRUCTION COMPANY

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AUTHORISATION AND REVISION RECORD

DATE	DOCUMENT	REV	DETAIL OF REVISION
June 2006	Environmental Toolkit	1	First issue of toolkit
March 2009	Environmental Toolkit	2	Updates
March 2011	Environmental Toolkit	3	Updates

The Environmental Toolkit is approved for use.



Stuart Chapman
ENVIRONMENTAL MANAGER



Graham Darlow
GENERAL MANAGER

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Nichollette Brown, Louise Gibson, Rachel Blake, Nessa Ryan Anderson
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Appendix H.R

Waikanae River Environmental Plans: Refer to Drawings CV-CM-500 – CV-CM-508, Management Plan Appendices, Appendix H, Volume 5