

**ACCOUNTING FOR THE POTENTIAL AND ACTUAL COSTS ASSOCIATED  
WITH ENVIRONMENT CANTERBURY'S PEST DEPOTS AND OTHER SITES**  
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## **INTRODUCTION**

The Financial Reporting Standard No. 15 issued under the Financial Reporting Act 1993 applies to all general purpose financial reports in accounting for provisions, contingent liabilities and contingent assets.

To meet its obligations within this standard that relate to Environment Canterbury's (ECan) land, Pattle Delamore Partners Ltd (PDP) were engaged to undertake a preliminary environmental investigation of 33 properties to assess potential contamination issues.

The investigation was undertaken principally in two stages. The objective of the Stage One investigation was to identify activities at each site that may have resulted in the contamination of soil, surface water and/or groundwater; the physical nature of the site; and whether further investigation was required to identify any potential or known contamination. To aid in categorising each site's potential risk to the receiving environment a rapid hazard assessment system (RHAS) was employed in conjunction with data gathered from completed generic questionnaires and accessing data held by ECan and other organisations. The results of the Stage One investigation determined whether further site-specific investigations were warranted. To this end, exposure pathways and requirements for additional site-specific information were identified and specific investigative works were undertaken according to the type of land use at each of the potentially affected sites. These additional site investigations were undertaken as a Stage Two work programme.

The Stage One and Two investigations were reported in accordance with the “*Guidelines for Reporting on Contaminated Sites in New Zealand*” (MfE, 2001).

## **STAGE ONE INVESTIGATION – METHODOLOGY & APPLICATION**

The Stage One investigation was desk-based and involved information collection and analysis.

### **Information Sources**

Environment Canterbury -

Environment Canterbury owns over 300 sites. Many of these are leased out to site occupiers, who use the sites for a variety of activities. Other sites are used by Environment Canterbury as regional depots, for past and present use in pest control operations and other purposes. Out of the total number of sites, 33 were selected for investigation on the basis of staff knowledge of present or historic activities that involve the storage, use or disposal of hazardous substances.

Information about these sites was gathered from ECan databases including resource consents and wells location/groundwater databases. The resource consent database was able to provide information relating to possible consenting of site practices and the wells database was able to provide information relating to the use of any underlying groundwater system and hence its potential to be affected by previous or current site practices. Drillers' logs were obtained, which in conjunction with regional geological maps assisted in describing the site geology and hence possible risk to the subsurface environment and groundwater supplies. ECan also made available to PDP previous site investigation reports for some of the sites and also provided a vast array of aerial photographs spanning, in some cases, a number of decades for some areas of Canterbury.

#### Site Occupier Questionnaire -

Site-specific information was obtained by way of generic questionnaires that were completed by each site's occupier. A phone call was made to the site occupier explaining the purpose of the investigation and to ensure that the questionnaire was completed and returned. Information provided from the questionnaire assisted in identifying the site's physical characteristics and present or historical activities undertaken on site that may have resulted in the contamination of soils, surface water or groundwater in the vicinity. Site plans/sketches were also obtained from the site occupiers. Telephone calls were made to each site occupier to clarify any answers and obtain further information as necessary.

#### Territorial Authorities/Land Information New Zealand -

Land Information Memoranda (LIM) from territorial authorities were used to gain information on land use consents, permits, certificates/licenses of registration (e.g. fuel storage), site characteristics, flooding risk, etc. Where available, Certificates of Title (C/T) were acquired and in some cases historic land uses could be established from the information provided in the records. In some instances, information from these two sources was useful where a current site occupier did not have extensive knowledge of the site history.

The information obtained from the above sources verified and expanded the information known about the diverse land uses associated with hazardous substance storage, use or disposal at the sites, either by ECan themselves or by independent occupiers.

The range of land use varies from aboveground/underground fuel/chemical storage (15 sites), pesticide storage depots (11 sites), landfills (9 sites), timber treatment (4 sites), works depots/workshops (4 sites), timber jointing and lamination (3 sites), sand blasting/spray painting (3 sites), sheep dip (2 sites), blacksmith and a gasworks. Several sites had two or more potential hazard uses associated with them, e.g. pest depot and underground storage of fuel. A number of the activities associated with the above sites are no longer occurring, i.e. underground storage tanks removed, landfills closed.

Using the information obtained from the above sources it was possible to gain specific knowledge for each site in relation to operational history, potential sources of contamination, and environmental factors such as geology and water use. This was used to determine the potential risk posed to the receiving environment. In order to categorise the potential risk information into a useable format a rapid hazard assessment system (RHAS) was employed, as described below.

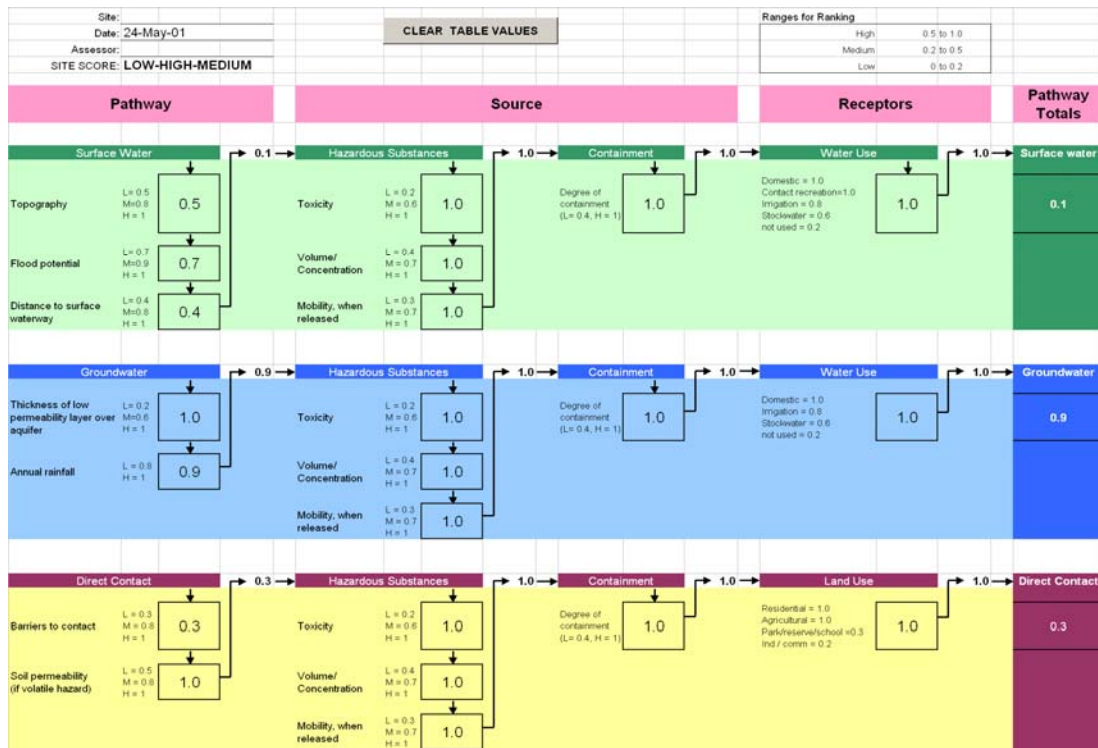
## **Rapid Hazard Assessment System (RHAS)**

To assist in streamlining the Stage One investigation process, a rapid hazard assessment system (RHAS) was employed using the information gathered from the above sources. The RHAS has been developed by PDP from a similar system used by the Ministry for the Environment since 1993 (MfE, 1993). It is to be emphasised that application of the RHAS is only as a tool for the classification and relative prioritisation of sites that may be contaminated, and not as a quantitative risk assessment tool.

The RHAS report for each site has a scoring system for the three main pathways of concern, i.e. surface water, groundwater and direct contact (including dermal contact and inhalation). The scoring system is based on a multiplicative approach so that for each pathway a maximum score of 1.0 can be attained. A score of 1.0 is interpreted as a high environmental risk and conversely, a score of 0.1 would be considered a low risk. A score is assigned to each of the three pathways in the order “surface water rank – groundwater rank – direct contact rank”.

For this investigation some of the RHAS parameters were given constant numerical weightings, either because the parameter was considered to be generally the same for all 33 sites in the investigation, or the information was not available. For example, a conservative weighting of 1.0 (assumed high environmental risk) was used throughout the RHAS site assessments for soil permeability since strata logs suggested that the sites were underlain by permeable soils. A conservative weighting of 1.0 was also used for the volume/concentration parameter due to the wide variation in accuracy and variability of data for each site making comparative ranking inconsistent. Similarly, with regard to containment a weighting of 0.7 was used for sites where it was unknown if any discharges of contaminants into the receiving environment had occurred, but it was considered likely due to practices indicated in the site history. With regard to assessing the potential risk to groundwater systems, the depth of nearby abstraction wells was not taken into consideration, only the lateral distance from the site was assessed. This allows for the risk of shallow contaminated groundwater affecting a well due to perforations in the well casing.

A worked example of a RHAS report completed for the investigation is shown below.



Applying a RHAS evaluation for each site enabled it to be broadly categorised into one of the three groups according to its environmental risk (low, medium or high). Sites being grouped into the “high environmental risk” group could then be prioritised for further investigative works.

## STAGE ONE - RESULTS AND INTERPRETATION

With the exception of one site all the sites were found to have had activities that may have resulted in hazardous chemical residues remaining in the site environs. The results of the RHAS assessment indicated that of the 33 sites:

- 18 were considered to be “high environmental risk”, i.e. sites that scored a ranking between 0.5 and 1.0 for at least one of the three pathways;
- 13 sites were considered to be “medium environmental risk”, i.e. sites that scored a ranking of not more than 0.5 for each of the three pathways but between 0.2 and 0.5 for at least one pathway;
- 2 sites were “low environmental risk” and scored not more than 0.2 for each of the three pathways.

Table1 below shows a summary of the RHAS assessments for the 33 ECan sites.

**Table 1. Summarised Rapid Hazard Assessment System Results**

Site Group Categorisation	Limiting Exposure Pathway/s (in the order SW – GW – DC) <sup>1</sup>	Comments	Potential Contaminant
<b>Group 1 –</b> 18 High Environmental Risk Sites	- H -	10 sites had Groundwater only as High Risk	Pesticide Storage Depot, Timber Treatment, Underground Storage Tank, Landfill, Timber Jointing Laminating, Works Depot, Sandblasting/Painting
	- H H	5 sites had Groundwater and Direct Contact as High Risk	Pesticide Storage Depot, Underground Storage Tank, Landfill, Works Depot, Gasworks
	- - H	3 sites had Direct Contact only as High Risk	Sheep Dip, Landfill
<b>Group 2 –</b> 13 Medium Environmental Risk Sites	M L M	1 site had Surface Water and Direct Contact as Medium Risk	Pesticide Storage Depot, Underground Storage Tank
	L M L	4 sites had Groundwater only as Medium Risk	Pesticide Storage Depot, Underground Storage Tank, Timber Jointing Laminating, Sandblasting/Painting
	L M M	1 site had Groundwater and Direct Contact as Medium Risk	Underground Storage Tank, Works Depot, Blacksmith
	L L M	7 sites had Direct Contact only as Medium Risk	Pesticide Storage Depot, Underground Storage Tank, Landfill, Works Depot
<b>Group 3 –</b> 2 Low Environmental Risk Sites	L L L	2 sites had Low Risk for each of the three Exposure Pathways	Underground Storage Tank, Aboveground Storage Tank

**Note:**

1) SW – GW – DC = Surface Water – Groundwater – Direct Contact

For the 18 sites that were categorised into the “high environmental risk”, group recommendations were made for each site to more accurately determine the potential environmental risk. The recommendations either took the form of a further request for additional site-specific information or fieldwork that should be undertaken at Stage Two of the investigation to help identify real environmental risks at each site. Typical examples of the issues and recommendations for Stage Two further investigations for three sites are shown in Table 2 below.

**Table 2. Recommendations for further (Stage Two) work based on Stage One results**

Site Name	Environmental Issues	Recommended Investigation	Analytes
Taggart Earthmoving Ltd, Rangiora	<ul style="list-style-type: none"> <li>• Dump for engineering equipment and sawdust (possibly treated timber)</li> <li>• Domestic water from well on site has been tested as a result of illness</li> <li>• USTs – historical and present</li> </ul>	<ul style="list-style-type: none"> <li>• Find out where historical USTs were located</li> <li>• Auger holes/test pitting</li> <li>• Test pitting of landfill to determine size and waste types</li> <li>• Find out results of water testing</li> <li>• Confirm usage of wells – are there any domestic wells on site?</li> </ul>	Cu, Cr, As, PCP, B TPH, BTEX Landfill leachate indicators
Rangitata Pest Depot	<ul style="list-style-type: none"> <li>• 3 m deep pits used to dispose of excess baits, poisoned rabbits and household rubbish for several decades until mid 1990s – the pits are filled in and marked by gravel mounds</li> <li>• 16 m<sup>2</sup> area where baits disposed of onto ground</li> </ul>	<ul style="list-style-type: none"> <li>• determine whether wastes are buried at a safe depth for prevention of direct contact</li> <li>• visual inspection and soil sampling in area where bait residues have been discharged onto the ground</li> <li>• confirm well usage</li> <li>• check location of site water supply well in relation to location of pits and sample if necessary</li> </ul>	VOC, SVOC, As, cyanide, TPH, BTEX Metals
Temuka Gasworks	<ul style="list-style-type: none"> <li>• USTs (petrol and diesel) removed – date unknown; no soil sampling details</li> <li>• Gas works site prior to 1945 – waste residues and underground pipes may remain at site, which has been levelled and covered with shingle</li> </ul>	<ul style="list-style-type: none"> <li>• complete a detailed site history to identify likely locations of underground piping, tanks or tar pits</li> <li>• test pitting for visual observations</li> <li>• soil sampling</li> <li>• confirm well usage</li> <li>• may sample closest downgradient well</li> </ul>	TPH, SVOCs Metals Cyanide

For the two sites that previously operated as sheep dips and categorised into the “high environmental risk” group for the dermal contact pathway it was recommended that no further investigative works were required. ECan considered that the issues associated with management of these sites were discussed adequately in a technical report they had commissioned, entitled “*Investigation of Arsenic Contamination of Soil and Groundwater Resulting from Historical Sheep Dipping Activities on the Kaikoura Plain*”, (PDP, 2001), and management decisions could be based on data generated from that study. Conversely, two sites that were ranked into the “medium environmental risk” group were recommended for additional Stage Two site investigation work due to the reported presence of inadequately covered waste on the site.

It was also recommended that as a prudent approach a site management plan should be prepared for every site, with the exception of one site, which did not show any activities that may have resulted in significant residual hazardous chemicals. The purpose of the plan is to acknowledge the potential for contamination to be present and to recommend measures that would minimise exposure risks for groundwater and surface water users, and for occupiers or excavation workers who may live on or carry out work at the site.

## STAGE TWO INVESTIGATION – METHODOLOGY & APPLICATION

Based on the potential environmental risk posed by each site, as defined in Stage One of the project, a work programme was designed for each site in the high environmental risk category (Group 1) and for two sites in the medium environmental risk category (Group 2) to identify the actual environmental risks posed.

The work programmes would use the following methods for each land use or environmental receptor:

<b>Landfills</b>	Test pitting to determine the type and thickness of cover and types of waste.
<b>Surface Contamination</b>	Soil sampling at surface and 0.5 m depth to test for migration of chemical residues toward water table.
<b>Operational USTs</b>	Check product reconciliation records. Environmental setting assessment including age, type of tank and soil conditions.
<b>Removed USTs</b>	Find out if ECan holds a soil sampling/environmental report. Auger holes/test pitting for visual inspection and/or soil sampling to assess possible contamination.
<b>Wells</b>	Confirm usage of wells. Sample closest down-gradient wells where necessary for likely indicators of contamination. In the case of landfills, this will involve the indicator set for small landfills as specified in Centre for Advanced Engineering, 2000 (i.e. pH, conductivity, alkalinity, chloride, ammoniacal nitrogen, total or nitrate nitrogen, total organic carbon and soluble zinc).
<b>Gasworks</b>	Complete a detailed site history to identify likely locations of underground piping, tanks or tar pits. Test pitting for visual observations. Soil sampling

Based on several factors including budget constraints, impending sale of sites, and in particular, lease arrangements with ECan, six of the twenty sites were selected for investigation as part of Stage Two.

The six sites were made up of four pest depots (Cheviot, Rangitata, Omarama and Windy Ridges), a river engineering depot and former gasworks (Temuka) and an earthmoving contractor (Taggart, Rangiora). In addition, a landfill was associated with one of the pest depots (Rangitata) and underground fuel storage with another (Windy Ridges).

PDP representatives visited each of the six sites to undertake the recommended Stage Two site investigation works particular to each site. It should be noted that all the appropriate and necessary health and safety protocols were implemented, as were the appropriate soil and groundwater sampling, handling, storage and shipping procedures. All sample analysis was undertaken at an IANZ accredited laboratory.

Where applicable the Stage Two investigation and reporting was carried out in accordance with the principles of a preliminary site inspection documented in “*Guidelines for Reporting on Contaminated Sites in New Zealand*” (MfE, 2001).

### **Earthmoving Contractor – Taggart Earthmoving Ltd, Rangiora**

The main environmental issues associated with the site related to a dump previously used for redundant engineering equipment, which may also have been used for treated timber sawdust, and the historic and current use of fuel underground storage tanks. A shallow unconfined groundwater aquifer (<10 m deep) is used within the immediate site vicinity for a number of uses including potable supply.

Based on the findings of the Stage Two investigation it was recommended that further testing of the on-site well should be undertaken to confirm the initial sampling results and for mandatory testing of any future wells installed within the site vicinity for dissolved TPH and metal concentrations.

### **Pesticide Storage Depots – Cheviot and Omarama**

It was reported that these two sites only operated as pesticide storage depots, with the main environmental issues being the storage of pesticides and toxins and preparation/disposal of baits. The Stage One investigation revealed that excess bait, old pesticide containers, etc were burned and/or buried at the sites. For both sites the shallow unconfined groundwater aquifers (<10 m deep) are used for potable supply. Based on site history, chemicals expected to remain within the underlying soils and/or groundwater at each site were arsenic and total cyanide, due to their persistency.

As a prudent approach for both sites, a recommendation was made for any future wells installed in the site vicinity to be tested so that the water quality is appropriate for its intended use.

### **Pesticide Storage Depot/Landfill – Rangitata**

The main environmental issues associated with the site were the storage of pesticides and toxins and preparation/disposal of baits. It was documented during the Stage One investigation that pesticide waste, poisoned rabbits and household rubbish was disposed of in two pits on the site. The shallow unconfined groundwater aquifer (<10 m deep) is used within the immediate site vicinity for a number of uses including potable supply.

Based on the findings of the investigation it was recommended that a suite of three groundwater monitoring wells be installed at the depot to check for the presence of potential contaminants within the shallow underlying groundwater.

### **Pesticide Storage Depot/UST Fuel Storage – Windy Ridges, Tekapo**

The main environmental issues associated with the site were the storage of pesticides and toxins and preparation/disposal of baits. The site obtains its drinking water supply from an adjacent creek. The ECan database showed no wells within 10 km of the site although the property did have a well that was no longer in use. It was documented during the Stage One investigation that underground storage of diesel occurred on the site. As the UST was no longer operational its removal was carried out as part of the Stage Two work. At the time of the removal, an environmental assessment was carried out detailing the site observations and results of soil sampling analysis, as detailed in the relevant OSH Code of Practice (OSH, 1992).

A recommendation was made for the disposal of site wash-down water and residues to the appropriate disposal facilities. In addition, it was recommended that any wells installed in the site vicinity would require testing to ensure that the water was suitable for the intended use.

### **Gasworks Site – Temuka**

The main environmental issues associated with the site relate to its previous use as a gasworks and more recently as an ECan depot that has been used for the storage of herbicides. Soakholes are present at the site. Two USTs have been previously removed from the site although no information is available with respect to potential contamination as a result of their use. Concerns relate to groundwater users, which abstract water from the shallow unconfined aquifer within the site vicinity and site personnel coming into contact with affected soils during excavation activities.

The results of the Stage Two investigation identified substances in concentrations that may present a risk to people working on the site, or to downgradient groundwater users. The potential exposure pathway of concern on the site is primarily dermal contact, such as during maintenance, excavation and construction activities.

Based on the outcome of the Stage Two investigation further works have been recommended and include the following:

- Implementation of a site management plan to protect workers during future excavation works; and
- Further investigation of the former tar well to determine its contents and integrity and to locate a reported additional well; and
- Further investigation in the vicinity of the gasholders and purifiers to investigate deeper impacts; and
- Further research to assess the likelihood of gasworks waste having being disposed of in other areas of the site and if warranted followed-up by soil sampling; and
- Installation of shallow monitoring wells at the site to assess whether any gasworks related contaminants are migrating into the underlying aquifer and to further define deeper soil impacts.

These recommended works are currently in progress.

### **STAGE TWO – SUMMARY OF INVESTIGATIONS**

From undertaking the six Stage Two investigations it was possible to gain a more accurate assessment of the potential and actual environmental and human health risks posed by the presence of contaminants at each property based on previous and current site activities.

From the results of the Stage Two investigation more detailed works have been recommended, as for example, the former gasworks at Temuka and the pesticide depot/landfill at Rangitata. The further work will assist in defining and benchmarking the extent of the contaminants that have been previously detected during Stage Two fieldwork investigations. For the remaining four sites, the risks have been adequately characterised

and recommendations have been made, more as a precautionary measure, for example, testing the water quality of future wells that are installed within each site's vicinity.

## **INCORPORATION OF ENVIRONMENTAL ASSESSMENT INTO FINANCIAL ACCOUNTS**

The financial implications of outstanding work associated with managing contamination at the Temuka Depot and other sites have been reported in the auditor's management letter (Audit New Zealand) to Environment Canterbury for the year ended 30 June 2002.

In terms of total potential liability to be reported through FRS-15, the environmental assessments conducted on Environment Canterbury's properties have identified a limited number of sites with the potential to be contaminated, and a low cost associated with remediation.

The audit of accounts noted that given the limited number of sites and low cost of remediation, no liability needed to be recognised in the financial statements. However, as further work is performed on the sites, should the potential liability increase the auditor requested Council create a provision for its environmental obligations.

## **CONCLUSIONS**

In order for Environment Canterbury's financial accounts to accurately report on known and unknown costs associated with contaminated land that it owns, as per the requirements of the Financial Reporting Standard-15, investigative work was required. These requirements are relevant to other regional and local authorities (and other businesses owning sites that have the potential to be contaminated) in New Zealand and the methodology used by Environment Canterbury for this purpose has been presented here.

Initially the work involved assessment of all sites owned by Environment Canterbury to identify those that had the potential to be contaminated by virtue of past or present land uses.

These sites were investigated using a staged approach that maximised implementation of national guidelines issued by, or in preparation by, the Ministry for the Environment.

Stage One involved a desk-top study of relevant information related to each of the 33 sites involved. A modified version of the Rapid Hazard Assessment System (MfE, 1993) was used for comparison of the results to identify higher risk sites requiring further work. Stage Two involved on-site preliminary site investigations as detailed in the "*Guidelines for Reporting on Contaminated Sites in New Zealand*" (MfE, 2001).

The systematic evaluation of records related to each site identified a variety of land uses that have the potential to cause contamination of land. Some of the land uses identified through this project were not initially apparent, for example, the former gasworks site at Environment Canterbury's river engineering depot at Temuka.

In addition to assessing and prioritising sites with the use of the Rapid Hazard Assessment System it should be noted that other factors took precedence in the final selection of sites. These included budget constraints, impending sale of some sites, and in particular, lease arrangements of site occupiers with Environment Canterbury. However, the general methodology used in this project provided a sound basis from which to make financial decisions related to contamination at Environment Canterbury's properties.

The financial liabilities associated with these sites are now included in accounting reports.

## **ACKNOWLEDGEMENTS**

The assistance of past and present site occupiers, and staff in the Property and Reserves section of Environment Canterbury is acknowledged.

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