Ministry for the Environment
Manatū Mō Te Taiao

Site Validation Report for the Former Fruitgrowers Chemical Company Site, Mapua

- Final Version 3.0
- 11 December 2008

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1. Introduction

The former Fruitgrowers Chemical Company (FCC) site was subject to organochlorine pesticide (OCP) and other pesticide. From 2004 to 2007 remedial works were undertaken at the site to reduce the risks posed by contaminates to acceptable levels set by the resource consents in order to protect future site users, local residents and the environment.

A number of reports have been produced detailing the remediation objectives, processes and controls. Table 1 provides a list of the reports and regulatory position of each document. The resource consents (Table 2 Section 2.6) specify the soil acceptance criteria (SAC) which have been used to validate the work undertaken during the remediation.

- **Table 1 Documents that Described how the Soil Acceptance Criteria would be Achieved**

Report	Produced by	Date Issued	Provided to:
Remedial Action Plan (RAP)	Thiess Services	July 2004	MfE, Site Auditor & Tasman District Council (TDC) (Basis of consent)
Remedial Action Plan	MfE	July 2005	TDC & Site Auditor
Letter – Variation of Attachment 1 for Consents RM030521-527 for Nickel	TDC	13th April 2007	MfE, Site Auditor & TDC (Change to consent)
Amendments to Remedial Action Plan & Site Works Plans	MfE	August 2007	TDC & Site Auditor

Sinclair Knight Merz (SKM) has been contracted by the MfE to prepare a Site Validation Report for the remediation work which has been undertaken at the former FCC site. The Site Validation Report is based on a number of assumptions and limitations which are set out in Section 1.3.

1.1. Validation Report Objectives

After remediation of a site the environmental conditions and the effectiveness of the remediation process must be assessed with respect to the objectives stated in the Remedial Action Plan.

The objective of this Site Validation Report is to detail the application of the Remedial Action Plan and any variances from the proposed plan.

This report has been prepared in accordance with the guidance provided in the relevant published guidelines which include;

- The Ministry for the Environment Contaminated Land Management Guidelines No. 1 – Reporting on Contaminated Sites in New Zealand (October 2003); and
- The New South Wales Environment Protection Authority Guidelines for Consultants Reporting on Contaminated Sites (November 1997).

This report has also been prepared to meet the requirements of the Australian (NSW and Victoria) site auditor schemes as it will be submitted to the Independent Site Auditor (SA) for review and to enable the auditor's assessment to be made on the suitability of the site for its expected end uses.

1.2. Remediation Objectives

During the course of this project, two Remedial Action Plans (RAPs) were produced. The first, written by Thiess Services and issued in July 2004 (Thiess, 2004), was subsequently added to and revised by the MfE to produce a document issued in July 2005 (MfE, 2005). Both of these RAP documents have been consulted in the production of this report. The greater emphasis has been given to the Thiess 2004 RAP in accordance with advice from the MfE. The 2005 RAP was provided to the SA & TDC. This was then amended to produce the "Amendments to RAP and Site Works Plans' (August 2007). This report documented the changes between the original Thiess RAP and MfE. For the purpose of this validation report the 2005 and 2007 RAP were used to augment information where necessary. In most instances the 2005 RAP provides a more conservative approach. Aspects of the remedial programme evolved during the conducting of the remediation and validation programme, and are documented by EMS (2006) and in correspondence from the Site Auditor. These documents have also been referred to in preparation of this Site Validation Report.

The principal objective for this project, as set out in the 2005 RAP (MfE, 2005), was to: *remediate the site to standards acceptable for intended purposes with the minimum of ongoing restrictions*. More specifically the requirements of the remediation were that:

- the various sub-sites must be remediated to the clean-up standards as specified in the resource consent conditions, being the Soil Acceptance Criteria (SAC) which are listed in Table 5 of this Site Validation Report;
- the land after remediation must be acceptable for its proposed use, and the nature and composition of the residual material in any part of the site must not adversely affect future

users of the site or the environment, given the range of activities that can be expected to take place at the site;

- the contaminated soils must not be blended or diluted with soil containing lower concentrations of contamination to make the material acceptable for offsite disposal or for retention on any part of the site without the express permission of the principal;
- the soils and sediments containing concentrations of contaminants which exceed the acceptance criteria defined by the resource consents for the selected clean-up scenario, must be either treated prior to return to the site or appropriately disposed of offsite;
- there shall be no disposal of soils, sediments, rubble, refuse or any other materials excavated from the site to any offsite location other than the Eves Valley Landfill and all disposal at this site shall be in accordance with the Landfill's requirements;
- the proposed remediation must involve some degree of treatment of soils so that there is a reduction in the total mass of contaminants;
- where possible the final re-contoured land must mimic natural topographic conditions and blend in with the surrounding landscape;
- all areas of the site will be capped with layer of 'clean soil' (DDX<5ppm) of a depth of at least 0.5m; and
- contaminated marine sediments at FCC East and FCC West will be removed and replaced with approved material that meets the SAC for aquatic ecosystem protection and matches as closely as possible marine sediments that already exist as part of the natural beach and marine sediments of the Waimea Inlet.

The effectiveness of the remediation project in achieving these objectives is discussed in individual sections of this Site Validation Report which address each separate area of the site (Sections 6 to 15), and in the discussion of the site as a whole in Sections 17 and 18.

1.3. Assumptions and Limitations

The Site Validation Report has been prepared based on the soil and sediment sampling information supplied by MfE. SKM did not undertake any sampling at the FCC site or the procurement of any additional information to develop the report.

For this Site Validation Report the resource consents have been used as main source of the SACs and site procedures. Where site procedures have been altered from the consented RAP, comments have been made to their relevance. The consent of most relevance to this validation report is RM30521. The soil acceptance criteria contained in Attachment 1 to the consent have been given precedence over those published in the RAPs.

This report does not include validation for remediation of groundwater. A separate report is being prepared by others for this work.

No interpretation as to the level of risk posed by residual site contamination has been made in the preparation of this report.

The marine sediment results have not been normalised to 1% total organic carbon (TOC) as required by the ANZECC 2000 marine sediment guidelines, due to TOC not being included in the analysis supplied by MfE for the marine sediment samples.

A number of assumptions have made in respect to the statistical analysis of the soil and sediment sampling results for each sub-area of the site, referred to as a subgrade (SG), for assessing whether or not the soil quality in the subgrades meet the SAC. They are set out below.

- Statistical analyses have been performed to calculate the 95% UCL according to the procedures in the NSW EPA Sampling Design Guidelines (1995).
- Sample results which are less than the laboratories analytical method limit of detection (LOD) have been assumed in the validation statistical analysis to be 0.5 x LOD, and that any exceedences of SACs are *potential* rather than confirmed exceedences, based on this assumption. This approach is recommended in the Ministry for the Environment's Contaminated Land Management Guideline No. 5: Site Investigation and Analysis of Soils. The 0.5 x LOD was supplied by the Ministry for the Environment.
- Statistical handling of samples bordering cells/subgrades. There were a number of samples in the east and west sites that were taken on the borders of either cells or subgrades. The contaminant concentrations of these samples have been assigned to the neighbouring cells/subgrades for incorporation into the average contaminant concentration calculations. For example sample 2558 in FCC East was taken in the centre of cell J25 which is the point of intersection of three neighbouring subgrades 9, 10 and 14, and this sample result has been assigned a weighting of 1 in each of the three subgrade averaging excel worksheets. This ensures that the soil contaminant conditions are equally represented in the surrounding subgrade areas.
- Stage 1 investigations identified the extent of contamination to a depth of 3m, as detailed in Section 2.7.5. The Stage 1 investigations also identified areas of the site where soils were already within the SAC. These soils were considered to be already validated by EMS and could therefore be left *in situ* or relocated to other parts of the site (provided the soils were within the SAC for the intended land end use for the area of relocation). Section 4.2.1 explains the validation sampling protocol of the *in situ* material however, for a review of the sample results from the original site characterisation work the Thiess Services (2002) report should be viewed.

- The SAC for DDT was assumed to be for total DDX (including DDT, DDE and DDD) and this was applied in the validation analysis.
- The sample results for all analytical suites (100%, 50% and 10%) pass the Thiess RAP conditions if no single result is 2.5 times higher than the relevant SAC value appropriate to the target end land use. However, the amended RAP (amended 2005) reduces this requirement to 1.5 times higher than the relevant SAC. Typically, EDL based their validation on the factor of 1.5 for all commercial grade validation and the factor of 2.5 for the more stringent residential grade validation. For this validation report the primary test for individual results is the original Thiess RAP conditions, i.e. 2.5 times SAC value.

1.4. Project Stages

The remediation project took place in three stages. An overview of what took place in these stages is provided in Sections 1.4.1, 1.4.2 and 1.4.3 below.

1.4.1. Stage 1 – Detailed Planning and Resource Consent Applications

The primary objectives of Stage 1 were:

- For the site to be further characterised (in terms of the extent of contamination and nature of onsite materials, via a site investigation detailed in Section 2.7.5) to aid in the revision and finalisation of the Remedial Action Plan (RAP) in accordance with the proposed Clean Up Criteria (subsequently referred to as the Soil Acceptance Criteria);
- To revise and finalise the RAP in accordance with the proposed Clean Up Criteria;
- To assess the resource consent requirements for the works and prepare an 'Assessment of Environmental Effects Report';
- Submit the relevant resource consent applications for all activities required by Stage 3 and any long term resource consents required for the management of the site subsequent to clean-up of the site;
- To respond to all Section 92 requests for further information resulting from the resource consent applications for the works; and
- To obtain all other statutory approvals for the clean-up activities proposed and the clean-up of the site.

  This work was managed by Thiess with input from subconsultants and EDC.

1.4.2. Stage 2 – Environmental Permits and Establishing Conditions for Stage 3 Site Remediation

The primary objectives of this stage were to:

- Present cases for various resource consents at the Resource Consent Commissioner Hearing;

- Evaluate the hearing decision and advise on any effects on Stage 3 – Site Remediation;
- Finalise the conditions for Stage 3 of the contract; and (if necessary) prepare an appeal to the decision of the hearing committee at the Environment Court hearing; and
- Undertake a proof of performance (PoP) trial of the mechano-chemical dehalogenation (MCD) treatment process.

The specific objectives of the PoP trial were:

- To confirm that the process complied with all conditions stipulated within the resource management consents;
- To confirm that the treatment of the contaminated material met the relevant soil acceptance criteria (SAC) at a minimum rate of 108 m^3/week;
- To demonstrate that the treatment process can achieve a target 'Destruction Removal Efficiency' (DRE) of not less than 90%; and
- To monitor expected environmental and safety parameters such as noise, air emissions, odour, vibration and material handling to ensure they were compliant with relevant legislation and resource consent requirements.

This work was managed by Thiess with input from subconsultants and EDC.

1.4.3. Stage 3 – Site Remediation

Stage 3 involved the supply of all equipment, materials, plant, and consumables and the remediation of the site. These works included, but were not necessarily limited to, the following:

- Mobilisation to site including the design, delivery, installation and testing of all equipment to be used for the treatment of contaminated soils and sediments to meet acceptable residual standards as specified by the consent;
- Establishment of a referencing system so that each area and depth of the site that is subject to clean-up or validation can be easily referenced and all excavated material can be tracked on a daily basis to the ultimate disposal location of this material;
- Break-out, excavation, cleaning, crushing and/or disposal of concrete foundations, disused subsurface drains and services, building slabs and asphalt paving, some of which may be contaminated;
- Excavation, treatment and reinstatement (onsite) of contaminated soils and sediments from the FCC West, FCC East and FCC Landfill sites and contaminated neighbouring properties that adjoin the FCC site;
- Excavation, treatment (as necessary) and disposal of general refuse and debris which has been landfilled on the site and more particularly in the FCC Landfill, including waste building

material, corrugated iron, drums, paper, plastic and timber, some of which will be mixed with waste pesticide materials and contaminated soils;

- Removal of contaminated sediments from the adjacent estuarine areas and the invert of the drain along the western boundary of the FCC Landfill, drying (as necessary) and used for backfilling in areas of the site designated for recreational use.
- Backfilling and compaction of treated soils, where these have been validated as suitable for this purpose (this may involve processing and moisture conditioning to make the soils suitable for the purpose);
- Site levelling, grading, surfacing, drainage and re-vegetation;
- All associated validation testing and monitoring as required under the resource consents; and
- Close-out reporting.

The works also included all ancillary works and services required for the execution of the project, e.g. connections to, and supply of, power, water and any other service utilities, supply of raw materials consumed by the treatment process, personnel and plant and equipment, decontamination facilities, surface and groundwater control and all other measures required for environmental and health and safety protection.

A detailed description of the remediation methodology can be found in Section 3.2. The results of the remediation are set out in the individual sections of this report covering each section of the site (Sections 6 to 13).

The site's remediation has been managed by Effective Management Systems (EMS) for the Ministry for the Environment (MfE). Environmental Decontamination Ltd (EDL) managed and operated the mechano-chemical de-halogenation (MCD) plant which has been used to treat the contaminated soils. An earth works contractor was also employed on-site to facilitate the excavation and movement of soils. Hiway Stabilisers originally carried out this work but it was taken over by Taylors Contracting in October 2006. MWH New Zealand (MWH) has been providing surveying and mapping support.

2. Background Information

2.1. Site Location

Mapua township is situated on a two kilometre wide peninsula, which forms the northwest side of one of the sea entrances to the Waimea Inlet (Figure 1). Rabbit Island forms the southeast side of the entrance. A flat coastal plain exists on the eastern side of the Mapua peninsula, decreasing in width to the north where it terminates in steep cliffs rising to 40m at Ruby Bay. The Seaton Valley stretches northwest from this coastal plain. To the west of the coastal plain the land rises to approximately 100m above sea level.

The site is located on the southeast edge of Mapua township at the base of a small peninsula, which is approximately 250m wide (Figure 2). This peninsula extends into the Waimea Inlet and terminates in Grossi Point. Tahi Street runs down the middle of this peninsula with areas on either side generally inclining to the Waimea Inlet away from Tahi Street.

- **Figure 1 Location of Mapua**

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- **Figure 2 Location of the Fruitgrowers Chemical Company Site**

2.2. Brief Site History

Fruitgrowers Chemical Company (FCC) first started operation in a cool store in Mapua in 1932 producing spraying oils and lime sulphur for the horticultural industry. In 1938 FCC bought a lime quarry on Takaka Hill and established the company Lime and Marble.

During the 1940s the production of lime sulphur was replaced by organo-mercury compounds. Lead arsenate and arsenicals were also stored at the site. In 1945 FCC introduced micronising (an air mill process to reduce particle sizes for spraying). Organochlorine pesticides were the main products micronised. These included DDT, DDD and dieldrin. Organophosphorous pesticide formulation was introduced in 1958. Over the years the persistent organochlorine pesticides were gradually replaced by the less persistent organophosphorous pesticides such as malathion and azinphos.

The FCC operations continued to expand from the 1960s to the 1980s. Herbicides (hormone and non-hormone), insecticides, fungicides and animal remedies were formulated onsite. In 1978 a total of 124 chemicals were used by FCC to produce 84 different formulations.

Lime and Marble, a company that was located on FCC East, processed non-toxic materials such as lime, calcite and dolomite. All of the buildings used by FCC and Lime and Marble during the operation of the site have been removed.

The FCC operations ceased in February 1988. This followed an unsuccessful appeal to the Planning Tribunal to expand chemical manufacture at Mapua to include copper-chrome-arsenate production. Lime and Marble continued operating on its land for a period, principally using it for mineral storage. This property was eventually transferred to Mintech NZ Ltd. Reclamation and landfilling of low spots and edges of the Waimea Inlet on the site boundaries appears to have been undertaken in the 1950s, as evidenced by aerial photographs. The nature of the fill material is not clear, but Ministry of Transport records indicate that it is likely to have included waste materials from the FCC operations. These reclamations were eventually vested in the former Nelson Harbour Board and leased back to the two companies. The Tasman District Council (TDC) inherited this vested land as the successor authority to the Nelson Harbour Board.

In May 1992 a 60m long clay cut-off wall was installed along the southern side of the FCC landfill to reduce leachate movement into the Waimea Inlet.

2.3. Site Description and Conditions prior to Remediation

The site covers a total area of approximately 5.06 hectares and is made up collectively of the FCC West and East sites, the FCC Landfill, the contaminated marine sediments and contaminated areas of the neighbouring properties. The FCC East and FCC West sites (as shown in Figure 3) historically contained the facilities used for pesticide formulation and storage (see description in Section 2.2). Parts of the FCC East site were reclaimed from the Mapua Channel. Wastes from the FCC operations were disposed of in the reclamation of the Waimea Inlet on the western boundary of the FCC West site, i.e. the FCC Landfill.

The FCC site was already highly modified prior to remediation works being undertaken, with most of the FCC East site having been paved and the FCC West site characterised by a mixture of damaged pavement and rough pasture. The FCC Landfill site was covered by rough pasture. All vegetation on site has been cleared to allow the remediation to take place.

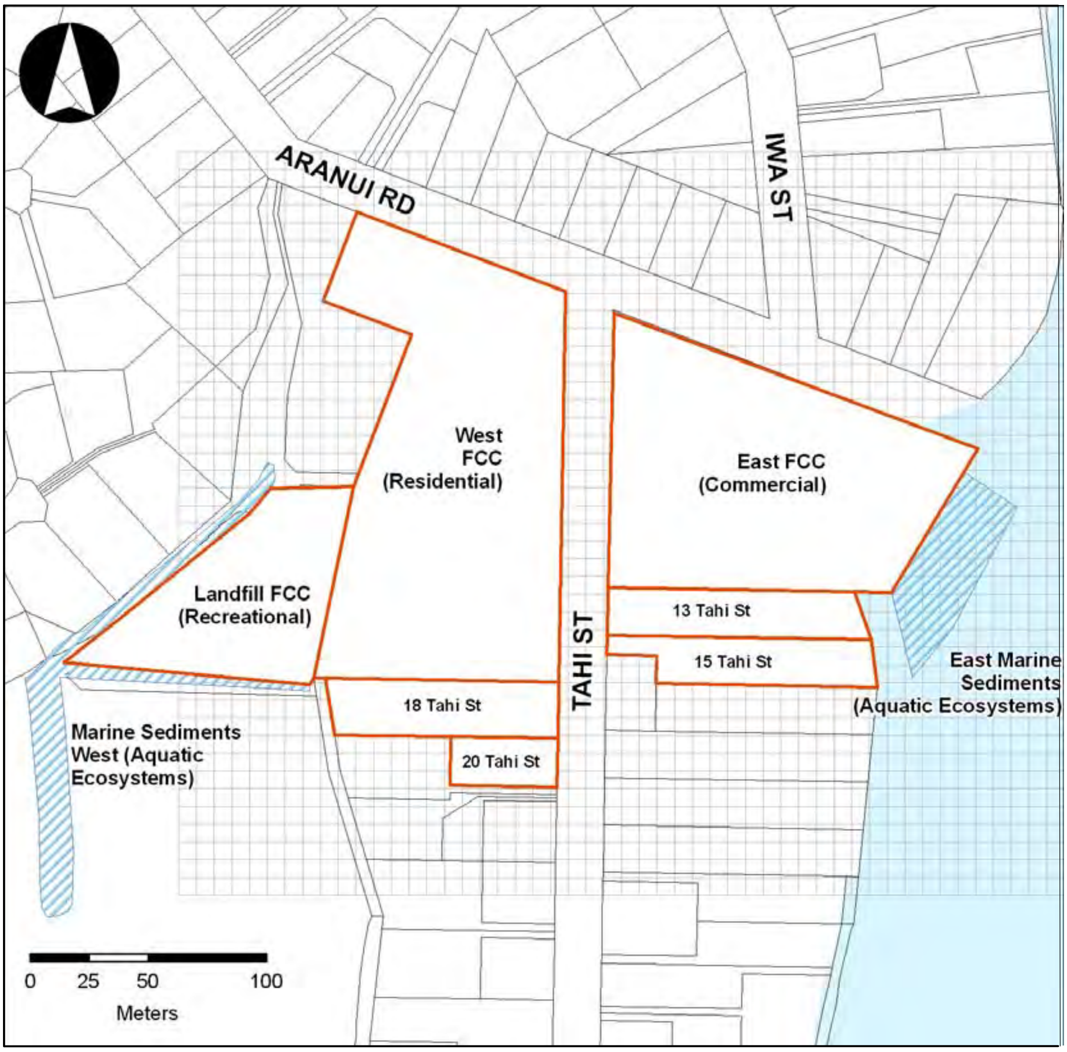
The land uses surrounding the site are residential housing to the south, residential and commercial to the north, residential housing and rural property to the west and estuary to the east.

The site has been divided into five areas according to the different future end uses intended for the site following remediation. These areas of the site and the end uses are shown in Figure 3 and are as follows:

- FCC Landfill to be used for recreational purposes;

- FCC West to be used for residential purposes;
- FCC East to be used for commercial purposes;
- West Marine Sediments to be used to support an aquatic ecosystem; and,
- East Marine Sediments to be used to support an aquatic ecosystem.

- **Figure 3 FCC Site Plan**



A detailed description of each of these sites is provided in the Sections 6 – 15 in which the remediation, validation sampling, and results from each area are discussed.

2.4. Geology

The geology in the vicinity of the site consists of Moutere Gravel, Tahunanui Sand, and Rabbit Island Gravel. The Moutere Gravel outcrops on the western boundary of the site and extends below the Tahunanui Sand and Rabbit Island Gravel under the site itself. The Moutere Gravel is clay-bound alluvial gravel. The Tahunanui Sand and Rabbit Island Gravel are marine sand and gravel that were deposited as storm beach ridges.

Drilling at the site indicates that the marine sands and gravels extend from ground surface to between 3.6m and 8.5m below ground surface. The sand is grey, fine to medium grained and contains shell and wood fragments. The gravel is grey, well-rounded, medium grained, and has a sandy matrix. The clay-bound gravel found below the marine sediments consists of medium to coarse-grained weathered clasts in a clay matrix.

2.5. Hydrology & Hydrogeology

Shallow groundwater is present at the site within the marine sands and gravels described above. Across the site, the water table varies from approximately 0.9m to 2.6m below ground surface. The elevation of the water table ranges from approximately 2.5m above mean sea level in the north-western part of the site to approximately 0.9m above mean sea level in the eastern part of the site. Marine sands and gravels at the site are underlain by the Moutere Gravels, a clay-bound gravel unit of fluvial origin.

The saturated thickness of the marine sands and gravels varies across the site from less than 2m to approximately 8.4m, based on the limited number of site borings that penetrate to the Moutere Gravels and July 1996 water levels. The direction of groundwater flow across the site in the marine sands and gravels is generally from northwest to southeast or south. Groundwater flow is generally toward the Waimea Inlet to the east and south, but this flow direction appears to be modified in the vicinity of the FCC landfill by an open drain located along the western edge of the FCC landfill. This drain extends for at least part of its length beneath the water table and collects groundwater and discharges it to the Waimea Inlet, hence resulting in groundwater flow towards the drain from the adjacent portion of the site. Horizontal groundwater gradients at the site range from 0.003 in the central part of the site to 0.02 in the southern area of the FCC landfill (based on water table contours for July 1996).

The water table fluctuates seasonally (up to 0.5m) and in response to tides. Annual groundwater level highs are expected to occur during the winter months when precipitation is highest. Tidal fluctuations in the marine sands and gravels appear to be rapidly attenuated with distance and tidal influence appears to be restricted to less than 35m from Waimea Inlet. No tidal fluctuations were observed on the west side of the site, with the nearest monitored well located approximately 30m from the Inlet.

The aquifer properties of the marine sands and gravels have been estimated from two injection tests carried out at the site. The transmissivity values estimated from these tests were $100m^2$/day and $280m^2$/day. The specific yield of the aquifer is expected to be in the range of 0.2 to 0.3, a typical range for unconfined sediments.

The water levels and hydraulic properties of the Moutere Gravels that underlie the marine sands are similar to those measured in the overlying sands and gravels in June 1996. However, conductivity for the Moutere Gravels (approximately 0.01m/day) is much lower than in the overlying sands and gravels.

2.6. Resource Consents

The remediation of the former FCC site is governed by seven resource consents. Amongst other things, these consents cover monitoring requirements and set limits for contaminants through the Soil Acceptance Criteria (SAC).

The consents require environmental monitoring including groundwater, marine sediment, ambient air and stack emissions. The consents require pre-remediation, ongoing and post remediation monitoring.

Table 2 below lists the resource consents held for the site and gives a synopsis of the requirements of the consents.

- **Table 2 FCC Site Resource Consents**

Resource consent reference	Purpose	Requirements
RM030521 General	Pertains to disturbance of the land for the purposes of remediating the site. It includes the construction of buildings, MCD plant, holding ponds and barriers. It covers operation of the MCD plant in hazardous area and under conditions that may exceed hazardous facility thresholds outlined in the Tasman Resource Management Plan.	Consent requirements include conditions relating to: *Rainwater (potable water supplies); Noise; Vibration; Hazardous Substances; Building Assessments; Screening; Earthworks; Re-vegetation*; *Vehicles; Lighting*, *Certification; Waste Manifests; Final Validation and Site Management*.
RM030522 Coastal Marine	Pertains to the disturbance of the coastal marine area surrounding the FCC site due to the excavation and removal of contaminated marine sediments. It includes provision for the removal/construction of stormwater outfalls and the discharge of water, stormwater, contaminants and sediment to the marine environment.	Consent requirements include conditions relating to: *Macroinvertebrate and Sediment Loading; Timing of Excavation; Noise; Re-vegetation; Roading; Management and Validation*.
RM030523 Air	Pertains to the discharge of contaminants to air within acceptable limits from the excavation and screening operations, and proposed MCD treatment plant. These discharges include odour, dust and treatment plant emissions.	General conditions include that (1) there shall be no "*odour, dust, particulate, smoke, ash or fume caused by discharge from the site…*[that is deemed]…. *noxious, dangerous or objectionable beyond the boundary'* and (2) the consent holder must also use best practice techniques to minimise fugitive dust from the site. Specific consent requirements include conditions relating to: *MCD plant operation; Site monitoring; Total Hazard Index; and Site Works.*

Resource consent reference	Purpose	Requirements
RM030524 Water	Pertains to the discharge contaminants to land (including sediments, soils, wash water, stormwater, diverted groundwater) during works and to discharge residual contaminants following remediation.	General conditions include that (1) the release of contaminants to land will be minimised, (2) avoid increasing the contaminant above levels specified in the Soil Acceptance Criteria (SAC) (3) soils shall comply to SAC and (4) the SAC will be defined as General Conditions. Specific consent requirements include conditions relating to: *Groundwater; Stormwater; and Sampling Protocol.*
RM030525 Sediment Discharge	Pertains to the discharge of sediments meeting Soil Acceptance Criteria (SAC) to groundwater.	General conditions include that (1) discharged sediments will meet SAC. Specific consent requirements include conditions relating to: *Groundwater; and Sampling Protocols.*
RM030526 Stormwater	Pertains to the diversion and discharge of stormwater.	Consent requirements include conditions relating to; *Stormwater Discharge, Quality and Monitoring.*
RM030527 Divert Groundwater	Pertains to the taking (interception) and diversion of groundwater.	Consent requirements include conditions relating to: *Dewatering; Water Quality; and Monitoring.*

The consent of most relevance to this Site Validation Report is RM30521. The Soil Acceptance Criteria contained in Attachment 1 to the consent have been given precedence over those published in the RAPs.

2.7. Summary of Past Contamination Studies and Investigations

Several contamination investigations on the site, surrounding marine sediments and adjacent residential lots have been previously undertaken. These investigations have included both preliminary and detailed assessments (such as the investigation undertaken during Stage 1 of the site works, detailed in Section 2.7.5), which are summarised in Sections 2.7.1 to 2.7.5 below. Descriptions of these past investigations and the results can also be found in the following documents:

- Bioresearchers, 1993. Mintech (NZ) Ltd Mapua Site Sediment and Shellfish Quality Appraisal;
- Woodward Clyde, 1996. Mapua Site Remediation: Assessment of Environmental Effects (Final Draft for Tasman District Council);
- Tasman District Council, 2000. Mapua Fruitgrowers Chemical Tip Investigations;
- O'Halloran, K.O. and Cavanagh, J.E., 2002. Investigation of Organochlorine Contamination in Biota and Sediment Collected from the Mudflats Adjacent to the FCC Site at Mapua (for Landcare Research);
- Thiess Services, 2002. Characterisation Investigation of Fruitgrowers Chemical Company Site, Final Report;

- Thiess Services, 2004. Remedial Action Plan, Fruitgrowers Chemical Company Site, Mapua; and
- Tonkin and Taylor, 2005. Report on Baseline Soil and Groundwater Sampling, Mapua, Nelson.

2.7.1. On-site Soil Contamination

In 1996 Woodward-Clyde conducted a number of investigations focused on soil contamination of the FCC East and West sites. A total of 63 soil sample locations were investigated and 41 of them exhibited concentrations of organochlorine pesticides (OCPs) above residential use criteria, and 15 locations exhibited concentrations above commercial use criteria. The concentration of OCPs was generally found to decrease with depth. However, in some locations, particularly in the 1–2m depth range, greater contaminant levels were identified. These locations are typically within filled/reclaimed areas or alternatively where bulk storage facilities were located.

Concentrations of other organic compounds and inorganic compounds were generally found to be at background concentrations. Elevated (above background) levels for mercury, sulphur, organophosphorus pesticides and phenoxyacid herbicides were, however, identified at four locations.

In summary, the investigations found that the observed pattern and distribution of soil contamination on the FCC sites correlated with historical site activities. Contamination was typically found in areas used for intensive chemical handling and bulk storage, and within stormwater drains and low lying areas.

The FCC Landfill site was not sampled in this investigation as a discrete area. As materials deposited in the landfill were of the same nature as those which had caused contamination of the FCC East and West sites, it was assumed that concentrations of contaminants in the FCC Landfill area would be at least as significant as in the FCC East and West areas.

2.7.2. Sediment Contamination

Sediment samples have been collected from the Waimea Inlet on a number of occasions from 1977 to 1996 and analysed for a range of potential contaminants.

The results of the marine sediment sampling indicate that contamination of marine sediment is predominantly by organochlorine pesticides, particularly DDT and its metabolites DDD and DDE, and to a lesser extent dieldrin. The highest concentrations of organochlorine pesticides were found in sediments adjacent to two stormwater discharge points, namely the surge chamber in the Mapua Channel and drainage channels in the tidal flats to the south of the FCC landfill.

Organochlorine pesticide concentrations appear to decrease significantly with sediment depth. Samples collected from depths greater than 0.25m showed significantly lower concentrations than shallower samples from the same locations. Most sediment samples collected below 0.25m did not contain excessive contaminant levels. Organochlorine pesticide concentrations appear to decrease rapidly with distance along the shoreline away from these stormwater discharge points, particularly in the sediments to the south of the FCC landfill. Similarly, concentrations of organochlorine pesticides appear to decrease significantly with distance from the discharge point towards the low tide mark.

2.7.3. Neighbouring Property Soil Contamination

Investigations have been carried out on the topsoil from residential properties located at 13, 15, 18 and 20 Tahi Street to the south of the FCC site (see Site Plan, Figure 3).

OCP levels above residential soil acceptance criteria were found in soils from 0.3 and 0.5mbgl. The extent of contamination at numbers 15, 18 and 20 Tahi Street was found to be limited to isolated hotspots. However, at 13 Tahi St (which directly abuts the southern boundary of the FCC East site), contamination was demonstrated over approximately 50 percent of the property including two areas of planted grape vines, the driveway into the property, and the area at the north eastern boundary of the property adjacent to the Waimea Inlet.

2.7.4. Groundwater Contamination

Investigations indicate that groundwater quality up-gradient of the FCC landfill has not been affected by contaminants found on the site. In May 1992 a 60m long clay cut-off wall was installed along the southern side of the FCC landfill to reduce leachate movement into the Waimea Inlet. Metal and OCP levels in groundwater (from boreholes taken across the site) were found to exceed guidelines for the protection of aquatic ecosystems and recreational water quality down-gradient of the cut-off wall. Chlorobenzene was also found to be discharging to the marine environment in concentrations in excess of the guidelines for the protection of aquatic ecosystems but below recreational water quality guidelines.

Groundwater on site is currently monitored by Tasman District Council for a range of contaminants from a series of six boreholes on site and four residential bores in properties along Tahi St (as detailed in resource consent RM03024). This monitoring programme has been carried out throughout the duration of remediation activities and is scheduled to continue as determined by the Site Auditor.

2.7.5. Additional Stage 1 Investigations

In addition to the previous investigations undertaken at the site, further investigation works were carried out during Stage 1 of the project. These were aimed at providing confidence in the feasibility and outcome of the site clean-up. Broadly the investigations included:

- Characterisation of the nature and distribution of site material (in terms of contamination status, geotechnical properties and treatability) to facilitate the planning, design and implementation of remediation and validation strategies;
- Screening trials on *in situ* materials to determine treatment and backfill volumes;
- Provision of consistent and reliable contaminant and physical property data to facilitate design requirements for the MCD plant and remediation approach; and
- MCD trials to assess process performance for highly contaminated materials.

The scope of the investigation included:

- Excavation, sampling and logging of test pits on a 15m grid across the FCC East and FCC West sites and on a 23m grid in the FCC landfill. Samples were taken of near surface soils (0-0.5m) and from each type of fill / stratum or at 0.5m intervals to a depth of 3m;
- Sampling and logging of test bores on a nominal 7.5m grid on residential Lots 13 and 15 south of FCC East and residential Lots 18 and 20 south of FCC West. Surface soils only (0-0.3m) were sampled;
- Installation and sampling of five new groundwater monitoring wells;
- Sampling and analysis of concrete at 25 locations across the sites;
- Validation sampling on a 7.5m grid over parts of site thought to be clean (mainly the northern part of FCC West, referred to as ‘FCC north’);
- Surveying of all investigation locations; and
- Compilation, interpretation and reporting of the investigation results.

The results of the 2001 investigation were combined with data from previous studies to estimate the degree of contamination and volumes of contaminated materials. The most critical determination was to ascertain the volume of OCP contaminated soil, as this was determined to be the most difficult material to treat.

Characterisation investigations at the former FCC site at Mapua have revealed a pattern of contamination consistent with the known history of activity at the site. Widespread contamination was found to exist at various depths below the FCC East, FCC West and landfill sites with a general pattern of decreasing contamination extent with increasing depth.

Soil contamination located in the eastern end of the FCC East site and in the landfill reflected filling practices in these areas, with zones of higher contamination at the depths where the most contaminated fill was placed. The portion of the FCC West site north of the boundary fence was shown to be largely clear of subsurface contamination apart from a localised area around the former laboratory.

Soil contamination at levels exceeding residential guidelines were found in unpaved areas on three residential properties bordering the southern end of the FCC West and East sites. Number 13 Tahi Street was shown to have significant levels of soil contamination in unpaved areas across a large percentage of the site.

Sampling of concrete materials at the site revealed that significant concrete contamination was limited to four areas. These were the former pesticide and prills manufacturing buildings, the solutions mixing plant and the dangerous goods store.

Groundwater contamination was detected in four of the five groundwater monitoring wells installed at the site. These values were used to provide a baseline with which results can be compared following site remediation. Information collected from the wells also allowed the assessment of current groundwater contamination across the site, the groundwater flow direction, and the receiving environment for the contaminated groundwater.

3. Remediation Methodology

3.1. Introduction

The following sections summarises the remediation methodology followed at the FCC site.

3.2. Screening Trials

An association between fine particles and organic and inorganic contaminants has been noted in previous contamination studies (Thiess, 2004). Therefore, site soils were screened to remove the coarser material (i.e gravel and cobbles), which was assumed to be ‘clean’, prior to treatment. Screening trials were carried out during the Stage 1 investigations to better characterise the nature of material and the effect the screening process would have on the volume of contaminated material once screening had occurred. Full details of the screening trials can be found in the Thiess (2004) RAP. Screening trials were carried out which sorted site soils into four size fractions:

- >65mm
- 20-65mm
- 5-20mm
- <5mm.

3.3. Material Classification System

In accordance with the resource consent requirements and to facilitate the location of discrete classes of contaminated materials on the site (based on SAC), each of the 15 by 15m cells established as the sampling pattern during the site characterisation (during the Stage 1 Investigations, see Section 2.7.5) has been given a unique identifier.

Each cell was assigned an alphanumeric name by assigning a letter (A to N) to a given row (based on its longitudinal position) and a number (1 to 26) to a column (based on its latitudinal position), for example as per Figure 27, in Section 10.46. The material within each cell was further delineated by depth. These ‘layers’ have been assigned a number 1 through to 5 as per Table 3.

- **Table 3 Cell layers and in situ cell volumes**

Layer	Depth (m)	In situ cell volume (m^3)
1	0.0–0.5	112.5
2	0.5–1.0	112.5
3	1.0–1.5	112.5
4	1.5–2.0	112.5
5	2.0–3.0	225
6	3.0–4.0	225
7	4.0-5.0	225

Within each cell, each layer was then given a contamination classification based on investigation data as measured against the SAC. This contamination classification system is summarised in Table 4. This spatial classification system effectively identified the probable degree of contamination at any given location and depth within the site to a depth of 3.0m and thus provided an indication of handling and processing requirements.

Table 4 Classifications for Untreated Materials

Class	Description	Explanation
A	**Remain in situ**	**This material had adequate geotechnical properties; and was validated as having contaminant concentrations below applicable SAC.**
B	**Concrete etc requiring breakout and cleaning**	**Materials in this class were all foundations, pavements, sumps, concrete slabs, foundations and services which following breakout, cleaning, and further breaking up, formed and adequate fill for areas of the site proposed for recreational purposes.**
C	**Soil, sediment and fill requiring excavation and treatment (this classification also applied to *in situ* treatment)**	**This material was all material that was above groundwater level in:** **The FCC landfill;** **All non-soil fill in other areas of the site; and** **All other material on the site that had inadequate geotechnical properties or contaminant concentrations above applicable SAC.**
D	**Material below groundwater requiring excavation and treatment**	**This classification is for materials similar to Class C materials but occurring below groundwater level. This material was excavated and treated / disposed of in addition to some requirements for screening and sorting.**
E	**Soil and sediment that may be excavated and backfilled at depth**	**This category refers to all material that would otherwise have been classified as Class C that was located within 500mm of the surface of the site and which was validated as having contaminant concentrations below the applicable SAC for material below 500mm and will have adequate geotechnical properties. Marine sediments were only to be backfilled in areas of the site proposed for recreational purposes.** **This category was to allow some contaminated material to be relocated from the surface of the site and buried at depth. However, the intention was not to undertake this action (with the exception of the marine sediments) unless it was required to remediate the site within the allocated budget.**
F	**Material that may be disposed of at the Eves Valley Landfill site**	**This category refers to:** **Material that was disposed of to the Eves Valley Landfill; or** **Material that would otherwise be classified as C or D and which had been validated as suitable for disposal at the Eves Valley Landfill site without sorting / treatment in accordance with one of the Landfill Acceptance Criteria (LAC). Material was to be further classified as F2, F3 or F4 depending on which of the LAC the material complied with.**
G	**Suitable as backfill above 500m**	**This was material that had been validated has having contaminant concentrations below the residential SAC and had adequate**

Class	Description	Explanation
		geotechnical properties for residential land use.
H	**Suitable as backfill below 500mm**	**This was material that had been validated as having contaminant concentrations below the applicable SAC for material below 500mm and adequate geotechnical properties for the proposed land use.**
I	**Suitable as backfill below groundwater level**	**This was material that had been validated as having contaminant concentrations below the applicable SAC for material below 500mm and adequate geotechnical properties for the proposed land use. Material that had contaminant concentrations at the higher end of those allowable for commercial reuse were to be placed above groundwater level.**
J	**Suitable for containment at Eves Valley Landfill site**	**This material was to have been validated as suitable for disposal either:** **In the Eves Valley Landfill (this material was further classified as J1); or** **In a purpose built cell in accordance with one of the LAC. This material was to be further classified as J2, J3 or J4 depending on which of the LAC the material complied with.**

Depending on the *in situ* contamination classification of the material, it was either left *in situ* or excavated and / or screened, stockpiled and assigned for treatment during the remediation process, as outlined in Table 4. All stockpiles that were created were composed of materials from the same contamination classification. Material that contained elevated concentrations of contaminants of concern was stockpiled as far as practicable from the marine environment and above the groundwater level.

3.4. Civil Remediation Works

A fuller description of the civil works undertaken during the remediation works is available in the following documents:

- Thiess (2004) Remedial Action Plan (Thiess, 2004);
- MfE (2005) Remedial Action Plan and Management Plan (MfE, 2005) which outlines a number of the excavation methods employed although has not been formally agreed;
- Amendments to Remedial Action Plan & Sitework Plans 2007; and
- Effective Management Systems (EMS, 2006) Quality Control / Quality Assurance Procedures Developed for the FCC Mapua Fruitgrowers Remediation.

These works are summarised in the following sections.

3.4.1. Hardstand and On-Shore Excavation

Prior to commencing bulk earthwork excavations, all surface hard stand areas were excavated, and hauled to a designated hardstand stockpile area in preparation for crushing operations. Each excavated slab section was brushed underneath prior to transfer to avoid cross contamination of the

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hardstand stockpile or crushing area. The upper side of the slabs was brushed free of fines prior to crushing. Crushed concrete was reused onsite in accordance with its contamination status. Any concrete found to be contaminated was isolated, crushed to suitable size and treated.

To facilitate the recovery of discrete classes of material, the location of each cell was marked on the ground by survey pegs and/or marker paint and the excavation activities supervised at all times to ensure discrete layer removal. Excavation was undertaken using tracked hydraulic excavators on a cell-by-cell basis corresponding to the pre-excavation classification. Materials other than rock or hardstand requiring treatment and/or relocation were loaded directly from the excavators to dump trucks for haulage to temporary stockpiles which underwent validation testing. These temporary stockpiles were maintained by rubber tyred front-end loaders and covered to minimise fugitive dust generation.

Stockpiled materials were either screened or re-used on site according to their contamination classification. Once stockpiled material had been screened, it was tested, then further classified and allocated for either treatment or reuse.

In the FCC Landfill area, a spotter worked during the excavations to ensure that any hazardous material (such as intact or compromised drums) did not release further contamination. Any material that was unable to be treated was isolated (via storage or containment within bunded areas) and an appropriate disposal method decided upon in consultation with the Site Engineer. Procedures were also put in place for the protection and recovery of any koiwi, taonga or other materials of cultural or archaeological significance.

General refuse that was excavated and could not be re-used onsite was cleared of contaminated soil, validated and then transported to Eves Valley Landfill for disposal. All refuse sent to Eves Valley Landfill was to meet the relevant Landfill Acceptance Criteria and any relevant transport regulations.

3.4.2. Off-Shore Excavation

Prior to commencing offshore excavation works a macro-invertebrate and sediment quality survey was undertaken, as well as a shoreline profile survey as detailed in WP8 (Marine Excavation Works: Appendix 8, MfE RAP).

Marine sediments were excavated using a long reach excavator from the eastern margin of the site within the Mapua channel and immediately south of the FCC landfill within the Waimea Inlet. Sediments from these locations were transferred to adjacent dry land, stockpiled and allowed to dewater prior to soil criteria testing. Providing the sediments met relevant soil acceptance criteria they were compacted and used as backfill below depths of 0.5m.

Works were undertaken on the low tide cycle and ideally were completed within that cycle. Excavations were not carried out during periods of rain or in areas covered by tidal waters. In the event that works were not able to be completed within the tide cycle, the area just excavated was covered with a layer of gravel so as to prevent the migration of fines onto the excavated surface. Works could then be recommenced on the next low tide. The gravel imported for this purpose were as similar as possible to existing gravels. Gravel was also used to create a gravel access road to facilitate excavator and/or truck access up to 100 m offshore.

The installation of a floating silt curtain was not considered necessary by the person undertaking the earth works as all work was undertaken on the foreshores at low tides. Swamp nets were used during excavations of the western foreshore.

As for terrestrial excavation activity, if any koiwi, taonga or other cultural/archaeological materials of significance were discovered the appropriate procedures were implemented.

3.5. Screening Operations

As described in Section 3.3, a significant volume of ‘clean’ oversize (>10mm) material was present within a fine-grained contaminated matrix on site. Contaminated material was screened using a variety of screening plant to remove ‘clean’ oversize materials down to 10mm diameter. This screening plant included:

- Conventional ‘grizzly’ screens for removal of coarse (>150mm) materials including debris and other solid wastes;
- Inclined vibrating screens capable of segregating a variety of sizes down to <10mm; and
- Rotating trommels capable of segregating a variety of sizes.

Bulk waste materials such as drums, pipes and other materials were removed by ‘hand’ and, where necessary cleaned to remove contaminated fines. This process took place in a bunded area within the stockpile processing area. Screened oversize materials were maintained in stockpiles adjacent to the screening plant to minimise handling requirements and dust generation. Prior to remixing all oversize materials underwent validation testing and where necessary was re-screened to remove excess contaminated fines.

Any bulk material requiring off-site disposal remained on site until clean of fines and until its off-site disposal had been approved and a waste transfer manifest had been completed.

3.6. Mechano-Chemical De-halogenation Treatment of Soils

The Mechano-Chemical De-halogenation (MCD) process involves the de-chlorination of organic compounds by the inputs of mechanical energy, as impact forces, in the presence of proprietary additives (electron and hydrogen donors).

Laboratory, pilot plant and full scale demonstration plant trials confirmed the irreversible, reductive destruction of the persistent organic pesticides in soils such as those found at the Mapua site. The trials confirmed that the through-put rate of the MCD plant was expected to be approximately 3 tonnes/hr. When in use on site, the actual throughput rate was approximately 22m^3 per day which equates to approximately 5 tonnes/hr.

A detailed description of the MCD process is contained in the Thiess (2004) RAP. In summary, the MCD process comprised the following elements:

- Feed soil pre-treatment and preparation which included screening and stockpiling (as detailed in Sections 3.3 and 3.5), pre-drying of sediments and wet soils which were left to drain on site;
- Drying in a rotary dryer to ensure optimal operation of the reactor. The drying process not only removed moisture but reduced the clay particle sizes through the tumble drying action. Material that had been through the dryer was screened once again and the clean oversized fraction (>5mm) removed. The dried fine fraction was conveyed to a fines storage silo;
- Exhaust air pollution control devices for the pre-treatment system;
- Material feed system where additives are metered and mixed;
- A reactor where contaminants are dechlorinated in the presence mechanical action (a result of the vibration of a multitude of steel balls contained within the reactor) and proprietary additives which are electron and hydrogen donors; and
- Treated soil handling and reconditioning where decontaminated soils are mixed to ensure their suitability for use as backfill.

4. Validation Sampling Protocols

Validation sampling was undertaken of the excavations, un-treated *in situ* material, screened and treated material and imported backfill to demonstrate that the site soil has been remediated to a standard suitable for the proposed end uses of the various sections of the site as detailed in Section 2.3.

Shortly after the start of the physical site remediation Effective Management Systems (EMS) took over the day to day running of the work on behalf of the MfE. All validation sampling during the FCC remediation was undertaken by EMS.

When working with the procedures set out in the 2004 RAP, EMS found that the original number of samples required to be taken during the site works, including validation, was estimated by Thiess that approximately 1000 samples would be required. It was found that the validation protocol was not clear, therefore EMS implemented a more rigorous sampling programme which could be used consistently across the site and resulted in a much larger number of samples being taken and analysed (approximately 8000).

The validation sampling protocols are detailed in full in the Thiess RAP (Thiess, 2004) and in the EMS Quality Control / Quality Assurance Procedures Developed for the FCC Mapua Fruitgrowers Remediation (EMS, 2006) and are summarised below.

4.1. Soil Acceptance Criteria

The standards to which the various areas of the site had to be remediated to , and to which soils on these areas have been validated, are set by the soil acceptance criteria (SAC) as set out as condition of the resource consents issues for the FCC site remediation. The full schedule of SAC from the resource consent conditions are set out in Table 5. The SAC for the key organochlorine contaminants of concern are set out in Table 6. The SAC for the organochlorine contaminants were developed by the Independent Site Auditor (Egis Consulting, 2001) as site specific risk-based soil and sediment acceptance criteria for the various land use scenarios. The SAC for all other contaminants were taken from the appropriate guidelines from New Zealand, New South Wales or Victoria to ensure that the land would be suitable for its proposed use. The guidelines utilised to create the full SAC schedule are indicated in the notes to Table 5. This table contains SACs based on the last correspondence from TDC confirming the SAC values.

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- **Table 5 Full Schedule of Soil Acceptance Criteria**

Substance	Residential[1] (mg/kg)	Open space[1,2] (mg/kg)	Commercial (mg/kg)[1,2]	Marine seds[7] (mg/kg)
Arsenic	30[3]	200	500	20
Boron	3[3] (sol)	6,000	15,000	
Cadmium	3	40	100	1.5
Chromium (III)	600[3]	24%	60%	
Chromium (VI)	9[3]	200	500	80
Copper	300[6]	2,000	5,000	65
Cyanide (complexed)	20[9]	1,000	2,500	
Cyanide (free)	50[9]	500	1,250	
Lead	300	600	1500	50
Manganese	1500	3,000	7,500	
Methyl Mercury	10	20	50	
Mercury (inorganic)	1	30	75	0.15
Nickel	600	600	3,000	21
Sulphur	600	600	600	
Zinc	200	14,000	35,000	200
Aldrin + dieldrin +10% lindane	3[4]	60[4]	60[4]	0.01[4]
Chlordane	50	100	250	0.0005
DDT (as DDX)	5[4]	200[4]	200[4]	0.01[4]
Heptachlor	10	20	50	
PAHs	20	40	100	
Benzo(a)pyrene	0.27[5]	25[5]	25[5]	0.430
Phenol	40[9]	17,000	42,500	
PCBs (total)	10	20	50	0.023
Total Petroleum Hydrocarbons in sandy silt				
C7-C9	500[5]	500[5]	500[5]	
C10-C14	510[5]	2,200[5]	2,200[5]	
C15-C36	NA[5,8]	NA[5,8]	NA[5,8]	

Notes:

1. The soil values without notation are from National Environmental Protection Council (NEPC) Assessment of Site Contamination Schedule B(1) "Guidelines on Investigation Levels for Soil and Groundwater" Table 5A Soil Health Investigation Levels or the interim urban Ecological Levels (whichever is lowest).
2. The commercial and recreational values apply to soil below 0.5 m depth. Surface soil should comply with the residential values.
3. Health and Environmental Guidelines for selected Timber Treatment chemicals. Ministry of Health, Ministry for the Environment, June 1997.
4. Risk based acceptance criteria for FCC Mapua, Egis 2001.
5. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Ministry for the Environment, August 1999.
6. Ministry for the Environment draft revised copper value, June 2003.
7. The marine sediment guidelines are ISQG-Low from ANZECC 2000.
8. NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
9. Ecotox values, RIVM, Technical Evaluation of the Intervention Values for Soil/Sediment and Groundwater, February 2001.

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Table 6 Acceptance Criteria for Key Organochlorine Contaminants of Concern

Land use	Depth (m)	DDX (total DDT, DDD, DDE) (mg/kg)	Aldrin + dieldrin + 10% lindane (mg/kg)
Residential	All	5*	3*
Commercial	0–0.5 Below 0.5	5* 200*	3* 60*
Recreational	0–0.5 Below 0.5	5* 200**	3* 60**
Aquatic Ecosystem protection	All	0.01	0.01

Notes:

* Based on protection of the offsite environment through rainfall run off. This will also be protective of human health and groundwater.

** Based on protection of groundwater.

4.2. Validation Sampling

4.2.1. Validation of *In Situ* Materials

Stage 1 investigations identified the extent of contamination to a depth of 3m, as detailed in Section 2.7.5. The Stage 1 investigations also identified areas of the site where soils were already within the SAC. These soils were considered to be already validated and could therefore be left *in situ* or relocated to other parts of the site (provided the soils were within the SAC for the intended land end use for the area of relocation). However, during the site remediation works there were some areas previously regarded as being validated where underground migration of contamination or previously unknown pits were discovered.

In this situation samples were taken from immediately below the ground surface and at deeper points below the base of the excavations. In some areas these were found to contain contaminant concentrations above the SAC and the area was excavated to a greater depth until further validation testing confirmed that the *in situ* material was within the SAC.

As each layer of the excavation was completed, validation testing was carried out. All cells were validated in this manner at their deepest extent prior to backfilling. Table 7 is a summary of the *in situ* validation requirements set out in the Thiess RAP (Thiess, 2004) and the actual procedures EMS followed on site as outlined in their Quality Control / Quality Assurance Procedures report (EMS, 2006), and as set out in Appendix 13 of the 2005 MfE RAP, which more closely represents the actual actions that took place on-site.

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Table 7 Summary of *In Situ* Material Validation Sampling

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
In situ - Residential	**Each 15m x 15m grid split into four 7.5m x 7.5m quadrants. Sample from 0.1m below floor excavation, 1 composite sample per wall per layer interval. At total of four samples per 15m x 15m grid.**	**Each 15m x 15m grid split into four 7.5m x 7.5m quadrants. A composite sample containing four sub-samples taken from each 7.5m x 7.5m quadrant at 0.1m or greater below surface, plus a composite sample taken from each layer interval of the walls of each 7.5m x 7.5m grid.** **To determine acceptance each sample from the 7.5m x 7.5m quadrants had to be within 1.5 times the relevant SAC and the average of all samples within the 15m x 15m cell had to be within the relevant SAC** *(note that this was used during remediation in accordance with 2005 RAP, but has not been considered in this Validation Report).*
In situ – Commercial / Open Space / Marine Sediments	**One sample 15m x 15m grid at 0.1m below floor, 1 composite sample per wall per layer interval.**	**Each 15m x 15m grid split into four 7.5m x 7.5m quadrants. A composite sample containing a sub-sample taken from each 7.5m x 7.5m quadrant at 0.1m or greater below surface, plus a composite sample taken from each layer interval of the walls of each 15 x 15m grid.** **To determine acceptance criteria each sample from the 7.5m x 7.5m quadrants had to be within 1.5 times the relevant SAC and the average of all samples within the 15m x 15m cell had to be within the relevant SAC (***note that this was used during remediation in accordance with 2005 RAP, but has not been considered in this Validation Report).*

Where below surface samples were required, they were obtained by hand auger (to a maximum depth of 3m). Samples taken of excavation surfaces were obtained from the excavator bucket or directly from the floor of the excavation using a trowel.

Areas that were validated to commercial or residential standards were at times used as sources of fill material for other areas classified to the same or a higher standard (i.e. material meeting the residential SAC could be used in any area of the site but material meeting the commercial SAC could not be used in residential areas).

The Thiess RAP indicated that where material was sourced from directly adjacent to a cell that was validated to a less stringent standard (i.e. a cell that was validated to residential SAC which was next to a cell that was validated to the commercial SAC), the excavated material was sampled at a rate of 1 sample per $25m^3$. Where this material is taken from areas that are validated to the same or a greater extent, it was sampled at a rate of 1 sample per $100m^3$. EMS have sampled at an average rate of 4 samples per $112m^3$. This volume is based on a 15m x 15m grid, excavated to 0.5m.

The Thiess RAP also stated that material which was classified as commercial, and was to be used in the areas of the site designated for commercial use, was sampled at a rate of 1 sample per 100m^3. During site operations EMS had to sample the soils to determine their classification, therefore approximately 4 samples per every 112m^3 were taken.

Further validation sampling was carried out in any of the 'certified clean' areas where cross contamination was suspected to have occurred. Measures to avoid cross contamination included erecting a fence around newly excavated areas to prevent access until the level of contamination was determined. If an area was entered before the results were known, the area would be re-excavated and sampled again.

4.2.2. Validation of Treated Materials

These materials were validated by sampling from the treated stockpiles prior to their re-use on site. Table 8 indicates the sampling procedures set out in the Thiess RAP (Thiess, 2004) and actual procedures as described in the EMS QC / QA Procedures document (EMS, 2006) and Appendix 13 of the MfE 2005 RAP.

- **Table 8 Summary of Treated Material Validation Sampling**

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
Treated	**Sampling and analysis of the stockpiles of treated material. Basis for acceptance is that the 95% UCL of the mean concentration of this material shall be less than the target SAC for target OCPs. The number of samples derived from the calculation in Appendix D of AS 4482.1:1997, or one sample per 25m^3, whichever is the lesser.**	**A composite sample was taken every day of treated material at least one sample per 25m^3. Four samples were taken from the stockpile to make up one composite. If results indicate the treated pile does not met SAC then it is mixed with other material to be treated (as once treated it is too fine to go through the system again) and re-treated and sampled.** **UCL method was found to be highly variable with a low number samples leading to high rejection rates so in July 2005 an auditor-approved method was implemented, based on a rolling average. Samples taken daily and averaged over 6 day period. Should any daily batch exceed 1.5 times** *(note that this was used during remediation in accordance with 2005 RAP, but has not been considered in this Validation Report)* **the SAC it is rejected for re-processing, in addition should any sample lead to the rolling average result exceeding the SAC then this is rejected also for re-processing.**

4.2.3. Validation of Imported Backfill

Validation of imported backfill was carried out to ensure materials being brought onto site were the correct quality for the intended end use (Table 9).

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Table 9 Summary of Imported Backfill Validation Sampling

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
Imported	**Imported backfill material should comply with section 4.1.2 of the New South Wales (NWS) Environment Protection Agency (EPA) Contaminated Site Sampling Design Guidelines, Sept 1995, Imported fill should be from a known origin and sampled at a rate of 1 composite (3 subsamples) per 1,000m^3 plus quality control sampling. Fill with an unknown origin should be sampled 1 composite per 400m^3 plus quality control sampling.**	**At least 1 composite sample taken every 1000m^3 of imported fill from a known source, plus quality control samples.** **At least 1 composite sample taken every 400m^3 of imported fill from an unknown source, plus quality control sampling. Random quality assurance samples also taken.** **Auditor advised that all imported soil samples (without averaging) should meet SAC.**

If this sampling showed that contamination above the SAC was present an alternative source of fill was found.

4.2.4. Validation of Exported Material

Only large objects were taken off-site including concrete, plastic and metal fragments. Table 10 summarises the proposed work procedures set out in the Thiess RAP (Thiess, 2004) and the actual work procedures undertaken as set out in the EMS QC / QA Procedures document (EMS, 2006) and Appendix 13 of the MfE 2005 RAP.

Table 10 Summary of Exported Material Validation Sampling

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
Exported	**Soil particles to be brushed or washed off in a bunded area. Material will remain on site until clean of fines and its off-site disposal has been approved. Waste transfer manifests will be completed and copies held on site. Material must meet Eves Valley Landfill acceptance criteria (Material classified as "inert" and "solid" by NSW EPA 1999 "Environmental Guidelines: Assessment, classification and**	**At least 1 composite sample of attached soil fines or other residues will be taken for each 1000m^3 of exported material, unless additional sampling is required.** **Results are based on total estimated mass of contaminants versus the total volume of material.** **Waste transfer manifests will be completed and copies held on site. Material must meet Eves Valley Landfill acceptance criteria (Material classified as "inert" and "solid" by NSW EPA 1999 "Environmental Guidelines: Assessment, classification and management of liquid and non-liquid wastes.").** **To determine acceptance all results from individual sources were averaged. The average was not to exceed the relevant SAC, and no individual sample**

	management of liquid and non-liquid wastes."	**was to exceed 1.5 times the SAC** *(note that this was used during remediation in accordance with 2005 RAP, but has not been considered in this Validation Report).*

4.2.5. Validation of Excavated Material Re-used On-Site and Not Treated

Some soils excavated onsite were moved to other areas without treatment, and validated to ensure they met their SACs for their intended end use. Table 11 highlights how these soils were validated.

- **Table 11 Summary of Validation Sampling for Excavated and Not Treated Material**

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
Excavated and not treated	**As material was taken out of each grid it was sampled as in section 4.2.1 of the RAP, if above SACs it would undergo treatment. If below SACs it was either stockpiled or backfilled into an area capable of accepting it.**	**Piles are again split into 4 quadrants and 4 samples taken from each quadrant to form a composite sample. This material will have also undergone *in situ* testing.** **Over size (>10mm) and crushed concrete which has been re-used on site was also sampled. A representative 50kg sample is taken from the oversize pile and a representative sample of crushed concrete or more solid concrete is chipped away or a core sample taken and then ground down in the lab.** **To determine acceptance all results from individual sources were averaged. The average was not to exceed the relevant SAC, and no individual sample was to exceed 1.5 times the SAC** *(note that this was used during remediation in accordance with 2005 RAP, but has not been considered in this Validation Report).*

4.2.6. Excavated Marine Sediments

Marine sediments were excavated from several areas and contaminant levels were such that once dried it could be used on site as fill. Table 12 indicates how these sediments were validated.

- **Table 12 Summary of Excavated Marine Sediment Validation**

Material Type	Thiess RAP Sampling Methodology	Actual Site Sampling Methodology
Marine sediments	**Sediments to be collected via long reach excavator. Transferred directly to FCC East boundary, stockpiled and allowed to drain, then treated as per 4.2.4.**	**Sampling for stockpiled marine sediments is either from the stockpile, by dividing a 100m^3 stockpile into 4 quadrants (based upon north, south, east and west). A representative sample is taken from a random location within each quadrant.** **Alternatively results from the excavations were used to validate the sediment, which was carried out on a 15m grid. Samples were taken along the edge of the excavation and within the excavation to determine compliance with SACs.**

4.3. Laboratory Analysis of Validation Samples

The Thiess RAP states that samples that are taken to validate materials of class A and E to J (material classes are outlined in Table 4, Section 3.3) are to be analysed as follows:

- **100%** of samples for OCPs;
- **50%** of samples for TPH, Volatile Chlorinated Hydrocarbons, and selected metals (As, Cd, Cr, Cu, CN, Pb, Mn, Hg, Ni, Se and Zn); and
- **10%** of all samples for the suite of analytes covered in the list of 'Soil Investigation Levels for Urban Redevelopment Sites in NSW', as found in the NSW EPA (1998) publication 'Contaminated Sites: Guidelines for the NSW Site Auditor Scheme'.

Sections 6 to 15 give summaries of the actual sampling which was undertaken on the individual areas of the site.

4.4. Site Procedures and Sampling Processes

All site operations and sampling QA/QC procedures are detailed in the Thiess (2004) RAP and the EMS report (EMS, 2006). A consistent approach was taken for all samples collected on site. This approach is summarised in the flow diagram in Figure 4 below, which represents the site procedures undertaken when taking samples. The procedures were set up to provide a routine to take samples which is consistent across the life of the project. Soil samples were recorded, treated correctly with regards to preservation, storage temperatures and transportation to the laboratory. Once received by the laboratory there is a clear paper trail with regards to chain of custody, acknowledgement of receipt of the samples and reporting.

Once the samples have been analysed and the results have been received they are interpreted in several ways including:

- Combining hard copies of the results with corresponding material or cell tracking sheets;
- Inputting the electronic data in spreadsheets on site; and
- MfE inputting the data into a spreadsheet providing a check with the site information.

The soil sampling events conducted by EMS can be broken down into three broad categories:

- Site Management Sampling (SMS);
- Validation Site Sampling (VSS); and,
- Validation Plant Sampling (VPS).

Summaries of these sampling categories are provided in the Sections 4.4.1 to 4.4.3 below.

Figure 4 Summary of Site Procedures

Develop Sampling Plan including:
- Sampling parameters & objectives;
- Develop expectation of sampling event;
- Develop sampling map.

Collect sampling equipment, including:
- Lab approved sample Containers;
- Sampling spoons (disposable);
- Indelible pen;
- Carrying mechanisms;
- Decon solution;
- Camera, etc

Label sample containers

Put on PPE required for particular sampling event

Go to site

Check sample map for any changes

Take samples according to plan

Return to office

Dispose or decontaminate sampling equipment. Decontaminate and remove PPE

Fill in Chain of Custody (CoC)

Give sample unique number and label record on CoC

Pack samples for transport and courier to laboratory with CoC

File copy of CoC

Lab sends an e-copy of CoC confirming receipt, Site verify sample numbers

Receive lab results as pdf and csv files. Match with CoC, create new spreadsheet and separate into cells and walls. Averages made where appropriate. Three copies made – two used in cell tracking system, one provided to earthworks contractor to verify area.

Create cell or pile tracking sheets. Break the results and link directly to a cell or pile. Notes made indicating high concentrations, depths, specific notes and further requirements. Site Operations Manager Reviews against SACs and validation decision made.

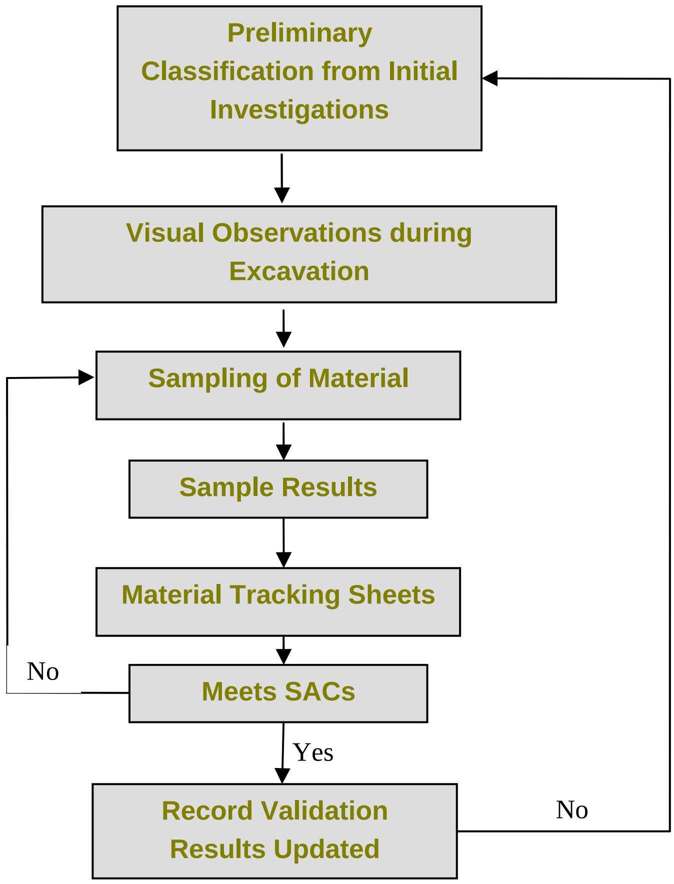
Enter data onto summary spreadsheets

File paper tracking sheets in appropriate colour coded binders

4.4.1. Site Management Sampling (SMS)

The Flow Diagram in Figure 5 indicates the SMS process and how the data is incorporated into the overall management of the site. The diagram represents a multi-task event to assess the OCP content of any cell, pile, imported material or solid materials (such as pipes, concrete, waste, unusual or unknown substances).

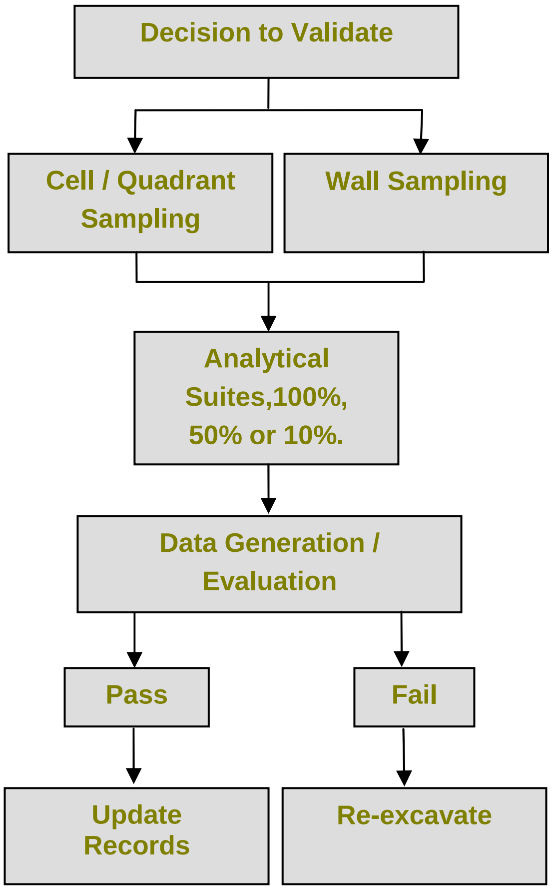
- **Figure 5 Summary of Site Management Sampling Process**



4.4.2. Validation Site Sampling (VSS)

The Flow Diagram in Figure 6 indicates the reasons for this sampling and how the data is incorporated into the overall management of the site. The diagram represents the process by which the site has been remediated to a standard suitable for the proposed land use (i.e. complying with the SACs).

- **Figure 6 Summary of Validation Site Sampling Process**



4.4.3. Validation Plant Sampling (VPS)

The flow diagram in Figure 7 indicates the VPS process and how the data is incorporated into the overall management of the site. The diagram represents a multi-task event to assess the validation of every production pile and ensures it meets the SACs.

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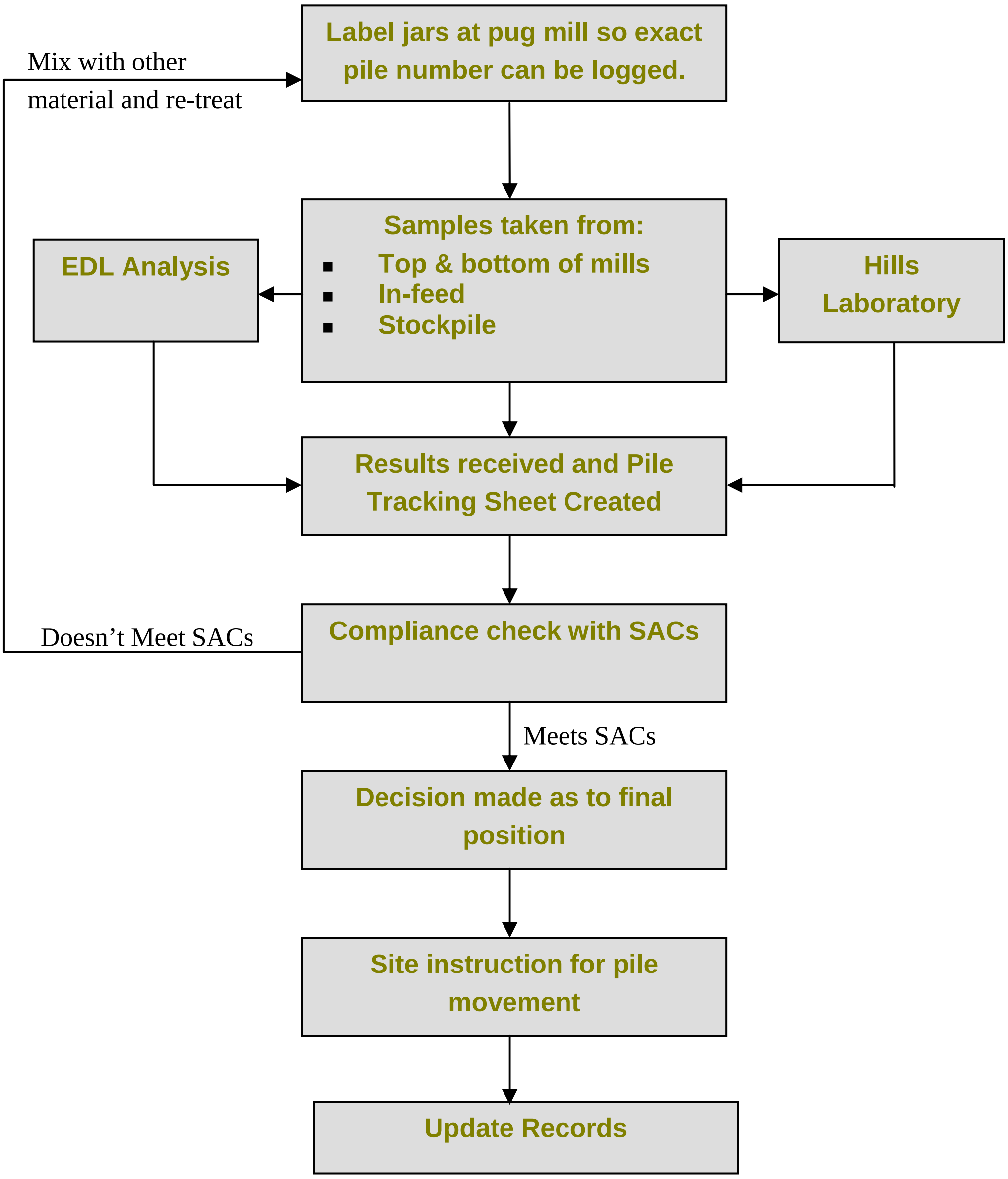
- **Figure 7 Summary of Validation Plant Sampling Process**



4.5. Thiess RAP QA/QC Requirements for Validation Sampling

The Thiess RAP included QA/QC requirements for the validation sampling. This was meant to be a component of the validation sampling programme designed and approved by the Site Auditor. These requirements were those set out in the Australian Standard AS4482.1, and included taking duplicate samples to be analysed by the laboratory. Specifically, QA/QC samples were to be taken and analysed in accordance with the ‘Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-Volatile and Semi-Volatile Compounds’ (AS 4482.1-1997/2005).

However, the full QA/QC sampling programme as planned, did not take place during the course of the validation sampling. Blanks and blind QA/QC samples were collected but duplicate samples were not collected during this phase of work, and a dedicated QA/QC programme was instead implemented after completion of the validation sampling. For details of this QA/QC sampling programme, refer to Section 14 of this report. It should be noted that the QA/QC samples were analysed in a manner that provided a lower limit of detection than the standard sample, which was subject to a three day turnaround. Hills Laboratories did carry out their own internal QA/QC processes on the validation samples which included analysing duplicates from each set of samples sent to the laboratory.

4.6. Material Tracking Process and Records

Section 4 has included all the procedures which are undertaken on site with regard to sampling and material movement. Figure 8 provides a summary of the process by which all material on site is tracked.

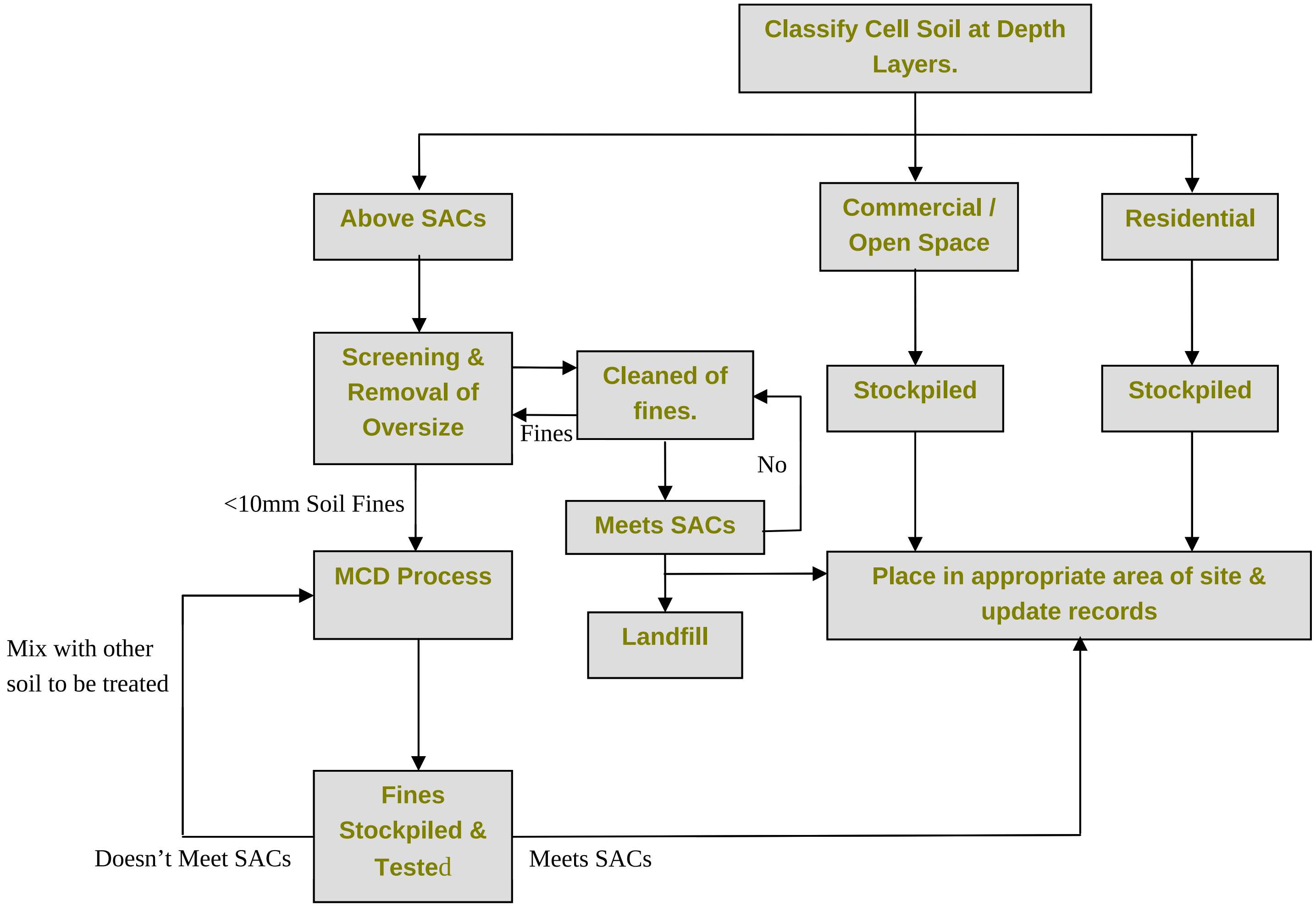
Detailed records are kept by EMS at the Mapua site and systems are in place to indicate where the data can be found. These procedures can be found in the EMS Quality Control / Quality Assurance Procedures report.

For each site MWH have been commissioned to create “as built” drawings from the data provided linked with site levelling data. These show before excavation and backfilled sections of each sub-grade of the site. As built drawings are not available for the East and West Sediments area, instead maps have been produced showing cell and sample locations.

4.7. As Built Drawings

MWH at the completion of the remedial works took the surveyed cells and developed a series of ‘as built’ drawings for the site. These drawings are provided in Appendix F.

■ **Figure 8 Material Tracking Flow Diagram**



5. Analysis of Validation Sampling Data

As stated in the previous sections there were a number of processes used for validating the materials found on site. These were developed from the original Thiess RAP and updated and included in the MfE RAP (April 2005) and in the EMS QA/QC report.

During the remediation work EMS found that the site contained multiple sources of material to remediate and/or replace in controlled locations, and depending on the size and contamination status of the material, it was processed in different ways.

This section outlines how those processes were put into place and the different materials generally encountered.

The sources and processes related to the movement of material around the site are illustrated in Figure 9.

The overall aim of the validation procedure is to validate soil quality on each of the site areas, specifically: FCC East, FCC West, the FCC Landfill and Private Residential. Sections 10 to 15 of this report discuss the validation data by site area. However, some aspects of the validation refer to types of material, e.g. the residential grade excavated material that was stockpiled and sampled prior to distribution. It would appear that the stockpiled material met the relevant SACs, however no separation of these results by final destination site areas can be made as it would have been very difficult to track exactly what portion of the stockpile went to which area. Therefore, the validation of the following material groups will be discussed on a site-wide basis (in Sections 6 to 9) prior to inclusion in the site specific validation sections:

- **'Clean' Residential Stockpiled Material including (Section 6):**
  - Mined Residential material from the excavation process of the FCC East, FCC West and, the FCC Landfill sites;
  - Mined Residential material from the excavated Marine Foreshores; and
  - Failed Imported Marine Sediments.
- **Commercial Grade Stockpiled Material including (Section 7):**
  - Mined Commercial material from the excavation process of the FCC East, FCC West, the FCC Landfill sites;
  - Treated Fines (including 5-10 mm component);
  - Oversize Material; and
  - Crushed Concrete.
- **Exported Material (Section 8)**

- **Imported Material (Section 9)**
  - Validation of soil quality in the final site areas is then based on the above site-wide validation data and additional validation of the following on a sub-site area specific basis.
- **Excavation Results including:**
  - Sample Quality
  - Sample Distribution

The report sections corresponding to each area of the site are:

- **FCC East (Section 10)**
- **FCC Landfill (Section 11)**
- **FCC West (Section 12)**
- **Private Residential Property (Section 13)**
- **Marine Sediments East (Section 14)**
- **Marine Sediments West (Section 15)**

Section 5.7 describes a number of deviations from the RAP that have occurred through the remediation process.

Data representing material either excavated or left in place has been compared against the relevant SACs for each area. The number of samples taken in relation to the area of sampling has also been determined from the data provided. In demonstrating the results, graphs of the sample statistics, normalised to the respective SAC values (converted to a scale where the SAC value = 1), have been generated to allow direct comparison of all values in each section reviewed. In addition, the 95% upper confidence limit of the mean (UCL) has been determined, for sample results in each section, to help provide an average result to assess if an overall area has met the 2004 RAP requirements. The 95% UCL offers a more conservative 'average' than the arithmetic mean.

5.1. Methodology for Additional Data Analysis

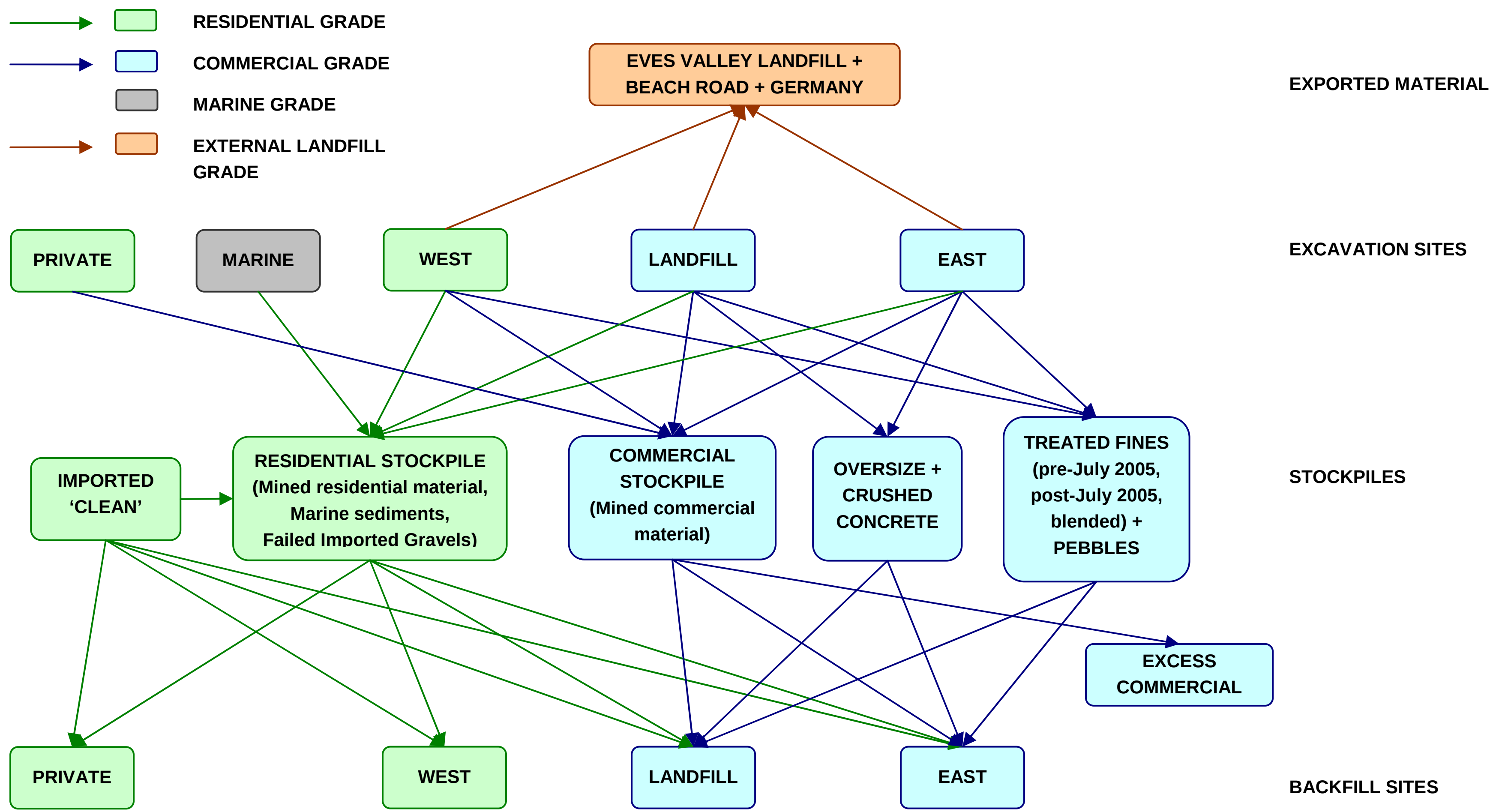
5.1.1. 95% Upper Confidence Limit of the mean (UCL)

As mentioned above, the groups of data (representing an area or volume of soil) have been analysed for the expected average contamination levels. Statistical analyses have been performed to calculate the 95% UCL according to the procedures in the NSW EPA Sampling Design Guidelines (1995). Procedure D in NSW EPA (1995) has been the basis of the analysis, but where the Coefficient of Variation exceeded a value of 1.2, statistical tests support the hypothesis of a lognormal distribution and Procedure G from NSW EPA (1995) was used. Where there were only few distinct data points for a particular substance in a particular area, the level of confidence for generating an expected mean was low and the 95% confidence limit could subsequently be much higher than the maximum detected value. Where this was the case, the maximum sample value in the data set has been used as the upper limit of the mean. This approach is based on recommendations made in the US EPA ProUCL guidance document for calculating the 95% UCL (*Directions to determine 95 percent upper confidence level of the mean using US EPA ProUCL Version 4.0 software package*, June 2008).

5.1.2. Summary Graphs

To compare the sample results for all test suites on the same graph, the maximum and 95% UCL of the results for each substance tested in each site area have been normalised to the relevant SAC target value (converted to a scale where the SAC value = 1). These graphs indicate which substances are of particular interest in each site area and how their statistics compare to the SAC values.

- **Figure 9. Flow diagram showing soil movements during the remediation process.**



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5.2. 'Clean' Residential Material

Excluding the specifically imported material, residential grade material was derived in three ways:

- Material mined from the FCC East, FCC West and the FCC Landfill site;
- Marine Sediments from the West and the East Marine Sites; and,
- Imported marine sediments that failed to meet the marine SAC.

The original Thiess (2004) RAP states that where material is taken from areas that are not adjacent to contaminated cells, it will be sampled at a frequency of 1 per 100 m^3. If material is sourced from a cell adjacent to a cell that exceeds residential criteria, the excavated material will be sampled on a 1 per 25 m^3 basis.

From a validation perspective, it is not possible to determine from the data exactly where the stockpiled material that was sampled came from, or any subsequent information about adjacent cells. The updated RAP (MfE 2005) removes the dependency on adjacent cell data and requires one sample per 100 m^3 for residential material, therefore the sampling frequency has been used.

The residential material was tested for the 100%, 50% and 10% analytical suites at the specified frequencies.

5.3. Commercial Grade Material

Commercial grade material was derived and processed in a number of forms. According to the updated RAP (MfE, 2005 – Appendix 13, Section 7.1), commercial material could be validated *in situ*, as material excavated to storage in piles, and/or material that is moved to access contamination or material located near it.

A more detailed description of the commercial grade material is included in Section 7.

5.3.1. Commercial Stockpiled Material

The updated RAP (MfE, 2005 – Appendix 13, Section 7.1) states that commercial/open space soil derived and used on-site must be sampled every 100 m^3 of commercial material and be analysed for organochlorines.

During removal and sampling of the material on site, to get round the difficult task of estimating 100 m^3 volumes of material, many additional samples were taken. This ensured that while the volumes of the material were not specifically measured per sample, there is confidence that multiple samples were taken for each 100 m^3 of material. This is illustrated by comparison of the number of samples taken with total volume of commercial material stockpiled.

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5.3.2. Treated Material (including 5-10 mm component)

Treated material was initially intended to be validated using the 95% UCL for the mean of the sample results, as per the Thiess (2004) RAP. However, this was found to require too many results to be statistically significant and so from July 2005 onwards, the rolling average method was used with the auditor's agreement, as outlined in Appendix 13, Section 6.6 of the MfE, 2005 RAP.

Information from site indicates that when Effective Management Systems (EMS) began managing the site (late 2004) the methodology for validating the treated fines had not been implemented so samples of the treated stockpiles were taken to verify them. The site then shut down for the Christmas break and in February 2005 EMS attempted to apply the 95% UCL process. As described in section 4.2.2 the 95% UCL method proved to be unworkable so the new rolling average system was put in place as of 26 July 2005.

The treated material validation is therefore split into 'pre-July 2005' and 'post-July 2005' results.

'pre-July 2005': According to the Thiess (2004) RAP, the basis for sample acceptance was that the 95% UCL of the mean concentration of the material shall be less than the target SAC for target OCPs (A+D+10%L and DDX). Although during the treatment process it was not possible to use the 95% UCL as a practical basis for sample acceptance, there are more than enough pre-July 2005 samples in the full data set for the validation to be based on the 95% UCL as originally intended.

'post-July 2005': As previously mentioned, the updated rolling average method of sample acceptance following treatment is outlined in Appendix 13, Section 6.6 of the MfE, 2005 RAP. Material is accepted if no single day's OCP results exceed 1.5 times the commercial SAC and if a rolling average of the last 6 valid samples does not exceed the commercial SAC.

The original RAP stated that the number of samples to be taken should be the lower of a calculation in Appendix D of the AS4482.1:1997 or one sample per 25 m^3. The updated RAP simplifies the process by stating that a sample will be taken from every day's production, at least one per 25 m^3. Each production day processed approximately 25 m^3 of material. Both the pre and post-July 2005 data sets will be validated on a daily basis or one sample per 25 m^3 of material for stockpiled material, with verification that the total number of samples was more than an average of one per 25 m^3.

In addition to the validation of the OCP samples, the updated RAP also required:

- Copper and leachable nitrogen to be analysed for one sample every third day (one sample per 75 m^3 equivalent);
- The 50% validation suite (manganese, selenium and sulphur) to be analysed for one sample every 200 m^3 (one per 8 days equivalent); and

- The 10% validation suite (TPH, VOCs including chlorobenzene, PAH, and heavy metals) to be analysed for one sample every 1000 m^3 of treated soil.

Post Reactor Treatment: Sections of the 'pre-July 2005' material were stockpiled and re-tested when site management changed to EMS. Some of the stockpiled material was found to just exceed the SAC and MfE agreed that the material could be used if it was blended with other clean commercial soil. The details of these agreements are contained in a letter from MfE to EDL (21 March 2005) and subsequently Site Instructions 08 (13 April 2005) and 13 (4 May 2005) (Appendix D.1). The volume of soil required for blending was calculated based on the volume of the contaminated material and the levels of contamination. A summary of the blending and estimated OCP concentrations has been completed to verify that the blended material is below the SAC (Section 7.2.2).

5-10 mm component: Part of the EDL plant process was to eject material between 5 and 10 mm in size. This material had been through the plant's dryer and trommel and therefore undergone a degree of scour cleaning. This material was collected in trucks and used as commercial reburial. A number of samples were taken to test for OCPs and one sample was tested for Chlordane, Heptachlor and other substances. The approximate volume of the 5-10 mm component of the fines was estimated to be 970 m^3 (1,604,000 kg at a density of 1,650 kg/m^3) which equates to approximately 10% of the treated material ("MWH DE table - 21 July 07 with averages.xls" spreadsheet from S. Rogers, 19/9/07).

5.3.3. Oversize Material

The updated RAP (MfE, 2005 – Appendix 13, Section 7.1) states that a representative 50 kg sample is to be taken from each pile of oversize material. The percentage of fines remaining with the oversize material is monitored and must be less than 5% (fines have been defined as percentage of material that passes through a sieve at 4.75 mm). However, Susan Rogers (EMS) reported several times that the wetness of the soil, particularly in the landfill, made screening difficult (if not impossible) to achieve 5%. The Site Auditor, Dr Peter Nadebaum indicated that the fines percentage could be moderated up to 10% as necessary (confirmed in email Susan Rogers to Peter Nadebaum and Susan Walsh of GHD, 13/08/07). Fine material was analysed for OCPs to determine the reburial options.

To estimate the contaminant level of the oversize material, the estimated percentage of fines was multiplied by a conservative estimate of the level of contamination of the fines. Although the RAP states that the OCP contamination levels would be used to determine the appropriate target land use, the reality was that all oversize material was used as commercial backfill. The oversize material comprises gravel, etc. which will not be significantly contaminated.

This is further discussed in section 7.1.3 of this report which analyses stockpiled material validation results.

5.3.4. Crushed Concrete

The updated RAP (MfE, 2005 – Appendix 13, Section 7.1) states that a representative sample of the crushed concrete is ground down in the laboratory and sampled for OCPs to determine the reburial options.

Although not specifically mentioned in the RAP, one sample was taken for every 100 m^3 of concrete.

5.4. Exported Material

Contaminated material and other rubbish (including green-waste and old truck tyres) were exported off-site. There are three groups of exported material:

1) Highly contaminated material was sent in sealed drums to Germany as part of MfE's Ag-Chem programme;
2) Two loads of old car and truck tyres were cleaned and sent to Streetsmart Ltd to be recycled;
3) General rubbish not suitable for reburial was exported to Eves Valley Landfill.

There are no contamination limits for the material drummed and sent to Germany for destruction. This material included highly concentrated products formulated on-site that could not be treated on-site or sent to a landfill. This material has been catalogued by weight being exported and records kept by EMS. Destruction Certificates have been supplied and are presented in Appendix E and they show that 4.046tonnes of material were destroyed at the AVG Hamburg Plant in Germany.

The old truck tyres taken to Streetsmart were cleaned and it was not possible to take samples (pers comm Susan Rogers, 19/09/2007).

As per the updated RAP (MfE, 2005 – Appendix 13, Section 7.1), the fines from the material being exported to landfill have been tested for OCPs and the results compared to the limits of the receiving environment. At least one composite sample was to be taken per 1000 m^3 of material.

The Eves Valley Landfill is managed by MWH and the acceptance guidelines for the Mapua Site waste were explained by Eric Newport, a senior engineering technician with MWH:

"The Eves Valley Landfill […] uses the NSWEPA Guidelines for the Assessment, Classification, & Management of Liquid & Non-liquid Wastes. Under the Guidelines DDX & ADL all fall under the Scheduled Chemical Wastes listed in Appendix 5 and as such are subject to Chemical Control

Orders. The Scheduled Chemical Wastes Chemical Control Order 1994 listed Aldrin, gamma-BHC Lindane, and Dieldrin in Schedule A together with DDD, DDE, & DDT. The order states in Clause 6.5.1 (b) that disposal can be by 'burial in a controlled landfill in an approved manner, where the total concentration of constituents in the waste is less than 50 milligrams per kilogram.' Our interpretation of this for acceptance of waste at Eves Valley from the Mapua site was that no load delivered to the landfill could have a total concentration of all these chemicals combined greater than 50ppm." (email from Eric Newport (MWH) to Phil Outram (SKM), 21 Sept 2007).

The total volume of material disposed to the Eves Valley Landfill was 866.37 tonnes and is contained on landfill charge receipts supplied by Tasman District Council and are provided in Appendix E.

5.5. Imported Material

All imported material came from known uncontaminated sources. According to the updated RAP (MfE, 2005 – Appendix 13, Section 7.1), at least 1 composite sample was to be taken for each 1,000 m^3 of imported material. OCPs were analysed and the results used to confirm that the soil was suitable for its intended end use.

5.6. Excavated Areas/Marine Sediments

According to the RAP (MfE,2005 – Appendix 13, Section 7.1), samples were to be taken from the floors and walls of the excavated areas to build up a data set of residual contamination levels at the cell and subgrade levels for different suites of chemical analyses. The samples from the excavated areas are validated at three levels:

- ***Individual Samples:*** The sample results for all analytical suites (100%, 50% and 10%) pass the Thiess RAP conditions if no single result is 2.5 times higher than the relevant SAC value appropriate to the target end land use. However, the amended RAP (amended 2005) reduces this requirement to 1.5 times higher than the relevant SAC. Typically, EDL based their validation on the factor of 1.5 for all commercial grade validation and the factor of 2.5 for the more stringent residential grade validation. For this validation report the primary test for individual results is the original Thiess RAP conditions, i.e. 2.5 times SAC value.
- ***Cells:*** 100% suite (organochlorine pesticides) results from each excavated cell, including all layers and floors, or marine sediments are averaged to determine the average concentration for each cell. The average concentration from each cell must not exceed the relevant SAC value.
- ***Subgrades:*** The sample results for all analytical suites (100%, 50% and 10%) from excavated cells are grouped into areas of excavation called subgrades that comprise approximately 4 to 8 cells. The average of each subgrade must not exceed the relevant SAC value.

A manual spatial check of the sample results has been performed to verify appropriate sample distribution across the site areas. The original RAP required a minimum of one composite sample to have been taken per wall and/or floor of the excavation which is interpreted as a minimum of one composite sample per cell. Typically, samples were taken from each layer of each wall, as well as from the floor of each cell and this additional level of analysis, above the minimum requirement, has been recorded to improve confidence in the results.

In addition to these minimum Thiess RAP requirements, some statistical analyses have been performed by SKM for this Site Validation Report to increase the confidence in the effectiveness of the remediation and in the validation results and to provide a more detailed picture of the residual contamination levels.

5.7. Variations from Validation Protocols

During the remediation/validation process, the following minor deviations from the RAP were recorded by EMS:

1) Free and complexed cyanide were not tested specifically, instead the total cyanide (CN) concentration was tested and compared to the sum of the SACs for the separate free and complex cyanide components. The SACs for commercial soil were 1,250 and 2,500 mg/kg respectively, so the adopted total cyanide SAC was 3,750 mg/kg. It is noted that this approach creates the possibility that either the free or complex CN SACs may be exceeded if the cyanide is present predominantly in one form or the other, and the total CN concentration exceeds one or both the individual SACs;
2) The laboratory analysed mercury-total recoverable rather than methyl mercury and mercury (inorganic) separately. The SAC for mercury-total recoverable has been calculated as the sum of the separate components, i.e. 50 + 75 = 125 mg/kg for commercial soil. The same issue arises as discussed above for cyanide;
3) There are no validation tests for sulphur (SAC 600 mg/kg) or phenol (SAC 42,500 mg/kg); and
4) The chromium III concentration as % was calculated by dividing chromium III values by 1,000,000 (to convert mg/kg to kg/kg) and multiplying by 100 (convert to %).

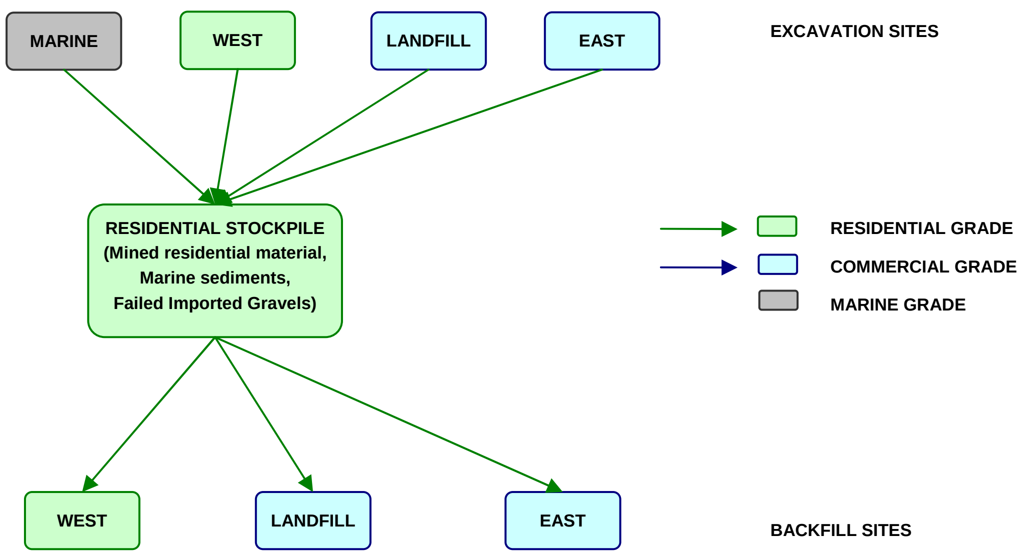
6. Validation Analysis – 'Clean' Residential Material

6.1. Validation Sampling

The 2004 RAP did not anticipate that material would be brought onto site. The 2005 RAP stated that one validation sample for every 100 m^3 should be analysed. It is not known how this figure was generated although the NZ unofficial standard for testing imported material is 1sample per 100 m^3. Other than material imported specifically as residential grade reburial material, the residential stockpile was generated from the following sources, as illustrated in Figure 10.

- Material mined from the FCC East, FCC West and FCC Landfill site;
- Marine Sediments from the West and the East Marine Sites; and,
- Imported marine sediments that failed to meet the marine SAC.

Figure 10. Flow diagram showing contributors and recipients of residential stockpile material.



6.1.1. Material mined from the FCC East, FCC West and Landfill sites.

The volumes of residential stockpile material and associated sample numbers taken from the FCC East, FCC West and Landfill sites are shown in Table 13.

▪ **Table 13. Residential stockpile volume and sample statistics.**

Source	Volume[1] (m^3)	Samples Taken	Avg. Sampling Rate
FCC East	13,888	356	1 sample per 39.0 m^3
FCC West	2,161	19	1 sample per 113.7 m^3
Landfill	2,153	41	1 sample per 52.5 m^3

Note: 1. Ref. MWH's Volume Balance Diagram FINAL, 31 January 2008

An additional 32 quality assurance samples were taken from the stockpile after some piles that were awaiting analysis results were incorrectly moved to the residential stockpile.

Average sampling rates for the residential material taken from FCC East and the Landfill site are better than the number of samples required by the RAP (one per 100 m^3). However, the sampling rate from FCC West is slightly lower than one per 100 m^3. Three additional samples from FCC West would have been required to comply with the RAP sampling rate.

6.1.2. Marine Sediments from the East and West Marine Sites

A volume of 4,796 m^3 was excavated from the East and West Marine sites (Volume Balance Diagram FINAL, MWH 31/01/2008) and added to either the residential ('Clean') stockpile or used directly on the FCC East site.

According to Susan Rogers (email to Phil Outram of SKM, 15/09/2007) the east marine foreshore was excavated and staged on the East by Highway Stabilizers Environmental (HSE). HSE indicated they wanted to try and "stabilise" the marine sediments and use them as residential material. For the East Marine Sediments, HSE indicated they used Portland cement (adding 5 – 7%) as their additive to stabilise the material. 1,855 m^3 of the stabilised material was used as residential backfill in FCC East subgrades 3, 5c, 7, 9, 10, 11 and 14 and FCC West subgrade 25. The balance of these East Marine Sediments was mixed with commercial material and largely used as reburial in subgrades 3 and 14 of FCC East. As the split of samples corresponding to material that went to commercial/residential reburial sites is not known, all the East Marine data must be validated in respect to residential quality.

For the East Marine Sediments, 60 samples were taken from the top of the sediment as pre-validation samples and 86 samples were taken from the walls and floors of the excavated area, doubling up as both excavation and mined material validation samples. The pre-validation and validation samples represent the material well, as it was taken out in a single relatively thin layer.

The West Marine foreshore was excavated by the earthworks contractor and mixed with existing residential material on site as it was still quite wet. It has been used on the FCC West site as backfill. For the West Marine area, 48 pre-excavation samples were taken and 146 validation samples. This totals 194 samples.

For the combined 4,796 m^3 of excavated marine sediments, 146 + 194 = 340 samples were taken. This equates to on average one sample being taken for every 14 m^3 of material which is almost twice the 2004 RAP requirement of one sample every 25 m^3 for residential material.

6.1.3. Imported Marine Sediments that Failed to Meet the Marine SAC

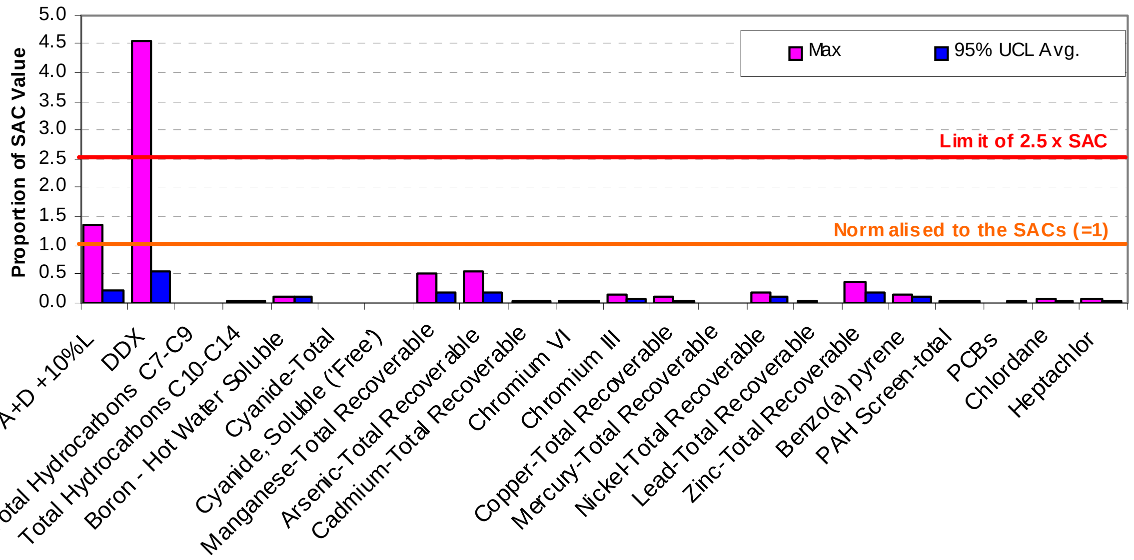
Three piles of marine sediments imported onto site were re-tested and found not to meet the marine SAC. The decision was therefore made by EMS to use the material as residential backfill. This material amounted to 430 m^3 (Volume Balance Diagram FINAL, MWH 31/01/2008) and is represented by 13 samples which equates to 1 sample for every 33 m^3 or 3 per 100 m^3.

6.2. Results

6.2.1. Material mined from the FCC East, FCC West and Landfill sites.

Due to the few results for residential grade material coming from the FCC West (19 samples) and Landfill (41 samples) sites, these and the FCC East results have been combined. The full statistics for the mined residential material are shown inTable 62, Appendix C.

The summary statistics (maximum sample value and 95% UCL of the mean) for the substances with valid SAC are illustrated by Figure 11. This chart shows that some of the ADL and DDX values exceeded the SAC. Of the 447 sample results, 2 ADL values exceeded the SAC of 3 mg/kg and 43 DDX values exceeded the SAC of 5 mg/kg with 7 values exceeding the 2.5 x SAC limit. These values are included in Table 14 with the explanatory notes for some of the higher DDX values on the following page.



- **Figure 11. Maximum and 95% UCL of the mean statistics normalised to the SAC for the mined residential material.**

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- **Table 14. Mined FCC East residential material – samples failing to meet the SAC (all samples in mg/kg)**

Sample ID	Site	Source	SG	Cell	Level	Depth	Lab ID	A+D +10%L	DDX	Note
Residential SAC								***3***	***5***	
1683	FCC East	Floor	5a	E20	1	0.4	381866, 430930	1.05	9.5	
1952	FCC East	Floor	2	F19	6	3.1	384378, 430930	1.05	**13**	Note 1
1949	FCC East	Cell	2	F19	4, 5	0	384379	0.875	8.4	
829	FCC East	0	4	F21	3, 4	0	373627	3.875	1.5	
630	FCC East	Cell	4	F22	2	0	371904	0.525	9.35	
823	FCC East	0	4	F22	3	0	373627	4.075	1.5	
553	FCC East	Cell	2, 20	G17	2	0	371375	1.65	5.3	
855	FCC East	Cell	2, 20	G17	5	0	373920	0.525	6	
857	FCC East	Cell	2	G18	5	0	373920	0.525	8.1	
565	FCC East	Cell	2, 20	H17	2	0	371375	1.875	5.15	
984	FCC East	Floor	2	H17	6	3.6	375728	1.05	8.5	
3629	FCC East	Pile	17	H20	3	0	405566	1.275	10.45	
3640	FCC East	Pile	17	H21	3	0	405567	1.275	**13.5**	Note 2
3641	FCC East	Pile	17	H21	3	0	405567	0.775	7.1	
3643	FCC East	Pile	17	H21	3	0	405567	1.175	**14.8**	Note 2
579	FCC East	Cell	2	I18	2	0	371375	0.525	5.05	
582	FCC East	Cell	2	I18	3	0	371375	0.525	6.95	
393	FCC East	Cell	8	J17	1	0	367910, 368280	0.525	7.25	
2579	FCC East	Cell	8	J17	3	0	390560	0.525	6.4	
2601	FCC East	Cell	8	J17	3	0	390559	1.05	5.5	
2578	FCC East	Cell	8	J17	4	0	390560	0.525	5.25	
1219	FCC East	Cell	8	J19	1	0	377751	2.775	**13.95**	Note 3
2096	FCC East	Cell	8	J19	3	0	385657	1.725	**22.75**	Note 3
2099	FCC East	Cell	8	J19	3	0	385657	0.525	6.65	
2146	FCC East	Cell	8	J19	4, 5	0	386359	2.3	8.1	
2258	FCC East	Floor	16	J22	5	2.42	387582	0.525	5.95	
2054	FCC East	Cell	8	K17	4	0	385283	0.525	6.55	
1550	FCC East	Pile	8, 16	K20	1	0	381405	1.05	5.5	
1551	FCC East	Pile	8, 16	K20	1	0	381405	1.05	5.5	
1556	FCC East	Cell	8, 16	K20	3	0	381405	1.05	9	
2845	FCC East	0	8, 16	K20	5	0	393635	0.58	5.05	
3209	FCC East	Floor	16	K22	5	2.45	397301, 430930	1.05	5.5	
2064	FCC East	Cell	8	L17	4	0	385283	0.975	**12.7**	Note 3
2847	FCC East	Cell	8	L18	4	0	393636	0.525	7.1	
1934	FCC East	Cell	8	L19	1	0	384380	0.775	7.65	
2849	FCC East	Cell	8	L19	5	0	393636	0.525	5.05	
2870	FCC East	Floor	8	L20	6	3.1	393928, 430930	1.05	6.5	
4912	FCC West	0	15	0	0	0	424709	0.525	10.55	
4862	FCC West	0	22	0	0	0	423749	0.525	6.35	
4865	FCC West	0	22	0	0	0	423749	0.525	6.25	
4866	FCC West	0	22	0	0	0	423749	1.075	**12.8**	Note 3
4750	Landfill	0	19	J8	5	0	421450	0.525	6.85	
4474	Landfill	0	19	J8	0	0	416914	0.525	5.8	
4757	Landfill	0	18, 19	K8	R5	0	421450	0.525	7.3	
928	Stockpile	928	Pile	0	0	0	374910	0.525	6.5	

- **Note:** Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Bold Red) if value > (2.5 x SAC)
See text that references this table for note explanations.

Explanatory Notes for Table 14:

Note 1. This sample is considered by EMS (pers comm Susan Rogers, 19/09/2007) anomalous and not representative of the excavated material. It is a floor sample from a significant depth (3.1 m) where the soil was found to be clean. Three other samples (numbers 1953 – 1955 from the original data) also taken from the floor of that cell had values of < LOD, < LOD and 4.5 mg/kg, all of which are below the SAC.

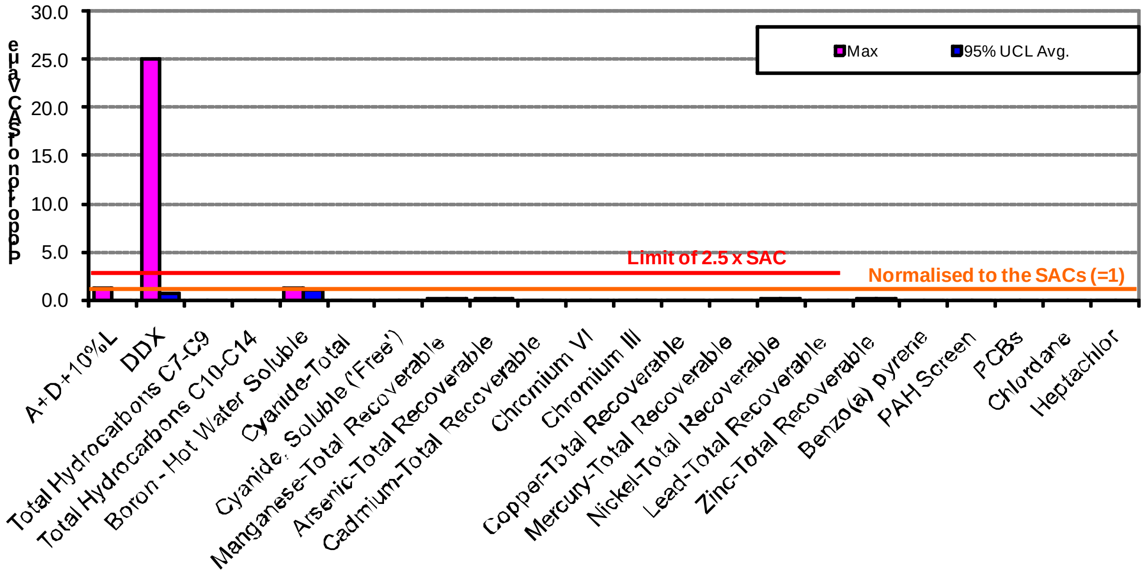
Note 2. These sample results are also considered by EMS (pers comm Susan Rogers, 19/09/2007) anomalous and not representative of the excavated material. In the three floor samples (numbers 1759, 1763 and 1767) where the material came from, neither ADL nor DDX were above the level of analytical detection.

Note 3. These results represent material that was incorrectly moved to the residential stockpile before the results had been verified. All four results exceed the 2.5 x SAC limit and were the prompt for a further 32 QA samples to be taken from the residential pile. All of the QA results were less than 2.5 x SAC.

6.2.2. Marine Sediments from the East and West Marine Sites

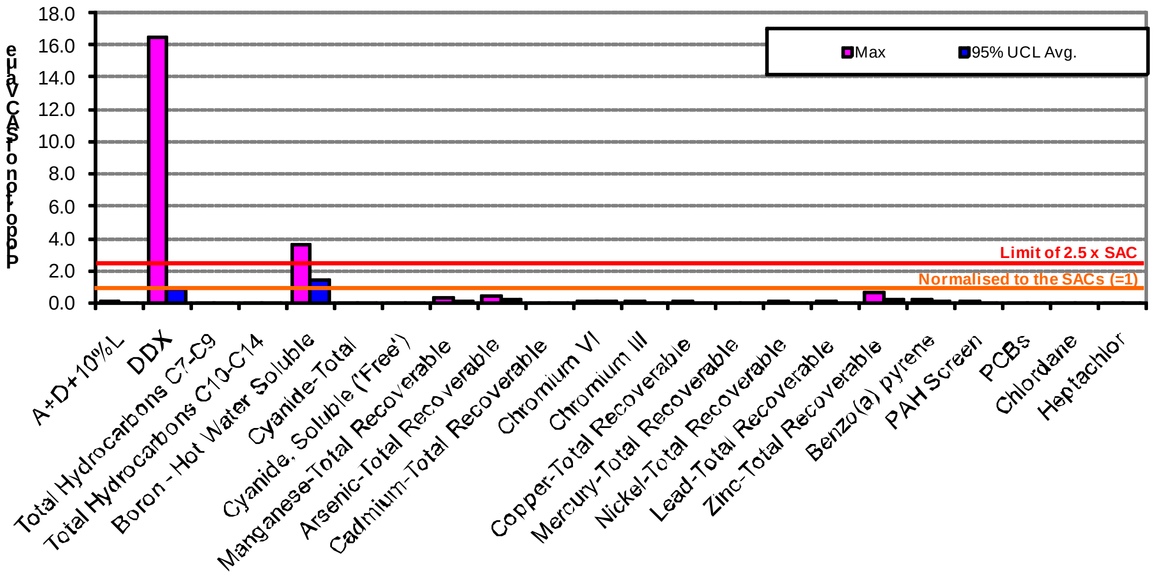
These results have been grouped by excavation site - East and West foreshores. The full statistics for Marine East mined residential material are shown in Table 63, Appendix C, and for Marine West are shown in Table 64, Appendix C.

The summary statistics (Maximum sample value and 95% UCL of the mean) for the substances with SAC are shown in Figure 12 (East Marine) and Figure 13 (West Marine).



- **Figure 12. Maximum and 95% UCL of the mean statistics normalised to the SAC for the Marine East mined residential material.**

Both summary statistics charts show that the maximum DDX values in the marine areas have far exceeded the residential SAC. The samples with concentrations higher than the SAC for the East and West Marine areas are shown in Table 15 and Table 16 respectively.



- **Figure 13. Maximum and 95% UCL of the mean statistics normalised to the SAC for the Marine West mined residential material.**

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- **Table 15. Excavated Marine East residential material – samples failing to meet the SAC (all sample values in mg/kg).**

Sample ID	Date	Cell	Level	Depth	Lab ID	A+D +10%L	DDX
Residential SAC						***3***	***5***
Pre-Excavation							
1003	26/04/2005	FE 1-1	0	0.15	376338	0.041625	**19.6582**
1021	26/04/2005	FE 3-3	15	0.15	376338	0.084225	5.3327
1065	26/04/2005	FE 5	10	0.5	376337	0.01955	8.2404
1067	26/04/2005	FE 6	10	0.5	376337	0.01003	7.5538
1075	26/04/2005	FE 10	10	0.5	376337	0.46142	5.876
Validation							
1418	24/05/2005	11			379457	0.2205	**125.47**
1423	24/05/2005	11			379457	3.923	**58.3**
Pile	8, 16	K20	1		381405	1.05	5.5

Note: Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Red) if value > (2.5 x SAC).

For the East Marine site, three DDX samples from 146 failed to meet the 2.5 x SAC limit, with two of the failures exceeding the SAC by factors of 12 and 25. However, the 95% UCL values are 0.06 mg/kg for ADL and 4.09 mg/kg for DDX which are both below the SAC of 3 mg/kg and 5 mg/kg respectively (Table 63, Appendix C).

- **Table 16. Excavated Marine West residential material – samples failing to meet the SAC (all sample values in mg/kg).**

Sample ID	Date	Cell	Level	Depth	Lab ID	A+D +10%L	DDX	Boron – Hot Water Soluble
Residential SAC						***3***	***5***	***3***
Pre-Excavation								
1125	4-May-05				377414	0.26803	9.02	
1134	4-May-05				377414	0.02642	**13.27**	
1170	9-May-05				377611	0.00381	7.91	
1171	9-May-05				377611	0.01918	10.48	
1172	9-May-05				377611	0.00888	5.86	
1175	9-May-05				377611	0.00387	**23.21**	
1176	9-May-05				377611	0.01706	**17.36**	
Validation								
4586	3-May-06	O8	1	0.5	417409	0.22434	**15.06**	
4554	3/05/06	P3	1	0.5	417189	0.000775	0.01	4.9
4415	28-Apr-06	I6	1	0.2-0.6	416945	0.02809	**13.26**	
4416	28-Apr-06	I6	2	0.2-0.6	416945	0.09118	7.68	
4445	28-Apr-06	I7	1	0.2-0.6	416944	0.01799	**30.81**	
4412	28-Apr-06	J5	1	0.2-0.6	416945	0.02775	**82.23**	
4409	28-Apr-06	J6	1	0.2-0.6	416945	0.00183	10.50	
4410	28-Apr-06	J6	2	0.2-0.6	416945	0.00598	**36.65**	
4418	28-Apr-06	K5	1	0.2-0.6	416945	0.00618	**13.78**	
4443	28-Apr-06	L3	2	0.2-0.6	416944	0.01686	**13.34**	
4430	28-Apr-06	N1	1	0.2-0.6	416946	0.05611	6.07	
4643	9-May-06	08	1 to 2	0.2-0.6	417966	0.13454	9.05	
4454	29-Apr-06	#7		0.6	416911	0.09379	**15.45**	
4445	28-Apr-06	I7	1	0.2-0.6	416944	0.01799	**30.81**	

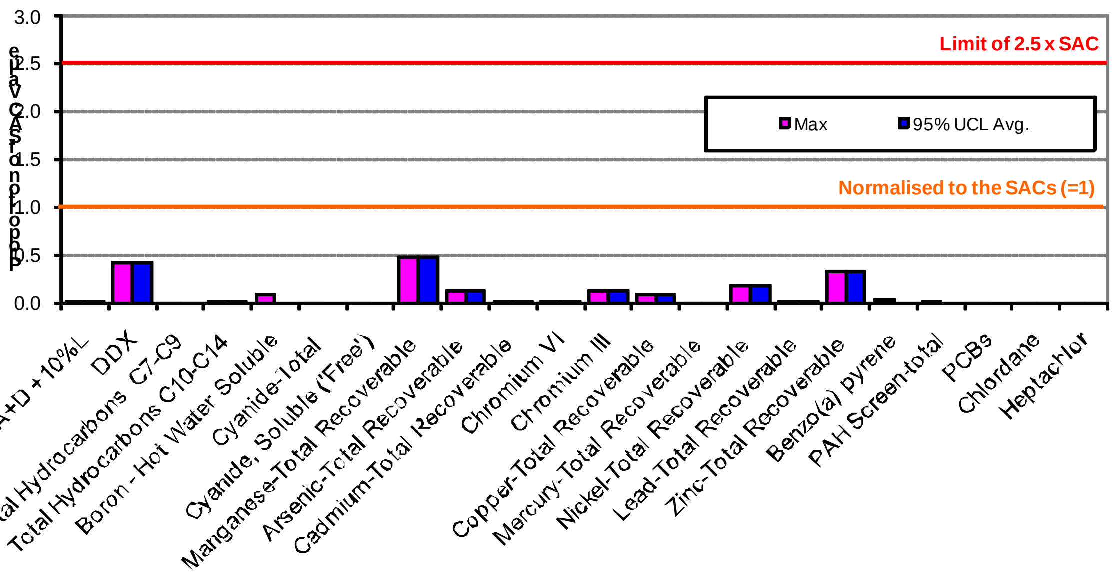
Sample ID	Date	Cell	Level	Depth	Lab ID	A+D +10%L	DDX	Boron – Hot Water Soluble
4412	28-Apr-06	J5	1	0.2-0.6	416945	0.02775	82.23	
4559	3/05/06	Q8	1	0.5	417189	0.05358	0.43395	6.1
4546	3/05/06	P2	1	0.4	417188	0.00222	0.3019	10.8
4453	29-Apr-06	#6	0	0.6	416911	0.00269	0.18455	5.9

Note: Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Red) if value > (2.5 x SAC) .

For the West Marine site, 12 of the 194 samples failed to meet the 2.5 x SAC limit (11 failing the DDX test and 1 failing the Boron test). Additionally, while the 95% UCL for the DDX, at 4.6 mg/kg is below the SAC (Table 64, Appendix C), due to the small number of Boron results and therefore greater uncertainty, the 95% UCL for Boron is 4.19 mg/kg which exceeds the Boron SAC of 3 mg/kg, therefore the SAC of 3 mg/kg was used.

6.2.3. Imported sediments exceeding marine SAC used as residential material.

The full summary statistics for the imported marine gravels used as residential material are shown in Table 65, Appendix C. None of the results exceeded the residential SAC and summary statistics (maximum sample value and 95% UCL of the mean) for the substances with SACs are shown in Figure 14.



- **Figure 14. Maximum and 95% UCL of the mean statistics normalised to the SAC for the failed marine sediment used as residential material.**

6.3. Discussion and Conclusions

The excavated residential material results contained seven samples with >2.5 x SAC contamination which mostly represents material that has been accidentally added to the residential stockpile.

However, these contaminated samples represent less than 2% of the samples taken for this excavated material. Assuming that the residential stockpile has had a degree of mixing as it was used, the small proportion of non-compliant results would be diluted to low concentrations in the material handling and placement process. In addition, the 95% UCL was only half of the SAC which gives additional confidence that overall the material has acceptable contaminant levels. All soils placed on the site will also be covered with an additional 0.5m of imported top soil from a known clean source, providing another layer of protection.

Both the East and West Marine sediments had some very high individual DDX results (the marine sediments referred to here are those excavated (mined) for residential use and not those discussed in Section 9, 14 and 15). However, the 95% UCL of the mean was below the SAC in both cases. On the West Marine site, there were also some high boron readings and the 95% UCL was above the SAC although with relatively few (25) sample points for the analysis. Susan Rogers (pers. comm. Phil Outram, SKM, 14/09/2007) reported that these results prompted significant discussion at site meetings and failures were acknowledged. However, the average was considered low enough to proceed.

The marine sediments which failed to meet the marine SAC and were then used as residential material, as they met the residential SAC.

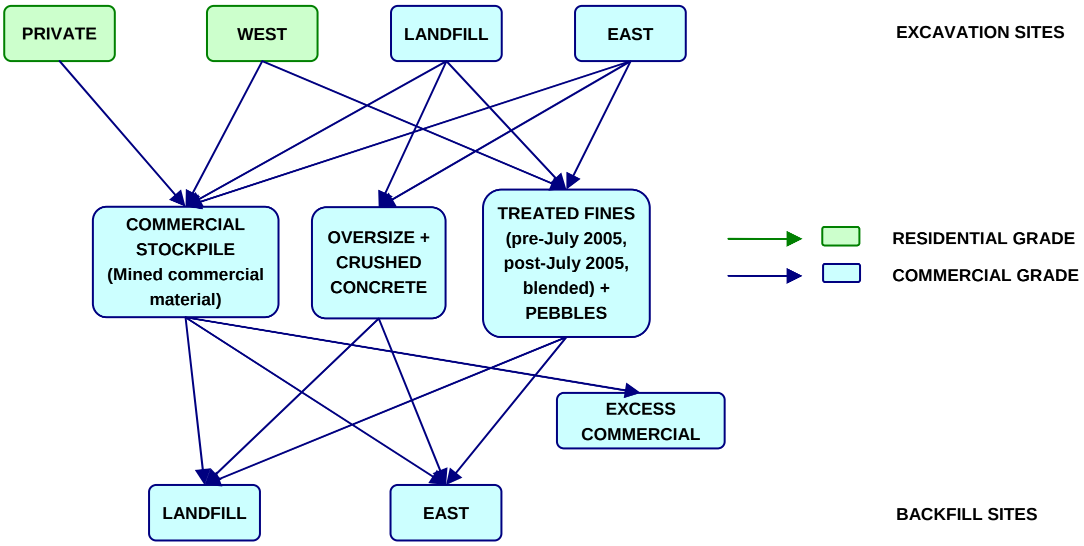
7. Validation Analysis – Commercial Material

7.1. Validation Sampling

Commercial grade material was derived and processed in the following forms, as illustrated in Figure 15.

- Mined Commercial material from the excavation process of the FCC East, FCC West, the FCC Landfill sites,
- Treated Fines (including 5-10 mm component),
- Oversize Material, and
- Crushed Concrete.

- **Figure 15. Flow diagram showing contributors and recipients of commercial stockpile material.**



7.1.1. Commercial Stockpiled Material

A volume of 27,485 m^3 of commercial grade material was mined from FCC East, FCC West, FCC Landfill and Private Residential property for use as reburial material (Volume Balance Diagram FINAL, MWH 31/01/2008). 1,698 samples were taken of this material (including excavation samples) which equates to an average sampling rate of one sample per 16.2 m^3 material. This gives confidence that the RAP requirement of one sample per 100 m^3 has been comfortably met.

7.1.2. Treated Material (including 5-10 mm component)

'pre-July 2005': The first samples of treated material were taken on 23 December 2004. Until the plant shut-down in July 2005 for major repairs, 151 samples were taken for analysis, and the material was considered to have met the treatment criteria. These samples were taken from both existing piles of treated material and newly treated material coming out of the plant. Summing the *in situ* volumes of material that 'passed' (were not consequently blended or re-treated) ('1874 EDL progress to 23 Jul 07 FINAL.xls' spreadsheet from S Rogers, 17/08/07) gives an estimate for the total volume successfully treated during this initial period of 1,410 m^3.

The original RAP required at least one sample to be taken per 25 m^3. 118 OCP samples were taken for the 1,410 m^3 which gives one sample per 12 m^3 and implies that double the minimum number of samples were taken, i.e. enough to confidently assess the contamination status of the treated material.

Having realised that the 95% UCL method of validation was impractical and then having adopted the rolling average method, the EMS site team went back and reviewed how the new protocol could be applied to the previous results. However, the rolling average technique was principally adopted to facilitate more straight forward acceptance/failure of a low number of samples, and is not the best post-remediation validation technique. This report will therefore validate the 'pre-July 2005' treated fines results using the original 95% UCL statistic; the full data set of 151 results provides enough samples to get a good appreciation of the contamination levels.

'post-July 2005': From September 2005, when the treatment plant reopened, the sampling followed the protocol outlined in Appendix 13 of the updated RAP. Validation focuses on verifying the rolling and daily batch results not exceeding 2.5 x SAC and the SAC respectively. However, to get a feel for the overall levels of contamination of the materials, all substances were tested for SAC compliance and the basic statistics calculated (max., min., 95% UCL).

According to MWH's Volume Balance Diagram FINAL (31/01/2008), 10,584 m^3 of material has been treated by the MCD plant. Less the 'pre-July 2005' treatment of 1,410 m^3, this implies that approximately 9,174 m^3 of material was treated between July 2005 and July 2007 (when the MCD plant was decommissioned).

The updated RAP required a range of analytical suites to be tested. OCPs have been tested on a daily basis, which satisfies the RAP on the assumption that the material treated each day is approximately 25 m^3. In addition to the validation of the OCP samples, the updated RAP also required:

- Copper and leachable nitrogen to be analysed in one sample every third day (75 m^3 equivalent). 136 samples were taken for copper analysis and 49 for leachable nitrogen.

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Assuming total production since Sept 2005 of 9,174 m^3 as discussed above, this equates to one copper analysis every 73 m^3 which satisfies the updated RAP. The leachable nitrogen however has been analysed at the average rate of once per 190 m^3;

- The 50% validation suite (manganese, selenium and sulphur) were to be analysed in one sample every 200 m^3 (8 days equivalent). 136 samples were analysed for manganese and 52 for selenium, both of which are at a higher rate than one sample per 200 m^3. As discussed in Section 5.7, sulphur has not been tested for; and
- The 10% validation suite (TPH, VOCs including chlorobenzene, PAH, and heavy metals) was to be analysed for one sample for every 1000 m^3 of treated soil. The 10% suite had between 9 and 42 samples taken and analysed per substance for the 9,174 m^3 of material. Over this range, all substances were tested at least once per an approximate 1000 m^3 of soil as per the RAP.

Post Reactor Treatment: Some of the first material to be put through the MCD treatment plant was immediately stockpiled. When EMS began managing the site and tested this material, some of it was found to marginally exceed the residential SAC. As discussed in Section 5.3.2, MfE agreed in consultation with the Site Auditor, that the material could be blended/diluted post treatment with some other low contamination treated fines at the ratio of two parts clean treated fines to 1 part contaminated treated fines.

There are no RAP conditions for this post reactor treatment, so the standard commercial OCP SAC have been used for the validation.

Two contaminated batches were blended. The first batch, with material from site piles 2, 3 and 5, had a volume of 87 m^3. The second batch, with material from site pile A and FCC East cells I23, I24, J23, J24, had a volume of 307.5 m^3.

Following the blending which took the total material volume in the two batches to 1,217 m^3, 8 samples were taken as additional validation of the material contamination. This equates to approximately one sample per 150 m^3 of material. There is nothing in the RAP to compare this number to, but this sampling frequency seems reasonable given that the material has knowingly been mixed and the contamination levels of the original material was already known.

Batch 1 has been reburied predominantly in SG14 and batch 2 reburied predominantly in SG8 of FCC East.

5-10 mm component: As discussed in Section 5.3.2, the MCD plant process sorted and ejected material between 5 and 10 mm in size. This material was collected in trucks and used as commercial reburial and so 6 samples were taken to test for OCPs and one sample was tested for Chlordane, Heptachlor and other substances for comparison to the commercial SAC.

The approximate volume of the 5-10 mm component of the fines produced was estimated to be 970 m^3 (refer to Section 5.3.2). 9 samples therefore give a sampling rate of approximately one per 100 m^3 which is the required sampling rate for commercial material derived and used on site (updated RAP Appendix 13, Section 6.4).

7.1.3. Oversize Material

Oversize material was removed from the FCC East, Landfill and FCC West areas. The level of oversize material contamination is a product of the amount of fines attached to the oversize material and the contamination level of the fines. The oversize material comprises gravel, etc which will not be significantly contaminated.

An estimate of the contamination of the oversize material was made using the following calculation:

Contamination of the oversize material =
Estimated percentage fines per volume of oversize sample
× Conservative estimate of the contamination of the fine material.

Individual OCP samples were taken of the fines from different oversize pieces. However, these OCP test results were not associated with specific oversize pieces so could not be connected with the percentage of fines for the oversize pieces and therefore were not used directly to calculate the contamination levels. Instead, the average MCD plant infeed contamination levels were used as a conservative estimate of the treated fines contamination for all oversize samples.

The updated RAP (Appendix 13, Section 6.4) required tests to be done on a single 50 kg representative sample from the oversize pile. In this case, 12 sample tests were performed on the oversize material.

7.1.4. Crushed Concrete

2,028 m^3 of crushed concrete has been generated from the FCC East, FCC West and Landfill sites (Volume Balance Diagram FINAL, MWH 31/01/2008).

For the crushed concrete, 53 samples were tested for OCPs which equates to approximately one sample per 40 m^3 of material which constitutes a representative sample as required by the updated RAP.

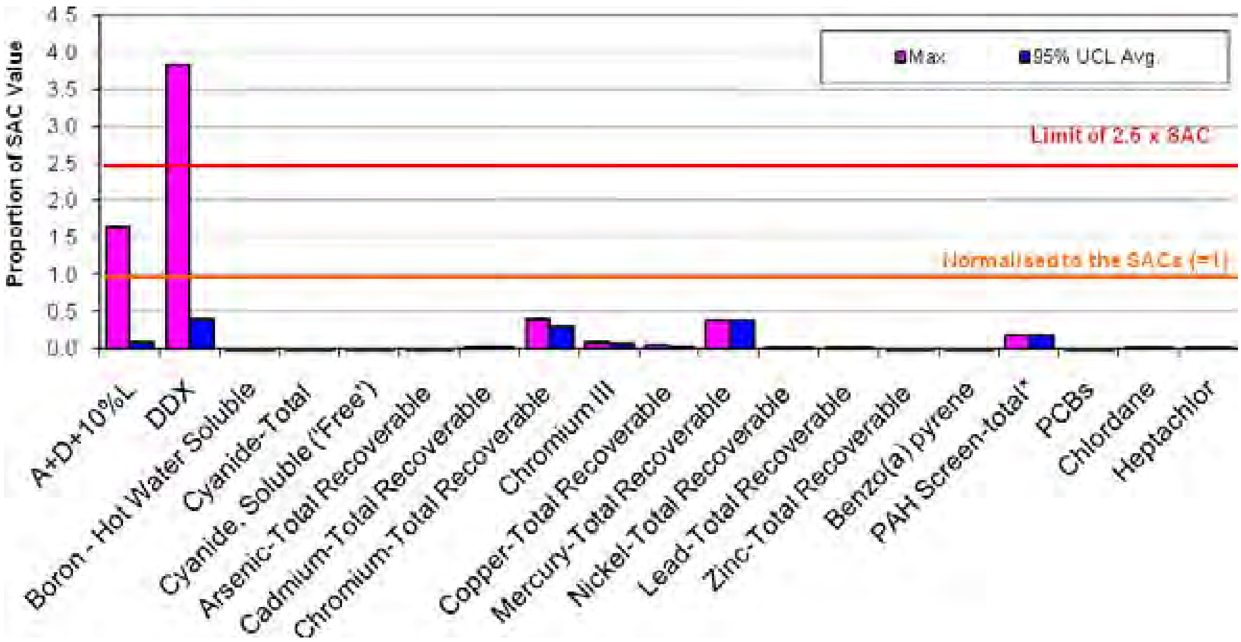
7.2. Results

7.2.1. Commercial Stockpiled Material

The full statistics for the commercial grade reburial material are shown in Table 66, Appendix C.

The summary statistics (maximum sample value and 95% UCL of the mean) for the substances with valid SACs are illustrated by Figure 16. From this chart and Table 66, it can be seen that of the 1,698 ADL results, 6 were marginal (between 1 and 2.5 of the SAC) and none failed (exceeded 2.5 times the SAC). Of the 1,698 DDX results 53 were marginal and 4 failed. These marginal and failed results are shown on Table 17. The 95% UCL average for ADL and DDX were 5.4 mg/kg and 79.3 mg/kg respectively.

- **Figure 16. Maximum and 95% UCL of the mean statistics normalised to the SAC for the commercial reburial material.**



- **Table 17. Commercial material – samples failing to meet the SAC (all sample values in mg/kg).**

Sample ID	Target Subgrade	Source Cell	Source Level	Other Descriptor	A+D+10%L	DDX
Residential SAC					***60***	***200***
287	SG 2	G18,	1, 2	From underneath EDL Pad	41.01	386.45
388	SG 2	I18	1		6.640	219.25
1208	SG 2	J20	1		7.875	216
1209	SG 2	J20	1		10.200	278.6
1599	SG 2	J20	1		18.025	210.15
446	SG 3	H23	4		2.875	208.95
1476	SG 3, SG 8	G22	2		1.275	303.35
2589	SG 3	K20	2		12.080	216.5
1626	SG 6	I22	1	Composite 2	13.920	231.55
1709	SG 6	I22	2	Pit 2 Wall Composite	16.950	391.85

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Sample ID	Target Subgrade	Source Cell	Source Level	Other Descriptor	A+D+10%L	DDX
1712	SG 6	I22	2	Pit 3 Top Pile	7.125	207.15
752	SG 7	I23	4		43.325	271.4
754	SG 7	I23	4		19.825	225.55
755	SG 7	I23	4		12.625	214.5
1792	SG 7	K18	1	Pit 3	2.475	301.9
1793	SG 7	K18	2	Pit 3	3.125	342
1923	SG 7	L18	1		1.775	579.2
2668	SG 8			North Pile, Left Over, Quad 3	24.350	506
2036	SG 9	I25, J25	1,2,3,4,5,6		27.025	219.5
2233	SG 9	I25, J25	1,2,3,4,5	unscreened #4	23.025	257.55
4236	SG 17, SG 18	N8	1, 2, 3, 4	Landfill	9.090	236.3
4239	SG 17, SG 18	N8	1, 2, 3, 4	Landfill	12.960	204.6
3144	SG 18	K5, K6,	1,2,3,4		11.380	251.8
3145	SG 18	K5, K6,	1,2,3,4		16.610	208.4
3152	SG 18	K7, K8	1, 2, 3, 4		18.040	257.6
3464	SG 18	L6, L7		Backfill	65.000	146.55
3465	SG 18	L6, L7		Backfill	25.500	239.15
3523	SG 18	J9	4		1.675	227.2
3532	SG 18	J7, J8,			36.800	246.15
3534	SG 18	J7, J8,			98.200	75.95
3535	SG 18	J7, J8,			83.300	198
3536	SG 18	J7, J8,			62.800	56.15
3537	SG 18	J7, J8,			90.200	176.1
3586	SG 18			Multiple TF cells	10.610	230.35
3808	SG 18	J9	3	Insitu	14.950	286.7
3863	SG 18	J8	3		59.600	223.7
3895	SG 18	L6, L7	2		1.620	204.85
3907	SG 18	M5, M6,	2		6.560	353.1
3921	SG 18	J20,	1, 2, 3, 4, 5	Screened	9.170	210.8
3953	SG 18	L8	1, 2, 3, 4	Dig A Waste Screened Pile	20.550	203.1
3955	SG 18	L8	1, 2, 3, 4	Dig A Waste Screened Pile	29.610	220.6
3923	SG 18	J20,	1, 2, 3, 4, 5	Screened	10.050	238.8
4709	SG 18	I8, J8	1,2	Strawberry Area	32.640	764.5
5189	SG 19b			Yard Scrap	32.210	265.6
5190	SG 19b			Yard Scrap	21.130	210.2
3835	East Surface	M10	2		81.240	109.9
5369	East Surface			Gate – Stockpile #2	1.275	342.3
5645	East Surface	J10	1	Quad 4	10.840	219.9
5885	East Surface	K10	1	Quad 1	9.625	282.45
5888	East Surface	K10	1	Quad 4	8.660	544.4
6156	East Surface	J10	1	Quad 1	6.225	348.7
6236	East Surface	J10	2	Quad 1	12.840	201
6387	East Surface	M12	1	Quad 4	13.690	225.8
6490	East Surface	J11	1	Quad 2	2.550	259
6566	East Surface	K12	1	Quad 1	14.410	207.3
6680	Landfill Surface	H11		Quad 3, +300 pile	5.680	295.5
6681	Landfill Surface	H11		Quad 4, +300 pile	33.720	203.3
6730	Landfill Surface	I10		Quad 2, +300 pile	10.670	248.3
6731	Landfill Surface	I10		Quad 3, +300 pile	20.380	220.2
6732	Landfill Surface	I10		Quad 4, +300 pile	16.150	237.8
6734	Landfill Surface	I11		Quad 2, +300 pile	24.950	242.5
6740	Landfill Surface	I12		Quad 4, +300 pile	13.425	287.3

Note: Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Red) if value > (2.5 x SAC)

To put the individual samples of the commercial reburial material into context, Table 18 shows the OCP sample results averaged over the subgrades where the material was used. All subgrade average concentrations were found to be below the commercial SAC.

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Table 18. Commercial reburial material – OCP results averaged by Target Subgrade (all samples values in mg/kg)

Target Subgrade	# Samples	ADL	DDX
Commercial SAC		***50***	***200***
East Site			
SG 2	168	2.35	36.66
SG 3	40	3.11	62.29
SG 4	36	3.18	41.52
SG 5	39	1.82	21.12
SG 6	22	4.54	85.95
SG 7	60	2.65	67.18
SG 8	73	3.95	35.89
SG 9	36	7.15	63.90
SG 10	0	N/A	N/A
SG 11	13	1.00	16.77
SG 12	35	2.81	30.58
SG 13	4	1.00	4.00
SG 14	4	1.00	2.00
SG 15	0	N/A	N/A
SG 16	29	2.14	46.67
SG 17	78	2.55	30.36
SG 20	31	0.92	9.84
Sub-Total	**668**	**2.87**	**40.64**
Landfill			
SG 18	276	8.29	72.79
SG 19 a	34	2.86	31.38
SG 19 b	16	12.94	84.63
SG 19 c	0	N/A	N/A
Sub-Total	**326**	**7.95**	**69.05**
Other			
East Surface	546	5.52	40.43
Landfill Surface	158	3.29	44.20
Sub-Total	**704**	**5.02**	**41.27**
Total	1698	4.74	46.36

Note: Zero samples for a subgrade indicates that the subgrade received no commercial reburial material.

7.2.2. Treated Material (including 5-10 mm Component)

'pre-July 2005': The results for all samples are shown on Table 67, Appendix C. A summary of these results are shown graphically in Figure 17.

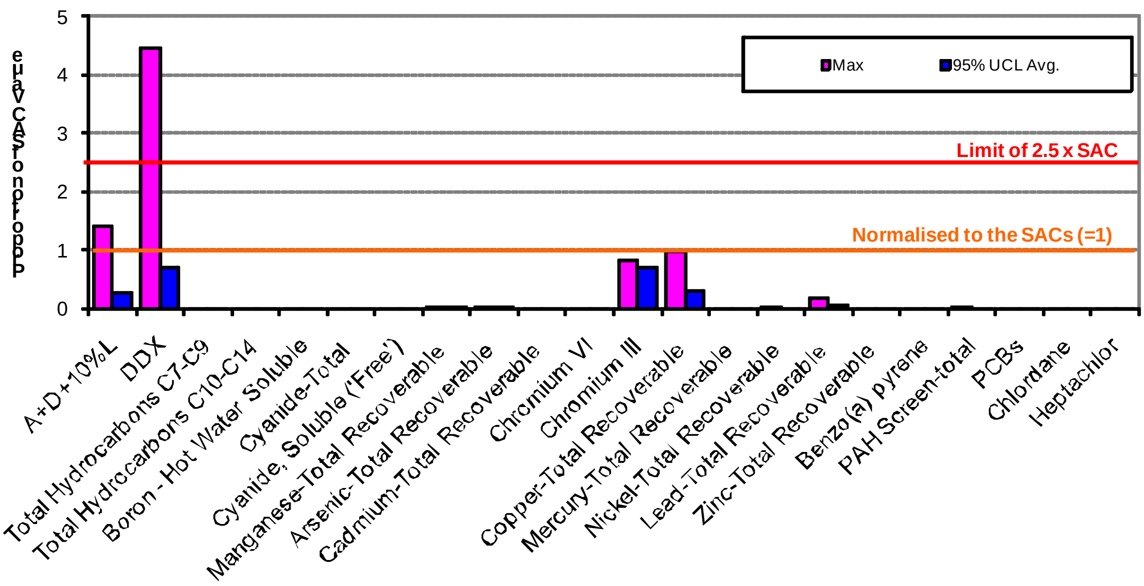


Figure 17. Maximum and 95% UCL of the mean statistics normalised to the SAC for the 'pre-July 2005' treated fines validation

As can be seen from Figure 17, the aim of the treatment has been met according to the original RAP – the 95% UCLs for all substances are well below the corresponding SAC. However, some DDX values are above the 2.5 x SAC limit and some ADL values are above the SAC (but below 2.5 times SAC). The 16 marginal or failed DDX and ADL values from the 151 samples that were passed are shown in Table 19.

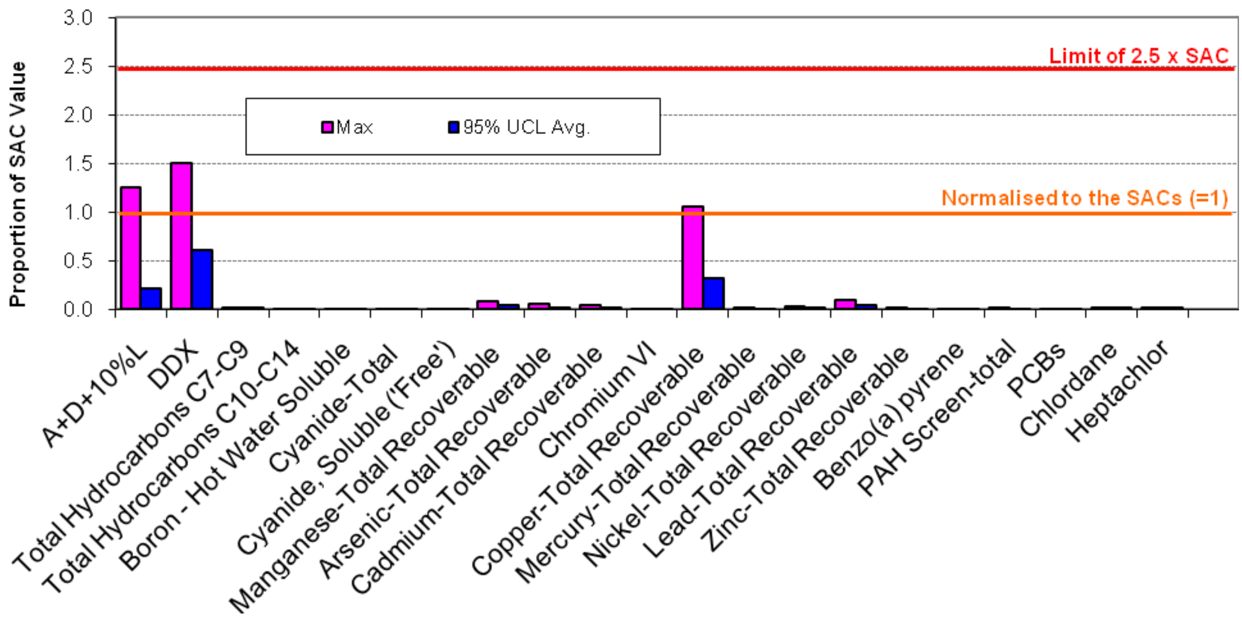
Table 19. 'Pre-July 2005' samples failing to meet the SAC (all samples values in m/kg).

Sample ID	Source	Date	Time	Cell	Level	Lab ID	A+D +10%L	DDX
Commercial SAC							***60***	***200***
108	Pile	23-Dec-04		J23	1	365327	22.925	232.9
118	Pile	23-Dec-04		J23	1	365327	70.22	878
261	Top	3-Feb-05	1100	J23, J24	1,2	367306	84.09	167.4
263	Bottom	3-Feb-05	1100	J23, J24	1,2	367306	70.55	103.25
600	T/B Mill	11-Mar-05	15:00	J23	2	371905	18.05	205.5
1098	T/B Mill	28-Apr-05	11:00	H23	3	376339	32.2	206
1110	T/B Mill	6-May-05	11:00	J20, G18, H18		377416	76.6	891
104	T/B Mill	20-May-05	15:30	Waimea Res No 1		379178	26.1	210
7028	T/B Mill	18-Jun-05	12:00	H20, G25	1	381532	25.61	235.6
7029	T/B Mill	20-Jun-05	09:00	H20, G25	1	381532	19.69	225.9
7031	Pile	20-Jun-05		H20, G25	1	381532	21.9	216.5
7056	T/B Mill	5-Jul-05	00:00	J23 Ben, HIJ No 1		383611	14.31	225.1
7065	T/B Mill	12-Jul-05	13:15	I21	2	384266	23.72	252.8
7066	T/B Mill	13-Jul-05	11:15	I21	2	384266	16.82	200

Sample ID	Source	Date	Time	Cell	Level	Lab ID	A+D +10%L	DDX
7067	Pile	18-Jul-05		I21	2	384266	16.27	209.8
7076	T/B Mill	22-Jul-05	11:15	I21	1	384900	6.02	229.2

Note: Orange values denote the sample result exceeded the SAC but was less than 2.5 x SAC. Red values have exceeded 2.5 x SAC.

'post-July 2005': The results for all samples are shown on Table 68, Appendix C. A summary of these results are shown graphically in Figure 18 which highlights the fact that no single value was above the limit of 2.5 x SAC. It also shows that the 95% UCLs are well below the commercial SAC, although there were two copper tests that just exceeded the SAC but not the 2.5 x SAC limit.



- **Figure 18. Maximum and 95% UCL of the mean statistics normalised to the SAC for the 'post-July 2005' treated fines validation**

The individual A+D+10%L and DDX results and the rolling averages are displayed on Figure 19 and Figure 20.

Figure 19 shows that the A+D+10%L rolling average never exceeded the SAC limit and the individual results never went above the 2.5 x SAC limit (consistent with the individual sample SAC limits of the original consent requirements).

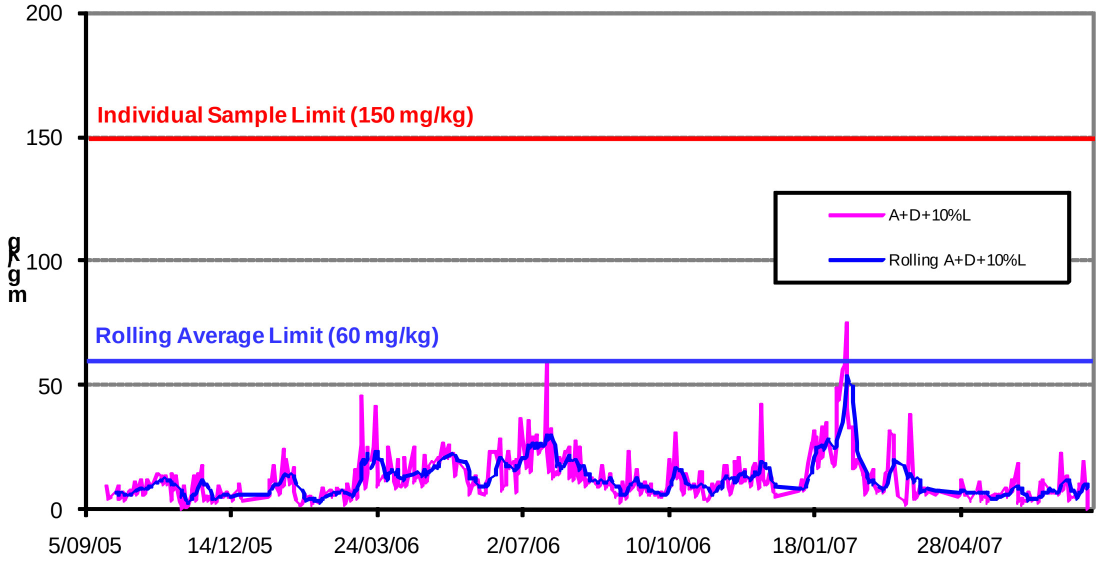


Figure 19. Individual ADL 'post-July 2005' treated fines results plus rolling average.

Figure 20, together with Table 68 (Appendix C), shows how the maximum individual DDX value never exceeded the 2.5 x SAC limit, but there was a single occasion (19/01/2006) when the rolling average exceeded the SAC value. This was due to an error in one rolling average formula but, Figure 20 illustrates the result (208 mg/kg versus the SAC of 200 mg/kg) is insignificant when considered against the full dataset of 477 results.

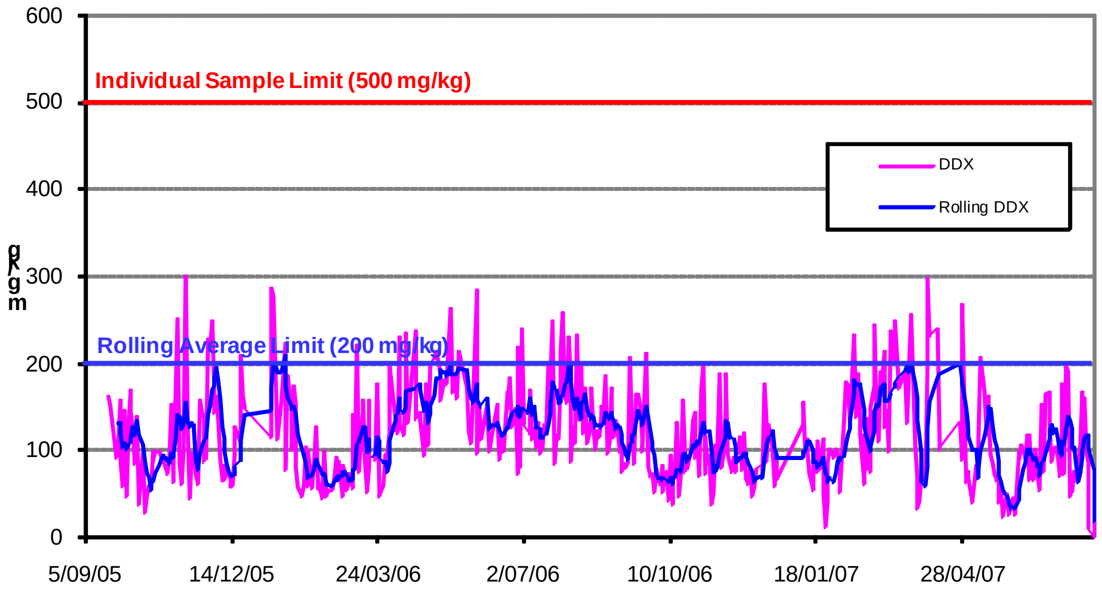


Figure 20. Individual DDX 'post-July 2005' treated fines results plus rolling average.

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These graphs show that the 'post-July 2005' treated fines process ensured the fines were meeting the updated RAP requirements.

Post Reactor Treatment: Two batches of contaminated treated fines were blended with low contamination treated fines and clay from the FCC East site surge chamber to reduce the contamination concentrations.

Table 20 shows the contamination levels and volume balance for Batch 1. To get a ratio of 2:1 clean to contaminated material, the blending process requires twice as much clean material as is contaminated. For Batch 1, the total volume of contaminated material (which can be seen to exceed the commercial DDX SAC) is 87 m^3 so an additional 174 m^3 is required. This was provided from a set of low contamination treated fines and imported clay that had been used at the surge chamber. Three clay samples were tested for DDX and ADL and as the clay was not kept separated, the clay material uses the average sample result for the three clay cuts. The clay is used in the blending of both batches.

Performing a mass/volume balance for the different components of the batch allowed an estimate to be made for the complete batch's average DDX and ADL concentrations as shown on the last line of Table 20.

- **Table 20. Summary of post reactor treatment for contaminated treated fines Batch 1.**

Source	Also Known As:	Estimated Volume (m^3)	DDX (mg/kg)	ADL (mg/kg)
Contaminated Material Being Treated				
Pile 2	I24 L1 (1/2)	34	218.6	15.54
Pile 3	H24 L1	23	218.3	19.4
Pile 5	H23 L2	30	215	13.8
Total Volume of Contaminated Fines		**87**		
Volume of Clean material required for a 2:1 ratio		**174**		
Low Contamination Blend material				
29-Apr	J20 G18 H18 etc	13.75	63	5.1
30-Apr	J20 G18 H18 etc	11.25	59	8.1
3-May	J20 G18 H18 etc	13.75	57	6.1
5-May	J20 G18 H18 etc	17.5	61	9.1
6-May	J20 G18 H18 etc	12.5	70	7.1
7-May	J20 G18 H18 etc	15	63	6.1
Clay from Surge Chamber		90	67.8	2.6
Total Volume of Low Contaminant Treated Fines		**173.75**		
Final Blended Material		**261**	**115.84**	**19.05**

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Table 21 shows the contamination levels and volume balance for Batch 2. Again, the final average contamination concentrations for the blended batch are significantly lower than the commercial SAC.

- **Table 21. Summary of post reactor treatment for contaminated treated fines Batch 2.**

Source	Also Known As:	Estimated Volume (m^3)	DDX (mg/kg)	ADL (mg/kg)
Contaminated Material Being Treated				
Pile A	Various	156	201	52
9,10,11 Feb	I23 L1 / I24 L2	47	212	19.27
17, 18, 19 Feb	I23 L1 / I24 L2	41.5	207.7	24.4
22, 23, 24 Mar	J23 L2/3 & J24 L2/3	21	231	14
29, 30 31 Mar	J23 L2/3 & J24 L2/3	42	199.2	7.9
Total Volume of Contaminated Fines		**307.5**		
Volume of Clean material required for a 2:1 ratio		**615**		
Low Contamination Blend material				
10-May	J20 G18 H18 etc	23.8	66	7.1
10-Jun	H25 L2	27.2	75	6
11-Jun	H25 L2	22	77	6
14-Jun	H20 L1	27	64	5
15-Jun	H20 L1	25	27	3
16-Jun	H20 L1	24	21	3
17-Jun	H20 L1	13.5	47	5
23-Jun	H25 L4 / HIJ No 1	12.5	47	2
25-Jun	H25 L4	22.5	40	2
27-Jun	H25 L4	6.25	28	2
30-Jun	J23 Bench / H25 L4	22.5	35	2
1-Jul	J23 Bench / H25 L4	17.25	100	9
2-Jul	J 23 Bench	10	108	9
4-Jul	J23 Bench	12.5	127	10
6-Jul	HIJ #1	12.5	51	2
8-Jul	HIJ #1	18.75	112	3
11-Jul	HIJ #1	20	96	3
15-Jul	I21 L2	4.25	133	10
23-Jul	I21 L1	7.25	174	9
Clay from Surge Chamber		320	67.8	2.6
Total Volume of Low Contaminant Treated Fines		**648.75**		
Final Blended Material		**956.25**	**111.9**	**35.3**

Table 22 shows the results of 6 validation samples taken from post reactor treatment Batches 1 and 2 after blending. The DDX and ADL values are all well below the SAC which gives confidence that the contamination has been successfully blended to commercial grade material.

- **Table 22. Validation samples for Batches 1 and 2 after post reactor treatment (all sample values mg/kg)**

Sample ID:	2641	2642	2643	2644	2645	2646	2647	2648	**Average**	***SAC***
2,4'-DDD	2	2	2	2	8	2	2	2		
2,4'-DDE	2	2	3	3	16	2	3	2		
2,4'-DDT	3	3	4	3	8	4	3	3		
4,4'-DDD	6	6	6	6	19	7	7	6		
4,4'-DDE	13	12	15	14	73	14	16	14		
4,4'-DDT	16	16	24	18	48	21	22	17		
DDX (TOTAL)	42	41	54	46	172	50	53	44	**62.75**	***200***
Aldrin	1	1	1	1	2	1	1	1		
Dieldrin	3	3	4	4	10	4	4	4		
Lindane	1	1	1	1	1	1	1	1		
A+D+10%L	4.1	4.1	5.1	5.1	12.1	5.1	5.1	5.1	**5.725**	***60***

5-10 mm Component: The results for the 9 samples are shown on Table 69, Appendix C and show that the cleaned pebbles are well below the SAC for OCPs.

7.2.3. Oversize Material

Table 23 shows how, from the estimated percentage fines per sample and (what were proved to be) conservative estimates for the fines contamination, the average contamination for each total oversize sample is calculated.

For five of the samples, the percentage fines (amount of fine material adhering to the oversize material) were too high and the samples were re-screened. Three of the remaining results had percentage fines between 5 and 7% but this percentage fine range is considered acceptable by the Site Auditor, Dr Peter Nadebaum due to the difficulty of screening wet soil (email Susan Rogers to Peter Nadebaum and Susan Walsh of GHD, 13/08/07).

Table 24 shows the DDX and ADL results from the samples that were taken from actual fines from the oversize samples. The averages of these results are significantly below the conservative estimates for the fines contamination used in the calculations in Table 23 (see note 2) which gives additional confidence that the final calculated oversize contamination levels are conservative estimates.

These results show that the conservative estimates for the OCP contamination levels of the oversize material are still well below half the commercial SAC and the oversize material is therefore acceptable as commercial reburial.

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Table 23. Summary of oversize analysis and estimation of treated fines.

	Period	Test Date	From	Source	% Fines	Est. DDX[2] (mg/kg)	Est. ADL[2] (mg/kg)	Est DDX total OS with fines (mg/kg)	Est ADL total OS with fines (mg/kg)	Comments
1	Oct 04 - Nov 05	18-Oct-05	East	Multiple piles	6.50%	Re-screened				
2	Oct 04 - Nov 05	7-Nov-05	East	Multiple piles	1.10%	1012.3	72.8	**11.13**	**0.80**	
3[1]	Oct 04 - Nov 05	7-Nov-05	East	Multiple piles	5.10%	1012.3	72.8	**51.62**	**3.71**	
4	Dec 05 - Mar 06	21-Mar-06	East	Multiple piles	4.70%	1012.3	72.8	**47.58**	**3.42**	
5	Apr 06 - Oct 06	30-Oct-06	East	<63mm piles	3.60%	1012.3	72.8	**36.44**	**2.61**	
6	Apr 06 - Oct 06	30-Oct-06	LF	<26.5mm piles	9.80%	Re-screened				Problems with wetness
7	Sep 06 - Nov 06	16-Nov-06	LF	<20 mm piles	2.70%	1012.3	72.8	**27.33**	**1.96**	
8	Sep 06 - Nov 06	16-Nov-06	LF	<63mm piles	7.60%	Re-screened				Problems with wetness
9	Oct 06 - Jan 07	22-Jan-07	LF	<53mm piles	2.10%	1012.3	72.8	**21.25**	**1.52**	
10	Oct 06 - Jan 07	22-Jan-07	LF	<26.5 mm	16.20%	Re-screened				Problems with wetness
11	Jan 07 - Feb 07	1-Feb-07	LF	<26.5 mm	6.10%	1012.3	72.8	**61.75**	**4.43**	
12	Jan 07 - Feb 07	15-Feb-07	West	<40 mm piles	0.90%	1012.3	72.8	**9.11**	**0.65**	
13[1]	Jan 07 - Feb 07	15-Feb-07	West	<19 mm piles	7.00%	1012.3	72.8	**70.86**	**5.09**	
14	Feb - Mar 07	7-Mar-07	West	<19mm piles	3.30%	1012.3	72.8	**33.40**	**2.40**	
15	Mar - Apr 07	2-Apr-07	West	<75mm piles	2.40%	1012.3	72.8	**24.29**	**1.74**	
16	Mar - Apr 07	2-Apr-07	West	<19mm piles	6.40%	Re-screened				Problems with wetness
17	Apr 07 - 27 Jul 07	27-Jul-07	West	<40mm piles	4.75%	1012.3	72.8	**48.08**	**3.45**	
							Average Results	**36.90**	**2.65**	

Note: [1] EMS completed an additional screening run after the results were received on the assumption it would get the fines down below 5%. [2] These values of fines-only concentrations were calculated from an average of the EDL plant infeed samples.

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Table 24. OCP results for fines from oversize material

Sample No	Details	ADL (mg/kg)	DDX (mg/kg)
406	Oversize from screener <2mm	272	1170
407	Oversize from screener <2mm	35	710
539	Red stuff	25	438
540	Nov/Dec screened	34	690
541	Nov/Dec screened	62	617
542	Nov/Dec screened	48	493
543	Nov/Dec screened	39	484
544	Nov/Dec screened	47	656
545	Jan/Feb screened	54	717
546	Jan/Feb screened	78	597
547	Jan/Feb screened	78	440
548	Jan/Feb screened	67	358
936	Pink crystals from Waimea oversize	22	346
937	GreenRubber from Waimea oversize	8	121
934	Hession Sack from Waimea oversize	5	396
1444	Oversize	30	316
1445	Oversize #1 Waimea & HSE rescreen	39	447
2340	Oversize 20 #1	9	162
2341	Oversize 20 #2	41	629
2342	Oversize 20 #3	15	520
2343	Oversize 20 #4	15	351
2899	Oversize	40.7	134
2900	Oversize	35.19	165
5334	Oversize	1	14
Average		**45.8**	**457.1**

The mass of oversize material was calculated for the site from the estimated proportions of the contaminated material (C) excavated from each site area that were oversize. The portion of CM made up by the oversize material was estimated by the MWH engineering group and is summarised in Table 25.

Table 25. Estimated volume of oversize material from each site area.

Area	Volume of Excavated Contaminated Material	Estimated % Oversize[1]	Volume of Oversize
East	5,100 m^3	35%	1,785 m^3
West	2,600 m^3	55%	1,430 m^3
Landfill	2,900 m^3	20%	580 m^3
Total Oversize Material			**3,795 m^3**

Note: [1] Values estimated by MWH Engineering group.

Note: An oversize material density of 1,650 kg/m^3 was used to convert oversize samples between volumes and masses.

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7.2.4. Crushed Concrete

A summary of the results for 53 crushed concrete samples is shown in Table 26. None of the 53 samples exceeded the commercial SAC and the 95% UCL means were less than half the SAC value.

- **Table 26. Summary statistics for crushed concrete samples (all sample values mg/kg)**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	53	0.3	2.4	0.52					
Dieldrin	53	0.3	14.5	2.94					
Lindane	53	0.3	0.7	0.27					
A+D+10%L	**53**	**0.5**	**16.2**	**3.12**	***60***	***150***	**53**	0	0
2,4'-DDD	53	0.3	6.0	1.10					
2,4'-DDE	53	0.3	10.3	0.84					
2,4'-DDT	53	0.3	24.1	7.20					
4,4'-DDD	53	0.3	13.7	2.59					
4,4'-DDE	53	0.3	42.5	7.43					
4,4'-DDT	53	0.3	135.0	85.49					
DDX	**53**	**1.5**	**176.9**	**61.69**	***200***	***500***	**53**	0	0

Note: [1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC
[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).
[4] All values in mg/kg.

7.3. Discussion and Conclusions

There were 6 failed individual sample results for the stockpiled commercial reburial material (exceeding 2.5 x SAC). These were all DDX and equated to 0.3% of the samples taken. The 95% UCL means and the subgrade averages were all well below half the commercial SAC. Coupled with the fact that the reburial material was mixed as it was stockpiled and distributed, these results suggest acceptable levels of remediation for the commercial reburial material.

The 95% UCLs for the ‘pre-July 2005’ treated fines results are well below the SAC although 2 DDX samples exceeded the agreed limit of 2.5 x SAC. As the basis for acceptance of the original RAP was based solely on the 95% UCL being less than the SAC for the OCPs.

The DDX and ADL rolling averages from the ‘post-July 2005’ treated fines results met the updated RAP requirements by being less than the SAC level for all samples except one which was slightly above the SAC and caused due to a small mathematical error with the rolling average being based on 5 days not 6.

The two batches of contaminated treated fines given post reactor treatment were sufficiently blended with low contamination treated fines and clay from the FCC East site surge chamber to reduce the contamination concentrations to well below the commercial SAC.

For the 5-10 mm component of the fines, the six samples are all well below the SAC for OCPs and the material was therefore suitable for commercial reburial.

Although the calculations for the oversize material OCP contamination levels are based on a number of estimates (specifically percentage fines and fines contamination), the estimates were made conservatively, and the final results are well below the commercial SAC.

None of the 53 crushed concrete samples exceeded the commercial SAC and the 95% UCLs of the mean were less than half the commercial SAC value.

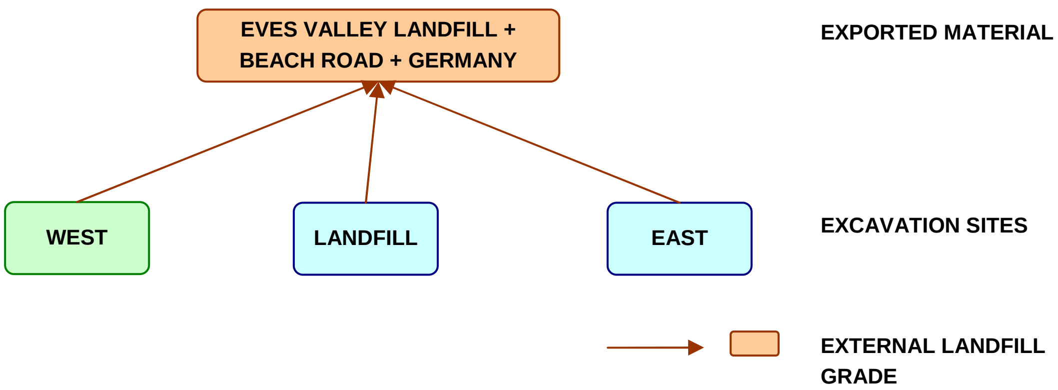
8. Validation Analysis – Exported Material

8.1. Validation Sampling

Some material derived from the site was exported in three ways, as illustrated in Figure 21:

1. Highly contaminated material was sent in sealed drums to Germany as part of MfE's Ag-Chem programme;
2. Two loads of old car and truck tyres were cleaned and sent Streetsmart Ltd on Beach Road to be recycled.
3. General rubbish that was not suitable for reburial was exported to Eves Valley Landfill.

▪ **Figure 21. Flow diagram showing sources of exported material**



8.2. Results

8.2.1. Highly Contaminated Material Shipped to Germany

Table 70 (Appendix C) shows the weights of high toxicity material shipped to Germany. This material was not tested explicitly as there is no maximum acceptance criteria for the German plant, however, the drums contained material with DDX values up to 300,000 mg/kg and ADL values over 20,000 mg/kg. A Medi-Chem Waste Services Certificate of Destruction for this material is presented in Appendix E.

8.2.2. Car and Truck Tyres Cleaned and Sent to Streetsmart Ltd

Having been cleaned, the old truck tyres taken to Streetsmart Ltd were not carrying any additional material that could be tested for contamination (pers. comm. Susan Rogers, 19/09/2007). The tyres were therefore considered by EMS to be acceptably clean.

8.2.3. General Waste Sent to Eves Valley Landfill

A summary of material exported to Eves Valley Landfill is shown in Table 71 (Appendix C).

As discussed in Section 5.4, the Eves Valley Landfill acceptance criteria for waste from the Mapua site was that no load delivered to the landfill could have a total concentration of DDX and ADL combined greater than 50ppm (equivalent to 50 mg/kg).

The maximum and average results of the loads in Table 71 show that the highest combined DDX and ADL value was 40.7 mg/kg.

8.3. Discussion and Conclusions

The material shipped to Germany for destruction did not have to meet any acceptance criteria. Chain of custody records were maintained for this material and examples were sighted during this validation process. These records should be maintained in safe storage. A Medi-Chem Waste Services Certificate of Destruction for this material is presented in Appendix E.

The tyres sent to Streetsmart Ltd were reported as being sufficiently clean that no sample was taken to test for contamination.

The maximum DDX+ADL concentration of the waste material sent to Eves Valley Landfill was almost 20% below the acceptance level (40.7 mg/kg compared to 50 mg/kg).

All of the exported material therefore met the validation criteria.

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9. Validation Analysis – Imported Material

9.1. Validation Sampling

Imported material was sampled at source before it was brought onto site to ensure it met the relevant SAC. Much of the sampled material was subsequently not brought onto site, and only the material brought onto site is validated here. The validation carried out here does not include the 0.5m final top soil intended to be imported to the site from a known clean source.

The following groups of material were imported (Figure 22):

1. To replace the contaminated marine sediments, clean sediments were imported from Appleby River, Greenhill River, Russell Lloyd and Motueka Port.
2. As outlined in Section 6.1.3 (not covered in this section), some imported marine sediments did not meet the SAC for marine sediments and so were instead used as reburial on the FCC West site.
3. Residential grade clays were imported from Russell Lloyd for use in the east bund of the FCC East site and replacement of material in the surge chamber (FCC East Subgrade 10).
4. Topsoil was imported from a number of sources to cover the FCC East, FCC West, Landfill and Private Land sites.

▪ **Figure 22. Flow diagram showing types of soil imported and receiving areas.**

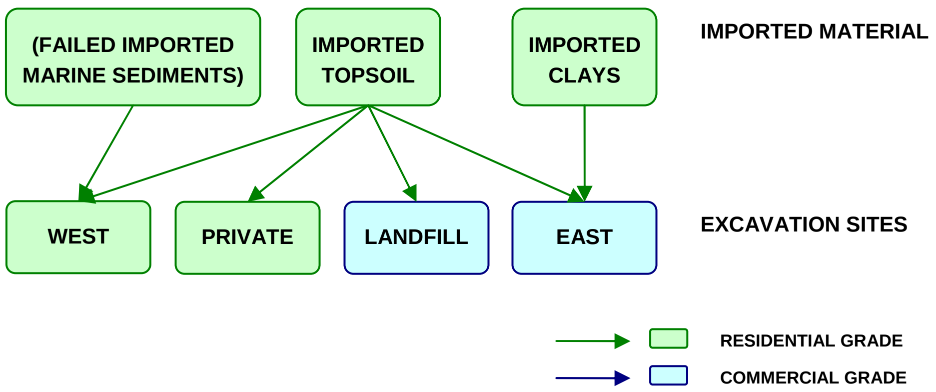

Table 27 shows the volumes of material imported, the number of samples taken and the respective sampling rates for each material type.

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Table 27. Imported Material Summary

Imported Material	Destination	Grade	Volume	Samples	Vol. per Sample	Source Descriptor
Clean Sediments	East Foreshore	Marine	2,868 m^3	6	478 m^3	Russell Lloyd, Motueka Port, Appleby River
Clean Sediments	West Foreshore	Marine	2,098 m^3	4	525 m^3	Greenhill River
Bund and Surge Chamber Clay	FCC East	Residential	1,057 m^3	4	264 m^3	Russell Lloyd
Failed Marine Sediments	FCC West	Residential	1,355 m^3	12	113 m^3	Marine Seds, Taylors
Topsoil	FCC East	Topsoil	1,281 m^3	15	85 m^3	Russell Lloyd, Stoke B S, Bark Processing
Reburial Material	Landfill	Residential	200 m^3	2	100 m^3	Road Quarry
Varied Topsoil	FCC East, FCC West, Private Land, Landfill	Topsoil	3,831 m^3	7	547 m^3	Stoke B S, Taylors
Totals			**12,690** m^3	**50**		

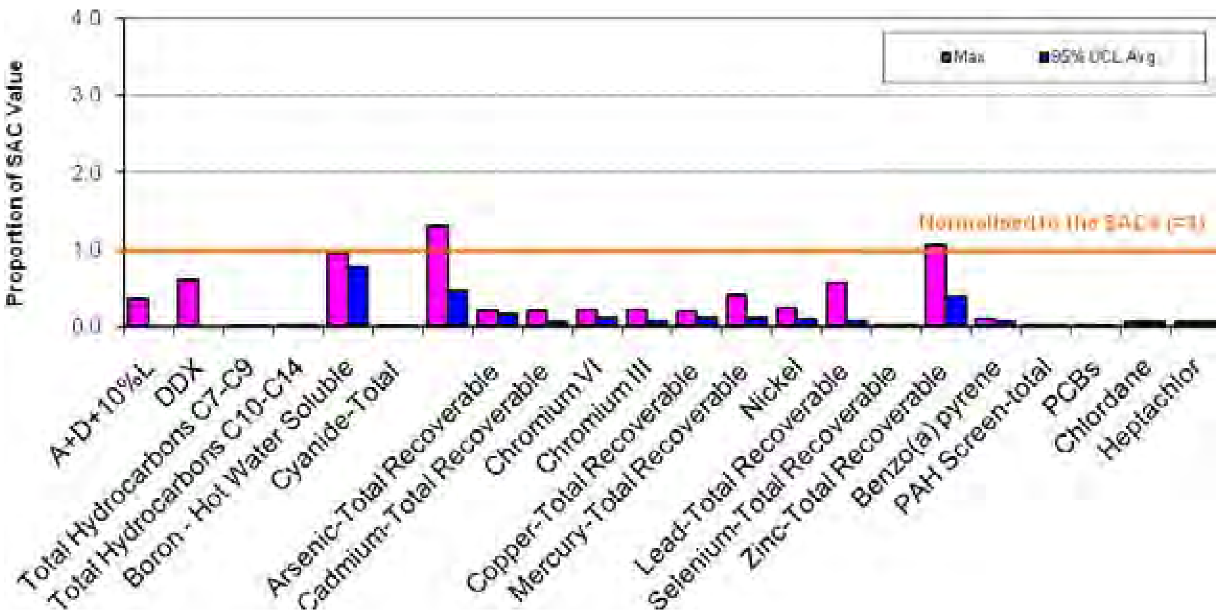
As all imported material was from a known source, the RAP sampling requirement was at least one sample per 1,000 m^3. Table 27 shows that the imported material met this sampling frequency.

9.2. Results

9.2.1. Residential and Topsoil Material

According to the original Thiess RAP, all surface soil should comply with the residential SAC values, so the residential and topsoil material has been validated together.

The full statistics for the imported residential and topsoil material are shown in Table 72, Appendix C and Figure 23 shows a graphical summary of the results. Figure 23 shows that 2 sample results exceed the residential SAC (Table 28). The exceedences were for manganese and zinc in samples from different materials.



- **Figure 23. Normalisation of individual residential/topsoil validation sample results to the SAC values.**

- **Table 28. Individual residential/topsoil samples that exceeded the SAC (all sample values in mg/kg).**

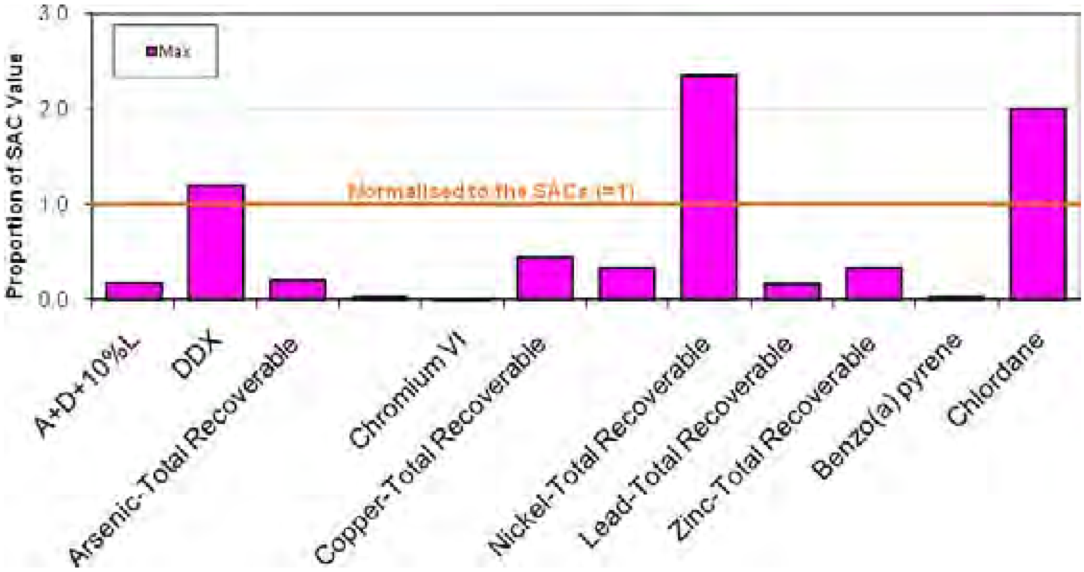
Site ID	Source	Date	Other Descriptor	Manganese-Total Recoverable	Zinc-Total Recoverable
SAC				***1,500***	***200***
4565	Road Quarry #1	3/5/06	FULL #24 - #39 w/o OCP	**1,960**	74
6609	Preferred Taylors Topsoil	18/5/07	#26, 27, 29, 31, 32, 33	684	**211**

According to the notes in MfE's data spreadsheet 'Mapua Imported and Exported Material Data - Updated.XLS', sample 6609 with a zinc level just above the SAC was approved by the Site Auditor.

However, there are no records sighted regarding the marginal manganese result.

9.2.2. Imported Marine Gravels

The full statistics for the imported marine gravels are shown in Table 73, Appendix C while Figure 24 shows a graphical summary of the results. Table 29 shows that sample 3386 marginally exceeds the aquatic ecosystems SAC for Nickel and potentially Chlordane. Sample 4476 marginally exceeds the SAC for DDX and potentially Chlordane. It should be noted that the Chlordane values are at the method detection limit of 0.001 which is in fact above the SAC.



- **Figure 24. Normalisation of individual marine gravels validation sample results to the SAC values.**

Note: there were not enough samples to work out a meaningful 95%UCL average

- **Table 29 Individual marine gravels samples that exceeded the SAC (all sample values in mg/kg).**

Site ID	Source	Date	DDX (SAC = 0.01)	Nickel-Total Recoverable (SAC = 70)	Chlordane (SAC = 0.0005)
3386	Appleby River (Used Dec)	15/12/05	0.00735	165	0.001
4476	Greenhill River Run A No 1	2/5/06	0.012	-	0.001

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9.3. Discussion and Conclusions

All of the imported material was from known sources and as such the sampling rates comfortably meet the RAP requirement of at least one sample per 1,000 m^3. The Site Auditor originally required the material to meet the SAC as in Table 9.

A single high zinc result in the imported residential and topsoil material was approved by the Site Auditor. In addition, there was one marginal manganese result. The manganese concentration is likely to be consistent with naturally occurring background ranges and is not considered to be of concern.

The imported sediment used in the East Sediments Site contained a marginal exceedence of DDX and potentially Chlordane.

The imported material used in the West Marine Site contained a marginal exceedence of Nickel and potentially Chlordane.

There are no records of conversations with the Site Auditor regarding these exceedences in the imported marine gravels. In any case, from the results of the post remediation samples discussed in Sections 14 and 15, contamination appears to have entered these imported sediments.

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10. Validation Analysis – FCC East Site

10.1. Description of East Site Area

The location of FCC East can be seen in Figure 3 in Section 2.3. The end use for FCC East is to be commercial and recreational. The area covers approximately 13,000 m^2. During the remediation of this area it was split into 19 separate sub-grades (SGs) including SG2, SG3, SG4, SG5A, SG5B, SG5C, SG6, SG7, SG8, SG9, SG10, SG11, SG12, SG13, SG14, SG16, SG17, SG20 and SG39, as listed in Table 3030 and shown in Figure 27. The SGs are of differing sizes due to contamination in some of the quadrants being followed during the excavation until acceptable soil results were obtained.

The area was further divided into 15m x 15m squares ('cells') which were individually labelled with a letter and a number. FCC East covers 80 cells either fully or partially and the cells contained within each sub-grade are listed in Table 30 and shown in Figure 28.

Table 30. Sub-grades within FCC East

Sub-Grade	Quadrant Numbers
SG2	F18, F19, G18, G19, H18, H19 & I18, I19 and F17, G17, H17 & I17 to the boundary
SG3	H23 to H25
SG4	South section of F20, F21 & F22
SG5A	E18 to E20 and north section of F20
SG5B	I20 and west half of J20
SG5C	G24 and G25 to boundary & G23
SG6	I21 & I22
SG7	I23, I24, J23 & J24
SG8	J18, J19, K18, K19, eastern sections of J17 and K17, western section of K20 and the northern sections of L17 to L20
SG9	I25 and small north west section of J25
SG10	Smaller area covering parts of J26 and J25
SG11	H26 to boundaries
SG12	G22 and H22
SG13	Smaller area covering parts of I26, J26 and I25
SG14	K23, K24 and K25, L23 & L24 to boundary
SG16	J21, J22, K21 & K22, east half of J20 & K20. L20 to L22 to boundary
SG17	G20, G21, H20 & H21
SG20	The northern strip of Tahi St, with E17 plus western sections of F17, G17 and H17, all to road boundaries.
SG39	The southern strip of Tahi St, with parts of H16, H17, I16, I17, J16, J17, K16, K17, L16 and L17.

10.2. Validation Sampling

The validation sampling for the FCC East site comprises validation of the walls and base of the excavated area, validation of the reburial material and some post validation as part of the quality assurance and quality control (QA/QC) programme.

10.2.1. Excavated Area

A total of 719 samples were taken from the base and walls of the excavations in the FCC East area, with at least one sample taken from every cell. There are 80 cells in the FCC East site, and so the sampling density equates to an average of almost 9 samples per cell which comfortably meets the RAP requirement of at least one sample per cell floor or wall. Where significantly fewer than average samples were taken in a cell, this was generally due to the cell being at the edge of the site and so only partially excavated – this is also the case for the Landfill, FCC West and Private Property excavations.

10.2.2. Reburial Material

From the Volume Balance Diagram (MWH 31/01/2008, FINAL), the following quantities of reburial material were used on FCC East.

- **Table 31. Split of reburial material used on FCC East**

Material Source	Quantity (m^3)	Report Section
Commercial Stockpile	21,445	Section 7
Residential Stockpile	6,299	Section 6
Treated Material	9,243	Section 7
Crushed Concrete	1,828	Section 7
Imported Clean	4,075	Section 9
Imported Topsoil	2,377	Section 9

The reburial material has all been validated in previous sections of this report as outlined in Table 31.

The final covering of topsoil over the site has not been validated in this report as, according to MfE (email from Tracey Ayre, 01/02/2008) the top-soil placement was not completed before TDC took over management of the site and it was to be undertaken later.

10.2.3. Other Sampling

Additional samples were taken specifically for the QA/QC programme. This sampling is outlined and discussed in Section 16 below.

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10.3. Results

10.3.1. Excavated Area

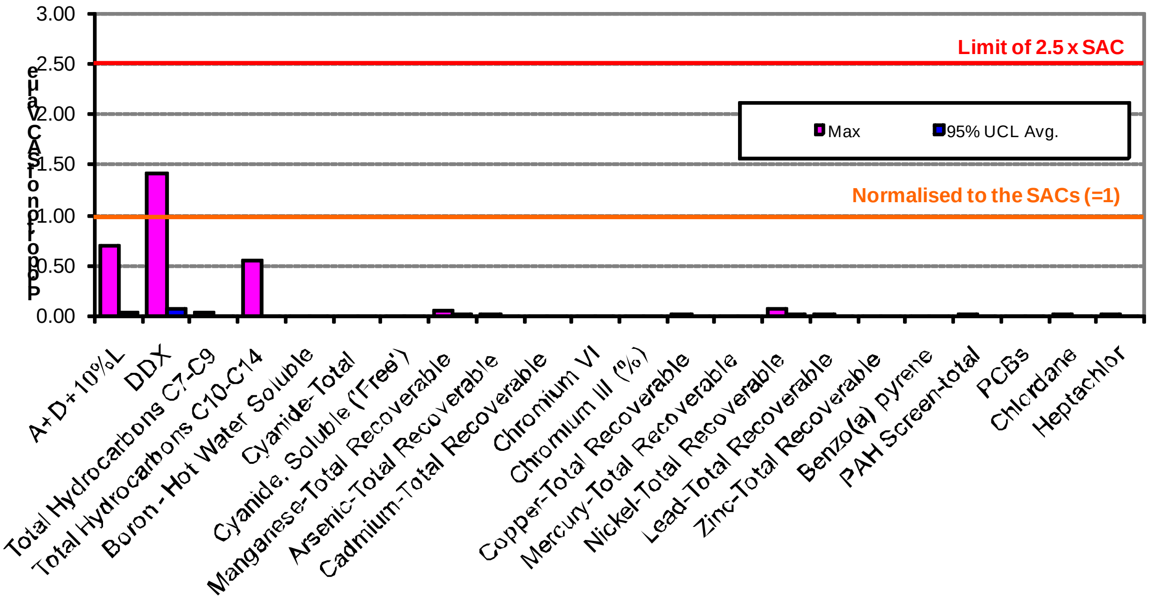
Individual Sample Results: 719 samples were taken to validate the final excavated East Site area. A full summary of the individual sample results is shown in Table 74 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

While all samples are below the validation limit of 2.5 times the SAC, four individual DDX sample results were between 1 and 2.5 times the SAC, as shown inTable 32.

- **Table 32 Individual excavation samples between 1 and 2.5 times the DDX SAC value (all sample values in mg/kg).**

Lab ID	Subgrade	Cell	Level	Depth (m)	Source	A+D+10%L (SAC = 60)	DDX (SAC = 200)
729	9	J25	4	2	Wall	17.17	**238.4**
1522	5b	I20	3, 4		Floor	2.375	**205.9**
1645	5c	G24	2	0.6	Floor	8.05	**282.5**
2036	9	J25	6	3.1	Floor	27.05	**219.5**

The summary statistics for the substances with valid SAC are shown graphically in Figure 25. Again, this data presentation shows that all reported concentrations are below the validation limit of 2.5 times the SAC and the 95% UCL of the means are well below the SAC for all substances.



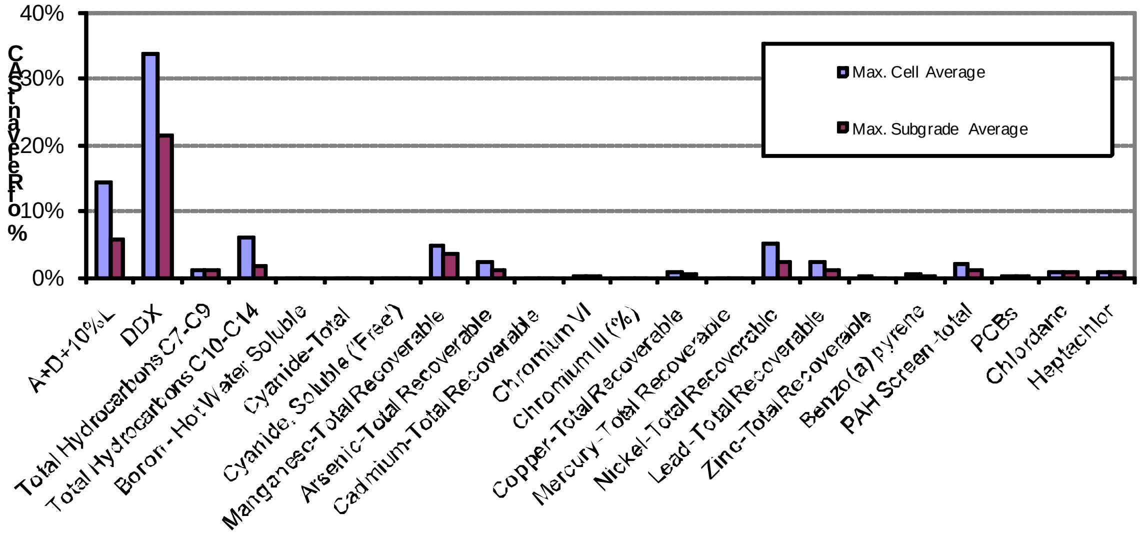
- **Figure 25. Normalisation of individual validation sample results to the SAC values.**

Cell and Subgrade Averages: The full averaged OCP results for each cell are shown in Table 75 of Appendix C and averages per subgrade are shown in Table 76 of Appendix C. A summary of the maximum cell and subgrade averages for each substance against the SAC limits is shown in Table 33 and graphically in Figure 26. These results show that all cell or subgrade averages are well below the SAC values.

- **Table 33 . Summary of the FCC East excavation cell and subgrade average validation results (all sample values in mg/kg).**

Substance	Max. Cell Average	Max. Subgrade Average	*SAC*
A+D+10%L	8.7	3.4	*60*
DDX	67.7	43.2	*200*
Total Hydrocarbons C7-C9	6.9	5.5	*500*
Total Hydrocarbons C10-C14	138.0	40.4	*2,200*
Boron - Hot Water Soluble	5.6	2.9	*15,000*
Cyanide-Total	0.1	0.1	*3,750*
Cyanide, Soluble ('Free')	0.2	0.2	*1,250*
Manganese-Total Recoverable	378.0	287.0	*7,500*
Arsenic-Total Recoverable	13.0	5.5	*500*
Cadmium-Total Recoverable	0.05	0.05	*100*
Chromium VI	1.0	1.0	*500*
Chromium III (%)	0%	0%	*60%*

Substance	Max. Cell Average	Max. Subgrade Average	*SAC*
Copper-Total Recoverable	51.5	27.5	*5,000*
Mercury-Total Recoverable	0.1	0.1	*125*
Nickel-Total Recoverable	155.0	74.6	*3,000*
Lead-Total Recoverable	35.7	20.2	*1,500*
Zinc-Total Recoverable	116.0	51.0	*35,000*
Benzo(a) pyrene	0.1	0.1	*25*
PAH Screen-total	2.0	1.3	*100*
PCBs	0.2	0.2	*50*
Chlordane	2.5	2.5	*250*
Heptachlor	0.5	0.5	*50*



- **Figure 26. Graphical summary of Maximum Cell and Subgrade averages in FCC East.**

10.3.2. Reburial Material

Residential: Section 6 has analysed all residential reburial material and demonstrated that it meets the relevant RAP acceptance criteria.

Commercial: Section 7 has analysed all commercial reburial material, including treated material and crushed concrete, and demonstrated that it meets the relevant RAP acceptance criteria.

Imported Material: Section 9 has analysed all imported material, including imported soil, and demonstrated that it meets the relevant RAP acceptance criteria

10.4. Discussion and Conclusions

The validation data show that the soil quality in the excavated area meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values.

Only four individual samples had results exceeding the SAC but these were below the individual sample limit of 2.5 times the SAC. The cell and subgrade averages for all of the substances were well below the SAC.

These results indicate that enough material was excavated from the FCC East site to be confident that remaining material meets the Commercial SAC.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.

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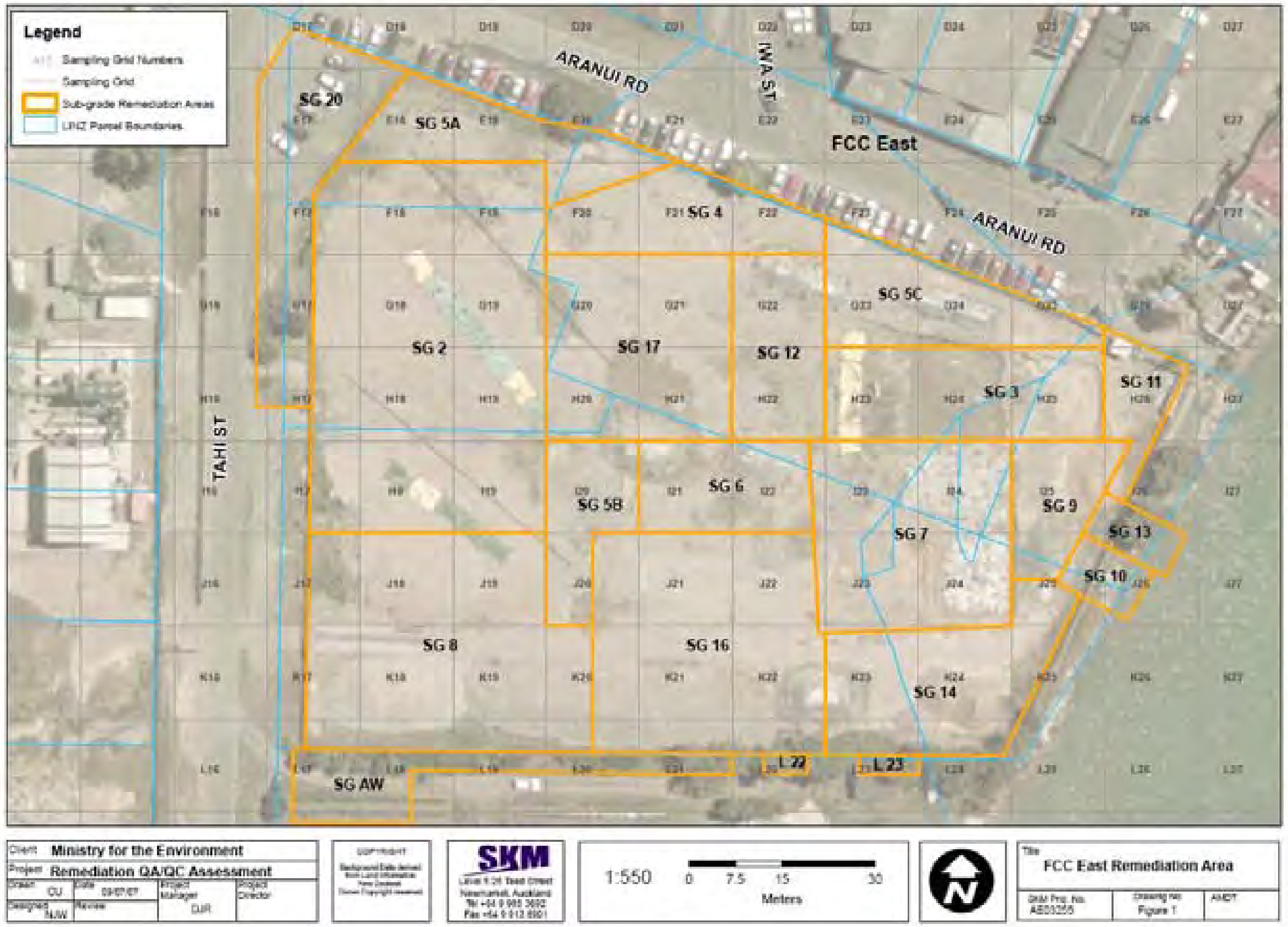


■ **Figure 27. FCC East Site Plan**

Note: SG39 is not shown but covers Tahi St to the south of SG20 from H16 and H17 through to L16 and L17.

11. Validation Analysis – FCC Landfill

11.1. Description of Landfill Site Area

The location of the Landfill site can be seen in Figure 3 in Section 2.3. The Landfill site covers an area of 6,000m^2 and its end use is to be recreational. During the remediation, this area was split into 5 separate sub-grades (SGs) including SG18, SG19a, SG19b, SG19c and SG38 as listed in Table 34 and shown in Figure 30. The SGs are of differing sizes due to contamination in some of the quadrants being followed during the excavation until acceptable soil results were obtained. SG38 is a unique area intended to be used a potential site for future burial of commercial or treated material (as per the Geotechnical Plan “Use” Zoning Areas, MWH 12/09/2008).

As with FCC East, the area was also divided into 15m x 15m squares (‘cells’) which were individually labelled with a letter and a number. The landfill site covers all or parts of 31 cells and the cells contained within each sub-grade are listed in Table 34 and again shown in Figure 30.

- **Table 34. Sub-grades within FCC Landfill**

Sub-Grade	Quadrant Numbers
SG18	Southwest tip of J8, K6 to K8, L5 to L8, M4 to M8 and N2 to N8
SG19A	Parts of J8, J9, K8, K9, L8 and L9
SG19B	Parts of L8, L9, M8 and M9
SG19C	Parts of M8, M9, N8 and N9
SG38	Parts of I7, I8, I9, J7, J8, J9 and K8

11.2. Validation Sampling

The validation sampling for the Landfill site comprises validation of the walls and base of the excavated area and validation of the reburial material.

11.2.1. Excavated Area

A total of 361 samples were taken from the base and walls of the excavations with at least one sample taken from every cell (sampling was approximately proportional to the proportion of cell excavated). There are 31 cells in the Landfill site, which equates to an average of almost 12 samples per cell which comfortably meets the RAP requirement of at least one sample per cell floor or wall.

11.2.2. Reburial Material

From the Volume Balance Diagram (MWH 31/01/2008, FINAL), the following quantities of reburial material were used on the Landfill site.

- **Table 35. Split of reburial material used on the Landfill site**

Material Source	Quantity (m^3)	Report Section
Commercial Stockpile	6,040	Section 7
Residential Stockpile	2,029	Section 6
Treated Material	2,400	Section 7
Crushed Concrete	200	Section 7
Imported Topsoil	698	Section 9

The reburial material has all been validated in previous sections of this report as outlined in Table 35.

The final covering of topsoil over the site has not been validated in this report as, according to MfE (email from Tracey Ayre, 01/02/2008) the top-soiling was not completed before TDC took over management of the site and it was to be undertaken later.

11.3. Results

11.3.1. Excavated Area

Individual Sample Results: A full summary of the 361 sample results is shown in Table 77 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

Of all samples, one result for ADL failed to meet the RAP limit for individual samples of 2.5 x SAC and two were marginal with values between 1 and 2.5 times the SAC, (Table 36).

- **Table 36 Individual excavation samples above the DDX and ADL SAC (all sample values in mg/kg).**

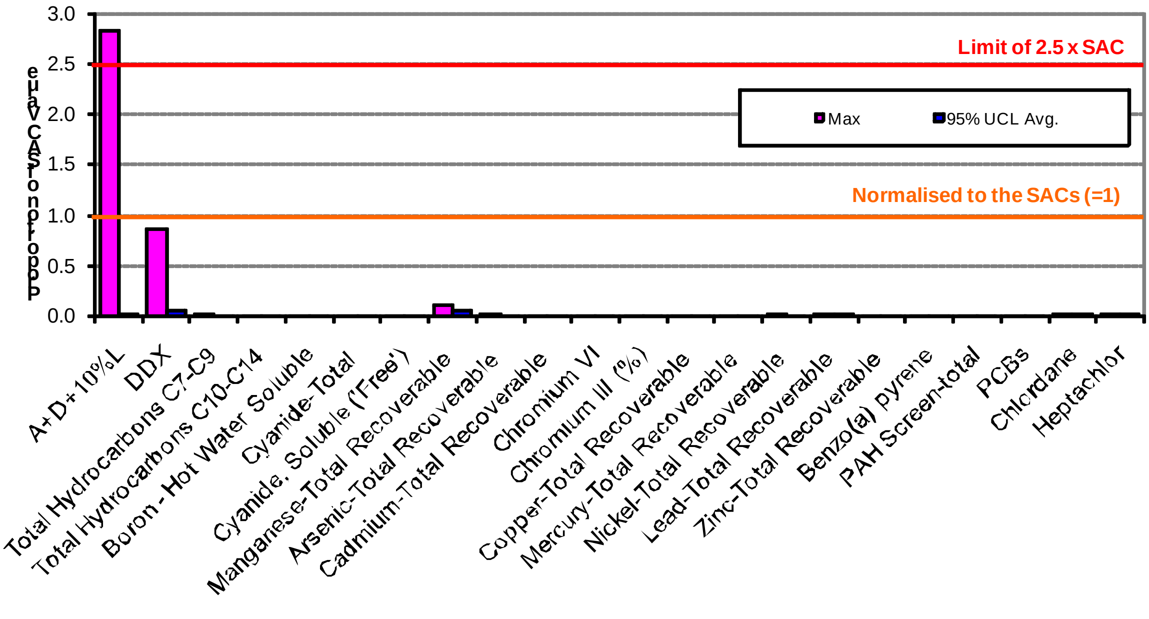
Sample ID	Subgrade	Cell	Level	Source	A+D+10%L (SAC = 60)	DDX (SAC = 200)
3541	18	K8	4	Floor	**124.3**	99.35
3545	18	K7	4	Floor	**146.8**	41.6
3575	18	N6	5	Floor	**170.5**	13.9

As well as the failed sample 3575, four other samples were taken from the floor of cell N6. These four other results are significantly lower (Table 37) and closer to surrounding cell values, therefore it would appear that the failed result is an anomaly. The average of these cell floor values (including the failed result) is 37.3 mg/kg, which is below the SAC for ADL (60 mg/kg).

- **Table 37. Examination of all individual excavation samples from the floor of failed cell N6 (all sample values in mg/kg).**

Sample ID	Source	SG	Cell	Level	A+D +10%L
SAC - commercial					***60***
3573	Floor	18	N6	4	0.53
3574	Floor	18	N6	4	1.77
3575	Floor	18	N6	4	**170.5**
3576	Floor	18	N6	4	12.6
4963	Floor	18	N6	4	1.05
AVERAGE					**37.3**

The summary statistics for the results of substances with valid SAC are shown graphically in Figure 28. Again, this data presentation shows the single ADL value that fails to meet the RAP limit of 2.5 x SAC and shows that all 95% UCL of the means are well below the SAC for all substances.

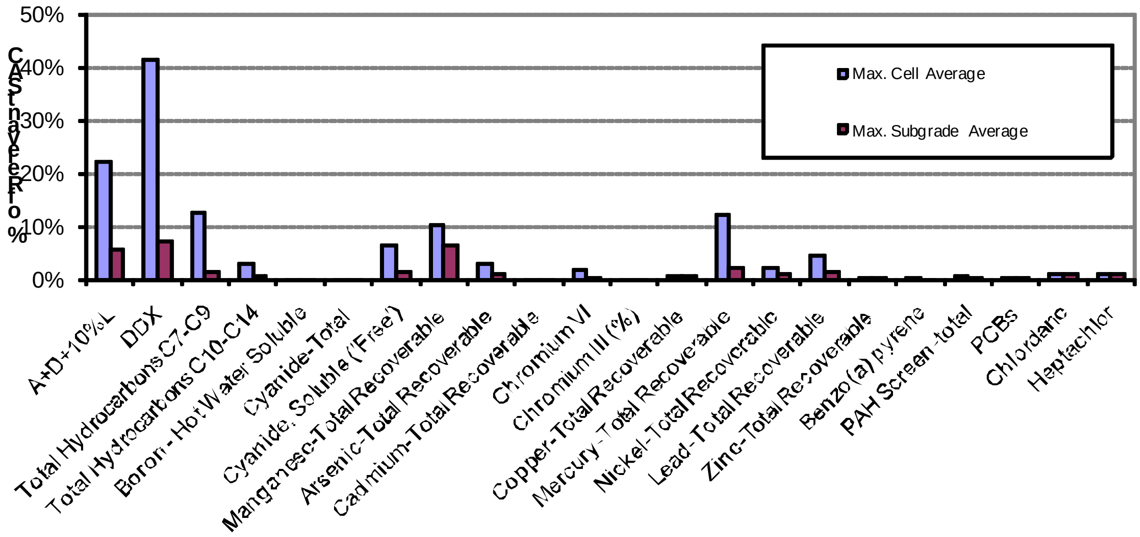


- **Figure 28. Normalisation of individual validation sample results to the SAC values.**

Cell and Subgrade Averages: The full averaged OCP results for each cell are shown in Table 78 of Appendix C and averaged per subgrade are shown in Table 79 of Appendix C. A summary of the maximum cell and subgrade averages for each substance against the SAC limits is shown in Table 38 and graphically in Figure 29. These results show that all cell and subgrade averages are well below the SAC values.

- **Table 38. Summary of the Landfill excavation cell and subgrade average validation results (all sample values in mg/kg).**

Substance	Max. Cell Average	Max. Subgrade Average	*SAC Commercial*
A+D+10%L	13.4	3.6	*60*
DDX	83.3	14.8	*200*
Total Hydrocarbons C7-C9	63.1	8.2	*500*
Total Hydrocarbons C10-C14	67.5	13.8	*2,200*
Boron - Hot Water Soluble	3.5	2.6	*15,000*
Cyanide-Total	0.1	0.1	*3,750*
Cyanide, Soluble ('Free')	83.6	16.9	*1,250*
Manganese-Total Recoverable	779.0	481.4	*7,500*
Arsenic-Total Recoverable	15.5	6.7	*500*
Cadmium-Total Recoverable	0.13	0.07	*100*
Chromium VI	9.5	2.3	*500*
Chromium III (%)	0%	0%	*60%*
Copper-Total Recoverable	40.0	40.0	*5,000*
Mercury-Total Recoverable	15.3	3.1	*125*
Nickel-Total Recoverable	65.0	31.0	*3,000*
Lead-Total Recoverable	67.1	24.4	*1,500*
Zinc-Total Recoverable	79.0	79.0	*35,000*
Benzo(a) pyrene	0.1	0.0	*25*
PAH Screen-total	0.6	0.3	*100*
PCBs	0.2	0.2	*50*
Chlordane	2.5	2.5	*250*
Heptachlor	0.5	0.5	*50*



▪ **Figure 29. Graphical summary of Maximum Cell and Subgrade averages in Landfill Site.**

11.3.2. Reburial Material

Residential: Section 6 has analysed all residential reburial material and demonstrated that it meets the relevant RAP acceptance criteria.

Commercial: Section 7 has analysed all commercial reburial material, including treated material and crushed concrete, and demonstrated that it meets the relevant RAP acceptance criteria.

Imported Material: Section 9 has analysed all imported material, including imported soil, and demonstrated that it meets the relevant RAP acceptance criteria.

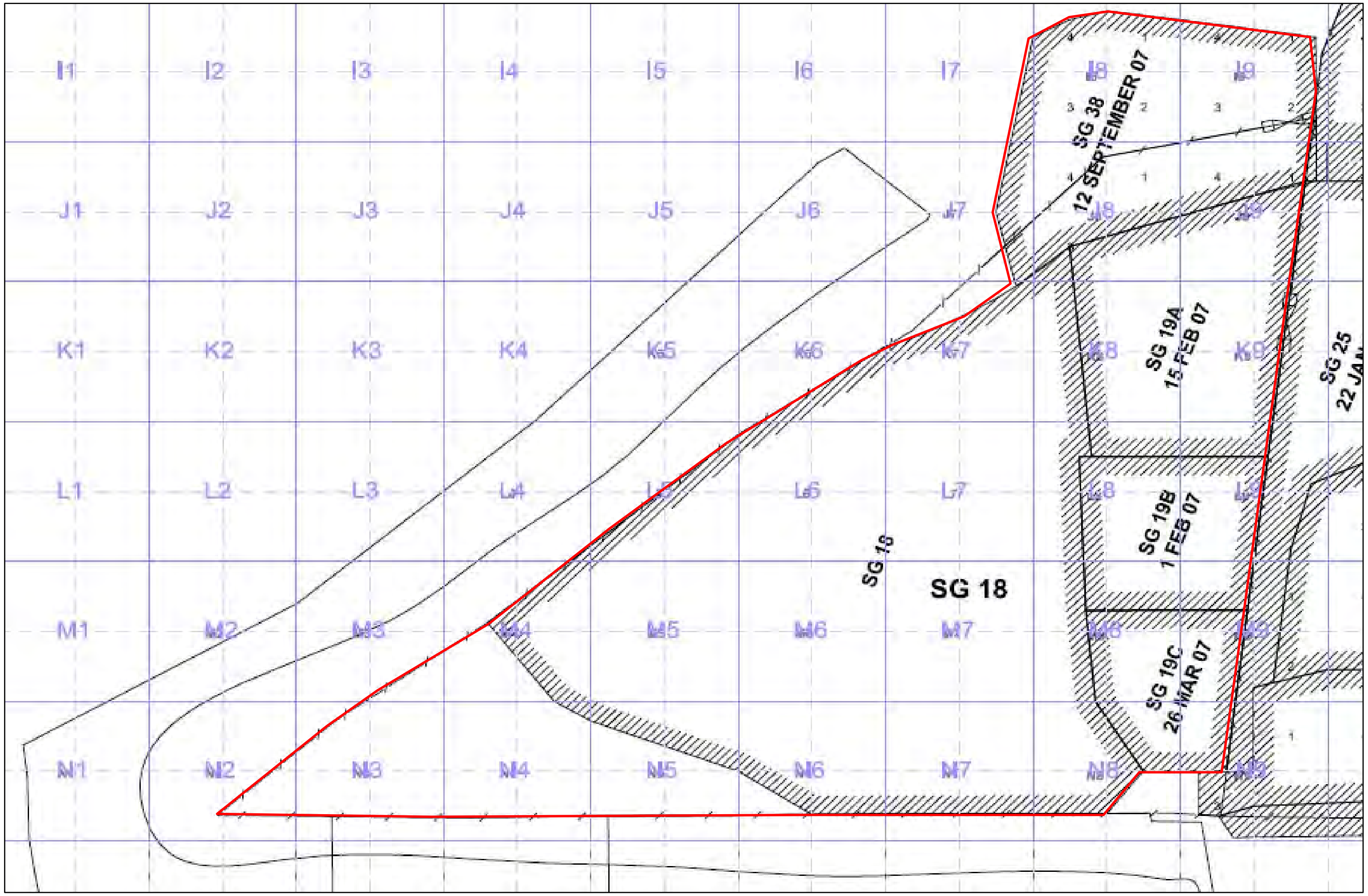
11.4. Discussion and Conclusions

With exception of a single individual sample of ADL, the validation data shows that the soil quality in the excavated Landfill site meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values. The two samples with marginal ADL results are acceptable as they have not individually exceeded the 2.5 x SAC limit, or pushed the cell or subgrade averages above the SAC.

The single sample value (from a total of 361 samples) that exceeds the RAP threshold of 2.5 x SAC appears to be an anomalous result. The average of the five floor samples in that cell is below the SAC and the average of all the samples in the cell (floors and walls) is less than 20% of the SAC.

These results indicate that enough material was excavated from the Landfill site to be confident that remaining material meets the Commercial SAC.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.



■ **Figure 30. Landfill Site Plan (each square cell measures 15 m x 15 m)**

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12. Validation Analysis – FCC West Site

12.1. Description of West Site Area

The location of FCC West can be seen in Figure 3 in Section 2.3. The end use for FCC West is residential. The area covers approximately 17,000 m^2. During the remediation of this area it was split into 21 separate sub-grades (SGs) including SG1, SG15, SG21, SG22, SG23, SG24, SG25, SG26, SG27, SG28, SG29, SG30, SG31, SG32, SG33, SG34, SG35, SG36, SG37, SG40 (Plant Pad) and the 'Fenceline', as listed in Table 39 and shown in Figure 33. The SGs are of differing sizes due to contamination in some of the quadrants being followed during the excavation until acceptable soil results were obtained.

The area was further divided into a grid of 15m x 15m squares ('cells') which were individually labelled with a letter and a number. Each 15m x 15m cell was split into four 7.5m x 7.5m quadrants. FCC West covers 94 cells either fully or partially and the cells contained within each sub-grade are also listed in Table 39 and shown in Figure 33.

Table 39. Sub-grades within FCC West

Sub-Grade	Cell Numbers (fully or partially included)
SG1	E11, E12, E13, F10, F11, F12 and F13
SG15	C9, C10, C11, C13, D9, D10, D11, D12, D13, E11, E12 and E13
SG21	A9, A10, B9, B10, B11, B12, C10, C11, C12 and C13
SG22	B9, B10, C10, C11, C12, C13, D12 and D13
SG23	N12, N13, N14 and N15
SG24	G12, G13, H12, H13 and I13
SG25	J9, J10, K9 and L9
SG26	L14, L15, M14 and M15
SG27	J10, J11, J12, K10, K11 and K12
SG28	C13, C14, C15, D13, D14, D15, E14, E15 and E16
SG29	N9, N10 and N11
SG30	F14, F15, F16, G14, G15 and G16
SG31	L9, L10, L11, M9, M10 and M11
SG32	H15, H16, I15 and I16
SG33	G10, G11, H10 and H11
SG34	H13, I10, I11, I12, I13, J10 and J11
SG35	J15, J16, K15, K16, L15, L16, M15, M16, N15 and N16
SG36	L12, L13, M12 and M13
SG37	J13, J14, J15, K13, K14 and K15
SG40 (Plant Pad)	H13, H14, H15, I13, I14, I15, J13, J14 and J15
Fenceline	N9, N10, N11, N12, N13, N14 and N15

12.2. Validation Sampling

The validation sampling for the FCC West site comprises validation of the walls and base of the excavated area (as per Table 7 in Section 4.2.1) for a 7.5m x 7.5m quadrant and validation of the reburial material.

12.2.1. Excavated Area

A total of 652 validation samples were taken from the base and walls of the excavations in the FCC West area, with at least one sample taken from every cell (sampling was approximately proportional to the proportion of cell excavated). There are 94 cells in the FCC West site, which equates to an average of approximately 7 samples per cell which comfortably meets the RAP requirement of at least one sample per cell floor or wall.

12.2.2. Reburial Material

From the Volume Balance Diagram (MWH 31/01/2008, Final), the following quantities of reburial material were used on FCC West.

Table 40. Split of reburial material used on FCC West

Material Source	Quantity (m^3)	Report Section
Residential Stockpile	11,210	Section 6
Failed Marine Sediments (Import)	430	Section 6
Imported Clean Material	1,756	Section 9
Imported Topsoil	2,406	Section 9

The reburial material has all been validated in previous sections of this report as outlined in Table 40

The final covering of topsoil over the site has not been validated in this report as, according to MfE (email from Tracey Ayre, 01/02/2008) the top-soiling was not completed before TDC took over management of the site and it was to be undertaken later.

12.3. Results

12.3.1. Excavated Area

Individual Sample Results: 652 samples were taken to validate the final excavated West Site area. A full summary of the individual sample results is shown in Table 80 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

The residential area has significantly more stringent SAC values and there were significantly more exceedences in the FCC West Site than in the commercial grade sites. Of the 652 validation samples taken, 56 had substances with results that were either marginal (between 1 and 2.5 times the SAC) or failed (above 2.5 times the SAC). There are several explanations for a number of these sample exceedences:

- There are 16 sample exceedences from subgrades 32 and 35 which run north-south along the Tahi Street road verge. These samples, listed in Table 41, were approved by TDC via a letter of 10 September TDC (Dennis Bush-King) to MFE. There are a further 4 samples shown in Table 41, one borders Tahi Street and the other three are at the fenceline of the southern border of the site.
- There are 10 marginal samples where, according to the MfE’s results spreadsheet emailed to SKM on 14/04/08, the lab report gave DDX values of 5 mg/kg and ADL values of 3 mg/kg, i.e. at the SAC, so just passed. However, recalculating the DDX and ADL values from the individual components (e.g. A + D + 10%L) gave more precise values that just exceed the SACs, as listed in Table 42. However, these marginal results are still acceptable for individual samples as long as they do not result in cell/subgrade averages above the SAC.
- In a number of cases, a 3-day turn-around sample was taken to give the site team direction on what to do with the material (email from Tracey Ayre, 14/04/2008). Some 3-day turn-around samples passed or were very close to the SAC and were recorded on the walls and floors spreadsheet. Table 43 shows 7 instances where this is the case, although these results are at worst marginal, so again are still acceptable for individual samples as long as they do not result in cell/subgrade averages above the SAC. The full test contaminant concentrations have been used in the statistical analysis.
- Table 43 also contains 11 samples where sample retesting returned contaminant concentrations below the SAC. The exception in this table is sample 8051 that gave a DDX value higher than the original testing and above the 2.5 x SAC limit. The average contaminant value has been taken in each case and used in the statistical analysis.
- There were a further 7 marginal samples, and 1 sample failed the 2.5 x SAC limit for Boron and another failed the 2.5 x SAC limit for Cadmium. There were no obvious explanations for these exceedences, which are listed in Table 44.

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- **Table 41. Failed or marginal FCC West Excavation samples at the Tahi St road verge approved by TDC (all sample values in mg/kg).**

Sample Id	Subgrade	Cell	Level	Source	A+D+10%L	DDX	Copper-Total Recoverable	Zinc-Total Recoverable	Benzo(a) pyrene
Residential SAC					*3*	*5*	*300*	*200*	*0.27*
6096	28	E16	1	Wall	0.5	3.8	**2,930**	**234**	
8463	35	N16	2	Floor	1.5	**19.4**			
8465	35	N16	1	Wall	0.9	**47.0**	21	52	0.025
8466	35	N16	1	Wall	1.5	**25.8**			
8467	35	N16	1	Wall	1.3	**56.1**			
8470	35	M16	1	Wall	**3.1**	**29.5**			
8471	35	M16	1	Wall	1.8	**10.2**			
8474	35	L16		Wall	**137.3**	**8.5**			
8475	35	L16		Wall	**3.9**	**16.7**			
8477	35	K16	2	Floor	0.7	**12.2**			
8478	35	K16	1	Wall	1.8	**29.5**	44	137	**0.81**
8479	35	K16	1	Wall	**3.6**	**66.7**			
8549	35	J16	2	Floor	0.5	**8.1**			
8551	35	J16	1	Wall	1.0	**40.2**			
8552	35	J16	1	Wall	0.4	**19.4**			
8567	32	I16	1	Wall	0.5	**23.2**			
8568	32	I16	1	Wall	0.6	**26.1**			
8010	Fenceline	N14	2	Wall	0.4	**5.4**			
8015	Fenceline	N15	1	Wall	0.2	**6.9**			
8031	Fenceline	N9	1	Wall	0.7	**7.8**			

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- **Table 42. Marginal FCC West Excavation samples where the lab reported the samples as passed (all sample values in mg/kg).**

Sample ID	Sub-grade	Cell	Level	Depth	Source	A+D+ 10%L	DDX
Residential SAC						*3*	*5*
4664	21	C11	4	1.4	Floor	0.5	**5.2**
4921	15	C9	1		Wall	0.5	**5.6**
5105	15	D13	2	0.55	Floor	0.5	**6.0**
6506	32	I15	2		Cell	2.1	**5.3**
8184	31	M10	2		Floor	0.5	**5.7**
8195	34	I10	2		Floor	1.7	**5.5**
8201	34	I11	2		Floor	0.5	**5.5**
8451	33	H10	3		Wall	0.5	**5.9**
8654	34	I10, J10	3		Floor	0.5	**5.6**
8663	34	I11	3		Wall	0.5	**5.1**

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- **Table 43. Marginal FCC West Excavation samples where the 3 day turn-around testing and retesting gave slightly different results to the full analysis (all sample values in mg/kg).**

Sample Id	Subgrade	Cell	Level	Depth	Source	Lab No.	A+D+10%L	DDX	Test
Residential SAC							*3*	*5*	
3-day turn-around samples marginal under full test									
5631	29	N11	3	1.1	Floor	444674	0.53	3.0	3-day turn-around
						451461	0.40	**5.4**	Full test
5942	27	K10	2	0.9	Floor	447660	0.53	3.8	3-day turn-around
						458187	0.05	**7.2**	Full test
6880	1	E11	1		Wall	457026	0.53	2.9	3-day turn-around
						460001	0.34	**6.1**	Full test
6894	1	F10	1		Wall	457025	0.53	4.5	3-day turn-around
						460001	0.50	**8.8**	Full test
8565	32	I16	1		Cell	462440	0.53	1.5	3-day turn-around
						463886	0.12	**5.1**	Full test
8655	34	I10, J10	3		Floor	463366	0.53	**5.1**	3-day turn-around
						465569	0.56	**8.2**	Full test
8662	34	I11	2		Wall	463366	0.53	3.5	3-day turn-around
						465569	0.43	**6.9**	Full test
Samples retested									
6660	33	G11	1	0.3	Floor	459556	0.30	**8.0**	Full test
						455194/3	0.53	1.5	Retest
						Average	0.41	4.7	
6675	33	H11	2	0.3	Floor	459556	1.66	**6.1**	Full test
						455199/4	1.03	4.0	Retest
						Average	1.34	**5.0**	
8051	33	H10	2	2nd lift - 0.3	Floor	459556	0.81	**16.7**	Full test
						458251/1	0.53	1.5	Retest
						459556/18		**41.0**	Retest
						Average	0.67	**19.7**	
8054	33	H11	2	2nd lift - 0.3	Floor	459556	1.68	**6.0**	Full test

						458251/4	1.03	1.5	Retest
						Average	1.35	3.8	
8484	40	H14	2		Cell	463886	0.72	**5.4**	Full test
						462204/5	1.18	4.0	Retest
						Average	0.95	4.7	
8493	40	I14	2		Floor	463886	0.14	**5.4**	Full test
						462225/2	0.53	1.5	Retest
						Average	0.33	3.4	
8505	35	N15	1		Floor	463668	0.19	**5.9**	Full test
						462336/2	0.53	1.5	Retest
						Average	0.36	3.7	
8506	35	M15	2		Floor	463668	**3.65**	**22.75**	Full test
						462336/3		4.9	Retest
						Average	**3.65**	**13.8**	
8593	34	I13	2		Wall	463885	0.44	**5.3**	Full test
						462646/7	0.53	5.0	Retest
						Average	0.48	**5.2**	
8604	35	L15	2		Cell	463886	0.39	**5.4**	Full test
						462883/6	0.53	1.5	Retest
						Average	0.46	3.4	

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- **Table 44. Individual FCC West excavation samples which were either marginal or failed to meet the residential SAC with no obvious explanation (all sample values in mg/kg).**

Sample Id	Subgrade	Cell	Level	Source	A+D+10%L	DDX	Total Hydrocarbons C10-C14	Boron - Hot Water Soluble	Cadmium – Total Recoverable
Residential SAC					*3*	*5*	*510*	*3*	*3*
4904	15	D12	2	Floor	0.5	**7.8**			
5103	15	C13	2	Floor	0.5	**6.0**		0.5	**22**
6560	31	M10	2	Floor	0.5	1.5	**660**		
8185	31	M10	2	Floor	0.3	**6.3**	15		
8295	24	H13	2	Wall	0.02	0.2	15	**5**	0.05
8339	37	K14	2	Floor	**3.7**	4.5	15		
8344	37	K15	2	Floor	0.1	0.5	20	**70**	0.05
8425	37	J15	3	Floor	0.9	**12.1**	15		
8730	30	G14	1	Wall	0.2	2.8	**570**	0.5	0.05

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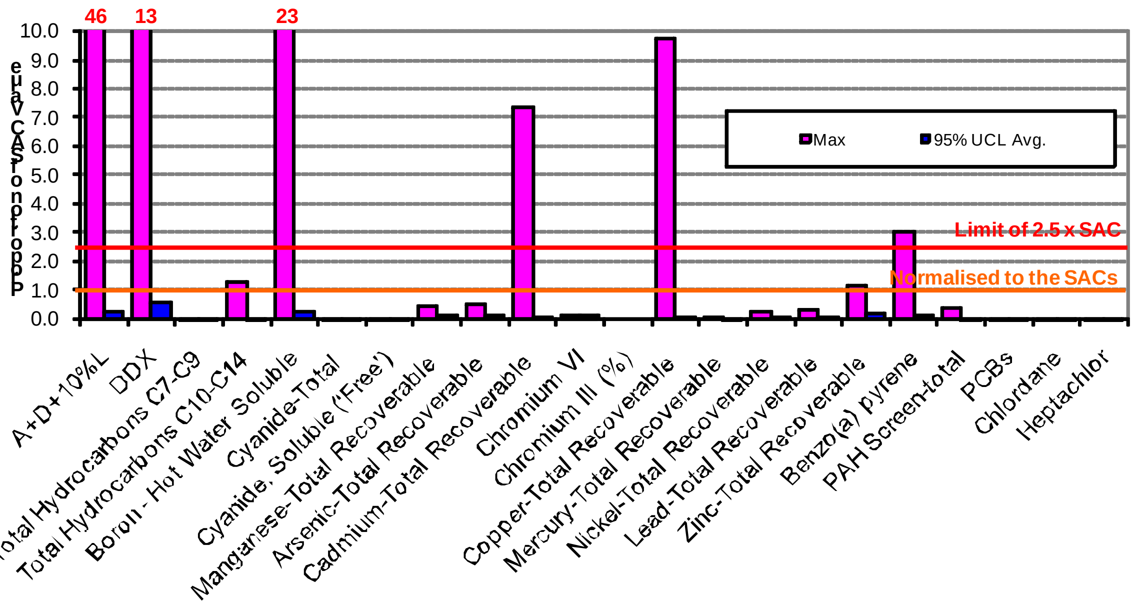
The summary statistics for the substances with valid SAC are shown graphically in Figure 31. The maximum values need to be considered in light of the valid explanations for a number of these exceedences as previously discussed. However, all of the 95% UCL of the means are below the SAC for all substances.



- **Figure 31. Normalisation of individual validation sample results to the SAC values.**

Cell and Subgrade Averages: The full averaged OCP results for each cell are shown in Table 81 of Appendix C and averaged per subgrade are shown in Table 82 of Appendix C. Seven cells had average DDX values that exceed the residential SAC and one cell average exceeded the SAC for ADL (Table 45). Cells I16, J16, K16, L16, M16 and N16 all border Tahi Street and contain individual sample exceedences which have been approved by TDC. Cell F10 borders the western boundary of the site.

- **Table 45. FCC West excavated cells with average ADL or DDX sample results that exceed the residential SAC (all sample values in mg/kg).**

Cell	Average A+D +10%L	Average DDX
SAC	*3*	*5*
F10	0.34	**6.86**
I16	0.48	**14.42**
J16	0.51	**17.36**
K16	1.63	**27.55**

Cell	Average A+D +10%L	Average DDX
SAC	*3*	*5*
L16	**36.05**	**6.84**
M16	1.38	**10.95**
N16	1.07	**30.37**

Two subgrades had average sample results that exceed the DDX SAC and one of these also exceeded the ADL SAC (Table 46).

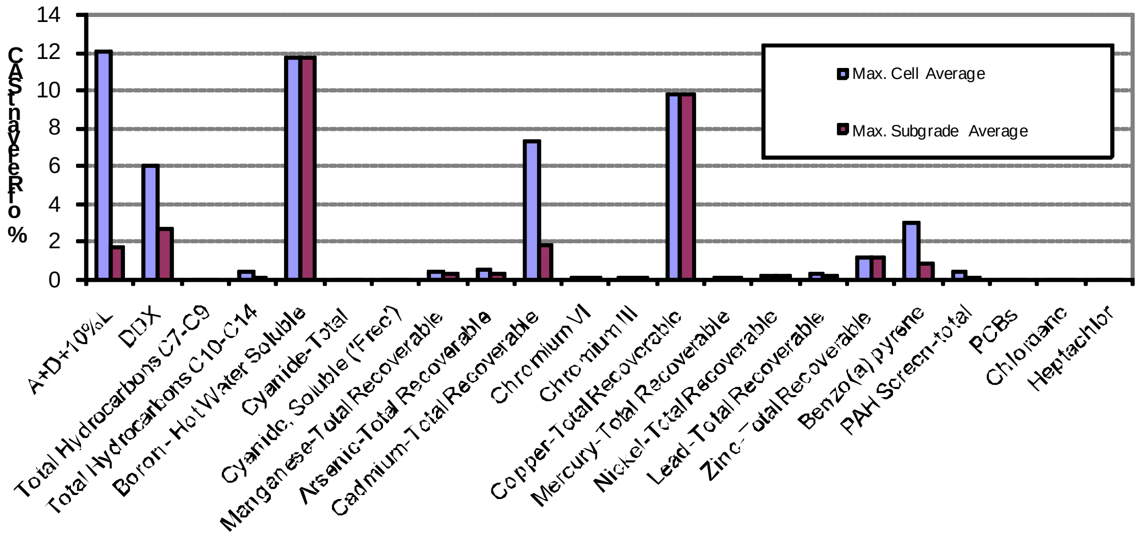
- **Table 46. FCC West excavated subgrades with average ADL or DDX sample results that exceed the residential SAC (all sample values in mg/kg).**

SG	Average A+D +10%L	Average DDX
SAC	*3*	*5*
32	0.54	**5.27**
35	**5.28**	**13.43**

A summary of the maximum cell and subgrade averages for each substance against the SAC limits is shown in Table 47 and graphically in Figure 32. As well as the DDX and ADL exceedences discussed above, one or more cells and subgrade averages also exceeded for Boron, Copper, Zinc and Benzo(a)pyrene.

- **Table 47. Summary of the FCC West excavation cell and subgrade average validation results (all sample values in mg/kg).**

Substance	Max. Cell Average	Max. Subgrade Average	*SAC*
A+D +10%L	**36.0**	**5.3**	*3*
DDX	**30.4**	**13.4**	*5*
Total Hydrocarbons C7-C9	10.0	10.0	*500*
Total Hydrocarbons C10-C14	196.7	47.1	*510*
Boron - Hot Water Soluble	**35.1**	**35.3**	*3*
Cyanide-Total	0.5	0.2	*70*
Cyanide, Soluble ('Free')	0.4	0.2	*50*
Manganese-Total Recoverable	657.0	411.0	*1,500*
Arsenic-Total Recoverable	15.0	11.0	*30*
Cadmium-Total Recoverable	**22.0**	**5.5**	*3*
Chromium VI	1.0	1.0	*9*
Chromium III	90.0	50.5	*600*
Copper-Total Recoverable	**2930.0**	**2930.0**	*300*
Mercury-Total Recoverable	0.9	0.9	*11*
Nickel-Total Recoverable	148.0	148.0	*600*
Lead-Total Recoverable	104.0	78.8	*300*
Zinc-Total Recoverable	**234.0**	**234.0**	*200*
Benzo(a) pyrene	**0.8**	0.2	*0*
PAH Screen-total	8.3	2.4	*20*
PCBs	0.2	0.2	*10*
Chlordane	0.0	0.0	*50*
Heptachlor	0.0	0.0	10



- **Figure 32. Graphical summary of Maximum Cell and Subgrade averages in FCC West.**

12.3.2. Reburial Material

Residential: Section 6 has analysed all residential reburial material and demonstrated that it meets the relevant RAP acceptance criteria.

Imported Material: Section 9 has analysed all imported material, including imported soil, and demonstrated that it meets the relevant RAP acceptance criteria.

12.4. Discussion and Conclusions

The validation data shows that enough samples were taken in the FCC West site excavation to comfortably meet the RAP sampling requirement.

Of the 652 validation samples taken, 36 had marginal (1 – 2.5 SAC) results and 20 had failed (>2.5 SAC) results. However, of these 56, 36 have explanations as to why the results were accepted. These samples either bordered Tahi Street, the site boundary or passed the initial 3-day turnaround test but failed the full test. Of the remaining 14 samples 4 samples (5103, 8051, 8344 and 8506) failed to meet the 2.5 x SAC limit for which no explanation can be provided.

The samples that failed to meet the SAC also had significant impacts on the cell and subgrade averages, with seven cell and two subgrade averages failing to meet the DDX SAC and one cell average failing to meet the ADL SAC. Six of the cells exceeding the residential SAC border Tahi Street and contain samples that have been approved by TDC. The seventh cell borders the western boundary of the site.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.

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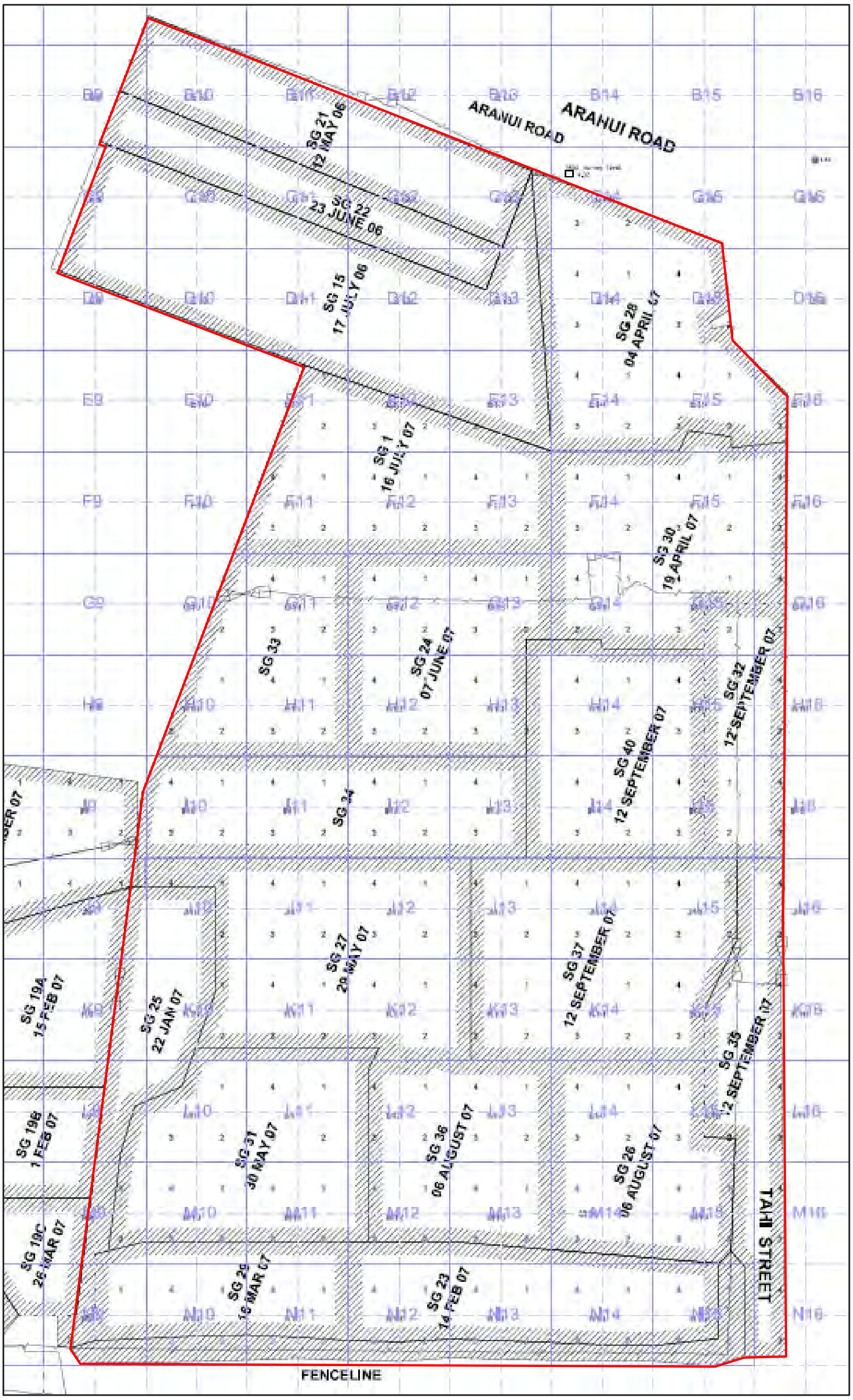

▪ **Figure 33. FCC West Site Plan (each square cell measures 15 m x 15 m)**

13. Validation Analysis – Private Property

13.1. Description of Private Property Area

The four private properties that have been included in the FCC clean-up are Tahi St numbers 13, 15, 18 and 20. According to MfE (email Tracey Ayre to Phil Outram, 14/04/08) properties 15 and 20 Tahi St were remediated prior to the clean-up phase covered by this report and, as such, the clean-up for these properties is not validated here. Private residential properties were to be cleaned to comply with the residential SAC.

The location of the private properties on the site can be seen in Figure 3 in Section 2.3. More detailed aerial photos showing the excavation locations are shown in Figure 36, Figure 37 and Figure 38. Both properties were considered as whole sub-grades (SGs). The remediated sections of 13 Tahi St are collectively referred to as SGAW; however, 18 Tahi St did not have a specific sub-grade name so for the purposes of this validation, it will be referred to as SG18TS. As with the rest of the site, the private properties were divided into 15m x 15m squares ('cells') which were individually labelled with a letter and a number, as listed in Table 48

- **Table 48. Sub-grades and cells covering the private properties**

Property	Sub-Grade	Quadrant Numbers ('Cells')
13 Tahi St	SGAW	Parts of L17 to L23, M17, M18, M24
18 Tahi St	SG18TS	P9 and O9

13.2. Validation Sampling

The validation sampling for private properties 13 and 18 Tahi St comprises validation of the walls and base of the excavated areas and validation of the reburial material.

13.2.1. Excavated Area

A total of 57 samples were taken from the base and walls of the excavations with at least one sample taken from every cell. 9 samples were taken from SG18TS (18 Tahi St) which covers 2 cells and 48 samples were taken from SGAW (13 Tahi St) which covers 10 cells. This equates to an average of approximately 5 samples per cell which comfortably meets the RAP requirement of at least one sample per cell floor or wall.

13.2.2. Reburial Material

From the Volume Balance Diagram (MWH 31/01/2008, Final), the following quantities of reburial material were used on the private properties.

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- **Table 49. Split of reburial material used on the private properties**

Material Source	Quantity (m^3)	Report Section
Residential Stockpile	495	Section 6
Imported Topsoil	80	Section 9

The reburial material has all been validated in previous sections of this report as outlined in Table 49.

13.3. Results

13.3.1. Excavated Area

Individual Sample Results: A full summary of the 57 sample results is shown in Table 83 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

Of all samples, two results failed to meet the RAP limit for individual samples of 2.5 x SAC and one result was marginal (above the SAC but below the 2.5 x SAC limit used for residential material) – see Table 50.

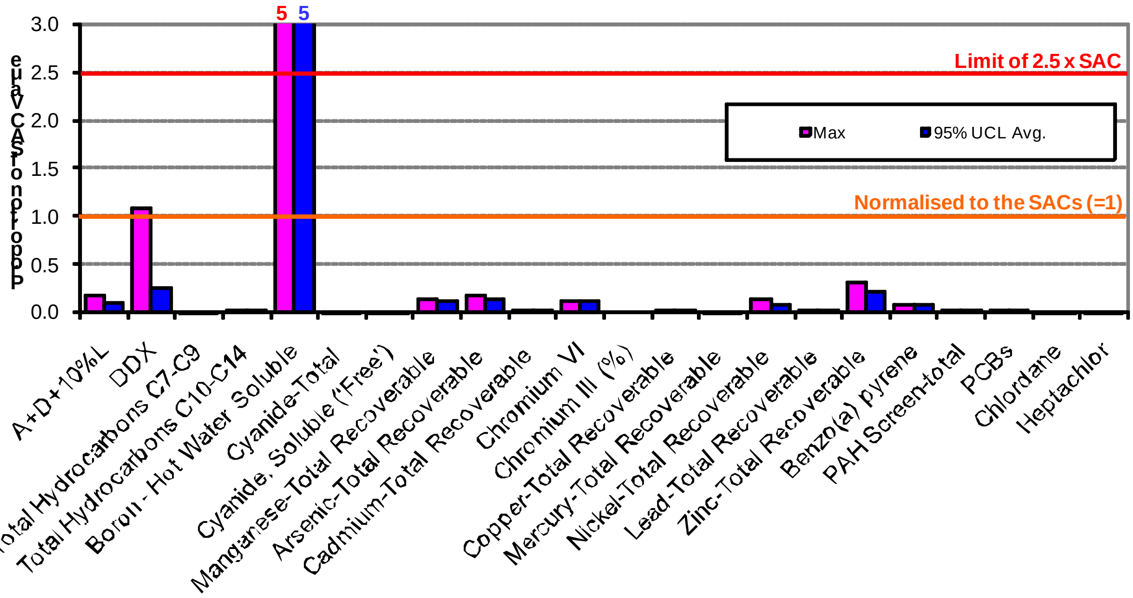
- **Table 50 Individual excavation samples above the DDX and Boron SAC (all sample values in mg/kg).**

Sample ID	Subgrade	Property	Cell	Level	A+D+10%L (SAC = 3)	DDX (SAC = 5)	Boron - Hot Water Soluble (SAC = 3)
8317	Site Mngmnt	18 Tahi St	O9	1	0.53	5.45	
2425	AW	13 Tahi St	M24	2	0.01	0.04	15
2469	AW	13 Tahi St	L19	3	0.01	0.45	15

However, the two Boron results that exceeded the SAC were as a result of the tests being done with a detection limit of 30 mg/kg –, 10 times the SAC. The results were less than the limit of detection, so recorded at half the detection limit, which still exceeds the SAC. With such a high detection limit, these two samples are effectively meaningless and the other two Boron results should be referred to as they both had a limit of detection of 0.5 mg/kg limit (well below the SAC of 3 mg/kg). The two exceedence samples have not been included in the cell and subgrade averaging.

The marginal DDX value was approved by TDC via a letter of 10 September TDC (Dennis Bush-King) to MFE, but as an individual sample is acceptable anyway as it does not exceed 2.5 x SAC limit.

The summary statistics for the results of substances with valid SAC are shown graphically in Figure 34. This chart shows the single marginal DDX result, as well as the nominally high boron results which are an artefact of the high LOD for 2 samples and not considered actual exceedences. All other values are well below the residential SAC.



- **Figure 34. Normalisation of individual validation sample results to the SAC values.**

Cell and Subgrade Averages: The full averaged OCP results for each cell are shown in Table 84 of Appendix C and averages per subgrade are shown in Table 85 of Appendix C. A summary of the maximum cell and subgrade averages for each substance against the SAC limits is shown in Table 51 and graphically in Figure 35. These results show that no cell or subgrade averages exceeded the SAC.

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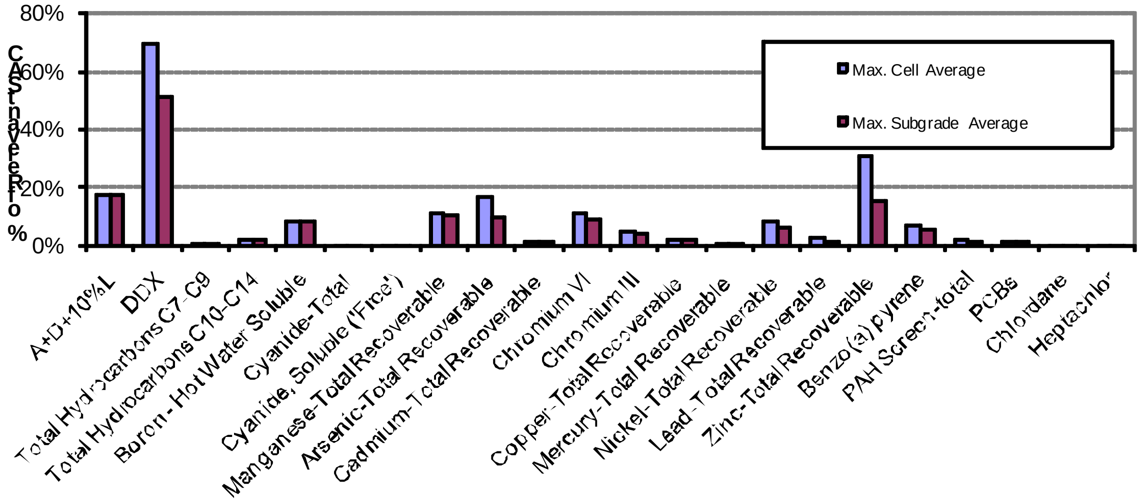
- **Table 51. Summary of the private property excavation cell and subgrade average validation results (all sample results mg/kg).**

Substance	Max. Cell Value	Max. Subgrade Value	*SAC*
A+D+10%L	0.53	0.53	3
DDX	3.49	2.55	5
Total Hydrocarbons C7-C9	5.00	4.83	500
Total Hydrocarbons C10-C14	12.5	10.7	510
Boron - Hot Water Soluble	0.25	0.25	3
Cyanide-Total	0.05	0.05	70
Cyanide, Soluble ('Free')	0.20	0.20	50
Manganese-Total Recoverable	168	154	1,500
Arsenic-Total Recoverable	5.0	3.0	30
Cadmium-Total Recoverable	0.05	0.05	3
Chromium VI	1.00	0.80	9
Chromium III	30.0	27.0	600
Copper-Total Recoverable	7.00	6.00	300
Mercury-Total Recoverable	0.05	0.05	11
Nickel-Total Recoverable	50.5	36.6	600
Lead-Total Recoverable	8.20	5.32	300
Zinc-Total Recoverable	62.0	30.4	200
Benzo(a) pyrene	0.02	0.02	0
PAH Screen-total	0.40	0.30	20
PCBs	0.15	0.15	10
Chlordane	0.03	0.03	50
Heptachlor	0.01	0.01	10



- **Figure 35. Graphical summary of Maximum Cell and Subgrade averages in FCC East.**

13.3.2. Reburial Material

Residential: Section 6 has analysed all residential reburial material and demonstrated that it meets the relevant RAP acceptance criteria.

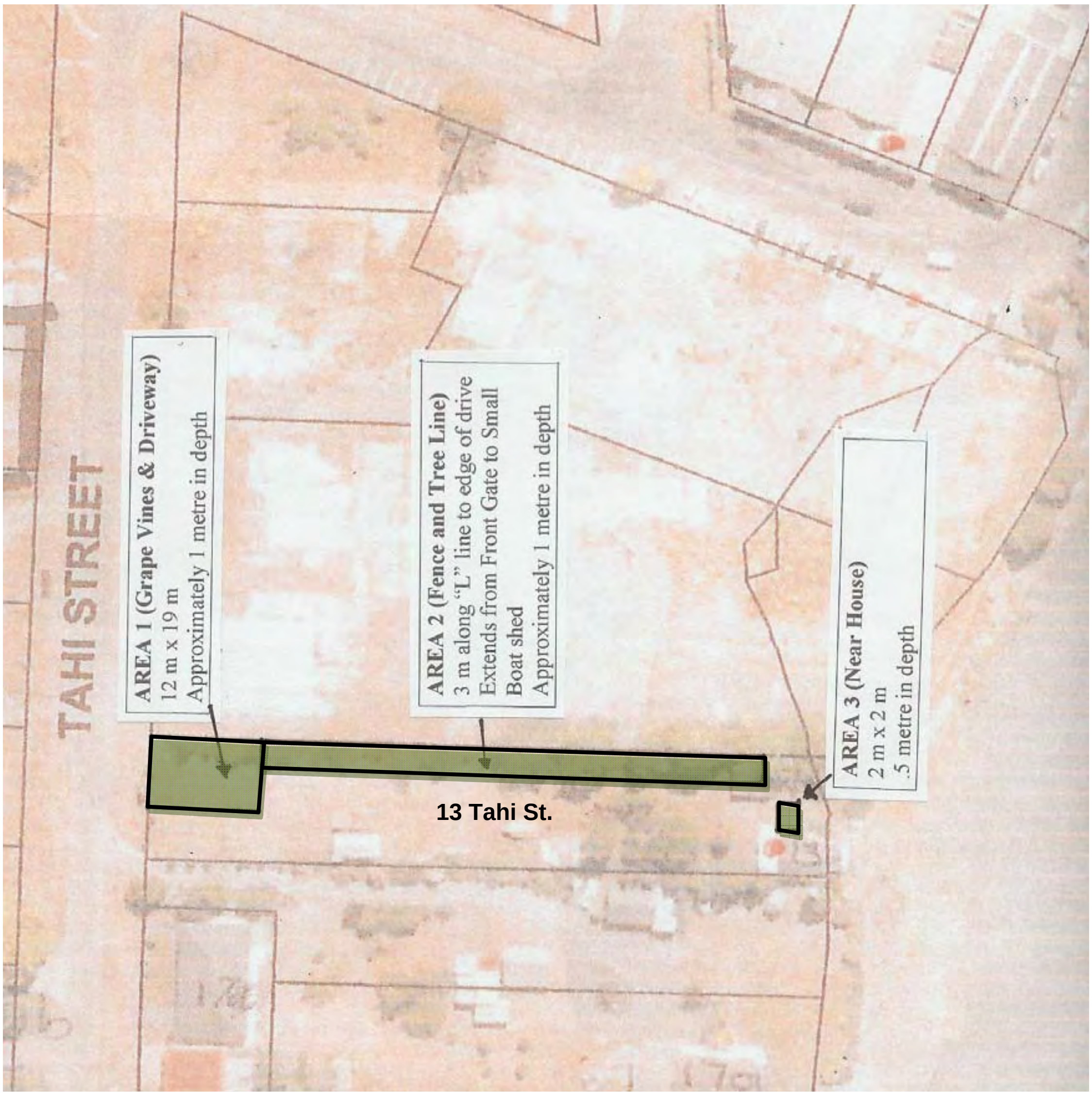
Imported Material: Section 9 has analysed all imported material, including imported soil, and demonstrated that it meets the relevant RAP acceptance criteria.

13.4. Discussion and Conclusions

With the exception of two individual Boron samples with a high limit of detection which exceeds the SAC, the validation data shows that the soil quality in the private property sites meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values.

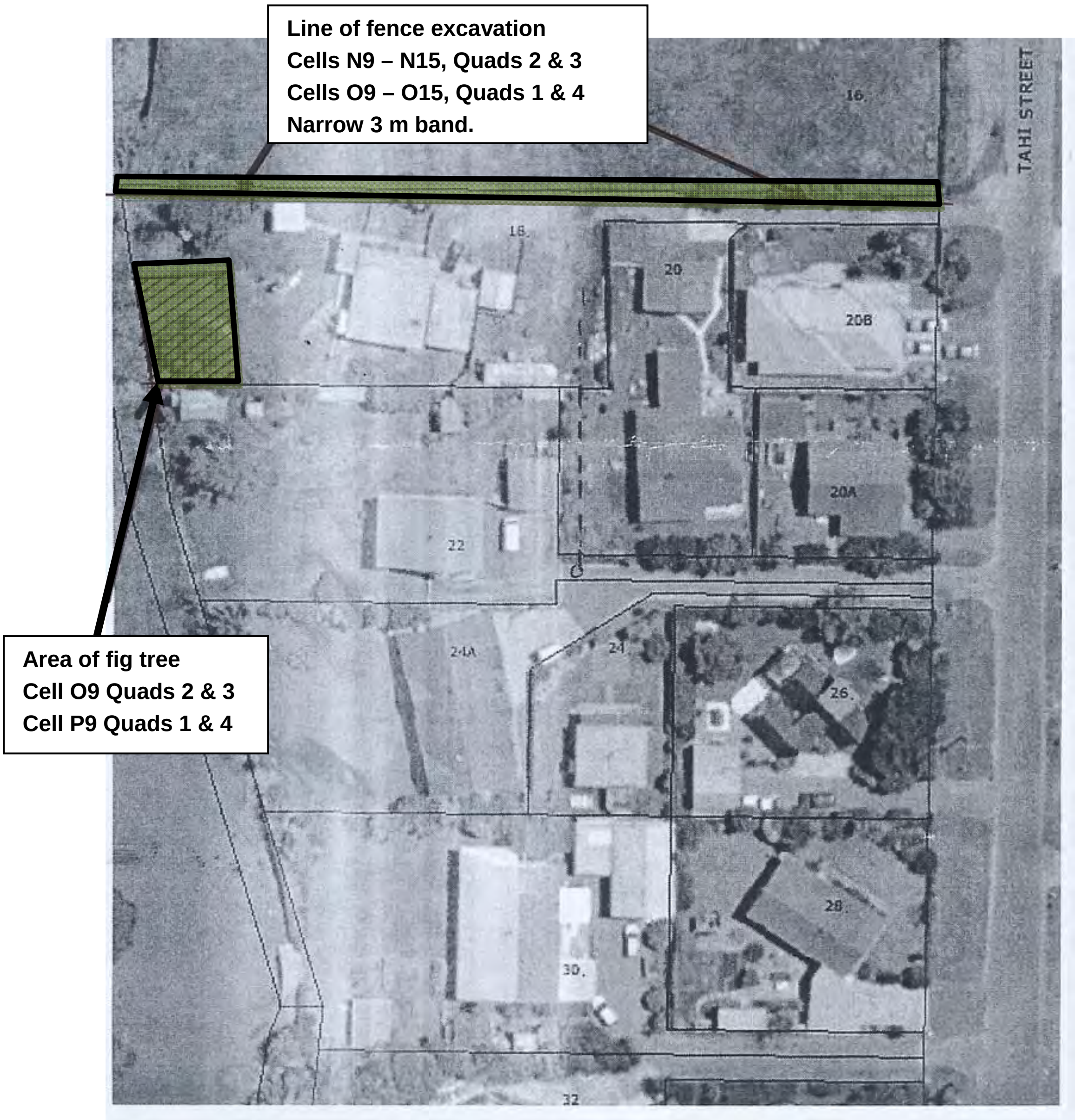
A single marginal DDX value (5.45 mg/kg versus the SAC of 5 mg/kg) is acceptable as it does not exceed the 2.5 x SAC residential limit for individual samples and has additionally been approved by TDC via a letter of 10 September TDC (Dennis Bush-King) to MFE.

The reburial material came from both the residential stockpile and imported topsoil and has been validated in Sections 6 and 9 above.



- **Figure 36. Private Property, 13 Tahi St – position relative to site.**

- **Figure 37. Private Property, 13 Tahi St – affected cells.**



- **Figure 38. Private Property, 18 Tahi St**

14. East Marine Sediments

14.1. Description of East Marine Sediments

The East Marine Sediment area is shown in Figure 3 in Section 2.3. The area is required to be remediated to meet the SAC for aquatic ecosystem sediments. It should be noted that the marine sediment SACs for OCPs are considerably more stringent than the SACs for terrestrial soils under any land use. The area covers approximately 2,100 m^2. During the remediation of this area it was split into 14 separate cells (FS1 -14) as listed in Table 52 and shown in Figure 41. The cells are of differing sizes due to tidal time constraints for excavation and placement of material.

The marine sediment results have not been normalised to 1% total organic carbon (TOC) as required by ANZECC 2000 marine sediment guidelines, due to TOC not being included in the analysis supplied by MfE for the marine sediment samples.

14.2. Validation Sampling

Validation sampling was performed within the work constraints imposed by the resource consent as described below.

"Work in the marine area was more difficult given the tidal nature of the area and the relative wetness of the material. The resource consent required that when marine excavation work was done that "the excavated area shall be covered with clean fill appropriate for the marine environment prior to being submerged by the tide." This meant that the area was excavated, sampled and backfilled with clean marine sediment within the one tide. The samples are from the base of the excavation i.e. the floor. The walls couldn't be sampled as the whole area was excavated and also due to the nature of the marine material." (email from Tracey Ayre, MfE to Phil Outram, SKM dated 5/09/2008)

A total of 102 samples were collected from the East Marine Sediments area, including 16 samples, labelled 2115 to 2030, that were taken in May 2005 (4 months after the remediation). Sample 2115 was taken from storm drain near Smokehouse Café. Subsequent samples were taken every 7.5 metres heading south along the beach at 15 metres from the top of the bund and at 300 mm depth. All samples were composites of soil at 300 mm in a radius of 3 metres.

14.2.1. Reburial Material

Imported Material: Section 9.2.2 has analysed all imported marine gravels and demonstrated that two samples had SAC exceedences for DDX, Nickel and potentially Chlordane (50 % of the level of detection exceeded SAC).

SKM

14.3. Results

14.3.1. Excavated Area

Individual Sample Results: A full summary of the 102 sample results is shown in Table 86 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

Of all samples, 68 results failed to meet the RAP limit for individual samples of 2.5 x SAC for one or more of ADL, DDX, Nickel, PCBs or Chlordane (Table 52). A further 16 results were marginal (above the SAC but below the 2.5 x SAC limit used for aquatic ecosystems sediment) for one or more contaminants.

Of the 68 failed results, 21 samples exceeded for ADL (SAC of 0.01 mg/kg), 62 exceeded for DDX (SAC of 0.01 mg/kg), 4 exceeded for Nickel (SAC of 21 mg/kg), 3 exceeded for PCBs (SAC of 0.023 mg/kg) and 15 exceeded for Chlordane (SAC of 0.0005 mg/kg). However, 2 of the failed PCB results, 7 of the 15 failed Chlordane results and all of the marginal Chlordane results are caused by the result being below the detection limit, but the detection limit being more than two times the SAC (therefore the result being set at 50% of the detection limit (i.e. 0.001mg/kg) still exceeds the SAC).

- **Table 52. Individual excavation samples above the DDX, ADL, Nickel & PCBs SAC (all sample values in mg/kg).**

Sample I.D	Cell	A+D+10%L	DDX	Nickel-Total Recoverable	PCBs	Chlordane[2]
SAC		*0.01*	*0.01*	*21*	*0.023*	*0.0005*
1266	1	0.004475	**0.01285**			
1267	1	**0.025675**	0.00885			
1268	1	0.004175	**0.0153**			
1270	2	0.002175	**0.01135**			
1271	2	0.001875	**0.01025**			
1274	3	0.001175	**0.0331**			
1275	3	0.003275	**0.03675**			
1276	3	0.000875	**0.0106**			
1277	3	0.001075	**0.0251**			
1284	4	0.003075	**0.0306**			
1287	4	0.002275	0.00205	**31**		
1288	4	0.001175	**0.03935**			
1289	4	0.002975	**0.03215**			
1290	5	**0.01266**	**0.1654**			
1291	5	**0.01729**	**0.5172**			
1292	5	0.00377	**0.4152**	**80**		
1293	5	0.002775	**0.02885**			
1294	5	0.0058	**1.2036**			
1295	5	0.002675	**0.04185**			

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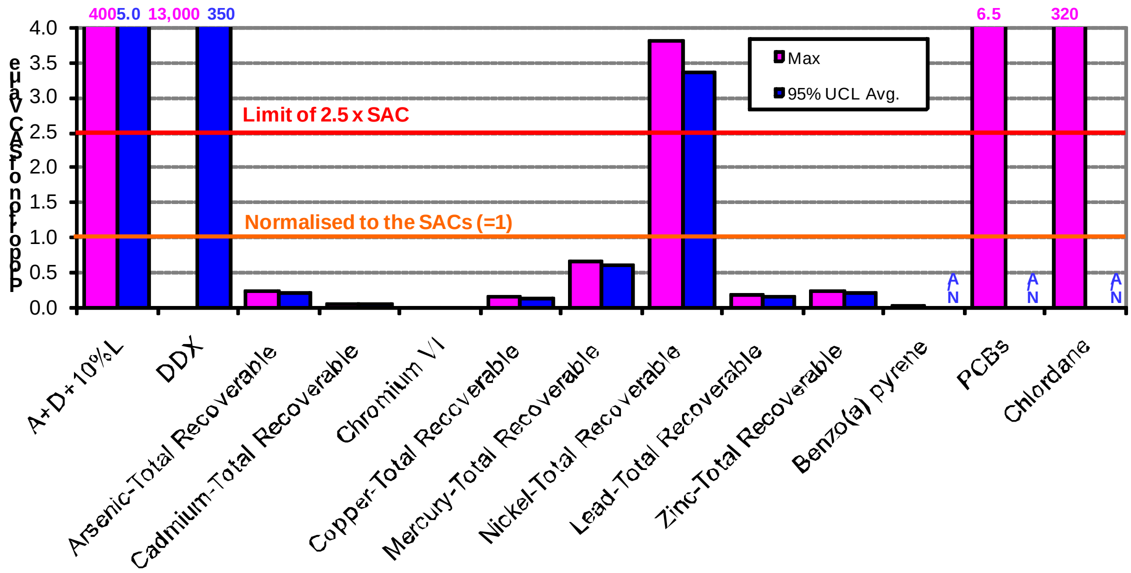
Sample I.D	Cell	A+D+10%L	DDX	Nickel-Total Recoverable	PCBs	Chlordane[2]
1296	6	0.00306	0.01835			
1297	6	0.00408	0.01375			
1299	6	0.003525	0.0405			
1300	6	0.00906	0.0798			
1301	6	0.00205	0.01275			
1302	6	0.00507	0.1491			
1303	7	0.00547	0.01235			
1305	7	0.01175	0.6506			
1306	7	0.0103	0.01115			
1307	8	0.00489	0.0467			
1308	8	0.00276	0.02335			
1309	8	0.00489	0.0467			
1310	8	0.00276	0.02335			
1371	9	0.002875	0.01835			
1372	9	0.004525	0.0213			
1373	9	0.003875	0.0217			
1374	9	0.054325	0.01705			
1376	9	0.01669	0.2603			
1377	9	0.003425	0.0514			
1384	10	0.16925	2.0905	72		
1385	10	0.35625	2.591	69	0.07	
1418	11	0.2205	125.47			
1419	11	0.015225	0.03025			
1420	11	0.1705	1.115			
1423	11	3.923	58.3			
1424	11	0.001175	0.0252			
1427	11	0.01076	0.1622	51	0.015	
1428	12	0.0105	0.5205			
1429	12	0.01716	0.0292			
1430	12	0.0105	0.25025			
1431	12	0.007825	0.03505			
1432	12	0.0306	0.3651			
1446	13	0.001275	0.0176			0.009
1447	13	0.003625	0.0142			0.047
1449	13	0.04815	0.0056			0.022
1450	13	0.000875	0.00415			0.027
1451	13	0.01239	1.2964			0.16
1452	13	0.011425	0.4827	58	0.015	
1453	13	0.01136	0.676			0.057
1454	14	0.002475	0.1034			0.006
1455	14	0.002825	0.5832			
1456	14	0.00746	1.703			
1457	14	0.00656	1.9645			
1458	14	0.003125	0.6495			
1459	14	0.000975	0.1221			
1460	14	0.000875	0.04825			
1461	14	0.003225	0.8227			
1462	14	0.0189	0.5443			
1463	14	0.002675	0.0304			
1464	14	0.00481	0.1079			

SKM

Sample I.D	Cell	A+D+10%L	DDX	Nickel-Total Recoverable	PCBs	Chlordane[2]
2116	Beach	0.019825	**0.543**			
2117	Beach	0.02326	**0.473**			
2118	Beach	**0.0334**	**0.6062**			
2119	Beach	**0.28543**	**6.411**			
2120	Beach	**0.18194**	**2.6279**			
2121	Beach	**0.09032**	**1.6951**			
2122	Beach	**0.06562**	**1.3762**			
2123	Beach	**0.15479**	**3.1384**			
2124	Beach	**0.06522**	**1.0723**			
2125	Beach	**0.16387**	**3.5368**			
2126	Beach	**0.05365**	**1.1121**			
2127	Beach	**0.0763**	**1.4242**			
2128	Beach	0.016625	**0.3664**			
2129	Beach	**0.060525**	**0.5421**			
2130	Beach	**0.027325**	**0.8244**			

- **Note:** 1 Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Bold Red) if value > (2.5 x SAC)
  2 Marginal and failed Chlordane and PCB results that were below the detection limit of the test are not shown.

The summary statistics for the results of substances with valid SAC are shown graphically in Figure 39. Again, this data presentation shows that the ADL, DDX, Nickel and PCBs values fail to meet the RAP limit of 2.5 x SAC. The 95% UCL of the means are above the SAC for 3 of these substances. There were insufficient benzo(a)pyrene, PCB and Chlordane samples above the detection level to give a meaningful confidence level.



- **Figure 39. Normalisation of individual validation sample results to the SAC values.**

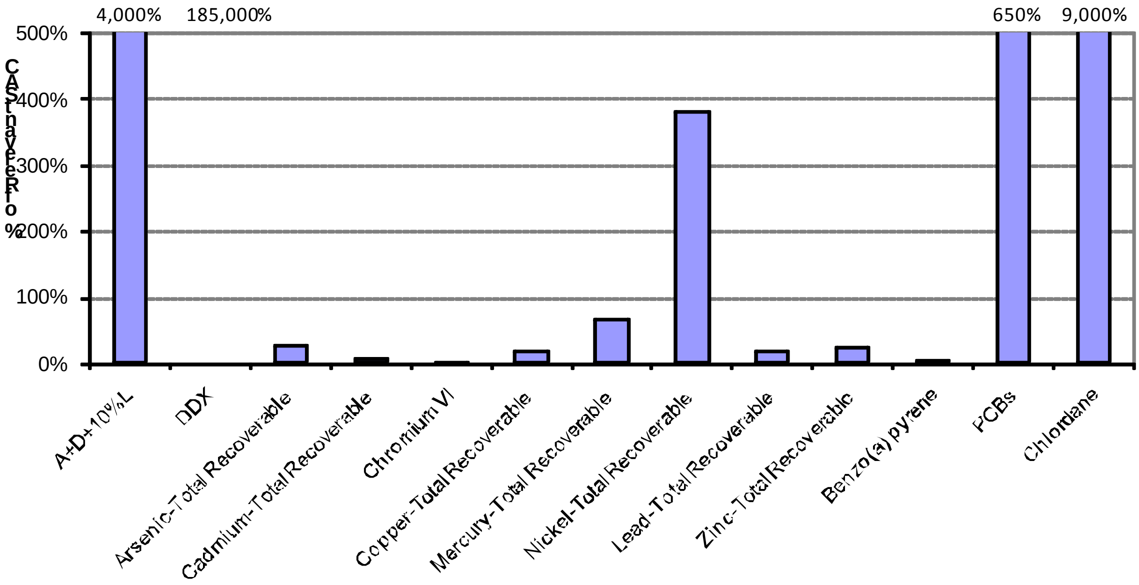
Cell Averages: A summary of the maximum cell averages for each substance against the SAC limits is shown in Table 53 and graphically in Figure 40. A detailed table of cell averages is provided in Appendix C, Table 87. These results show that 13 of the 14 cell averages exceed the SAC values for ADL and DDX. The average for the 14 samples, taken 4 months following the excavation and fill, also exceed the SAC for ADL and DDX.

It should be noted that only cells 4, 5, 10, 11, 12 & 13 were analysed for the compounds listed below, therefore the maximum cell average does not represent the entire East Marine Area.

- Arsenic-Total Recoverable
- Cadmium-Total Recoverable
- Chromium VI
- Copper-Total Recoverable
- Mercury-Total Recoverable
- Nickel-Total Recoverable
- Lead-Total Recoverable
- Zinc-Total Recoverable
- Benzo(a)pyrene

Table 53. Summary of the East Marine Sediments excavation cell average validation results (all sample values mg/kg).

Substance	Max. Cell Average	*SAC*
A+D +10%L	0.43	*0.01*
DDX	18.5	*0.01*
Arsenic-Total Recoverable	5.0	*20*
Cadmium-Total Recoverable	0.1	*1.5*
Chromium VI	0.2	*80*
Copper-Total Recoverable	11.0	*65*
Mercury-Total Recoverable	0.1	*0.15*
Nickel-Total Recoverable	80	*21*
Lead-Total Recoverable	8.1	*50*
Zinc-Total Recoverable	45	*200*
Benzo(a) pyrene	0.015	*0.43*
PCBs	0.015	*0.023*
Chlordane	0.05	*0.0005*



- **Figure 40. Graphical summary of Maximum Cell averages in East Marine Sediments Site.**

14.4. Discussion and Conclusions

The validation data shows that enough samples were taken in the East Marine Sediment area to comfortably meet the RAP sampling requirement.

The remediation has not achieved SAC compliant contaminant concentrations in extensive areas. Of the 102 validation samples taken, 16 had marginal (1 – 2.5 SAC) and 68 had failed (>2.5 SAC) results. These samples failed due to one or more of the following contaminants: ADL, DDX, Nickel, PCBs or Chlordane.

The samples that failed to meet the SAC also had significant impacts on the cell averages, with all but one of the cell averages failing to meet the DDX and/or ADL SAC. The average for the beach samples taken 4 months later also failed to meet the SAC for these contaminants.

The reburial material came from a number of off-site sources and has been validated in Section 9.2.2.

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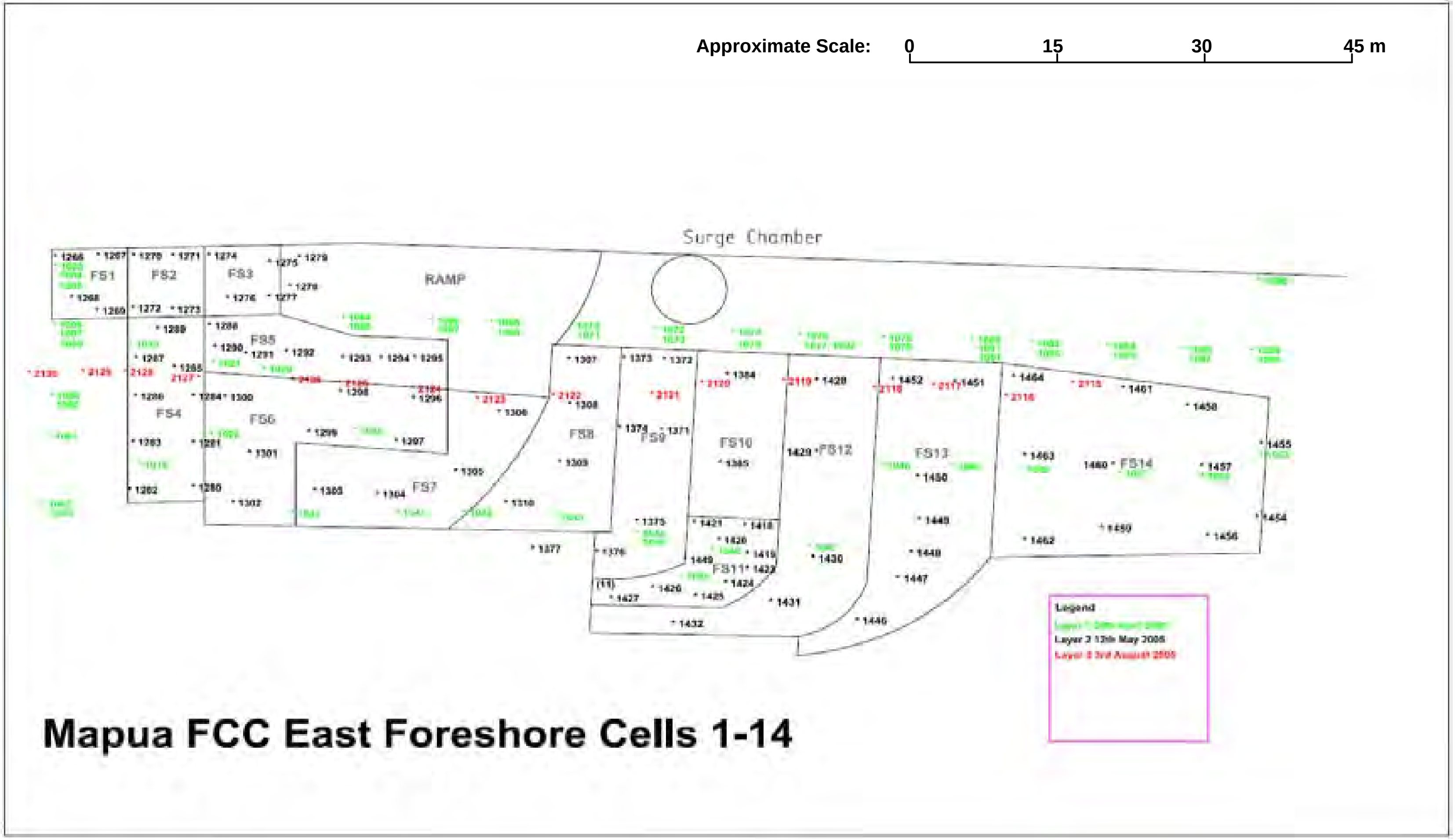


- **Figure 41. East Marine Sediment Cells and Sample Locations**

15. West Marine Sediments

15.1. Description of West Marine Sediments Area

The west marine sediment area is shown in Figure 3 in Section 2.3. The area's end use will be as an aquatic ecosystem. The area covers approximately 12,150 m^2. During the remediation of this area it was split into 54 separate cells as listed in Table 54 and shown in Figure 44. The cells were of 15m x 15m squares ('cells') and were a continuation of the numbering system from the Landfill and FCC West areas.

The marine sediment results have not been normalised to 1% total organic carbon (TOC) as required by ANZECC 2000 marine sediment guidelines, due to TOC not being included in the analysis supplied by MfE for the marine sediment samples.

15.2. Validation Sampling

15.2.1. Excavated Area

Validation sampling was performed within the work constraints imposed by the resource consent as described below.

A total of 146 samples were taken from the excavation with at least one sample taken from every cell (sampling was approximately proportional to the proportion of cell excavated) to meet the RAP requirements. There are 54 cells in the West Marine Site, which equates to an average of 2.7 samples per cell.

A further 3 samples were taken on 13/07/2007, one year after the remediation work. These were samples 8181, 8182 & 8183.

15.2.2. Reburial Material

Imported Material: Section 9.2.2 has analysed all imported marine gravels and demonstrated that two samples had SAC exceedences in DDX, Nickel and potentially Chlordane (50% level of detection exceeded SAC).

15.3. Results

15.3.1. Excavated Area

Individual Sample Results: A full summary of the 149 sample results is shown in Table 88 of Appendix C. This includes the number of samples tested for each substance, the statistical 95% UCL of the mean for each substance and a comparison of the maximum sample values against the relevant SAC.

Of all samples, 68 results failed to meet the RAP limit for individual samples of 2.5 x SAC for one or more of ADL, DDX, Mercury, Nickel or Chlordane (Table 54). A further 29 results were marginal (above the SAC but below the 2.5 x SAC limit used for aquatic ecosystems sediment) for one or more contaminants.

The 3 samples taken 1 year after the remediation listed at the bottom of Table 54 exceeded the 2.5 x SAC for ADL and DDX and the results for Nickel and Chlordane were potential marginal failures as although the results were below the limit of detection, the detection limits were above the SAC.

- **Table 54. Individual excavation samples above contaminant SAC (all sample values in mg/kg).**

Sample I.D	Cell	A+D +10%L	DDX	Mercury-Total Recoverable	Nickel-Total Recoverable	Chlordane
SAC		*0.01*	*0.01*	*0.15*	*21*	*0.0005*
4406	H7	0.003	**0.13**			**0.001**
4407	H7	0.001	0.01	0.05	**25**	**0.001**
4408	H7	0.002	**0.08**	0.05	14	**0.001**
4409	J6	0.002	**10.50**			**0.001**
4410	J6	0.006	**36.65**			**0.001**
4411	J6	0.001	**0.01**			**0.001**
4412	J5	**0.028**	**82.23**			**0.001**
4413	J5	0.001	**0.14**			**0.001**
4414	J5	0.001	**0.03**	0.05	11	**0.001**
4415	I6	**0.028**	**13.26**			**0.001**
4416	I6	**0.091**	**7.68**			**0.001**
4417	I6	0.001	**0.06**			**0.001**
4418	K5	0.006	**13.78**			**0.001**
4419	K5	0.004	**0.24**			**0.001**
4420	K5	**0.011**	**0.08**			**0.083**
4421	K4a	0.008	**1.28**			**0.001**
4422	K4a	0.001	**0.02**			**0.001**
4423	K4a	0.003	**0.05**	0.05	14	**0.001**
4424	K4b	0.008	**4.57**			**0.001**
4425	K4b	0.001	**0.02**			**0.001**
4426	K4b	0.003	**0.13**			**0.001**
4427	G7	0.002	**0.07**			**0.001**
4428	G7	**0.027**	**0.97**			**0.001**
4429	G7	0.001	**0.04**	0.05	16	**0.001**
4430	N1	**0.056**	**6.07**			**0.001**
4431	N1	**0.013**	**0.54**			**0.001**
4432	N1	0.004	**0.17**			**0.001**
4433	M2	**0.015**	**2.37**			**0.001**
4434	M2	0.006	**0.34**			**0.001**
4435	M2	0.008	**0.23**			**0.001**
4437	M1	0.003	**0.07**			**0.001**
4438	M1	0.001	**0.08**	0.05	15	**0.001**
4439	L2	0.002	**1.10**			**0.001**

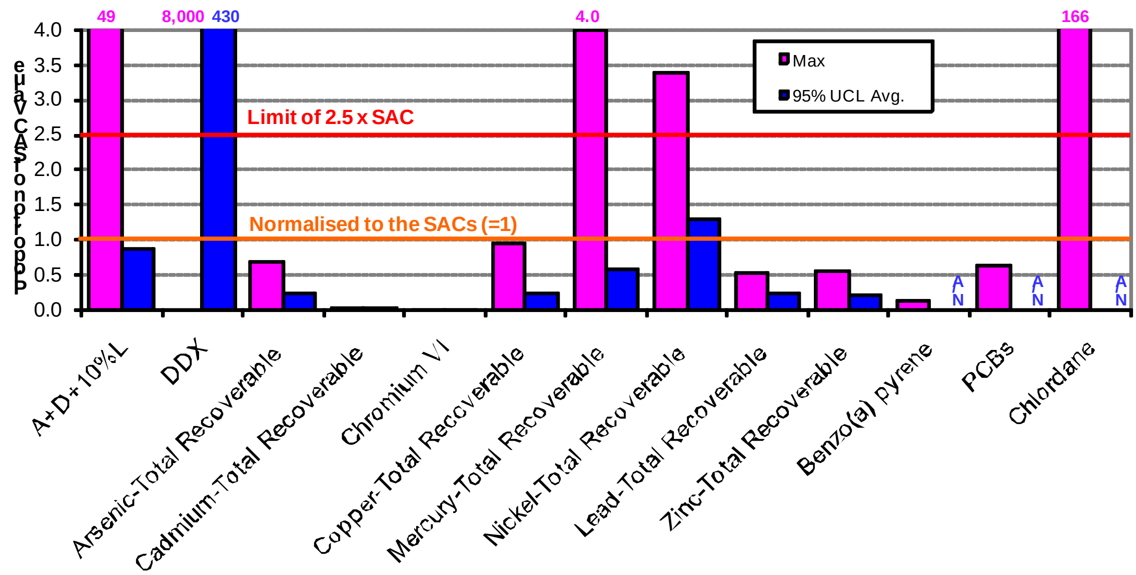
4440	L2	0.004	0.16	0.05	11	0.001
4442	L3	0.016	1.35			0.001
4443	L3	0.017	13.34			0.001
4444	L3	0.001	0.02	0.05	16	0.001
4445	I7	0.018	30.81			0.001
4446	I7	0.001	0.17			0.001
4447	I7	0.004	0.13			0.001
4448	#1	0.003	0.12			0.001
4449	#2	0.006	0.32			0.001
4450	#3	0.016	0.87			0.001
4451	#4	0.005	0.14			0.001
4452	#5	0.001	0.03			0.001
4453	#6	0.003	0.18	0.05	9	0.001
4454	#7	0.094	15.45			0.001
4455	#8	0.009	1.32			0.001
4456	#9	0.001	0.02			0.001
4480	P4	0.006	0.01			0.001
4481	O4	0.004	0.01			0.001
4482	P4	0.001	0.02	0.05	9	0.001
4483	O4	0.001	0.01			0.001
4484	P5	0.003	0.02			0.001
4488	P2	0.001	0.01	0.05	29	0.001
4491	O7	0.002	0.02			0.001
4495	R1	0.001	0.02			0.001
4496	R1	0.001	0.02			0.001
4497	Q1	0.010	0.28	0.05	19	0.001
4498	Q2	0.003	0.03			0.001
4499	P1	0.001	0.01			0.001
4500	P1	0.001	0.03			0.001
4501	O1	0.005	0.90			0.001
4526	O7	0.001	0.00	0.05	27	0.001
4535	O6	0.001	0.00	0.05	23	0.001
4542	Q6	0.002	0.02	0.05	28	0.001
4544	P2	0.003	0.47			0.001
4545	P2	0.003	0.51			0.001
4546	P2	0.002	0.30	0.1	71	0.001
4547	Q3	0.001	0.01			0.001
4548	Q3	0.002	0.09			0.001
4549	R2	0.003	0.16			0.001
4550	R2	0.004	0.14			0.001
4551	S1	0.006	0.15			0.001
4553	P3	0.001	0.02			0.001
4554	P3	0.001	0.01	0.05	37	0.001
4558	Q8	0.001	0.01			0.001
4559	Q8	0.054	0.43	0.05	34	0.001
4582	L4	0.001	0.02	0.3	13	0.001
4583	L4	0.000	0.03	0.6	16	0.001
4586	O8	0.224	15.06			0.001
4587	O8	0.001	0.02			0.001
4632	O3	0.004	0.08			0.001
4633	P4	0.001	0.03			0.001
4634	P5	0.001	0.02	0.05	25	0.001

4635	P6	0.001	0.01			0.001
4636	P7	0.001	0.05			0.001
4637	Q7	0.001	0.01			0.001
4638	Q8	0.001	0.04			0.001
4639	Q9	0.010	0.13			0.001
4640	Q9	0.001	0.02			0.001
4641	P8	0.001	0.04			0.001
4642	P8	0.026	3.29			0.001
4643	08	0.135	9.05			0.001
8181	8181	0.492	24.25	0.05	47	0.001
8182	8182	0.162	4.90	0.05	38	0.001
8183	8183	0.093	7.10	0.05	39	0.001

- **Note:** 1 Marginal (Orange) if SAC < value < (2.5 x SAC); Failed (Bold Red) if value > (2.5 x SAC)
  2 The potentially marginal chlordane results were below the detection limit of the tests.

The summary statistics for substances with valid SAC are shown graphically in Figure 42. This data presentation shows that the maximum concentrations of ADL, DDX, Mercury, Nickel and Chlordane fail to meet the RAP limit of 2.5 x SAC. However the 95% UCL of the mean for DDX is the only contaminant which is above the SAC.

There were insufficient benzo(a)pyrene, PCBs and Chlordane samples above the detection level to give a meaningful confidence level.



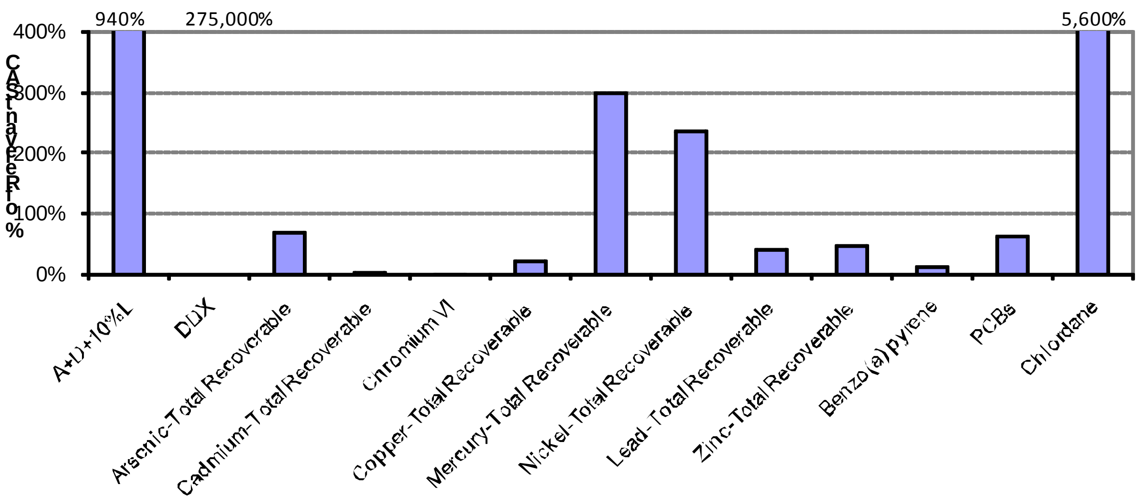
- **Figure 42. Normalisation of individual validation sample results to the SAC values.**

Cell Averages: A summary of the maximum cell averages for each substance against the SAC limits is shown in Table 55 and graphically in Figure 43. A detailed table of OCP cell averages is provided in Table 89 of Appendix C.

These results show that 47 of the 54 cell averages exceed the SAC values for ADL and/or DDX. As noted for the East Marine Sediments site, only a selection of cells were analysed for metals, benzo(a)pyrene and PCBs, and therefore the maximum cell averages (Table 55) do not represent the entire West Marine Area.

- **Table 55. Summary of the West Marine Sediments excavation cell average validation results (all sample values mg/kg).**

Substance	Max. Cell Average	*SAC*
A+D +10%L	**0.09**	*0.01*
DDX	**27.5**	*0.01*
Arsenic-Total Recoverable	14.0	*20*
Cadmium-Total Recoverable	0.05	*1.5*
Chromium VI	1.0	*80*
Copper-Total Recoverable	16.0	*65*
Mercury-Total Recoverable	**0.45**	*0.15*
Nickel-Total Recoverable	**50.0**	*21*
Lead-Total Recoverable	21.8	*50*
Zinc-Total Recoverable	94.0	*200*
Benzo(a) pyrene	0.060	*0.43*
PCBs	0.015	*0.023*
Chlordane	**0.028**	*0.0005*



- **Figure 43. Graphical summary of Maximum Cell averages in West Marine Sediments Site.**

Note: Not all of the cells were analysed for contaminants other than the OCPS, therefore the maximum cell averages do not represent the entire West Marine site.

15.4. Re-excavation during Sept/Oct 2007

During September and October of 2007 certain areas of the West Marine Sediment Site were re-excavated to remove contaminated material. The material was replaced by marine gravels assumed to be obtained from the same locations as the previously imported marine gravels. The exact location of the re-excavation is not known. These samples have been excluded from the statistical analysis of the West Marine Site.

The base of the re-excavation was sampled 14 times and the samples exceeding the relevant SAC are shown in Table 56 below. 7 samples fail to meet the 2.5 x SAC limit for DDX, and 9 of the 14 samples are marginal fails for either ADL or DDX (above the SAC but below the 2.5 x SAC limit used for aquatic ecosystems sediment)

- **Table 56 Results of the re-excavation validation sampling Sept/Oct 2007 (all sample values mg/kg).**

Sample I.D	Cell	A+D +10%L	DDX
SAC		*0.01*	*0.01*
8800	O3	**0.019**	**0.230**
8801	O6	**0.020**	**0.593**
8802	O8	**0.013**	**0.366**
8803	P5	**0.010**	**0.338**
8804	P7	**0.014**	**0.385**
8805	Q4	0.001	**0.036**
8806	Q6	0.003	**0.014**
8807	Q8	0.003	**0.122**
8809	O6	0.001	**0.015**
8811	P5	0.001	**0.011**
8812	P7	0.001	**0.014**

15.5. Discussion and Conclusions

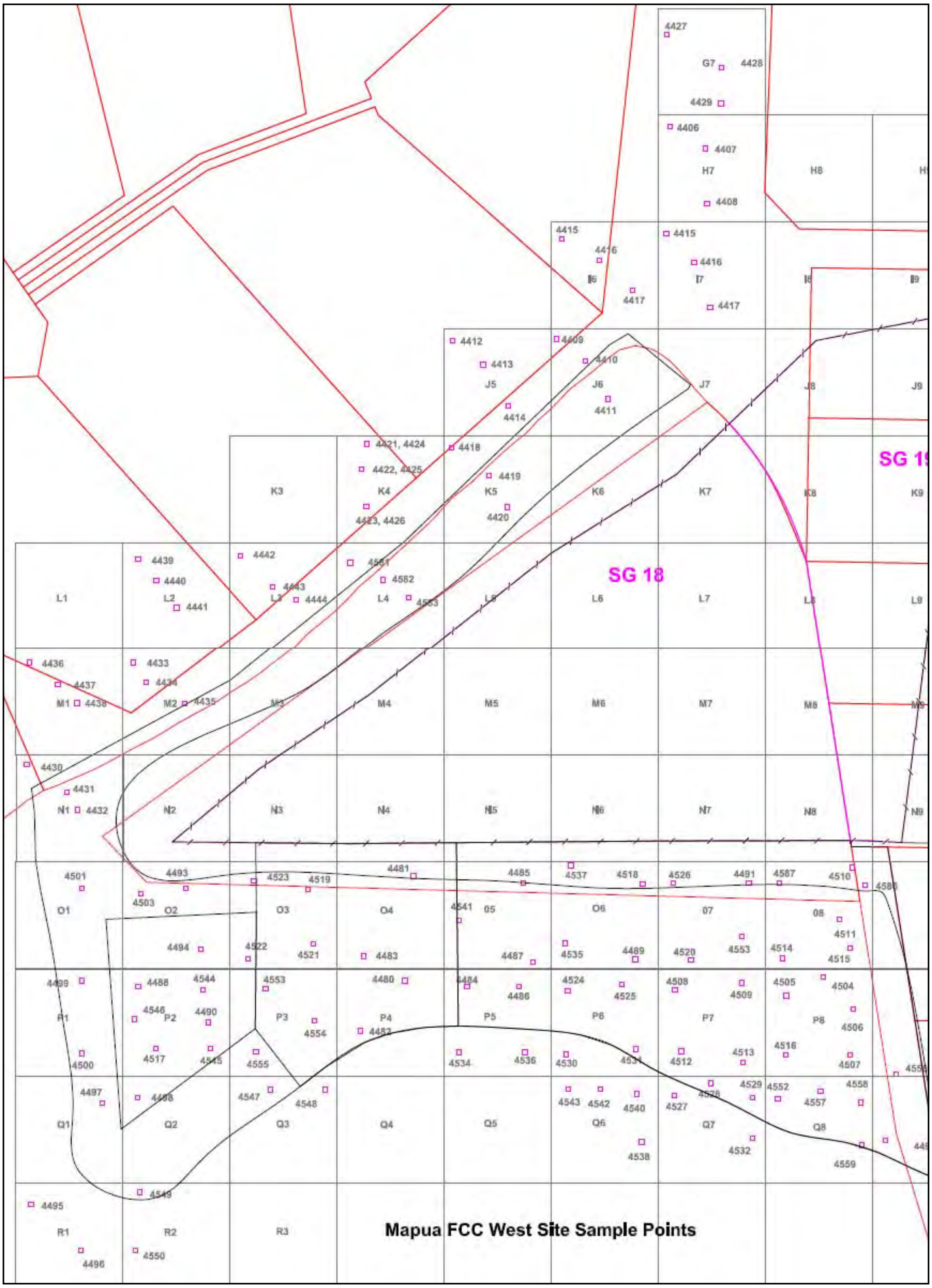
The validation data shows that enough samples were taken in the West Marine Sediment area to comfortably meet the RAP sampling requirement.

The remediation has not achieved SAC compliant contaminant concentrations in extensive areas. Of the 149 validation samples taken during the initial excavation, 68 had failed (>2.5 SAC) and 29 had marginal (1 – 2.5 SAC) results. These samples failed due to one or more of the following contaminants; ADL, DDX, Mercury, Nickel or Chlordane.

The samples that failed to meet the SAC also had significant impacts on the cell averages, with 47 of the 54 cell averages failing to meet the DDX and/or ADL SAC. The 3 samples taken one year later also failed to meet the SAC for these contaminants.

The re-excavation of September and October 2007 aimed to replace contaminated material that remained from the original remediation. Although the exact location of this work is unknown, it is clear from the re-sampling that the base of the excavation is still contaminated.

The reburial material came from a number of offsite sources and has been validated in Section 9.2.2.



- **Figure 44. Location of Cells and Samples for West Marine Sediments (each square cell measures 15 m x 15 m).**

16. Quality Assurance and Quality Control

16.1. QA/QC Sampling Programme (April 2007)

MfE and the (then) Site Auditor (Dr. Peter Nadebaum) recognised the deficiencies in the QA/QC components of the main site validation analysis programme. Additional QA/QC sampling was subsequently carried out in April 2007 as a separate phase of work from the validation sampling. The aim of the QA/QC sampling was to add confidence in the results and procedures undertaken on the site and had two broad objectives:

- To confirm that post-reinstatement validation data generally agrees with the data from the main validation programme, and
- To retrospectively confirm the reliability of Hills Laboratory data (by means of blind duplicate and split duplicate sample analysis as part of the QA/QC programme).

This programme was conducted concurrently with additional investigation into potential impact on groundwater from contaminant leaching, by means of new groundwater well installation and sampling/analysis (groundwater assessment is not reported in this Validation Report).

16.1.1. QA/QC Sampling Methodology

All QA/QC sampling was to be conducted in accordance with Australian Standards AS 4482.1: ‘1997 Guide to the Sampling and Investigation of Potentially Contaminated Soil’ (Standards Australia, 1997).

The sampling plan involved taking a series of soil samples at various depths from 12 of the larger sub-grades over the east site, once they had been backfilled. The rationale for this analysis programme was based on the number of sub-grade areas and type of backfilled material. The 12 larger areas of the FCC East were investigated and the smaller were disregarded. The areas that were sampled were selected to represent the different types of fill material backfilled on the site. The locations from which soil and groundwater samples were collected are shown in Figure 45.

The bore locations were marked in the field in accordance with the Mapua FCC Site Remediation Plan, 1 May 2006. Bores were excavated using a rotary drill mounted on a tracked mini-rig. Samples were obtained using a Multi Dig 150mm diameter spiral auger. At each location the bore hole was drilled to the target depth, then the hand auger was used to collect an undisturbed sample from the target depth interval. Soil samples were collected jointly by the MfE Mapua Site Team (EMS personnel representing MfE) and a GHD representative at the depths specified in the sampling and analytical programme (Table 1, Memorandum GHD to Mapua Site Team, 26 April 2007).

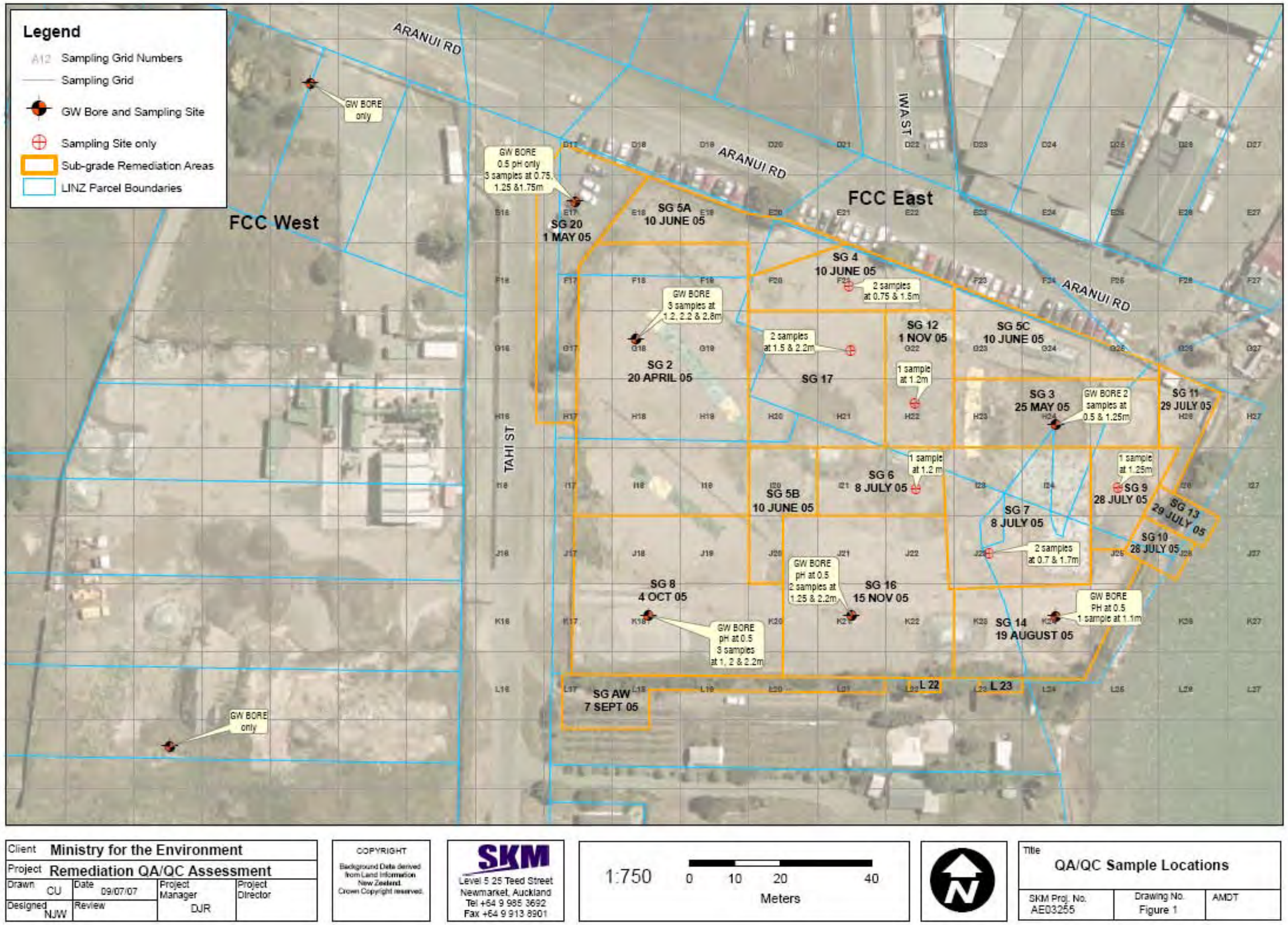
Each soil sample was placed on a mixing board and mixed using a trowel. Where analysis for TPH was required, the sample was not mixed in order to minimise the loss of the volatile fraction. The sample was divided using the trowel and soils were transferred into laboratory-supplied glass jars. The Mapua Site Team obtained two (the primary and blind duplicate) samples and the split duplicate samples were obtained by a GHD staff member (representing the auditor). All samples were transferred directly to a chillybin with ice packs for preservation while on site and in transit to the respective laboratories.

The Mapua Site Team's blind duplicate samples were given a separate identifier to ensure that the receiving laboratory (Hills) was not privy to the location or depth of the blind sample. The primary and blind duplicate samples were sent by the Mapua Site Team to Hill Laboratories under their Chain of Custody documentation.

Split duplicate samples were retained by GHD and subsequently sent to the receiving laboratory (MGT in Australia) under separate Chain of Custody documentation.

Samples were scheduled for analysis according to the analytical programme, detailed in Section 16.1.2 below.

Figure 45. QA/QC Sample Locations (FCC East)



16.1.2. QA/QC Sample Contaminants

Analysis was undertaken on the samples from the various locations to determine the presence of contaminants and their potential leachability. Soil samples were analysed for the following:

- OCPs in 18 split duplicates (analysed by MGT as independent laboratory), 10 blind duplicates (analysed by Hills as the primary laboratory), as well as 31 primary samples analysed by Hills;
- TPH in 17 primary samples analysed by Hills taken from 'commercial' backfill.
- Target suite (pH, nitrate, ammonia, Total Kjeldahl Nitrogen (TKN), Fe, Cu and OCPs and leachability for nitrate, ammonia, TKN, Fe, Cu and OCPs) in typically 10 split duplicates (MGT), as well as approximately 15 primary samples analysed by Hills.

This sampling/analysis programme scope is summarised in Table 57.

- **Table 57 Summary of QA/QC Sample Analysis**

Sample No.	Backfill	Average Depth of Base of Sub Grade	Depth (m) of Sample	Analysis	GW Bore Installed
FCC East -					
SG2	Commercial Commercial Oversize	3.4	1.2 2.2 2.8	Full Suite Full Suite Leachable OCPs	Yes
SG3	Seds-Com-OS TF – OS - Seds	2.3	0.5 1.25	Full Suite & Target Full Suite & Target	Yes
SG4	Commercial TF – Comm - OS	3.0	0.75 1.5	Full Suite Full Suite & Target	-
SG6	TF	1.68	1.5	Target (pH 2 & 5)	-
SG7	Commercial TF – Comm - OS	3.2	0.7 1.7	Full Suite Full Suite & Target	-
SG8	TF – Comm – OS TF – Comm – OS TF – Comm – OS TF – Comm – OS	3.0	0.5 1.0 2.0 2.4	pH only Full Suite & Target (pH2 & 5) Full Suite & Target Target	Yes
SG9	Commercial	2.5	1.25	Full Suite	-
SG12	TF – Comm - OS	3.5	1.2	Full Suite & Target	-
SG14	TF – OS – Seds	2.1	0.5 1.1	pH only Full Suite & Target	Yes
SG16	TF – Comm – OS TF – Comm – OS OS – Concrete	2.2	0.5 1.25 2.2	pH only Full Suite & Target (pH2 & 5) Leachable OCPs	Yes
SG17	TF – Comm – OS TF – Comm - OS	3.1	1.5 2.2	Full Suite & Target Full Suite & Target	-
SG20	TF TF TF TF – Com - OS	2.5	0.5 0.75 1.25 1.75	pH only Target (pH 2 & 5) Target Full Suite & Target	Yes
FCC West -					
SG21	No soil analysis / GW Bores only				Yes
M10					Yes

Notes: TF = Treated Fines; OS = Oversize; Seds = Foreshore / Marine sediments; Comm = Commercial

16.2. Analysis of QA/QC Samples

The analytical results were assessed differently for each of the QA/QC objectives.

16.2.1. Soil Remediation Validation

Collating all of the QA/QC validation samples gives data for a total of 55 samples which cover the testing of 140 different substances and provide 3,022 results. This data set represents soil quality post FCC East Site completion (prior to the addition of topsoil).

To compare these post-remediation results with the main remediation validation results, the data has been analysed in a similar way to the original FCC East Site excavation and reburial validation data. The base statistics (including maximum, minimum, mean and 95% UCL of the mean) for each substance have been tabulated and a bar graph (Figure 46) comparing the maximum and 95% UCL has been produced to compare the results with the commercial SAC values.

16.2.2. Hills Laboratory Validation

Primary vs Blind Duplicate Samples: The 10 pairs of primary and blind duplicate samples tested by Hills were compared by calculating the relative percentage differences (RPD) between the primary and blind duplicate results for the A+D+10%L and DDX OCPs. The RPD calculation method is as outlined in Section 8 of the AS4482.1 standard.

The data quality objectives (DQO) for this part of the analysis are that the RPDs should be less than 30 - 50% (as per AS4482.1). As higher RPDs are expected and acceptable for lower measured values nearer the detection limit, the results are presented on a graph comparing the RPD against the average of the sample pair as a proportion of the appropriate SAC value (Figure 47). On this graph, values with high RPD and measurements close to or above the SAC value are of concern. For the FCC East Site QA/QC samples, the end land use is Commercial and Recreational so the appropriate Commercial SAC levels are used.

Primary vs Split Duplicate Samples: Primary and split duplicate samples were taken for analysis for a range of contaminants from between three and eighteen locations. The primary samples were sent to the MfE laboratory (Hills) and the split duplicate sample was sent to the GHD laboratory (MGT Environmental (MGT) laboratory in Australia) to be tested.

Again, to gain an understanding of the difference in the results, the RPDs have been calculated. However, given the additional variation potentially arising from testing at separate laboratories, no explicit DQOs have been set. This is in accordance with the Site Auditor's advice to SKM.

As OCPs are the most significant substances being tested on the Mapua site, all of the individual OCP results have been tabulated and graphed in the results section below. For the other substances, all the results have been summarised and their significance discussed.

16.3. Results

16.3.1. Soil Remediation Validation Results

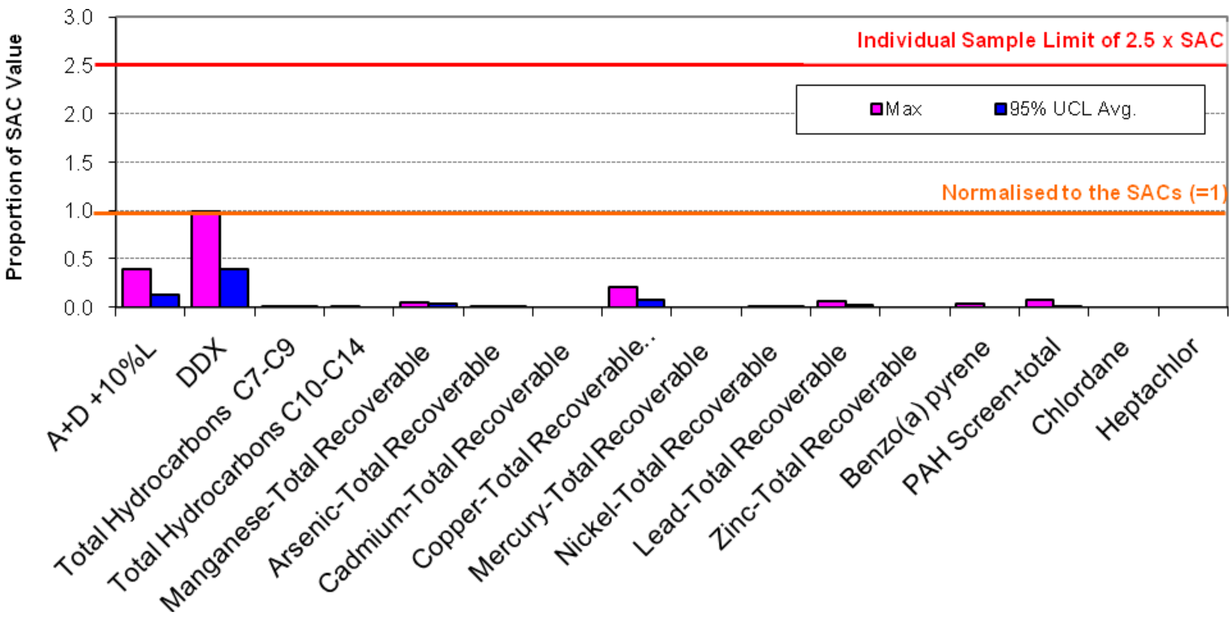
A full summary of the results of all the substances tested can be found in Table 90, Appendix C.

Table 58 below summarises the results from both labs for substances with corresponding commercial SAC values and these results are plotted on Figure 47.

- **Table 58. QA/QC Results from Substances with SAC (all sample values mg/Kg).**

Sample	# of Samples	Min	Avg	Max	95% UCL Avg	SAC
A+D +10%L	49	0.3	6.9	23.5	8.1	*60*
DDX	49	1.3	69.0	199.1	79.5	*200*
Manganese-Total Recoverable	27	88	228.19	382	248.4	*7,500*
Arsenic-Total Recoverable	27	1	3.25	7	3.7	*500*
Cadmium-Total Recoverable	29	0.05	0.18	0.5	0.2	*100*
Copper-Total Recoverable	31	12	343.42	1050	409.5	*5,000*
Mercury-Total Recoverable	27	0.05	0.16	0.4	0.2	*125*
Nickel-Total Recoverable	27	15	37.81	53	39.9	*3,000*
Lead-Total Recoverable	27	2.5	25.68	106	30.7	*1,500*
Zinc-Total Recoverable	27	20	58.63	160	65.8	*35,000*
Total Hydrocarbons C7-C9	17	3.5	3.7	4	3.8	*500*
Total Hydrocarbons C10-C14	17	5	8.6	27	10.6	*2,200*
Benzo(a) pyrene	17	0.01	0.081	0.81	0.134	*25*
PAH Screen-total	17	0.2	0.940	7.37	1.335	*100*
Chlordane	49	0.025	0.105	0.5	0.143	*250*
Heptachlor	49	0.005	0.014	0.07	0.016	*50*

Note: all results and SACs are in mg/kg



- **Figure 46. QA/QC Summary Statistics for the Samples with Corresponding SAC Values.**

As can be seen from both Table 58and Figure 46 the results look very similar to the results found when initially validating the FCC East Site – see Section 10. As expected A+D+10%L and DDX are the only two substances with significant results above 25% of the SAC and no individual sample of any substance exceeded the appropriate commercial SAC (a single DDX value was approximately at the SAC level). The 95% UCL were all significantly below the SAC levels.Table 58. QA/QC Results from Substances with SAC (all sample values mg/Kg).

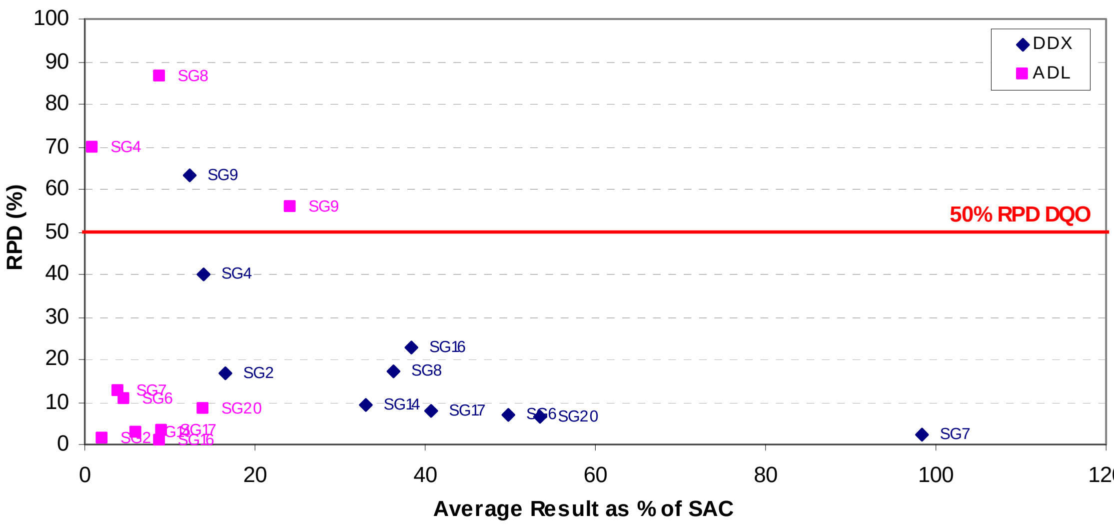
This post-reinstatement validation data agrees with and gives additional confidence in the data from the main validation programme.

16.3.2. Hills Laboratory Validation

Intra-laboratory Validation – Primary vs Blind Duplicate Samples: The results of the primary and blind duplicate samples analysed by Hills Laboratory are shown in Table 59 (exceedences of DQO of RPD<50% are shown in red) and plotted on Figure 47.

- **Table 59 Results from the Primary and Blind Duplicate sample comparison.**

Sample	Depth	A+D+10%L			DDX		
		Primary (mg/kg)	Blind (mg/kg)	RPD (%)	Primary (mg/kg)	Blind (mg/kg)	RPD (%)
SAC		*60*			*200*		
SG2	2.2	1.27	1.26	1.4	30.15	35.59	16.6
SG4	0.75	0.72	0.35	69.7	33.76	22.50	40.0
SG6	1.5	2.87	2.58	10.6	96.00	103.10	7.1
SG7	0.7	2.52	2.22	12.7	194.62	199.10	2.3
SG8	1.0	7.61	3.02	86.3	66.41	78.88	17.2
SG9	1.25	18.48	10.44	55.7	32.43	16.85	63.2
SG14	1.1	3.60	3.71	3.0	68.97	62.74	9.5
SG16	1.25	5.27	5.32	1.1	68.09	85.80	23.0
SG17	2.2	5.54	5.35	3.5	78.18	84.50	7.8
SG20	0.75	8.74	8.02	8.5	110.42	103.45	6.5



- **Figure 47. RPDs for the Primary and Blind Duplicate sample pairs.**

Figure 47 shows that there were three A+D+10%L sample pairs and one DDX sample pair for which the RPDs exceeded the DQO of RPD<50%. However, the average values for these samples were low relative to the SAC values (all below 25% of the respective SAC) and none of the DDX sample pairs with averages above 35% of the SAC had RPDs above 25%. That is, the data pairs which represent samples with higher contaminant concentrations have lower RPDs, confirming confidence in these results. The higher proportion of RPDs exceeding the DQO for A+D+10%L suggests lower confidence can be placed in the ADL results. However, there are no sample pairs with averages close to the SAC value and no individual result greater than about 20% of the SAC.

Overall, these findings confirm that the A+D+10%L and DDX data from this component of the QA/QC programme are reliable for the purpose for which they were obtained. By extension, assuming that the laboratory procedures and methods during the QA/QC programme are the same as during the main validation programme, these later results assist in providing confidence in the earlier main validation programme results.

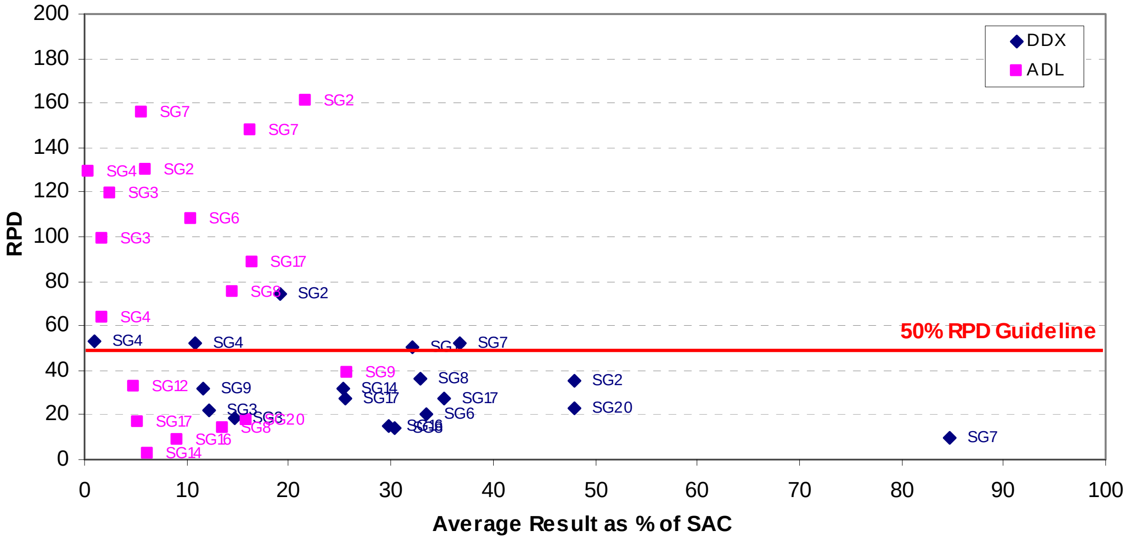
Inter-laboratory Validation – Primary vs Split Duplicate Samples: Samples were sent to the two laboratories (Hills and MGT) to test for OCPs, Leachable OCPs, Metals, Leachable Metals, Nitrogen and a few other potential contaminants.

The individual OCP results of the primary and split duplicate samples are shown in Table 60 (50% RPD exceedences are shown in red) and plotted on Figure 48.

- **Table 60. OCP Results from the Primary and Split Duplicate sample comparison.**

Sample	Depth	A+D+10%L			DDX		
		Primary (mg/kg)	Split (mg/kg)	RPD (%)	Primary (mg/kg)	Split (mg/kg)	RPD (%)
SAC		*60*			*200*		
SG2	1.20	**2.53**	**23.53**	**161.2**	79.10	113.00	35.3
SG2	2.20	**1.27**	**6.01**	**130.1**	**23.99**	**52.50**	**74.6**
SG3	0.50	**0.51**	**1.51**	**99.1**	26.96	21.60	22.1
SG3	1.25	**0.61**	**2.42**	**119.2**	32.30	26.80	18.6
SG4	0.75	**0.72**	**1.39**	**63.9**	**27.17**	**15.90**	**52.3**
SG4	1.50	**0.06**	**0.29**	**129.0**	**2.30**	**1.33**	**53.4**
SG6	1.50	**2.87**	**9.66**	**108.4**	73.50	60.00	20.2
SG7	0.70	**2.52**	**16.92**	**148.2**	161.10	178.00	10.0
SG7	1.70	**0.74**	**5.99**	**155.8**	**54.38**	**92.60**	**52.0**
SG8	1.00	7.61	8.73	13.7	54.00	77.80	36.1
SG8	2.00	**5.40**	**11.92**	**75.3**	56.60	65.20	14.1
SG9	1.25	18.48	12.42	39.3	26.95	19.60	31.6
SG12	1.20	3.43	2.46	32.9	**80.40**	**47.90**	**50.7**
SG14	1.10	3.60	3.71	3.0	58.80	42.70	31.7
SG16	1.25	5.27	5.74	8.6	55.30	64.10	14.7
SG17	1.50	3.34	2.83	16.6	58.10	44.00	27.6
SG17	2.20	**5.54**	**14.26**	**88.1**	60.90	80.00	27.1
SG20	0.75	8.74	10.39	17.3	84.90	107.00	23.0

SKM



- **Figure 48. OCP RPDs for the Primary and Split Duplicate sample pairs.**

Note: For clarity, the data labels contain only the subgrade number and not the depth. To indentify individual samples within the subgrade, the data points should be cross-referenced against Table 60. OCP Results from the Primary and Split Duplicate sample comparison.

As expected for duplicate pairs analysed at different laboratories, Figure 48 shows that many of the pairs of results differed by more than a RPD of 50%, up as high as 161%. However, the majority of the values are below the 50% limit and those significantly above are all from low sample concentrations (average is less than 25% of the relevant SAC) where larger variability (when expressed as RPD) is expected.

The inter-laboratory results for the DDX have only one result above 55% RPD which gives particular confidence to these samples.

All other inter-laboratory results are summarised in Table 61and the detailed results are included in Appendix C Table 91 to Table 93.

For the Leachable OCPs, with the exception of Lindane, all the recorded values were below the GHD (higher) lab detection limit. Lindane had a single high RPD where the GHD lab result was 0.11 g/m^3 which is still only 2.2 times the GHD lab detection limit. Therefore, no comparison can be made between the labs for the Leachable OCPs as the sample results were all low.

For Arsenic, Cadmium, Mercury Total Iron (TCLP) and Copper Total Recoverable (TCLP) the results were all very close to, or below, the detection limits which explains the high number of >50% RPDs. For the other metals, only 11 of the 60 results had an RPD >50% and none had an RPD above 100%.

The Ammonium-N and Nitrate-N results had a large number of RPDs >50% although many of the Nitrate-N results are very close to the lab detection limits (see Table 93). The % Moisture, Dry Matter and Final pH results had no RPDs above 50%.

- **Table 61. All other results from the Primary and Split Duplicate sample comparison.**

Sample	Count	Max Value (mg/Kg)	Max DL[1] (mg/Kg)	Max RPD[2] (mg/Kg)	Avg RPD (mg/Kg)	RPD Classifications			Notes[3]
						< 30% RPD	30 - 50% RPD	> 50% RPD	
Leachable OCPs									
Aldrin (TCLP g.m-3)	3	0.001	0.001	86%	53%	1	1	1	A
Dieldrin (TCLP g.m-3)	3	0.015	0.001	53%	27%	2	0	1	C
Lindane (TCLP g.m-3)	3	0.11	0.001	76%	27%	2	0	1	C
4,4'-DDD (TCLP g.m-3)	3	0.005	0.001	105%	51%	1	1	1	B
4,4'-DDE (TCLP g.m-3)	3	0.0021	0.001	181%	62%	2	0	1	B
4,4'-DDT (TCLP g.m-3)	3	0.002	0.001	86%	57%	0	2	1	B
DDX (TCLP g.m-3)	3	0.0083	0.003	71%	35%	1	1	1	B
Alpha-BHC (TCLP g.m-3)	3	0.001	0.001	133%	133%	0	0	3	A
Beta-BHC (TCLP g.m-3)	3	0.0005	0.001	22%	7%	3	0	0	A
Delta-BHC (TCLP g.m-3)	3	0.0005	0.001	164%	116%	0	1	2	A
Chlordane (TCLP g.m-3)	3	0.0025	0.005	-	-	-	-	-	F
Endosulphan I (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Endosulphan II (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Endosulphan sulphate (TCLP g.m-3)	3	0.001	0.001	181%	169%	0	0	3	A
Endrin (TCLP g.m-3)	3	0.002	0.001	190%	172%	0	0	3	E
Endrin aldehyde (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Heptachlor epoxide (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Heptachlor (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Hexa chloro benzene (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Methoxy chlor (TCLP g.m-3)	3	0.0005	0.001	-	-	-	-	-	F
Metals									
Iron (mg/kg)	10	24000	40	31%	14%	9	1	0	
Manganese Tot. Rec. (mg/kg)	8	357	5	60%	41%	2	3	3	G
Arsenic Tot. Rec. (mg/kg)	8	6	2	143%	111%	1	0	7	B
Cadmium Tot. Rec. (mg/kg)	10	0.25	0.5	133%	87%	2	0	8	A
Chromium Tot. Rec. (mg/kg)	8	33	5	100%	33%	5	2	1	C
Copper Tot. Rec. (mg/Kg)	10	852	5	61%	22%	8	1	1	C
Mercury Tot. Rec. (mg/kg)	8	0.3	0.1	100%	58%	2	0	6	D
Nickel Tot. Rec. (mg/kg)	8	53	5	82%	23%	7	0	1	C
Lead Tot. Rec. (mg/kg)	8	38	5	92%	43%	3	2	3	B
Zinc Tot. Rec. (mg/kg)	8	82	5	77%	36%	3	3	2	B
Leachable Metals									
Total Iron (TCLP g.m-3)	3	2	5	164%	153%	0	0	3	A
Copper Tot. Rec. (TCLP g.m-3)	3	3.7	5	162%	83%	0	2	1	A

Sample	Count	Max Value (mg/Kg)	Max DL[1] (mg/Kg)	Max RPD[2] (mg/Kg)	Avg RPD (mg/Kg)	RPD Classifications < 30% RPD	30 - 50% RPD	> 50% RPD	Notes[3]
Nitrogen									
Ammonium-N (mg/kg)	10	8300	5	89%	40%	4	3	3	D
Nitrate-N (mg/Kg)	10	250	5	183%	89%	3	0	7	D
Nitrate-N (TCLP g.m-3)	2	10	5	68%	41%	1	0	1	C
pH and Other									
% Moisture	17	24	0.1	47%	12%	16	1	0	
Dry Matter (g/100g)	17	94	0.1	11%	2%	17	0	0	
Final pH	11	10.4	0.1	18%	5%	10	0	0	
Totals						*105*	*24*	*89*	

Notes: [1] Max DL refers to the higher detection limit from the two labs. [2] RPD is the Relative Percent Difference. [3] The following notes apply: A – All measured values are at or higher than the higher detection limit (DL), Where the measured value is at the DL the max value provided is 0.5 times the DL; B – All values are within an order of magnitude of the higher DL; C – One high value. D – Some high values; E – Values are within an order of magnitude of the higher DL; F – All sample results are below the DLs.

16.4. Conclusions and Discussion

The post-remediation results for the FCC East Site look very similar to the results found when initially validating that area of the site – see Section 10. As expected A+D+10%L and DDX are the only two contaminants with significant concentrations above 25% of the SAC values and no individual sample of any substance exceeded the appropriate commercial SAC (a single DDX value was approximately at the SAC level). The 95% UCL were all significantly below the SAC levels.

The comparison of primary and blind duplicate samples by RPDs indicates that there was some discrepancy between the results at low measured values, but that the general level of accuracy is considered acceptable, particularly for the more significant DDX results with measured values closer to the SAC limit.

The comparison of primary and split duplicate samples also indicates that there was some discrepancy between the results of the two labs, particularly at levels approaching detection limits. However, within the levels of expected discrepancy for samples measured at different labs, these results are again considered acceptable.

17. Discussion Summary

17.1. 'Clean' Residential Material

The mined residential material results contained seven samples with results greater than 2.5 x SAC, which is likely to represent material that has been accidentally added to the residential stockpile. These contaminated samples represent less than 2% of the samples taken for this mined material. It is likely that the residential stockpile had a degree of mixing as it was used resulting in some dilution of concentrations through material handling and placement. The 95% UCL was only half of the SAC.

Both the East and West Marine sediments were excavated to remove contaminated sediments. They were found to be able to be used for residential use as some had some high individual DDX results when compared to the marine sediment SAC. However, the 95% UCL of the mean was below the SAC in both cases. On the West Marine site, there were also some high boron readings and the 95% UCL was above the SAC although with relatively few (25) sample points for the analysis. Susan Rogers of EMS (pers. comm. Phil Outram, SKM, 14/09/2007) reported that these results prompted significant discussion at site meetings and failures were acknowledged. However, the average was considered by the site personnel (EMS) low enough to proceed.

The marine sediments which failed to meet the marine SAC but met the residential SAC were used as residential and commercial material.

17.2. Commercial Material

There were 6 failed individual sample results for the stockpiled commercial reburial material (exceeding 2.5 x SAC). These were all DDX and equated to 0.3% of the samples taken. The 95% UCL means and the subgrade averages were all well below half the SAC. Reburial material was mixed as it was stockpiled and distributed and it is likely that there was some dilution as a result of this process.

17.3. Treated Fines

The 95% UCLs for the 'pre-July 2005' treated fines results are well below the SAC although 2 DDX samples exceed 2.5 x SAC. The basis for acceptance of the original RAP was based solely on the 95% UCL being less than the SAC for the OCPs.

The DDX and ADL rolling averages from the 'post-July 2005' treated fines results met the updated RAP requirements by being less than the SAC level for all samples except one. This sample was slightly above the SAC and caused due to a small mathematical error with the rolling average being based on 5 days not 6. This error is not significant and the treated material met the criteria for commercial reburial.

The two batches of contaminated treated fines given post reactor treatment were sufficiently blended with low contamination treated fines and clay from the FCC East site surge chamber to reduce the contamination concentrations to well below the commercial SAC.

For the 5-10 mm component of the fines, the six samples are all well below the SAC for OCPs and the material has met the criteria for commercial reburial.

The calculations for the oversize material OCP contamination levels are based on a number of estimates (specifically percentage fines and fines contamination), the estimates were made conservatively and the final results are well below the commercial SAC.

None of the 53 crushed concrete samples exceeded the commercial SAC and the 95% UCLs of the mean were less than half the SAC value.

17.4. Exported Material

The material shipped to Germany for destruction did not have to meet any acceptance criteria. Chain of custody records were maintained for this material and examples were sighted during this validation process. These records should be maintained in safe storage.

The tyres sent to Streetsmart Ltd were sufficiently clean that no sample could be taken to test for contamination.

The maximum contamination of the waste material sent to Eves Valley Landfill was almost 20% below the acceptance level (40.7 mg/kg compared to 50 mg/kg).

All of the exported material therefore met the validation criteria.

17.5. Imported Material

All of the imported material was from known sources and as such the sampling rates comfortably meet the RAP requirement of at least one sample per 1,000 m^3.

A single high zinc result, in the topsoil and residential material, was approved by the auditor. In addition, there are a number of marginal manganese and nickel results and a single failed manganese result.

The imported sediment used in the East Sediments Site contained a marginal exceedence of DDX and potentially Chlordane.

The imported material used in the West Marine Site contained a marginal exceedence of Nickel and potentially Chlordane.

There are no records of conversations with the Site Auditor regarding these exceedences in the imported marine gravels. In any case, from the results of the post remediation samples discussed in Sections 14 and 15, contamination appears to have entered these imported sediments.

17.6. FCC East Site

The validation data show that the soil quality in the excavated area meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values.

Only four individual samples had results exceeding the SAC but these were below the individual sample limit of 2.5 times the SAC. The cell and subgrade averages for all of the substances were well below the SAC.

These results indicate that enough material was excavated from the FCC East site to be confident that remaining material meets the Commercial SAC.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.

It is therefore concluded that the FCC East site meets the SAC for residential and commercial use.

17.7. FCC Landfill

With exception of a single individual sample of ADL, the validation data shows that the soil quality in the excavated Landfill site meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values. The two samples with marginal ADL results are acceptable as they have not individually exceeded the 2.5 x SAC limit, or pushed the cell or subgrade averages above the SAC.

The single sample value (from a total of 361 samples) that exceeds the RAP threshold of 2.5 x SAC appears to be an anomalous result. The average of the five floor samples in that cell is below the SAC and the average of all the samples in the cell (floors and walls) is less than 20% of the SAC.

These results indicate that enough material was excavated from the Landfill site to be confident that remaining material meets the Commercial SAC.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.

It is therefore concluded that the Landfill site meets the SAC for residential use.

17.8. FCC West Site

The validation data shows that enough samples were taken in the FCC West site excavation to comfortably meet the RAP sampling requirement.

Of the 652 validation samples taken, 36 had marginal (1 – 2.5 SAC) results and 20 had failed (>2.5 SAC) results. However, of these 56, 36 have explanations as to why the results were accepted. These samples either bordered Tahi Street, the site boundary or passed the initial 3-day turnaround test but failed the full test. Of the remaining 14 samples 4 samples (5103, 8051, 8344 and 8506) failed to meet the 2.5 x SAC limit for which no explanation can be provided.

The samples that failed to meet the SAC also had significant impacts on the cell and subgrade averages, with seven cell and two subgrade averages failing to meet the DDX SAC and one cell average failing to meet the ADL SAC. Six of the cells exceeding the residential SAC border Tahi Street and contain samples that have been approved by TDC. The seventh cell borders the western boundary of the site.

The reburial material came from a number of different sources and has been validated in Sections 6, 7 and 9 above.

17.9. Private Property

With the exception of two individual Boron samples with limits of detection well above the SAC, the validation data shows that the soil quality in the private property sites meets the RAP validation criteria at all levels, both in terms of rate of sampling and sample values.

A single marginal DDX value (5.45 mg/kg versus the SAC of 5 mg/kg) is acceptable as it does not exceed the 2.5 x SAC residential limit for individual samples and has additionally been approved by TDC via a letter of 10 September TDC (Dennis Bush-King) to MFE.

The reburial material came from both the residential stockpile and imported topsoil and has been validated in Sections 6 and 9.

17.10. East Marine Sediments

The validation data shows that enough samples were taken in the FCC East site excavation to comfortably meet the RAP sampling requirement.

The remediation has not achieved SAC compliant contaminant concentrations in extensive areas. Of the 102 validation samples taken, 16 had marginal (1 – 2.5 SAC) and 68 had failed (>2.5 SAC) results. These samples failed due to one or more of the following contaminants; ADL, DDX, Nickel, PCBs or Chlordane.

The samples that failed to meet the SAC also had significant impacts on the cell averages, with all but one of the cells averages failing to meet the DDX and/or ADL SAC. The beach samples taken 4 months later also failed to meet the SAC for these contaminants.

The reburial material came from an offsite source and has been validated in Section 9.2.2. The imported sediment contained a marginal exceedance of DDX and potentially Chlordane.

17.11. West Marine Sediments

The validation data shows that enough samples were taken in the West Marine Sediment area to comfortably meet the RAP sampling requirement.

The remediation has not achieved SAC compliant contaminant concentrations in extensive areas. Of the 149 validation samples taken during the initial excavation, 68 had failed (>2.5 SAC) and 29 had marginal (1 – 2.5 SAC) results. These samples failed due to one or more of the following contaminants; ADL, DDX, Mercury, Nickel or Chlordane.

The samples that failed to meet the SAC also had significant impacts on the cell averages, with 47 of the 54 cell averages failing to meet the DDX and/or ADL SAC. The 3 samples taken one year later also failed to meet the SAC for these contaminants.

The re-excavation of September and October 2007 aimed to replace contaminated material that remained from the original remediation. Although the exact location of this work is unknown, it is clear from the re-sampling that the base of the excavation is still contaminated.

The reburial material came from a number of offsite sources and has been validated in Section 9.2.2.

17.12. Quality Control

The post-remediation results for the FCC East Site look very similar to the results found when initially validating that area of the site – see Section 10. As expected AD10%L and DDX are the only two contaminants with significant concentrations above 25% of the SAC values and no individual sample of any substance exceeded the appropriate commercial SAC (a single DDX value was approximately at the SAC level). The 95% UCL were all significantly below the SAC levels.

The comparison of primary and blind duplicate samples indicates that there was some discrepancy between the results at low measured values, but that the general level of accuracy is considered acceptable, particularly for the more significant DDX results with measured values closer to the SAC limit.

The comparison of primary and split duplicate samples also indicates that there was some discrepancy between the results of the two labs, particularly at levels approaching detection limits. However, they are within the levels of expected discrepancy for samples measured at different labs, these results are again considered acceptable.

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Appendix A Old / New RAP

REMEDIAL ACTION PLAN

FRUITGROWERS CHEMICAL COMPANY SITE, MAPUA

ISSUED July 2004

Thiess Services Pty Limited

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1.0 INTRODUCTION

Thiess Services Pty Limited (TS) has prepared this Remedial Action Plan (RAP) for the Fruitgrowers Chemical Company (FCC) site located at Mapua, New Zealand.

The site location is shown in Figure 1.1. The site layout is shown in Figure 1.2. For the purposes of this RAP the FCC (West and East) sites, the FCC Landfill, the contaminated marine sediments and contaminated areas of the neighbouring properties are collectively referred to as the 'Site'.

Soil and groundwater at the Site is affected by organochlorine pesticide (OCP) contamination. The FCC Landfill contains wastes from the operation of the FCC sites and soil, sediments and groundwater in this location are also contaminated. Contaminated stormwater, groundwater and dust from the Site have discharged to the Waimea Inlet, resulting in the contamination of estuarine sediments, tidal waters and marine sediments in close proximity to the Site. Soil on some neighbouring properties has also been contaminated by discharges from the Site.

The Tasman District Council (hereafter referred to as the Principal) requires that the Site be remediated to the Clean Up Scenario described in Table 1.1.

A number of studies have been carried out by the Principal, and later by Thiess Services, involving assessment of the degree and extent of contamination, assessment of the risk to human health and the ecosystem associated with this contamination and reviews of remediation options.

This RAP details the remedial actions proposed by TS in response to the Principal's Project Requirements and the subsequent Resource Management consent conditions (RM030521, RM030522, RM030523, RM030524, RM030525, RM030526, RM030527) generated from a consent hearing that took place in August 2003**.**

1.1 Scope of Work

The RAP describes the works required to remediate the Site in accordance with Scenario B. The project works will be undertaken in the following stages:

- Stage 1 – Detailed Planning and Submittal of Resource Consent Applications (completed);
- Stage 2 – Environmental Permitting and Finalisation of Stage 3 of the Contract including a Proof of Performance trial (Stage 2a); and
- Stage 3 – Site Remediation

An overview of these portions is provided in the following sections.

1.1.1 Stage 1 – Detailed Planning and Submittal of Resource Consent Applications

This Stage of the works has been completed, the objectives of Stage 1 were:

- for the Site to be further characterised (i.e., extent of contamination, soil/fill type, etc);
- to revise and finalise the Remedial Action Plan in accordance with the proposed Clean Up Criteria;
- to revise the quantities for each of the work items listed in the Schedule of Prices to the Principal's approval; not yet revised.
- to assess the resource consent requirements for the works and prepare an appropriate Assessment of Environmental Effects and submit the relevant resource consent applications for all activities required by Stage 3 and any long term resource consents required for the management of the Site subsequent to clean-up of the Site;
- to respond to all Section 92 requests for further information resulting from the resource consent applications for the works; and
- to obtain all other statutory approvals for the clean-up activities proposed and the clean-up of the Site.

1.1.2 Stage 2 – Environmental Permitting and Finalisation of Stage 3 of the Contract

The objectives of Stage 2 are:

- present the case for all resource consents applied for at a resource consent Hearing;
- evaluate the Hearing decision and advise on any effects on Stage 3 – Site Remediation;
- finalise the conditions for Stage 3 of the Contract; and (if necessary);

- prepare an appeal to the decision of the Hearing committee, if advised to do so by the Principal, and to appeal the decision at an Environment Court Hearing; and

- **Stage 2A**, undertake a Proof of Performance (PoP) trial of the treatment process. The objective of the trial will be:

  (a) to confirm that the process can comply with all conditions stipulated within the Resource Management Consents;

  (b) treatment of the contaminated material to meet the relevant soil acceptance criteria at a minimum rate of $108m^3$/week;

  (c) to demonstrate the treatment process can achieve a target destruction removal efficiency (DRE) of not less than 90%; and

Areas that will be monitored during the PoP will be production, noise, air emissions, odour, vibration and material handling.

During the PoP production and emissions will be monitored to determine they comply with the above objectives.

1.1.3 Stage 3- Site Remediation

Stage 3 will involve the supply of all equipment, materials, plant, and consumables and the remediation of the Site in accordance with Clean-up Scenario B. This shall include, but not necessarily be limited to, the following:

- mobilisation to Site including the design, delivery, installation and testing of all equipment to be used for the treatment of contaminated soils and sediments to meet acceptable residual standards as specified by the Principal;

- establishment of a referencing system so that each area and depth of the Site that is subject to cleanup or validation can be easily referenced and all excavated material can be tracked on a daily basis to the ultimate disposal location of this material;

- break-out, excavation, cleaning (of all surface soil and sediment), removal and disposal of concrete foundations, disused subsurface drains and services, building slabs and asphalt paving, some of which may be contaminated;

- excavation, treatment reinstatement (on-site) of contaminated soils and sediments from the FCC West and East sites, the FCC Landfill and contaminated neighbouring properties that adjoin the Site;

- excavation, treatment (as necessary) and disposal of general refuse and debris which has been landfilled on the Site and more particularly in the FCC Landfill, including waste building material, corrugated iron, drums, paper, plastic and timber, some of which will be mixed with waste pesticide materials and contaminated soils;

- removal of contaminated sediments from the adjacent estuarine areas and the invert of the drain along the western boundary of the FCC Landfill, drying (as necessary) and backfilling in areas of the Site designated for recreational use (these sediments have only minor contamination and the Principal anticipates that they will meet the Recreational Use Soil Acceptance Criteria);

- backfilling and compaction of treated soils, where these have been validated as suitable for this purpose (this may involve processing and moisture conditioning to make the soils suitable for the purpose);
- site levelling, grading, surfacing and drainage;
- validation testing; and
- close-out reporting

The works will also include all ancillary works and services required for the execution of the project, e.g., connections to, and supply of, power, water and any other service utilities, supply of raw materials consumed by the treatment process, personnel and plant and equipment, decontamination facilities, surface and groundwater control and all other measures required for environmental and health and safety protection.

1.2 Proposed Future Land Use

The proposed land use criteria for each section of the site are defined in Table 1.1.

They are as follows:

FCC East– Commercial and Recreational
FCC West – Residential
FCC Landfill – Recreational
Marine Sediments – Aquatic Ecosystem protection
Neighbouring Properties – Residential

Table 1.1 - Clean-up scenario

Clean-Up Scenario	West and East FCC Sites	FCC Landfill	Marine Sediments	Neighbouring Properties
B – End Use Preferences	Residential (West) – Commercial and recreational (East)	Recreational	Aquatic Ecosystem protection	Residential

1.3 Objectives and Minimum Outcomes

The objectives of the Principal for this project are identified as follows:

- remediation of the Site to standards acceptable for intended purposes with the minimum of ongoing restrictions; and

The minimum requirements of the remediation identified by the Principal are:

- the minimum acceptable clean-up standards for the various portions of the Site as listed in Table 1.1;

- the land after remediation must be acceptable for whatever its proposed use, and the nature and composition of the residual material in any part of the Site must not adversely affect future users of the Site or the environment, given the range of activities that can be expected to take place at the Site;

- contaminated soils must not be blended or diluted with soil containing lower concentrations of contamination to make the material acceptable for off-site disposal or for retention on any part of the Site;

- soils and sediments containing concentrations of contaminants, which exceed the acceptance criteria defined by the Principal for the selected Clean-up Scenario, must be either treated prior to return to the Site or appropriately disposed of off-site;

- there shall be no disposal of soils, sediments, rubble, refuse or any other materials excavated from the Site to any off-site location other than the Eves Valley Landfill and all disposal at this site shall be in accordance with the Principal's requirements; and

- the proposed remediation must involve some degree of treatment of soils so that there is a reduction in the total mass of contaminants.

2.0 SITE IDENTIFICATION AND HISTORY

2.1 Site Location

Mapua township is situated on a 2km wide peninsula, which forms the northwest side of one of the sea entrances to the Waimea Inlet. Rabbit Island forms the southeast side of the entrance. A flat coastal plain exists on the eastern side of the Mapua peninsula, decreasing in width to the north where it terminates in steep cliffs rising to 40m at Ruby Bay. The Seaton Valley stretches northwest from this coastal plain. To the west of the coastal plain the land rises to approximately 100m above sea level.

The Site is located on the southeast edge of Mapua township at the base of a small peninsula, which is approximately 250m wide (Figure 1.1, excluding contaminated private residencies). This peninsula extends into the Waimea Inlet and terminates in Grossi Point. Tahi Street runs down the middle of this peninsula with areas on either side generally inclining to the Waimea Inlet away from Tahi Street.

2.2 Site Description

The Site covers a total area of approximately 5.06 hectares including land and marine excavation areas.

The FCC East and FCC West sites historically contained the facilities used for pesticide formulation and storage. Parts of the FCC East site were reclaimed from the Mapua Channel. Wastes from the FCC operations were disposed of in reclamation of the Waimea Inlet on the western boundary of the FCC West site i.e. the FCC Landfill.

Lime and Marble, a company that was located on FCC East, processed non-toxic materials such as lime, calcite and dolomite.

All of the buildings used by FCC and Lime and Marble during the operation of the Site have been removed.

The vegetation of the Site is highly modified, and is largely determined by the presence or absence of pavement.

The FCC East site is almost exclusively paved, and is bounded by intermittent margins of trees including scrubby conifers, magnolia, eucalyptus, ngaio, and introduced grasses. The vegetation on the eastern boundary is slightly denser and includes several large, healthy ngaio and pohutakawa and a variety of introduced shrubs.

The FCC West site is characterised by a mixture of damaged pavement and rough pasture, and is again bounded by intermittent margins of trees. In particular, there are large trees along the north-western boundary including eucalypts and a single *Pawlownia tormentosa*. There are also several large conifers in the south-western corner of the Site.

The FCC Landfill site is covered by rough pasture, and bounded by a strip of mixed scrub between the landfill edge and the high tide zone, containing blackberry, gorse and other species.

2.3 Site History

Fruitgrowers Chemical Company (FCC) first started operation in a cool store in Mapua in 1932 producing spraying oils and lime sulphur for the horticultural industry. In 1938 FCC bought a lime quarry on Takaka Hill and established the company Lime and Marble.

During the 1940s the production of lime sulphur was replaced by organo-mercury compounds. Lead arsenate and arsenicals were also stored at the site. In 1945 FCC introduced micronising (an air mill process to reduce particle sizes for spraying). Organochlorine pesticides were the main products micronised. These included DDT, dieldrin, and DDD.

Organophosphorous pesticide formulation was introduced in 1958. Over the years the persistent organochlorine pesticides were gradually replaced by the less persistent organophosphorus pesticides such as malathion and azinphos.

The FCC operations continued to expand from the 1960s to the 1980s. Herbicides (hormone and non-hormone), insecticides, fungicides, and animal remedies were formulated. In 1978 a total of 124 chemicals were used by FCC to produce 84 different formulations.

The FCC operations ceased in February 1988. This followed an unsuccessful appeal to the Planning Tribunal to expand chemical manufacture at Mapua to include copper-chrome arsenate production.

Lime and Marble continued operating on its land for a period, principally using it for mineral storage. This property was eventually transferred to Mintech NZ Ltd.

Reclamation and landfilling of low spots and edges of the Waimea Inlet on the boundaries Site appears to have been undertaken in the 1950s, as evidenced by aerial photographs. The nature of the fill material is not clear, but records of the Ministry of Transport indicate that it is likely to have included waste materials from the FCC operations.

These reclamations were eventually vested in the former Nelson Harbour Board and leased back to the two companies. The Principal inherited this vested land as the successor authority to the Nelson Harbour Board.

In May 1992 a 60m long clay cut-off wall was installed along the southern side of the FCC Landfill to reduce leachate movement into the Waimea Inlet.

3.0 SITE CONDITIONS

3.1 Geology

The geology in the vicinity of the Site consists of Moutere Gravel, Tahunanui Sand, and Rabbit Island Gravel. The Moutere Gravel outcrops on the western boundary of the Site and extends below the Tahunanui Sand and Rabbit Island Gravel under the Site itself. The Moutere Gravel is clay-bound alluvial gravel. The Tahunanui Sand and Rabbit Island Gravel are marine sand and gravel that were deposited as storm beach ridges.

Drilling at the Site indicates that the marine sands and gravels extend from ground surface to between 3.6m and 8.5m below ground surface. The sand is grey, fine to medium grained and contains shell and wood fragments. The gravel is grey, well-rounded, medium grained, and has a sandy matrix. The clay-bound gravel found below the marine sediments consists of medium to coarse-grained weathered casts in a clay matrix.

3.2 Hydrogeology

Shallow groundwater is present at the Site within the marine sands and gravels described above. Across the Site, the water table varies from approximately 0.9m to 2.6m below ground surface. The elevation of the water table ranges from approximately 2.5m above mean sea level in the north-western part of the site to approximately 0.9m above mean sea level in the eastern part of the site. Marine sands and gravels at the site are underlain by the Moutere Gravels, a clay-bound gravel unit of fluvial origin. The saturated thickness of the marine sands and gravels varies across the site from less than 2m to approximately 8.4m, based on the limited number of site borings that penetrate to the Moutere Gravels and July 1996 water levels.

The direction of groundwater flow across the Site in the marine sands and gravels is generally from northwest to southeast or south. Groundwater flow is generally toward the Waimea Inlet to the east and south, but this flow direction appears to be modified in the vicinity of the FCC Landfill by an open drain located along the western edge of the FCC Landfill. This drain extends for at least part of its length beneath the water table and collects groundwater and discharges it to the Waimea Inlet, hence resulting in groundwater flow towards the drain from the adjacent portion of the Site. Horizontal groundwater gradients at the Site range from 0.003 in the central part of the site to 0.02 in the southern area of the FCC Landfill (based on water table contours for July 1996).

The water table fluctuates seasonally (up to 0.5m) and in response to tides. Annual groundwater level highs are expected to occur during the winter months when precipitation is highest. Tidal fluctuations in the marine sands and gravels appear to be rapidly attenuated with distance, and tidal influence appears to be restricted to less than 35m from Waimea Inlet. No tidal fluctuations were observed on the west side of the Site, with the nearest monitored well located approximately 30m from the Inlet.

The aquifer properties of the marine sands and gravels have been estimated from two injection tests carried out at the Site. The transmissivity values estimated from these tests were $100m^2$/day and $280m^2$/day. The specific yield of the aquifer is expected to be in the range of 0.2 to 0.3, a typical range for unconfined sediments.

The water levels and hydraulic properties of the Moutere Gravels that underlie the marine sands are similar to those measured in the overlying sands and gravels in June 1996. However, conductivity for the Moutere Gravels (approximately 0.01m/day) is much lower than in the overlying sands and gravels.

Recharge to the marine sands and gravels are expected to be predominantly from rainfall infiltration and from upward flow from the Moutere Gravels.

3.3 Contaminant types

The following contaminants have been identified during past site characterisation studies:

- inorganic material (heavy metals);
- total petroleum hydrocarbons (TPH);
- organochlorine pesticides;
- chlorinated hydrocarbon herbicides;
- chlorophenoxyacetic acid herbicides; and
- volatile organic compounds (VOCs)

The major contaminants of concern are organochlorine pesticides (OCPs), with parts of the Site contaminated with OCPs at levels, which exceed relevant guidelines. The OCPs that are present include DDT (and its breakdown products), lindane, dieldrin and aldrin, all of which are potentially toxic, persistent chemicals that bioaccumulate in fatty tissue.

The chemistry of the different OCPs is variable, but generally they have low solubility in water, and bind in preference to non-polar organic matter in soils and dusts, and the waxy layer of leaves. They will likely only be present in water if the concentration in the adjacent soils is high. Due to their chemistry, the main pathway of concern for humans is ingestion, rather than inhalation or dermal absorption.

DDT is highly toxic to many invertebrates and fish, and has the potential to be acutely and chronically toxic to humans. Acute toxicity would require the ingestion of 10 mg of DDT per kg of body weight, which usually only occurs with unsafe occupational handling of pesticide formulations. The effects of chronic low-level exposure are dependent on concentration and the availability of pathways.

Dieldrin and aldrin are analogous neurotoxins. In mammals they act as nervous system stimulants and are stored unchanged primarily in fatty tissues. In humans dieldrin and aldrin are readily absorbed through the skin, the gastroenteric tract and the respiratory tract.

They are acutely toxic to humans at doses as low as 0.2mg/kg of body weight. However, as with DDT acutely toxic doses usually only occur with inappropriate occupational handling of pesticide formulations. The effects of chronic low-level exposure include amnesia, loss of body weight and degenerative changes in the liver as well as general stimulant effects to the central nervous system.

Lindane, otherwise known as *gamma-Hexachlorcyclohexane* or *g-BHC,* was commonly used for the treatment of wood inhabiting beetles and seeds but was also used to control insects of the foliage of fruit and trees. It is less soluble than dieldrin and aldrin but will still accumulate slightly in fish and shellfish. Short-term exposure to lindane may cause high body temperature or pulmonary edema, whilst long-term exposure may lead to liver and kidney damage. Like dieldrin and aldrin, lindane can be readily absorbed through the skin, the gastroenteric tract and the respiratory tract.

3.4 Overview of previous contamination investigations

Several contamination investigations on the Site, surrounding marine sediments and adjacent residential lots have been previously undertaken, including those that were completed as part of the Stage 1 works. These investigations have included both preliminary investigations and more detailed assessments. The objectives of these investigations were:

- to determine the nature and extent of contamination present on the Site as a result of past and current activities on the Site;
- to assess whether any contamination present would pose a risk to human health; and
- to assess whether any contamination on the Site has the potential to impact on the surrounding environment.

Full details of the sampling that was undertaken and the results that were obtained as part of the Stage 1 investigations can be found in Section 6.1 of this document. Results of the investigations undertaken prior to this highlighted the following:

- FCC East and West soil contamination

  In 1996 Woodward-Clyde conducted a number of investigations focused on soil contamination. A total of 63 soil sample locations were investigated and 41 exhibited concentrations of organochlorine pesticides (OCP's) above residential use criteria and 15 locations exhibited concentrations above commercial use criteria. In general, the concentration of organochlorine pesticides decreases with depth. However there are some exceptions, particularly in the 1-2 m depth range, where contamination at depth significantly exceeds concentrations in the upper strata. These are normally associated with filled/reclaimed areas and areas where bulk storage facilities for chemicals were located. For example, concentrations at depth in the drum store on the south-western corner of the FCC West site and in the reclaimed area in the east of the FCC East site where significantly higher than those found in surface soils.

  Concentrations of other organic compounds and inorganic compounds were generally found to be below background concentrations. Elevated (above background) levels of mercury, sulphur, organophosphorus pesticides and phenoxy acid herbicides where identified at 4 locations. These however, were not significant in terms of their concentration and are typically associated with OCP contamination requiring remediation.

  In summary, the observed pattern and distribution of soil contamination on the FCC sites correlates with historical site activities such as buildings housing activities involving intensive handling of chemicals, chemical holding tanks, stormwater drains and filling of low lying areas. For example, the highest concentrations of OCP's in soil were identified at location 58, where a large holding tank existed.

- FCC Landfill soil contamination

  A wide range of wastes are known to have been deposited in the FCC Landfill and, therefore, concentrations of contaminants in this area are expected to be at least as significant as in soils on the FCC East and West sites.

  The evidence referred to above for the FCC East and West sites suggests that the materials in the landfill are likely to require remediation. On this premise, investigation samples have not been collected from the FCC Landfill in previous investigations.

- Sediments

  Sediment samples have been collected from the Waimea Inlet on a number of occasions and analysed for a range of potential contaminants. Samples were collected by Fruitgrowers Chemical Company (1977), Nelson Marlborough Regional Council (June 1983 and January 1991), Mintech (1993) and Tasman District Council (January 1993, December 1995 and June/July 1996).

  The most comprehensive sampling programmes were undertaken in January 1993 and July 1996. In January 1993, sediment samples were collected from eight sites south of the FCC Landfill and four sites east of the Site. At each location, a sediment sample was taken from a depth range of 0 to 0.5m. The 1993 samples were analysed for a range of metals and organochlorine pesticides.

  The results of the marine sediment sampling indicate that contamination of marine sediment is predominantly by organochlorine pesticides, particularly DDT and its metabolites, and to a lesser extent dieldrin. The highest concentrations of organochlorine pesticides were found in sediments adjacent to two stormwater discharge points, namely the surge chamber in the Mapua Channel and drainage channels in the tidal flats to the south of the FCC Landfill.

  Organochlorine pesticide concentrations appear to decrease significantly with depth. Samples collected from depths greater than 0.25m showed significantly lower concentrations than shallower samples from the same locations. Most samples collected below 0.25m did not exceed guidelines levels. Organochlorine pesticide concentrations appear to decrease rapidly with distance along the shoreline from these stormwater discharge points, particularly in the sediments to the south of the FCC Landfill. Similarly, concentrations of organochlorine pesticides appear to decrease significantly with distance from the discharge point towards the low tide mark.

- Neighbouring properties

  Initial investigations indicated that the topsoil on properties at 13 and 18 Tahi Street has organochlorine pesticide contamination exceeding residential criteria. Further investigations undertaken during the Stage 1 site characterization included these properties, along with the properties at 15 and 20 Tahi Street.

  The results of these investigations confirmed the presence of contamination above residential levels within the upper 300mm to 500mm of stratum. The extent of contamination on 15, 18 and 20 is limited to isolated hotspots, whilst on 13 it evident over the majority of the site. Given that No. 13 adjoins the FCC East site, there may be localised deeper areas of contamination along the common boundary and this will be investigated more fully during the Stage 3 works.

Subsequent to the completion of the Stage 1 site characterisation, the contaminated fill on No. 20 was excavated and stockpiled on the FCC west site by TDC. This was undertaken as the owner was selling the property prior to the commencement of the Stage 3 works. The excavation was validated and backfilled as part of this work.

- Groundwater

The investigations indicate that groundwater quality up-gradient of the FCC Landfill has not been affected by contaminants found on the Site. Both metals and organochlorine pesticides exist in groundwater down gradient of the cut-off wall in concentrations, which are in excess of guidelines for the protection of aquatic ecosystems and the recreational water quality guidelines. The Principal believes that this indicates that either contaminants are escaping the cut-off wall, or that the contamination detected in groundwater down gradient of the cut-off wall is a residue of contaminated groundwater discharges from the FCC Landfill prior to the installation of the cut-off wall.

The investigations indicate that groundwater quality up-gradient of the east site has not been affected by contaminants found on the Site. The investigations also indicate that both metals and organochlorine pesticides in groundwater may be discharging to the Mapua Channel in concentrations in excess of guidelines for the protection of aquatic ecosystems and the recreational water quality guidelines. Chlorobenzene may also be discharging in concentrations in excess of the guidelines for the protection of aquatic ecosystems but below the recreational water quality guidelines.

3.5 Distribution and quantity of contaminated materials

3.5.1 Overview

There have been a number of estimates of the volumes of material to be excavated and treated as part of the works and the quantity has varied, primarily as a result of the way in which the results have been interpolated. This is not uncommon with a project of this nature.

Following the completion of the Stage 1 site characterisation, both TS and Montgomery Watson Harza (MWH) undertook a volumetric analysis based on the results of the sampling using Clean Up Scenario B as the accepted criteria. The results of this volume analysis are discussed in Section 6.

3.5.2 FCC Landfill

The FCC Landfill material contains a mixture of soil, sediment, refuse, fill and debris. The Principal intends that all refuse and debris materials in the FCC Landfill, shall be removed. The distribution of fill materials within the FCC landfill is discussed in more detail in Section 6.0.

3.5.3 Refuse, Fill and Debris

There are other locations on the Site, including the area referred to as Lake Tas, that also contain mixtures of soil, sediment, refuse, fill, debris etc

3.5.4 Foundations, Sumps, Paving and Buried Services

There are various foundations, sumps, paving and buried services remaining on the Site that may contain contaminated soils and sediments. When encountered, these elements will be removed, excavated, separated (if required), and cleaned for validation and re-use, or treated and disposed of accordingly.

3.5.5 Materials Below the Groundwater Table

Groundwater remediation is not an objective of this RAP. However, it is anticipated that materials below groundwater level will need to be removed to meet the relevant criteria.

3.5.6 Neighbouring Properties

Based on current and previous investigations, and following the works that have been undertaken to date on No. 20 Tahi Street, it is estimated that up to $1000m^3$ of soil may require removal from the adjoining properties. This quantity is primarily associated with surface soil.

3.5.7 Sediments

The estimated quantity of contaminated material in sediments is $1000m^3$ from the Waimea Inlet and Mapua Channel.

4.0 REMEDIATION OPTIONS

4.1 Introduction

A detailed review was undertaken to assess those remedial approaches that were considered viable within the constraints defined by the Principal's objectives and minimum outcomes (see Section 1.3 for discussion). The main factors that were considered in applying any of these options are outlined below:

- treatment technology availability – which technologies can be reliably and affordably utilised to destroy contaminants of the kind found on the Site?
- location of treatment facility – what are the relative advantages and disadvantages of locating the treatment facility either on Site, or at Eves Valley Landfill?
- design of the disposal facility – if a containment cell (referred to by the Principal as a 'Hazardous Waste Containment Cell" (HWCC)) was to be established at Eves Valley Landfill, what is the design philosophy that should be adopted?

4.2 Treatment Technology

4.2.1 Overview

Those technologies that were considered to be potentially applicable from a technical and commercial standpoint are listed below:

- Mechano-chemical Dehalogenation (MCD): a process developed by EDL that involves the processing of soil in the presence of proprietary additives;
- Thermal desorption and destruction: processes that utilise heat (either directly or indirectly) to volatilise organics from the soil, followed by destruction, in which the organics are either oxidised or chemically dehalogenated; and
- Ex-situ bioremediation: processes that rely on the use of naturally occurring or introduced bacteria (and other life forms) to biologically degrade organic compounds.

The bioremediation of DDT, its derivatives and related pesticides, which are common contaminants in urban, industrial and rural environments, has been the subject of a significant research effort over the last decade. DDT in particular is susceptible to stepwise dechlorination by metabolism under alternating aerobic and anaerobic conditions.

However these processes are poorly understood, difficult to control and outcomes are uncertain to the extent that they are rarely guaranteed for large-scale commercial applications on pesticide contaminated sites. Hence this option was discounted as an alternative.

Based on the assessment it was concluded that only Mechano-Chemical Dehalogenation (MCD) and Indirect Thermal Desorption (ITD) were commercially viable technologies for the remediation of soils and sediment from the Site. Whilst each technology is capable of reliably delivering treatment to the required standard, the affordability of the MCD process as compared to ITD dictates that MCD is the preferred technology.

4.2.2 Mechano-Chemical Dehalogenation (MCD) Process

Details of the operations of the MCD Process are described in Section 8.3.1.

Trials of the MCD plant as part of the Stage 1 works have been completed and the results of these trials are discussed in Section 6.0.

The advantages and potential limitations of MCD are summarised in Table 4.1.

Table 4.1 - MCD process

Advantages	Potential Limitations
Production rates are relatively high at up to 3T/hr.	The material must be dried to prevent clogging of the plant.
The system is relatively compact and mobile.	Noise and vibration emissions could be a problem in residential areas and have been engineered out.
The process is relatively inexpensive	Destruction efficiencies and throughput may be reduced for high concentrations (>1000mg/kg).
The process is relatively robust and can treat a range of organic compounds.	Soil containing high clay contents may require amendment with coarse material for treatment.
The process is relatively robust and can treat a range of matrix types.	Treated material is very fine and has to be reconstituted by mixing with coarse material.

4.3 Location of the Treatment Facility

Significant Community Consultation was undertaken with respect to the siting of the treatment plant, with both the site and the Eves Valley Landfill and Mahana sites considered.

Table 4.2 summarises the relative advantages and disadvantages of each alternative.

Table 4.2 — Relative advantages and disadvantages of alternative treatment facility locations

Location	Advantages	Disadvantages
Mapua site	Minimises haulage costs and impacts from truck movements	Progress of works will be constrained by presence of facility.
	Avoids need to obtain / resource consents for treatment facility at EVL.	Treatment facility is not compatible with surrounding land use.
	Limits environmental impacts to immediate vicinity of Site.	Noise impacts more costly and difficult to manage than compared to EVL / Mahana.
EVL / Mahana	Both are more remote from residences and other sensitive receptors than the Site.	Need to obtain resource consents for treatment facility to be sited at EVL / Mahana.
	Likely to be favoured by residents near the Site.	Unlikely to be welcomed by land owners near EVL / Mahana.
	Treatment facility is compatible with current site operations.	Increases haulage costs and impacts from truck movements.
	Treatment facility would be isolated (visually and for noise).	Trucking contaminated material opposed by residents along haul route

The sitting of the treatment facility at either the Eves Valley Landfill or Mahana sites would allow the remediation works to proceed in the most straightforward manner. However, after consultation with the community the impacts associated with additional vehicle movements to and from the landfill were determined too significant. The disadvantages associated with on site treatment are manageable and as such the decision was made to treat the material on site.

5.0 ENVIRONMENTAL EFFECTS AND PERMITTING

5.1 Introduction

The Resource Management Act 1991 establishes the primary regulatory framework for environmental permitting in New Zealand. Regional and District Councils prepare Plans under the Act that determine which activities require resource consents. The Proposed Tasman Resource Management Plan is the key plan relevant to the proposed activities at the Site.

Based on the anticipated volumes and nature of dangerous goods that are to be stored on-site, a Dangerous Goods Licence may be required for the diesel storage for the rotary drier.

5.2 Resource Consents Needed

A review of the Proposed Tasman Resource Management Plan has been undertaken to identify expected resource consent requirements based on the activities proposed at the Site including those to cover land use, building/storage facilities, discharge permits, coastal permits and permits to divert groundwater.

5.3 Environmental Permitting Documentation

An Assessment of Environmental Effects (AEE) is the main environmental permitting document and must accompany any application for a resource consent.

Requirements for an AEE are set out in the Resource Management Act and further detailed in Plans prepared under the Act.

In summary, the AEE must:

- describe the proposed activities, including monitoring, mitigation measures and contingency plans;
- describe the receiving environment (the Site and its surrounds);
- assess the actual and potential environmental effects of the proposed activities; and
- describe consultation that has been completed.

5.4 Methodology to Prepare AEE Documentation

Thiess commissioned Tonkin & Taylor Ltd to prepare the Assessment of Environmental Effects (AEE) report to accompany the Thiess applications for resource consents for the remediation works. This Assessment of Environmental Effects Report is structured as shown in Table 5.2.

Table 5.2 —AEE structure

Section		Summary
1	Introduction	Provides an overview of the proposed works, consents required, and the applicant's details
2	Background	Briefly describes the Mapua Site and the history of operations, which have given rise to the contamination. It also describes the justification for the remedial works.
3	Environmental Setting	Briefly describes the physical and social environment of the Mapua Site including topography, geology and hydrogeology, coastal marine environment, surface water and ecology, and cultural and historical information.
4	Overview of Contamination Investigations	Investigations have been undertaken that describe the contamination status of soil, groundwater and stormwater at the Mapua Site and of the receiving environment, the need for remedial action.
5	Proposed Remedial Works	Describes the proposed remedial works and environmental management measures.
6	Statutory Planning Context	Addresses the statutory provisions and requirements that are relevant to the proposed remediation works.
7	Consultation	Briefly describes the consultation process undertaken specifically for the proposed remedial works, the concerns and issues arising from this process, and the actions taken in response.
8	Assessment of Environmental Effects	Assesses the environmental effects of the proposed remedial works particularly with respect to the criteria identified in the review of the statutory documents.
9	Mitigation and Monitoring	Describes the mitigation measures proposed to reduce adverse effects, and the monitoring proposed to be undertaken during the remedial works.
10	Consideration of Alternatives	Describes the alternatives that were considered in planning the remediation process and mitigation of effects.
11	Suggested Conditions	Lists the conditions the applicant proposes be attached to resource consents.
12	References & Abbreviations	Lists the references and abbreviations that are used throughout the report.

5.5 Environmental Permits / Resource Consents

Following submittal of the AEE and resolution in the Environment court, the Resource Consent was finalised in October 2003, details are shown in Table 5.1.

Table 5.1 — Resource consents granted

REGULATORY AUTHORITY	LICENCE/ PERMIT REFERENCE	PURPOSE	LICENCE HOLDER	EXPIRY/ RENEWAL DATE
TDC	RM030521	Disturb land- site establishment and commissioning	TS	4* years
TDC	RM030522	Disturb marine area	TS	4* years
TDC	RM030523	Discharge to air	TS	4* years
TDC	RM030524	Discharge to land	TS	4* years
TDC	RM030525	Discharge sediments	TS	4* years
TDC	RM030526	Divert/discharge stormwater	TS	4* years
TDC	RM030527	Intercept/divert groundwater	TS	4* years

6.0 STAGE 1 INVESTIGATIONS

In addition to previous investigations undertaken at the site, further investigation works were undertaken as part of the Stage 1 works. These additional investigations were aimed at providing confidence in the feasibility and outcome of the site cleanup. Broadly the investigations included:

- characterisation of the Site material in terms of contamination status, geotechnical properties and treatability, so that the Site remediation and validation works can be properly designed and constructed;
- screening trials on the insitu materials to assist in the determination of the volumes requiring treatment and those that could be re-used on site; and
- treatment trials of the MCD process using screened material so as to better determine the ability of the process to treat high concentrations of organochlorine compounds.

The objectives and scope of these investigations for the Site are outlined below.

6.1 Stage 1 Site Investigations

The investigations conducted during Stage 1 of the works were undertaken in October 2001 to provide consistent and reliable contaminant and physical property data focussed on the remediation works. The majority of the existing data is over 5 years old and was not collected for a specific remediation and validation design. The data from the latest investigations has been used to assess the treatability and fate of materials on the Site, and serves to validate areas of the Site and neighbouring properties that meet nominated criteria.

6.1.1 Objectives

The aim of the site investigation was to thoroughly characterise the nature and distribution of contamination on the FCC site so that the site remediation could be planned and executed in the most cost-effective manner. The scope of the investigation included:

- excavation , sampling and logging of test pits on a 15 m grid across the FCC East and FCC West sites and on a 23 m grid in the FCC Landfill;
- sampling and logging of test bores on a nominal 7.5 m grid on residential Lots 13 and 15 south of FCC East and residential Lots 18 and 20 south of FCC West;
- installation and sampling of 5 new groundwater monitoring wells;
- sampling and analysis of concrete at 25 locations across the sites;
- validation sampling on a 7.5 m grid over parts of site thought to be clean (mainly the northern part of FCC West, referred to herein as FCC North);
- surveying of all investigation locations; and

- compilation, interpretation and reporting of the investigation results.

The results of the investigation combined with data from previous investigations form the basis of the interpretations and estimations of volumes. The critical quantity for estimation is the amount of material requiring treatment to destroy the organochlorine contaminants (mainly DDT and related compounds or DDX compounds), since this is the most expensive part of the project.

The analytical data obtained during this additional investigation is contained in Appendix 1, along with contaminationlevels from test cores taken in 1996 as part of the AEE.

6.1.2 Sampling Plan

The sampling plan was based on an approximate 15m x 15m grid covering both the FCC East and West sites as defined in the Principal's Project Requirements.

Test pits were excavated near the presumed limits of fill areas to delineate their edges. Additional samples were taken in areas where it was presumed that contamination was not present to confirm this delineation.

Fill and natural strata under the FCC landfill was investigated on a 23 m grid across the entire area (6,000 m^2) of the landfill.

Soil samples were collected from the following depths:

- the surface (0 - 0.5 m);
- each type of fill/stratum or every 0.5 m interval to a depth of 3m, as may be the case;

Soil samples from neighbouring properties were obtained from surface soils (0-0.3m) only.

6.1.3 Materials Separation

The association between fine particles and organic and inorganic contaminants has been noted for contaminated earth materials. This reported association was the basis for field screening trials undertaken on a bulk sample from the Site in 2000. The results of these initial screening trials showed only a separation of contaminated and uncontaminated material for the bulk sample.

The ability to achieve a low cost separation and concentration of contaminants for the Site has the potential to significantly reduce remediation costs and to provide a better standard of clean-up, and therefore a more cost effective clean-up. Given the amount of visually clean coarse material on the FCC in the form of gravel and cobbles, there is the potential for a large low cost volume reduction of material for treatment.

Additional screening trials were undertaken as part of the Stage 1 investigations so as to better characterise the nature of material and the effect the screening process had on the volume of contaminated material once processed. These results, coupled with the additional site investigation works have allowed a better estimation of the total volume to be treated to be determined.

Screening/separation trials were carried out using a small trommel screen (trommex) with a 65 mm square screen aperture fitted to 10 tonne excavator. The undersize was subsequently screened through a Chieftain power screen, with a square screen size of 20 mm and a 5 mm piano wire harp. Hence, screening produced 4 piles of material from each source location:

- > 65 mm,
- 20 - 65 mm,
- 5- 20 mm, and
- < 5 mm.

The volume of material in each stockpile was estimated from field measurements, which took into account the stockpile shape (conical or otherwise). No adjustment was made to the measured volume to account for swell, difference in material density or void space.

Soil was excavated from 4 locations, west of Lake Tas (grid I22), north west of the landfill (grid J10), the previously 50 mm screened stockpile of highly contaminated soil used for the trials (Trial Pile), and from the landfill (grid L9).

The sampling protocol was developed through a process of iteration in consultation with the site auditor to allow for estimation of the amount of contamination in oversize material following multiple screening passes.

The estimation method assumed that the amount of contamination remaining in the 5 – 20 mm and 20 – 65 mm fractions would be directly proportional to the percentage of fines in each fraction. That is that only the fines were contaminated since the oversize consisted mainly of impermeable rock.

This can be expressed mathematically as:

$C_{clean} + (F_{fines\text{-}oversize} \times F_{oversize} \times C_{undersize}) < $ Acceptance Criterion for the site soil
assuming that the fraction of residual contaminated fines is small (eg < 5% of total combined fine material) and where:

C_{clean}	=	Concentration of contamination in any clean undersize material which is mixed with the contaminated oversize
$F_{fines\text{-}oversize}$	=	Weight fraction of contaminated fines and permeable material remaining in the contaminated oversize To be determined by field sieving samples of the oversize to separate fines and permeable material
$F_{oversize}$	=	Volume fraction of contaminated oversize in the total combined material returned to the site
$C_{undersize}$	=	Concentration of contamination in the fines (i.e. undersize) separated from and associated with the oversize material. To be determined from the analysis of the undersize material which was separated from the oversize in the screening operation (prior to treatment)

Samples were taken as follows:

- 5 samples from the < 5 mm stockpile (i.e. $C_{undersize}$) of each screening trial for analysis of total and leachable (in distilled water) concentrations of pesticides; each sample being a field composite comprising at least 5 subsamples taken randomly from the pile. Samples were sent under COC to Amdel Laboratories in Sydney;

- 1 sample of approximately 1kg from the 20 - 65 mm and 5 - 20 mm piles for sieving to determine the fines fraction present. Due to the likely presence of contamination, the soils laboratory (Cawthron Institute *Nelson*) was only able to process the soils at *insitu* moisture content through 10mm and 5mm sieves. Processed sample material was returned to the FCC Site for storage.

The results of the Screening Trials can be found in Appendix 2.

The screening operation worked well, although the limiting step appeared to be the removal of irregular debris (+ 65mm) from the bulk material. It is considered that the small size of the trommex (approximately $1m^3$) contributed to this affect. At times material, particularly paper and plastic packaging, adhered to the cutting edge of the trommex and contributed to the quantity of fines in the rubble pile. Hence, a full-sized trommel is recommended for coarse-screening material (at least in the landfill area). The full-sized trommel will better handle materials such as pipes and weeds, and some crushed metals material (drums/debris).

The + 65 mm material was variable in nature, dependent on the location on site. Where there was not a lot of rubbish present (Trial 1 & 3), the oversize was largely rocks with minor surface rubble and was accordingly generally free from fines. There was rubbish present in Trials 2 & 4. The rubbish was irregular and was mainly iron and metal, and stones and rubble in Trial 2 (suggestive of a non-putrescible landfill). In the landfill, (Trial 4) the rubbish consisted predominantly of plastics and papers, with some inclusions of timber (estimated at <5%).

In Trials 1 – 3, the major part of the 20 – 65 mm material was impermeable rock, and in the first pass through the Chieftain the amount of fines retained in the fraction was 1.3 – 2.6% and was most likely dependent on the moisture content and location on the site. In the landfill (Trial 4), 66% of the 20 – 65 mm pile was <5mm, which is considered a result of higher clay and moisture contents.

Based on the screening trails undertaken significant carry over of undersized material within the oversized stream is expected where moisture content of the material is elevated (fines adhering to the oversized) and there is a significant content of clay fines within the material. In order to recover the bulk of fines within the oversized material stream re-screening is proposed. The degree of re-screening required will be dependent on the recovery efficiency of fines from the over sized materials.

6.1.4 MCD Destruction Efficiency and Materials Reuse

Laboratory, pilot plant and full scale demonstration plant trials have confirmed the irreversible, reductive destruction of the persistent organic pesticides in soils such as those found at the Mapua site. As expected, production rates depend on the initial contaminant concentration of the in-feed material.

Environmental Decontamination Limited (EDL) began pilot plant trials in mid 1999 with the aim of optimising the dehalogenation process. Numerous trials were conducted in the development of the MCD process, testing the effectiveness of different catalysts for the destruction of the contaminants present in the Mapua soil. Several different catalysts were found to be effective with the final selection coming down to a balance between reactivity and cost. A summary of treatability data for pilot scale trials on soil from Mapua is given below in Table 6.1.

Table 6.1- Pilot plant results

Contaminant	Untreated Soil (ppm)	Treated Soil (ppm)
Dieldrin	71.9	0.5
2,4' – DDE	1.7	0.3
2,4' – DDD	8.2	0.1
2,4' – DDT	50.7	0.1
4,4' – DDE	13.0	3.8
4,4' – DDD	27.4	0.3
4,4' – DDT	289.0	0.1
DDX	412.0	4.8

In addition to the successful destruction of Dieldrin and DDX, the following critical performance areas were confirmed as per Table 6.2.

Table 6.2- Critical performance areas of MCD Treatment

Parameter	Observation
No volatilisation	Outlet air tested at less than 1 part per trillion contaminant, confirming reaction.
Chloride analysis	The chloride levels in the treated soil increased as expected.
Non-reversible	Chromatographs confirm no replacement toxic chlorinated species.
Intermediates	DDT intermediates are formed and then degraded further.
Dioxins	No dioxins were detected in pilot plant emissions.
PH	The pH of the treated soil varied between 6.0 and 8.5, depending on reagents used.
Ammoniacal -N	Zeolite has proved efficient in reducing ammonia levels.

A summary of treatability data for recent trials at Mapua on soil with high concentrations of contaminants (> 1000 mg/kg DDXs) is shown in Tables 6.3, 6. 4, and 6.5.

Table 6.3 - Full scale results at a treatment rate of 3 m^3/h

Contaminant	Untreated Soil (ppm)	Treated Soil (ppm)
Lindane	<1	<1
Dieldrin	45	29
Aldrin	26	13
DDX	1827	203

Table 6.4 - Full scale results at a treatment rate of 1.5 m^3/h

Contaminant	Untreated Soil (ppm)	Treated Soil (ppm)
Lindane	<1	<1
Dieldrin	45	14
Aldrin	26	5
DDX	1827	92

Table 6.5 : Full scale results at a treatment rate of 1.3 m^3/h

Contaminant	Untreated Soil (ppm)	Treated Soil (ppm)
Lindane	0.8	<0.5
Dieldrin	128	27
Aldrin	34	3
DDX	3650	136

The pilot and full scale results confirm effective destruction of the organochlorine pesticides present in the Mapua soil to acceptance criteria for commercial (and recreational) use.

In accordance with the project objectives an agreed Target Destruction Removal Efficiency (DRE) for organochloride pesticides (OCP) contaminants is required. For the purpose of calculation only DDX, Lindane, Dieldrin and Aldrin are considered. The target DRE will be between 90 to 95 % and measured in accordance with the procedure presented below. The DRE will be tracked on a continuous basis in order to adjust treatment parameters to ensure the target is achieved.

DRE Calculation:

- the DRE should be calculated as the moving arithmetic mean of the total organochlorine contaminant mass removed from the screened (<10mm) material post MCD treatment compared to the total mass of OCP's within the screened <10mm pre-treated material expressed as a percent;

- DRE target percentage removal does not apply individually to each OC contaminant;

- samples will be retrieved from the pre-treated <10mm material at a frequency of 1 per 100 bank cubic meters (or as agreed between the Contractor and the Principle);

- samples will be analyses for the full range of OCP's and the total concentration will be calculated for that volume of material;

- validation sampling and analysis will be undertaken post treatment to determine concentrations measured against the site SAC in accordance with validation plan detailed in Section 9.2.3 of the RAP;
- these validation results will provide total OCP concentrations post treatment; and
- the OCP concentrations post treatment calculated as the arithmetic mean will provide the comparison data set to generate a DRE figure expressed as a percent.

7.0 BASIS FOR ACCEPTANCE CRITERIA

7.1 Soil/Sediment Acceptance Criteria

As identified in Table 1.1, the Site may be used for a variety of purposes including recreational, commercial and residential uses. For the purposes of this RAP, it is assumed that for the residential scenario, there will be access to underlying soils and the growing of produce will be possible on site.

The Principal engaged Egis Consulting (now GHD) to develop site specific risk based soil and sediment acceptance criteria (SAC) for the various landuse scenarios identified above. Table 7.1 summarises the results of this assessment for the key organochlorine contaminants of concern.

Table 7.1 - Soil/sediment acceptance criteria

Land Use	Depth (m)	DDX (total DDT, DDD, DDE) (mg/kg)	Aldrin + Dieldrin + 10% Lindane (mg/kg)
Residential	All	5[1]	3[1]
Commercial	0–0.5	5[1]	3[1]
	Below 0.5	200[2]	60[2]
Recreational / Open Space	0–0.5	5[1]	3[1]
	Below 0.5	200[2]	60[2]
Marine sediment	All	0.01	0.01

Notes:

- 1. Based on protection of the off-site environment through rainfall run off. This will also be protective of human health and groundwater.
- 2. Based on protection of groundwater.

The Principal has indicated that the acceptance criteria for other contaminants (other than OCP's) including additives and by-products of the treatment process shall be those which ensure that the land will be suitable for its proposed use and which, if not specified in guidelines in New Zealand, would be acceptable in Victoria or New South Wales. The New Zealand guidelines utilised to generate a complete schedule of SAC is as follows:

Health and Environmental Guidelines for Selected Timber Treatment Chemicals (Ministry for the Environment and Ministry of Health, June 1997).

Guidelines for Assessing and Managing Contaminated Gasworks Sites in New Zealand (Ministry for the Environment, June 1997).

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand (Ministry for the Environment, 1999).

Additional guidance referenced in MfE (2002) Hierarchy and Application of Environmental Acceptance Criteria in New Zealand (due to be published October 2003) may need to be considered if adopted by TDC in consultation with Applicant.,).

Based on the aforementioned New Zealand Guidelines, a complete Soil Acceptance Criteria (SAC) has been developed as shown in Appendix 3.

In addition, it is proposed that the following buffer zones as detailed in Table 7.2 will be adopted to ensure on going protection of the aquatic ecosystem.

Table 7.2 - Buffer distance schedule for placement of contaminated soil 0.5m below the surface (source: Egis consulting, 16 April, 2002)

Buffer / Distance from Shoreline (m)	**Maximum concentration of DDX (total DDT, DDD, DDE) (mg/kg)**	**Maximum concentration of Aldrin + Dieldrin + 10% Lindane (mg/kg)**
3	40	12
10	120	40
15	200	60

It is noted that the Principal requires validation of the site for volatile chlorinated compounds and selenium. No Australian standards exist for these compounds as such have been omitted from Appendix 3. We assume that the Principal will provide appropriate validation criteria for these species if required.

8.0 REMEDIATION WORKS METHODOLOGY

8.1 Introduction

In this section, a description of the proposed remediation works methodology is provided including discussion of the following:

- the proposed material classification system;
- the anticipated material balances generated by the works;
- the environmental controls to be employed;
- the methods to be used for excavation and screening of materials;
- the technologies proposed for treatment of contaminated materials;
- off-site haulage operations; and
- the methods to be used to reinstate the Site.

Section 9 of this RAP describes the methods proposed to validate excavated and imported materials and the Site excavations following removal of contaminated material.

8.2 Material Classification System

In accordance with the Principal's requirements, following the Stage 1 site investigation, the sampling grid pattern established for the Site characterisation has been used to assign the material in each cell a classification on the basis of the existing and additional Site characterisation carried out during Stage 1. Based on the data derived from the Stage 1 site investigation/characterisation, a series of contamination location plans of the site have been prepared.

These plans delineate the site on a grid by grid basis with each grid approximately 15 metres by 15 metres in dimension within FCC East, West and landfill. The material within each individual grid has been assigned at each specific depth interval (0 – 0.5m, 0.5 - 1.0m, 1.0 - 1.5m, 1.5 - 2.0m and 2.0 – 3.0m) a contamination classification when compared to the Site acceptance criteria (SAC).

It is this classification that effectively determines the remedial option to be employed for that specific grid in order to achieve the overall remediation objectives. Refer to Appendix 4, which presents these contamination location plans.

Depending on the material's insitu contamination classification the material will be excavated and/or screened, stockpiled, assigned for treatment or left insitu. Tables 8.1 and 8.2 detail the classification schedule for material both pre treatment and post validation respectively.

Table 8.1 - Classifications for Untreated Material

Class	Description	Explanation
A	Remain *in situ*	This material will: • have adequate geotechnical properties; and • be validated as having contaminant concentrations below applicable SAC.
B	Concrete etc requiring break-out and cleaning	This material will be all foundations, pavements, sumps, concrete slabs, foundations and services which following break-out, cleaning, and further breaking-up will form an adequate fill for areas of the Site proposed for recreational purposes.
C	Soil, sediment and fill requiring excavation and treatment (this classification also applies to *in situ* treatment)	This material will be all material that is above groundwater level in: • the FCC Landfill; • all non-soil fill in other areas of the Site; and • all other material on the Site that has inadequate geotechnical properties or contaminant concentrations above applicable SAC. This material will require excavation and treatment/disposal, and may possibly also require screening and/or sorting.
D	Material below groundwater requiring excavation and treatment	This classification is for materials similar to Class C materials but occurring below groundwater level. This material will require excavation and treatment/disposal, and may possibly also require screening and/or sorting.
E	Soil and sediment that may be excavated and backfilled at depth	With the exception of the marine sediments, this category shall only be used if approved by the Principal. It refers to all material that would otherwise be classified as Class C material that is located within 500mm of the surface of the Site and which has been validated as having contaminant concentrations below the applicable SAC for material below 500 mm and will have adequate geotechnical properties. Marine sediments shall only be backfilled in areas of the Site proposed for recreational purposes. This category would allow some contaminated material to be relocated from the surface of the Site and buried at depth. However, it is not the intention of the Principal to allow this (with the exception of the marine sediments) unless this is required to remediate the Site within the allocated budget.
F	Material that may be disposed of at the Eves Valley Landfill site	This category shall only be used if approved by the Principal. It refers to: • material that may be disposed in the Eves Valley Landfill; or • material that would otherwise be classified as C or D material and which has been validated as suitable for disposal at the Eves Valley Landfill site without sorting/treatment in accordance with one of the Landfill Acceptance Criteria (LAC). This material will be further classified as either F-2, 3 or 4 depending upon which of the LAC the material complies with.

Table 8.2 — Classifications for Treated/Validated Material

Class	Description	Explanation
G	Suitable as backfill above 500 mm	This material will have been validated as having contaminant concentrations below the Residential Soil Acceptance Criteria and will have adequate geotechnical properties for residential land use.
H	Suitable as backfill below 500 mm	This material will have been validated as having contaminant concentrations below applicable SAC for material below 500 mm and will have adequate geotechnical properties for the proposed land use.
I	Suitable as backfill below groundwater level	This material will have been validated as having contaminant concentrations below applicable SAC for material below 500 mm and adequate geotechnical properties for the proposed land use. Material with concentrations at the higher end of those allowable for commercial reuse will generally be placed above the groundwater level.
J	Suitable for containment at Eves Valley Landfill site	The material will have been validated as suitable for disposal either: • in the Eves Valley Landfill (i.e., J-1 materials); or • a purpose-built cell in accordance with one of the Landfill Acceptance Criteria (LAC). This material will be further classified as either J-2, 3 or 4 depending upon which of the LAC the material complies with.

All materials that are stockpiled shall be stockpiled according to their classification. Information is to be maintained as to the fate of each class of material from each grid on the Site.

Material that contains elevated concentrations of contaminants of concern, whilst still complying with the SAC, shall be placed as far as practical from the marine environment and above the groundwater level in accordance with the backfilling of excavated materials requirements detailed in section 9.5 of the RAP.

In conjunction with the materials classification, a total materials mass balance has been prepared detailing the volumes of materials in each category. These depict the mass flow of material onsite in order to achieve the remediation objectives. It is anticipated that treated material will be mixed with screened oversize to achieve adequate geotechnical propertiews. Refer to Appendix 5 for the Mass Balance.

8.3 Material Volume Calculations

Following completion of the Stage 1 detailed Site Characterisation of the FCC site, a revised estimate of the volumes of material requiring treatment and those available for re-use has been undertaken by both Thiess and MWH New Zealand.

All calculations have been made assuming clean up Scenario B, which involves remediation of:

- FCC East for commercial land use;
- FCC Landfill for open space (recreational) land use; and
- FCC West (which includes FCC North) for residential land use.

For the purpose of estimating treatment volumes we have assumed that only material exceeding the commercial reuse criteria will be treated. This means that there would be a requirement to exchange commercial and residential material between the sites (mainly FCC East and FCC West).

The results of the volume calculations based on detailed site characterisation, and accepted as the basis for treatment volumes in the Lump Sum contract, are presented below along with the original tender volume estimates.

Table 8.3 - Volume estimates of material greater than Commercial SAC pre-screening.

GROSS TREATMENT QUANTITY	TENDER M^3 IN SITU	REVISED M^3 IN SITU
FCC EAST	4825	6537
FCC WEST	2750	2416
FCC LANDFILL	6800+1300	2750
TOTAL	15675	11703

The total quantity of material for treatment after screening is estimated to be approximately 6200 m^3. The quantity estimated at the time of the tender was 8,400 m^3. The break-up of the treatment quantities around the site (post-screening) is shown below.

Table 8.4 - Volume estimates of material post screening requiring MCD treatment

NET TREATMENT QUANTITY	ORIGINAL M^3	REVISED M^3 (MWH)
FCC EAST	3124	4249
FCC WEST	1876	1087
FCC LANDFILL	2100+1300	825
TOTAL	8400	6161

8.4 Civil Remediation Operations

8.4.1 On-Shore Excavation Including Hardstand

Prior to commencing bulk earthwork excavations, all surface hard stand areas will be excavated and hauled to a designated hardstand stockpile area in preparation for crushing operations. Prior to crushing, each slab section will be brushed clean free of visual fines by a sweeper on the upper side. The lower side will be brushed manually in the area it is taken from to prevent contamination of the crushed product or adjacent areas. Surface fines will be removed by a street sweeper. Crushed concrete will be reused onsite in accordance with its contamination status. If material is found to be impregnated with contamination (as per validation work procedures) this will be isolated, crushed to suitable size and treated.

Excavation will be undertaken using tracked hydraulic excavators of between 20 ~ 40T operating mass. Materials other than rock or hardstand will be loaded directly from the excavators to tip trucks or articulated dump trucks for haulage to stockpile. Stockpiles will be maintained by rubber tyred loader.

To facilitate the recovery of discrete classes of material, the location of each cell will be marked on the ground by use of survey pegs, and the excavation will be supervised at all times by an experienced Supervisor.

The excavation will be undertaken on a grid-by-grid basis corresponding to the pre-excavation classification resulting from the Stage 1detailed site characterisation investigation (see Section 8.2 for details of classification system). As detailed within section 8.2 of the RAP each grid within FCC East and West is approximately 15 metres by 15 metres for a depth interval of 0.5 metres, hence generating a material volume of 112.5 m^3.Proposed stockpile locations are included in Appendix 8.

The classification of the material insitu will determine the fate of each lot. In general the material will be excavated and hauled to stockpile for either screening or re-use within other sections of the Site. Post screening the stockpiles of both undersized and oversized material will then be tested and classified and will be allocated to either treatment, relocation for reuse or reuse directly.

In the event hazardous material is found in the landfill, a spotter will be utilised during excavations to observe and ensure any in-tact containers (ie. In metal drums) are not compromised releasing further contaminants. If hazardous material contained or otherwise is uncovered that is unable to be treated by the MCD plant, it will isolated and an off-site disposal method agreed upon with the Engineer. Isolation includes methods such as storage or containment within a bunded/contained area to prevent any risk of further release. If any koiwi, taonga or other cultural/archaeological material of significance is discovered in any of the works, the procedure as outlined in “Remediation of FCC Site Mapua- Cultural Heritage Protocol and Procedures” shall be implemented.

An excavation plan and estimates of volumes is included in Appendix 7. It details fate and volumes of material excavated, approximate time of process and notes excavations that require Iwi observation. An Iwi Monitor will be present for all excavations in areas that are deemed “likely” or “possible” as per the Iwi protocol.

8.4.2 Off-Shore Excavation

Prior to commencing off-shore excavation works:

- a program of macroinvertebrate and sediment quality sampling shall be undertaken. It will be undertaken within and distant to the area of sediment excavation prior to commencing the sediment excavation. The sampling is to be arranged by Tasman District Council (TDC) in consultation with TS to ensure work is carried out at prescribed times. The program will extend throughout the remedial works at the following intervals (unless otherwise directed by TDC): 12 month, 24 month and 36 month;

- a shoreline profile survey will be completed; and

- relevant stakeholders will be notified of the commencement of works within the specified timeframe.

Sediments will be recovered from Mapua Channel by long reach excavator working adjacent the FCC East boundary. Sediment from this location will be transferred directly to the FCC East site, where they will be stockpiled and allowed to drain.

These sediments will the be placed at below 0.5m in accordance with the backfill and compaction required detailed in section 8.7 of this RAP.

These works will be undertaken on the low tide cycle and will ideally be completed within that cycle. No excavation works shall be undertaken during periods of rain or in areas covered by tidal waters. Long reach excavators will position themselves such that they can access the material at the limit of the works and excavation to the nominated depth would commence. Should the works not be able to be completed in the tide cycle, the area just excavated would be covered with a layer of gravels so as to prevent the migration of fines onto the excavated surface. Works would then recommence on the next low tide cycle and be carried out in the same manner. Gravel imported to the Site for use during the tidal zone works, shall, where possible be similar to existing gravels.

As sediments are scheduled for removal up to 100m offshore adjacent the FCC Landfill, a similar method will be adopted with a gravel access being constructed to the limit of the works. The excavator will then, working on low tide, excavate the sediments and retreat toward the FCC landfill, recovering gravels as areas are completed.

This method may negate the need for a floating silt curtain however these will be installed if the need arises and the proposed method is found to be inadequate for protecting the marine environment from silt discharge during the works.

All marine earthworks excavations shall be undertaken in adherence to all cultural heritage provisions that pertain to the Site.

If any koiwi, taonga or other cultural/archaeological material of significance is discovered in any of the works, the procedure as outlined in “Remediation of FCC Site Mapua- Cultural Heritage Protocol and Procedures” shall be implemented.

8.4.3 Screening Operations

As described in Section 8.2 of this RAP, it is anticipated that significant ‘clean’ oversize (>10mm) material will exist at the Site within a contaminated fines matrix.

A variety of screening plant will be established to sort oversize materials including:

- conventional ‘grizzly’ screens for removal of coarse (>150mm) materials including debris and other solid wastes;
- inclined vibrating screens capable of segregating a variety of sizes down to <10mm; and
- rotating trommels capable of segregating a variety of sizes. Trommels are envisaged for use where agglomeration of fines is a problem e.g. clayey soil.

Such plant will be supplemented by manual and visual sorting of bulky goods e.g. drums, steel sheet, pallets, etc. etc.

8.4.4 Washing of Debris and Bulky Solid Waste

Where debris and bulky wastes are recovered from the excavation and sorting process and these materials have appreciable quantities of adhering fine material, then such fine material will be removed by either high pressure water washing or preferably physical brushing of the fines if the materials are dry. This work will take place in a bunded area within the stockpile processing area, or alternatively at one of the Site wheel washes if the quantity of material is relatively small. Wash water will be contained and managed in accordance with Section 8.6.2.

Material will remain on-site until clean of fines and its off-site disposal has been approved and a waste transfer manifest completed. The Eves Valley Landfill Criteria is as per *NSW EPA 1999 "Environmental guidelines: Assessment, classification and management of liquid and non liquid wastes."* Eves Valley accepts material classified as "inert" and "solid" by the guidelines but not that which is classified as industrial or hazardous. The relevant guidelines are included in Appendix 9.

8.4.5 Handling of Wet Materials

Wet materials will be stockpiled adjacent to the excavation to allow excess fluids to drain out of the material. Wet materials will be dried out so that the material becomes:

- spadeable such that it can be moved and tracked over by hydraulic excavator; and
- contains no free phase fluids that can seep out of the material after it is removed from the stockpile.

Wet materials will be stockpiled adjacent to the excavation in a manner that will cause free phase fluids to flow back into the excavation or into a sump constructed for the purpose. A schematic depiction of this operation is shown in Figure 8.1.

It is intended that stockpiled wet material be left to drain and dewater for at least a 24 hour period. Where programming requirements require additional treatment of the wet material, such treatment may comprise:

- spreading of the material;
- mixing the material with other contaminated dry material; and/or
- leaving the material stockpiled for a longer period.

8.4.6 Stockpile Testing

Section 9 of this RAP describes the methods to be used to recover and analyse stockpile samples for the purposes of material classification.

8.5 Treatment of Contaminated Materials

8.5.1 Mechano-Chemical Dehalogenation (MCD)

The MCD process involves the dechlorination of organic compounds by the input of mechanical energy as impact forces in the presence of proprietary additives as electron and hydrogen donors. The overall rate of throughput of material through the MCD plant is expected to be in the order of 3 T/hr.

The MCD process comprises the following elements as shown in Figure 8.5:

- feed soil pre-treatment and preparation, including pre-drying, drying in a rotary dryer, screening and delivery of oversize material;.
- exhaust air pollution control devices for the pre-treatment system comprising a pulsed baghouse and carbon adsorption beds with a packed bed scrubber;
- material feed system where additives are metered and mixed;
- a reactor where contaminants are dechlorinated in the presence of electron and hydrogen donors; and
- treated soil handling and reconditioning.

Feed Soil Pre-treatment

The screened feed soil will be collected from the designated stockpile using a wheeled loader and taken to the purpose built and enclosed contaminated soil storage shed, to protect it from wind and rain.

A concrete nib will be provided around the perimeter of the concrete slab within the shed to assist with housekeeping and to contain any water draining from the stored soil. Any drainage water will be collected in a sump and pumped to the on-site sludge separation filter bags. Sludge volumes are not expected to be significant with the main source being from the mixing bowl. As required the sludge will be dried and validated.

The wheeled loader will also be used to manage the stored feed soil and for transferring feed soil into the feed hopper, located within the shed. The feed hopper will comprise conveyor feeders thereby avoiding problems with the soil hanging up and/or bridging. Contaminated soil will be transferred from the feed hopper to the enclosed weigh belt via an enclosed screw conveyor.

The enclosed weight belt will be used to control the rate of material processed through the plant. In this way the planned rate of feed soil addition to the plant can be called for by the operators and then maintained automatically so long as material is available from the feed hopper. Contaminated soil will be transferred from the belt conveyor to the drier via an enclosed chute.

Rotary Drier

The drier is a diesel fired, rotary drum unit. As the contaminated soil enters the drier, it is exposed to an induced draught. The draught temperature at the drier inlet is monitored and controlled automatically by modulation of the drier’s burner flame.

As the contaminated soil passes through the drier the combination of the drying process and the tumbling action results in both drying and clay particle size reduction. The soil exits the drier at typically 2% moisture content as monitored by a dedicated moisture meter located in the transition between the drier outlet and the subsequent enclosed screw conveyor.

Operation of this unit is critical to the process as material moisture contents significantly above or below that required for optimal operation of the reactor will adversely affect the performance therein resulting in reduced throughputs and reduced contaminant destruction.

Coarse Fraction

After drying the feed soil will be screened to produce a potentially clean oversize fraction (>5mm) and contaminated fraction (separated in MCD silos to 0-2mm and 2-5mm). The coarse fraction will be transported via conveyor to a collection bin for validation and then returned to the site. In the event that the oversize material is non-compliant, it would be returned to the storage shed and reprocessed.

Any water collected from the sumps is pumped to sludge filtering bags. The fine sludge collected will be validated, and if non-compliant will be retreated by the MCD. Excess water will be filtered and reused on site for washdown. The area within which all the water processing operations are to be undertaken will be provided with appropriate bunding to contain and manage any spillage.

Fine Fraction

The dried fine fraction will be conveyed to a fines storage silo. Dust collected in the cyclones and bag filter will also be transferred to the fines storage silo. The fines storage silo will be provided with a vent line back to the bag filter to avoid the release of any dust therein to atmosphere.

To provide positive confirmation of the satisfactory performance of the bag filter instrumentation will be provided to indicate differential pressure across the unit and to detect for particulate matter in the outlet duct. Exhaust air from the bag filter will be passed through activated carbon to remove any volatile organics present prior to discharge to atmosphere. In addition, a packed bed scrubber will further protect the environment in the event of bag house bag failure.

Mechano-Chemical Dehalogenation (MCD) Reactor

Contaminated material for treatment will be transferred to the MCD reactor via enclosed screw conveyors. Based on initial bench trials of the process it was considered necessary to include additives (reagents A & B) to ensure appropriate destruction. Reagents used will be approved by the Site Auditor before use. The contaminated material will be conveyed into the reactor using enclosed screw conveyors.

The reactor is a German made vibratory mill, comprising two horizontally mounted cylinders made to perform almost circular movements by the effect of unbalanced weights. The cylinders contain grinding media that provide the mechanical impact energy required to drive the chemical reaction.

In the reactor the contaminated material is exposed to extreme mechanical action as a result of the vibration of a multitude of steel balls contained within the reactor. The energy provided in this environment activates the decomposition reaction and during the subsequent passage through the reactor the OCP contamination within the soil is reduced to achieve the required SAC.

Treated Soil Handling System

Treated, uncontaminated soil exiting the base of the reactor passes through enclosed screw conveyors to a series a mixing bowl. Here it is mixed in an enclosed environment to reduce any risk of dust emissions and deliver a prodcut suitable for transportation and backfill. When validated the treated will be returned to the site as backfill. In the event that the treated soil fails the validation criteria, it will be retreated.

8.6 Haulage Operations

Materials destined for disposal at the Eves Valley Landfill will be hauled off-site in semi-trailers or truck and trailer combinations and comply with requiredments as per Appendix 9.All loads will be covered prior to departure from the Site. A waste transfer manifest shall be maintained recording all truck movements transporting waste from the Site.

In addition, all trucks will pass thru a wheel shaker or wheel wash to displace and fines/clays that have adhered to the tread this will ensure no potentially impacted material will be deposited on the road surface.

Periodic inspections of the haulage route to Eves Valley will be undertaken to identify any spillage of material. Where such spillage is identified, a work crew will be dispatched to recover this material. Further details of the spill response protocols are provided in the Emergency Response Plan (see Section 11 of this RAP).

8.7 Backfilling Operations

8.7.1 Backfill Properties

Soil recovered from the sorting and treatment operations will be used to the greatest extent possible in reinstating the Site. Based on the current material balances there will be no need to import material to the site to enable reinstatement, however, material may be “borrowed” so as to achieve balance and meet the SAC for the various land uses.

For residential / commercial land use, backfill must have the following characteristics:

- have chemical contaminant concentrations suitable for use as stipulated in Section 7;
- be free of material greater than 150mm in size;
- contain not more than 2% vegetative matter;
- be capable of being brought to a moisture content suitable for compaction as specified elsewhere herein, under the weather conditions prevailing on Site; and
- possess all other physical properties suitable for placement at an adequate state of compaction.

Where material is to be placed below the water table (i.e. into standing water) its characteristics will be as above with the additional requirement that it contain material that will have a similar permeability to pre-existing material, achieved through the combination of treated material with screened oversize.

For recreational land use, the following backfill characteristics are proposed:

- have chemical concentrations suitable for use as stipulated in Section 7; and
- be free of material greater than 500mm in size.

8.7.2 Placing and Compacting Fill

Fill material will be placed and compacted in successive horizontal layers for the full width of the cross section. The loose depth of the material in each layer will be such that the specified compacted layer thickness shall be not more than 200mm.

At the time of compaction of each layer the moisture content of the material will be such that the specified compaction is achieved.

Equipment will be properly weighted and sufficient passes will be made to attain the compaction specified in section 8.7.3 In areas which are not accessible for rolling with power equipment, mechanical hand tampers or vibrators will be used.

Where material is to be placed below the water table (i.e. into standing water), then this material will be end tipped and spread in a single lift to a level above the standing water level, and then subjected to heavy compaction by a roller of not less than 10T operating mass. A minimum number of 8 passes will be made to the entire surface, prior to placement of subsequent fill lifts as per the general filling methodology described earlier.

If, at any time during the progress of the work, tests show that the specified degree of compaction is not being obtained, equipment and/or methods will be replaced or modified, as required, to obtain the specified results.

At the completion of each days work and at any time during a shift when a delay to work appears imminent on account of rain, all fill deposited will be spread, graded and lightly rolled to form a surface sufficiently dense and shaped to shed the rain to drains. Upon resumption of work, those areas that have not been fully compacted will be ripped for their full depth, bladed to shape and processed as newly deposited fill.

Acceptance of each layer will be conditional upon the application of uniform and sufficient compactive effort by appropriate equipment over the whole of the layer.

8.7.3 Compaction Standards

It is proposed that backfill to be compacted as specified in Table 8.5.

Table 8.5 - Compaction standards

Land-Use	Compaction
Recreational	Roller/track compaction
Residential/Commercial	95% std Max Dry Density

Track compaction is proposed to aid revegetation of the recreational areas but will be limited to the top layer.

8.7.4 Testing for Compaction

Compaction will be checked by standard maximum dry density tests and field density tests for materials other than sand or by the density index and field density tests for sands in accordance with Table 8.6.

Tests will be carried out in groups of at least three and compaction of the layer concerned will be considered to be satisfactory if no single result falls below 100% of the desired density. Should the results not reach this standard the area will be rolled again, if necessary after scarifying, adding water, blading to reduce the moisture content and/or removing and replacing excessively moist fill as may be required.

Table 8.6 - Frequency of field density tests

Area	Frequency of Tests
Residential/Commercial areas	Not less than: • 1 test per 200m^3 distributed reasonably evenly throughout full depth and area; or • 1 test per layer or 200mm thickness And/Or 1 per 1000m^2.
Confined operations filling behind structures	1 test per 2 layers per 50m^2
Service Trenches	1 test per 2 layers per 40 linear metre

8.7.5 Finished Surface of Earthworks

On completion the site will be graded in accordance with contours detailed on Drawings 1939/1/01 and 1939/1/02 attached in Appendix 10. There may be the need to raise the levels of the FCC landfill above the pre-existing levels to accommodate relocated material and to potentially realign the drain along the western edge to accommodate riparian planting (awaiting direction from TDC re: design).

It is proposed that all areas be graded and finished surfaces will be smooth, compacted as specified, and free from irregular surface changes.

Grading will include connections or entrances to drainage facilities or natural drainage, and will not create pockets in which water will stand.

8.8 Environmental Protection

8.8.1 Introduction

This section sets out the methods by which the environment will be protected at the Site and in the surrounding areas throughout the duration of the works and during extreme weather events.

Thiess Services' Integrated Management System will be utilised to control the works. Details of the system as it relates to environmental management are provided in Section 11 of this RAP.

Environmental control measures will be implemented progressively in accordance with the works program and prevailing weather conditions. Materials and equipment used for protecting the environment will be present and operating at all times during the works in sufficient quantities to ensure that all likely contingencies and weather conditions can be properly managed in a short time frame.

These works will include but are not limited to:

1. The installation, operation and maintenance of stormwater retention basins, covers over existing stormwater pits, bunding, silt fences and straw bale barriers;
2. The installation, operation and maintenance of groundwater control measures comprising cut-off barriers;

3. Installation and operation of systems and work methods designed to control air emissions from the works;
4. The installation, operation and maintenance of equipment control measures comprising truck wash facilities; and
5. The installation and maintenance of protective fences.

Details and proposed locations of environmental controls are shown in Figures 8.3 and 8.4.

Mitigation of the effects of the works will not be limited to physical measures. The manner in which the works are undertaken, coupled with a flexible programme will also be key mitigating features of the remediation. We recognise the impacts the works may have on the commercial activities adjacent to the site, as well as the impacts on neighbouring residents. A flexible and co-operative approach to the works on boundary will be adopted in consultation with the residents so that their concerns are adequately addressed.

For the duration of the works a complaints register shall be maintained recording any issues relating to the operation of the Site. The status of each complaint shall be updated in the register through to the point of closure.

A key element of this co-operative approach is open communication with the adjoining residents and a willingness on their part to communicate their concerns to us in a pro-active manner.

Ways in which we will be able to mitigate effects of the works by way of a flexible approach will include but are not limited to:

- undertaking works on the north eastern corner of the site during the winter months and before midday so that Café patronage is not generally affected;
- maintaining vegetative cover and boundary fences along the southern boundaries of FCC East and West for as long as possible so as to provide a natural screen to the site;
- completing the excavation to the southern boundaries in consultation with the neighbours needs;
- locating screening and crushing plant as far as practical from site boundaries to minimise effects;
- undertaking noise, dust and vibration monitoring during the works and reporting results in accordance with the Resource Management Consent Conditions; and
- adjusting and / or ceasing works if prevailing wind carries dust and / or odour beyond site boundaries.

A detailed programme for the works will be completed prior to commencement and this programme will consider the range of issues that will affect the sequencing and staging of the works. This programme will be discussed with affected residents and explained to them prior to the works commencing. The following sections detail the proposed physical mitigation measure that will be used on the project in conjunction with construction and operational techniques to mitigate environmental affects.

8.8.2 Control of Surface Water Runoff

The works will be developed to prevent surface water from being contaminated. Surface water runoff will be controlled on-site by intercepting and redirecting runoff in a controlled manner by appropriate means including the use of temporary bunds, diversion drains, ditches, straw bales and silt fences. Figures 8.1, 8.2, 8.3 and 8.4 provide a plan layout and details of the proposed surface water controls from the Site.

The environmental control measures for managing surface water runoff will be installed progressively as works proceed.

Controls on the Existing Stormwater System

Where existing stormwater pits and pipes remain on site prior to excavation of the area, works will be undertaken to seal off these drains prior to the commencement of any earthworks in the area. Such work will typically involve placement of a concrete or clay plug/seal within pits.

This will be done to ensure that there is no chance that sediment laden run off can make its way to the natural water course or estuary via the existing stormwater drainage system.

Controlling Surface Runoff from Outside Work Areas

Works will be undertaken to prevent surface water from entering work areas by the construction of perimeter drainage control measures. These diversion works shall include but not be limited to temporary bunds, diversion drains and ditches.

These may include establishment of bunds to the entire site perimeter to prevent run off from outside of the site area entering the site. Or, alternatively, they may be bunds around selected works areas to prevent on site run off from entering excavations.

Excluded water will be directed to the existing on-site detention basins.

Controlling Surface Runoff within Work Areas

Bunds and/or diversion drains will be constructed around all excavations to prevent surface water runoff from entering the excavations.

Disposal of surface runoff within the work areas will be accomplished by either:

- directing the surface run-off to stormwater detention basins which shall be constructed as part of the works; and/or
- allowing surface runoff water that collects in depressions on the site to naturally evaporate/infiltrate.

The surface water runoff that is contained in work areas shall be tested and treated prior to discharge in accordance with relevant resource consent conditions.

Stormwater Retention Basins

Stormwater retention basins will be designed and constructed to control all surface water flows from disturbed areas on-site to store peak runoff as required by the relevant guidelines. All surface water runoff from rehabilitated areas will be directed into the stormwater basin system.

Works will be undertaken to regularly clean out and remove sediment and rubbish that may collect in stormwater detention basins, in order that their capacity is not reduced more than 10% by volume. These basins will be regularly inspected for storm damage and where necessary cleaning and/or repairs will be undertaken.

The water that is contained in stormwater detention basins areas shall be tested and treated prior to re use or discharge in accordance with required resource consent conditions.

Spill Response Plan

A spill response plan has been developed and will be implemented as part of the Management Plan. The procedures specified in the spill response plan will be designed to minimise the impact of any contaminant releases, which may occur during the works. This plan requires that an assessment of any potential spill scenario and provides procedures to be followed by site personnel including identification of any potential spill points, the acquisition and storage of appropriate spill containment equipment (such as oil absorbent pads and biodispersants), and the training of site personnel in appropriate spill response techniques.

This plan will cover issues that include but are not limited to:

- fuels / oils spills;
- contaminated material spills;
- barging operations / plant working over water;
- contaminated water release;
- works within the estuary; and
- spills which may affect neighbouring properties or residents

Materials and equipment to be used for spill response purposes will be present and in an operational state at all times during the works in sufficient quantities to ensure that all likely contingencies can be properly managed in a timely manner.

8.8.3 Control of Groundwater

Groundwater monitoring shall be undertaken prior to the commencement of remediation works and on a monthly basis during the works. All existing groundwater wells shall be protected throughout the works period to allow ongoing monitoring.

It is not proposed that the Site be dewatered prior to the excavation of materials from below the water table. Rather, it is proposed that materials be excavated from below the water table in a wet state. This will likely result in the generation of turbid water in excavations as ‘fines’ become suspended in the water column.

Were this to occur in the FCC Landfill or in localised deep excavations e.g. Lake Tas, then such turbidity would be effectively contained. However, in the reclaimed part of FCC East, where excavation will extend beyond the boundary and into the waterway, the migration of turbid water may have detrimental impacts. Accordingly, in this area, it is proposed that either a clay cut-off wall be constructed to isolate the excavation from the Channel or the excavation process is managed in a manner that minimises tidal impacts by both reducing the area of excavation in conjunction with sequencing the works to take advantage of low tide cycles.

A concept design of the clay cut-off is shown in Figure 8.2. The cut-off wall will be constructed in a piecemeal fashion with works undertaken during low tide cycles.

Protocols for validation of excavations below water, and for backfill of excavations below water have been developed, as described in later sections of this RAP.

In addition to the above, the following general conditions will be satisfied:

- discharge of untreated contaminated water into surrounding waterways, onto lands adjoining the site, into stormwater culverts, or onto areas of the Site that have been remediated will not be permitted. The discharge of groundwater into a surface water system will only be undertaken in instances where groundwater quality meets the criteria for stormwater discharges;

- bunds and diversion drains will be constructed around all excavations containing contaminated water to prevent surface water runoff from entering the excavations; and

- works will be carried out in a manner that minimises any deviation of natural groundwater flow or deterioration of groundwater quality.

8.8.4 Air Quality Control

A key objective is to conduct site works in a manner that ensures ambient air quality complies with statutory requirements and that nuisance odours are minimised.

The Resource Consent Conditions call for substantial amounts of emission monitoring to be undertaken at the commencement of the remedial works and throughout the duration of the project. Emission monitoring will be summarised in text within the following sections, however to derive a complete understanding on the monitoring required an Consent Monitoring Table has been prepared and included as Appendix 6 of this RAP.

The table identifies the Resource Management Consent number, the specific condition, the medium to be monitored, the frequency, the standards/methodology of the monitoring and the criteria that the results will be compared too.

Dust and Odour Control- Overview

No single emission control technique can be expected to be 100% effective under all conditions. Accordingly, a variety of techniques must be employed at any time to mitigate potential impacts to the extent practicable. Table 8.7 summarises the applicable dust emission control techniques for each of the potential emission sources. Table 8.9 summarises applicable gaseous emission control techniques

Each of the applicable control methods is described in the following sections.

Table 8.7 - Dust control techniques

Dust Emission Source	Appropriate rates of progress	Minimise open excavation areas	Covers	Partial / complete enclosure	APCD's	Watering by sprinkler systems	Watering by water cart	Use of surface stabilisation agents	Revegetation of finished surfaces	Revegetation of inactive work areas	Wind barriers	Wheel washes	Paving/hard stand	Speed limits and plant controls
Excavation/loading	X	X				X	X				X			
Transportation	X		X			X	X	X			X	X	X	X
Active stockpiling	X					X	X				X			
Inactive stockpiles		X	X			X	X	X		X	X			
Exposed surfaces						X	X	X	X		X			
Treatment processes				X	X	X							X	

Table 8.9 - Gaseous emission control techniques

Gaseous Emission Source	Appropriate rates of progress	Minimise open excavation areas	Covers	Partial / complete enclosure	APCD's	Odour suppressant sprays	Odour misting systems	Free product recovery / containment	Water reuse restrictions
Excavation/loading	X	X				X	X		
Transportation	X					X	X		
Active stockpiling	X					X	X		
Inactive stockpiles			X			X	X		
Exposed surfaces		X	X			X	X		
Water bodies			X			X	X	X	
Reuse of site water	X					X	X		X
Treatment processes				X	X			X	

Note: APCD's – air pollution control devices as applied to operating plant

Identification Of Appropriate Rates Of Progress

Dust and odour generation is generally proportional to the rate at which excavation and related haulage/stockpiling processes are undertaken. Furthermore dust generation from such activities is likely to be exacerbated when adverse climatic conditions (such as high winds) prevail.

During the progress of excavation, haulage and stockpiling works will be tailored to optimise the performance of air quality mitigation activities with a view to prevailing weather conditions.

Minimisation Of Open Excavation Areas

When practically achievable, excavation of single full depth pass will be done to minimise the plan area of contaminated soil exposed to the atmosphere. In addition, clean up/trimming of the base of excavations will be undertaken concurrently with bulk excavation.

Covering Of Excavation Faces

Odour and dust control from such sources will be provided by use of odour suppressants and watering as covering of excavation faces when an excavator is being used is not practical.

Covering of excavation faces after hours will be achieved by one of the following means:

- Non-odorous soil cover: typically spread to 150mm thickness; or

- Synthetic sheeting: lightweight polyethylene sheeting or tarps.

Covering Of Stockpiled Material

Stockpiles will be maintained at a size that allows for appropriate dust and odour management.

If necessary, stockpiles will be covered with high-density polyethylene (HDPE) sheeting. Sheets will be welded to provide a continuous barrier to the migration of odours and dust. Covers will be securely held down by either weighting or a cover mesh, appropriately secured to the stockpile foot.

Stockpiles covers will be inspected on a daily basis. Repairs to torn or degraded sheeting will be undertaken immediately upon identification.

Covers to odorous material stockpiles will comprise:

- synthetic sheeting – lightweight polyethylene sheeting on tarps; or

- hydromulching – use of straw mulch acts as a biofilter and is effective at controlling odorous emissions; and

- non-odorous soils – a thin lift of soil (~150mm thick) is effective at mitigating odours.

Hydromulching and non-odorous soil covers are more practical than sheeting for large stockpiles or active stockpiles and will be used preferentially.

Odour Suppressants

Odour suppressants are chemicals that either chemically react with or mask volatile odorous compounds.

Odour suppressants may be applied either direct to the surface of an odorous material, or via misting systems. They are often used in conjunction with watering for dust control.

A variety of odour suppressants are available. Some are proprietary chemicals (such as 'Biosolve'), whilst others use natural oils and fragrances (such as those based on citrus extracts). The effectiveness of such agents is site and chemical specific. Accordingly, trialling is required to obtain optimal performance. In any event, only non-toxic suppressants will be used.

Odour suppressants may be applied by water sprays (either hand held sprays or from water carts) directly to excavation surfaces and at stockpiles where odorous materials are being handled.

Controls On The Movement Of Vehicles

The following controls will be placed on the movement of vehicles from work areas:

1. All surfaces carrying vehicular traffic shall be kept free of contaminated[1] materials.

2. All trucks transporting solid materials off-site shall be securely and completely covered immediately after loading the material, to prevent wind blown emissions and spillage. Such covering shall be maintained until immediately before unloading the trucks.

3. All truck tail gates shall be securely fixed prior to loading and immediately after unloading solid materials.

4. Trucks or equipment shall only move within designated transportation corridors. No trucks or equipment carrying contaminated materials shall be allowed to move across remediated or clean areas except via designated transportation corridors.

5. Vehicles transporting materials on-site shall be operated in a manner so as to prevent any loss of materials during loading, transport and unloading activities.

6. A site speed limit of 10 km/hr will be observed for all plant travelling on site haul roads.

7. Vehicles leaving the site must be clean so as to prevent soiling of on-site and off-site roadways by dirt or tyre marks.

Equipment Cleaning

[1] Contaminated material as referred to as CMT in Variation Agreement, DDX >200mg/kg; A+D+L/10 >3 mg/kg

Either a wheel shaker or wheel wash facility suitable for the removal of dust, mud and other detritus from the wheels and underbodies of vehicles leaving the site shall be established close to the two main exit points. All vehicles leaving the site or travelling between FCC East and West shall proceed via these controls.

In the case of wheel wash, water used shall be contained within the facility and, where possible recirculated. As necessary, wash water will be transported to the contaminated water storage basin.

Street sweepers will be employed if necessary if dust, mud etc become evident on roadways surrounding the site.

Dust Suppression By Watering

Use of water to wet down an area or an operation is an effective dust control technique. However, this control is only temporary if water is not periodically or continuously applied, or if not supplemented by chemical stabilisation agents. Water may be applied by the following methods:

- water cart – by spray bar and canon; and
- sprinkler system – both fixed and mobile systems.

These application methods, and the proposed use of chemical stabilisation agents are discussed in the following sections.

Water Carts

Water carts will be used to spray water onto haul roads, at excavation faces and stockpiles. Water carts will be equipped with a pump and sprays capable of spraying water at a rate in excess of 3L/sec. Water carts will also be fitted with water canon capable of directing water at localised operations such as excavator and dozer operations.

Sprinkler Systems

As required, a number of mobile irrigators will be moved around the site to address particular operations. Such equipment will typically be able to irrigate a 50m radius at a flow rate of up to 10L/sec. Timing systems will be in place to enable after hours watering if necessary.

Boundary Wind Barriers And Screening

Whilst primarily designed to mitigate noise impacts, the boundary barriers will also act as wind barriers. Wind barriers reduce the amount of wind blown dust by reducing wind speed on the soil surface, by reducing the drying effects of wind (thereby enhancing the effectiveness of water based dust suppression techniques) and by acting as a barrier to course particle transport.

Ambient Air Quality Monitoring Program

An air quality monitoring program will be implemented that complies with the requiresments setout in the Resource Consent Conditions. The program for ambient air quality can be summarised as follows:

- high volume samplers run on a continuous basis at the Site boundaries to determine Total Suspended Particulate (TSP) levels and PM_{10} levels;
- dust deposition gauges at the Site boundaries to measure dust deposition rates;
- olfactory observation at Site boundaries and in the surrounding residential areas using personnel specifically trained for odour level determination; and
- sampling pumps fitted with reactive tubes targeted to respond to key contaminants.

In addition, the weather recording station will provide information to site personnel on the prevailing wind direction and strength. Please refer to the Consent Monitoring Table within Appendix 6.

MCD Plant Air Quality Monitoring Program

Emission test from the discharge stack of the MCD plant shall be undertaken at weekly intervals for the first month of operation. After the first month, emissions shall be monitored at three monthly intervals.

At the completion of the first month of MCD plant operations a dispersion modelling assessment of the effects of the MCD discharge shall be undertaken. Dispersion modelling shall also be undertaken at six monthly intervals thereafter.

All emission monitoring from the MCD plant will be carried out in accordance with ISO 9096:1992(E), or equivalent. This monitoring will identify the Organochlorine discharges as well as the particle size distribution of the particulate fraction.

Total suspended particulate monitoring in the ambient air will be monitored in accordance with AS 3580.9.6: 1990, or equivalent and deposited particulate in accordance with ISO/DIS 4222.2. Please refer to the Consent Monitoring Table within Appendix 6.

8.8.5 Noise

The works will be developed to ensure that the levels of noise generated on-site are within the limits acceptable to the relevant regulatory authorities.

MCD Plant

Noise monitoring was undertaken during a five day trial conducted over the period Monday 17 February to Friday 21 February 2003. The monitoring showed that operational noise level were near or below the allowable limit of 55 dBA L_{10} at the residential boundaries.

The change from a diesel engine drive to an electric drive with a silenced 450kVA generator will further reduce noise levels. Encapsulating the electric motor drive and fan on the baghouse, along with ducting the reactor exhaust fan could also be considered if required to further mitigate noise levels.

Noise Control Measures

The following noise control measures will be used throughout the works:

- the normal working hours shall be as set out in the Resource Consent conditions. Heavy vehicle traffic will not be permitted to arrive or depart the Site outside 30 minutes of the beginning and end of the hours of operation;
- construction vehicles will enter and leave the site in accordance with the Site entry controls;
- equipment in operation in open areas on the Site will be fitted with residential silencers. Approved residential silencing devices to relevant standards shall be provided and maintained as required in respect of all power-operated plant used during works;
- equipment will have noise attenuation measures fitted which make the equipment suitable for use in urban areas and which comply with regulatory requirements. The protection measures shall include:
  - The encapsulation of engine chambers;
  - Fitting approved silencers to all power operated plant;
- the use of reversing alarms will be restricted, subject to Health and Safety of Employment legislation requirements;
- maintenance and/or repairs of plant and equipment may be carried outside the above hours provided that:
  - Plant and equipment subject to maintenance and/or repairs, and compounds for overnight on-site parking of vehicles and mobile plant are located as far away as possible from noise-sensitive premises (being any occupied residential premises).
  - No heavy machinery will be operated during this period.
- sub-contractors will be directed to cease maintenance and/or repair work during the extended operational hours if noise emission becomes audible at any noise sensitive premises;
- it is proposed that emergency work may be carried out outside specified hours provided that the Principal is satisfied that the proposed work is of an essential nature and cannot be carried out during specified hours. A report summarising the event (nature of the work, commencing and completion times and details of the noise mitigation measures undertaken) will be provided to Principal within 48 hours after the event commenced;
- natural vegetation and boundary fences along the southern boundaries of both the FCC east and west sites will be retained for as long as possible so as to provide noise attenuation in these locations;
- the works along the northern boundary of the FCC east site will be undertaken, as far as practicable, in a co-operative manner with the local businesses, with flexible working hours adopted so as minimise effects to patronage. Noisy works, or works that may affect customers will be undertaken, as far as practicable, during periods of low trade i.e. early morning, cooler months when patronage is generally lower than usual. Similarly, work may be able to be suspended in these areas during periods of high patronage;

- due consideration will be given to erecting sound attenuation barriers to assist with noise mitigation and to provide a visual barrier to the works. These may be located along sections of property boundaries or around specific items of plant or equipment. Each area will be assessed on a case by case basis, with particular reference to background and ambient noise levels, and the duration of the works in those areas. These barriers may take the form of sound mounds constructed of material that is to be retained on site, treated timber screens erected on the property boundary, barriers made of straw bales, barriers consisting of sea containers or other physical barriers that are suitable and practical; and

- demolition works will not be undertaken on weekends and, subject to programming, excavation, stockpiling and screening works may be reduced on weekends;

Noise Emission Standards

All site works shall be designed and conducted to ensure that whenever practicable noise from those activities does not exceed the noise limits as detailed in table 8.9 table. Sound levels shall be measured and assessed in accordance with the provisions of NZS6803:1999 *Acoustics - Construction Noise.*

The maximum noise level of each item of plant and equipment will be monitored to ensure that it does not exceed the maximum noise levels set out in Table 8.9 as measured at the building/dwelling adjacent to the site

Types of equipment other than those listed in Table 8.10 may be used or operated provided the maximum noise level L_{max} does not exceed that shown in the table for a similar item.

Table 8.9 —Noise emission standards of site operations

<table>
<tr><td colspan="9">When measured at dwellings in residential areas</td></tr>
<tr><td rowspan="2">Time period</td><td colspan="3">Weekdays (dBA)</td><td colspan="3">Saturdays (dBA)</td><td colspan="2">Sundays / P. Holidays (dBA)</td></tr>
<tr><td>L_{10}</td><td>L_{eq}</td><td>L_{max}</td><td>L_{10}</td><td>L_{eq}</td><td>L_{max}</td><td>L_{eq}</td><td>L_{max}</td></tr>
<tr><td>0700-0730</td><td>55</td><td></td><td>75</td><td>55</td><td></td><td>75</td><td></td><td></td></tr>
<tr><td>0730-1800</td><td></td><td>70</td><td>85</td><td>55</td><td></td><td>75</td><td></td><td></td></tr>
<tr><td>1800-2000</td><td>55</td><td></td><td>75</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2000-0630</td><td>40</td><td></td><td>70</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="9">At or within the boundary of any site in commercial areas for all days of the year excluding Sundays and Public Holidays</td></tr>
<tr><td></td><td>L_{10}</td><td>L_{eq}</td><td>L_{max}</td><td colspan="5"></td></tr>
<tr><td>0730-1800</td><td>-</td><td>70</td><td>-</td><td colspan="5"></td></tr>
<tr><td>1800-0730</td><td>55</td><td>-</td><td>70</td><td colspan="5"></td></tr>
</table>

In certain circumstances where the noise mitigation measures are impracticable or provide other unacceptable adverse effects, or are not wanted by neighbours then the above limits may be exceeded provided that:

- Noise levels are kept as quiet as reasonably practicable;

- Neighbours likely to be exposed to levels that exceed the limits are consulted about the proposed timing and duration of the works;

- The works are undertaken at times that best suit the neighbours as far as the works scheduling can accommodate neighbours requirements and any conflicting needs.

Noise Monitoring Program

An ambient noise monitoring program will be conducted throughout the period of the works. The purpose of the monitoring program will be to monitor compliance with noise emission standards at the boundaries of the property, and to demonstrate that Site works have not adversely impacted the surrounding community.

Maximum noise levels emitted by each piece of plant and equipment at the Site will be monitored at least once every three months. The purpose of the monitoring will be to assess compliance with noise emission standards and to check that noise levels of individual items have not increase through wear and tear. The first test will be carried out within three (3) days after the arrival of any equipment at the Site and prior to its use on any excavation or construction activity.

The results the noise monitoring program will be provided to the Principal as part of the Monthly Report. Please refer to the Consent Monitoring Table within Appendix 6.

Table 8.10 — Maximum noise levels of plant and equipment

Item	**Typical Plant Type or Acoustical Treatment**	**Maximum Noise Level L_{Amax} dBA at 7m**
Bulldozer	Caterpillar D7, D9	88
Bulldozer	Caterpillar D10 or greater	93
Front end Loader	Wheeled	90
Jackhammers	Silencing Bags	85
Air Track Drill	800 CFM Compressor	96
Scraper	Caterpillar 651	85
Grader	Caterpillar 16	85
Compactor	Caterpillar 825	85
Vibratory Roller	10-12 Tonne	89
Excavator	Kato 750	86
Rockbreaker	Hydraulic, on Excavator KATO 75086	97
Semi Trailer	25-28 Tonne	87
Crane	Truck Mounted	85
Compressor	600 CFM	75
Compressor	1500 CFM	80
Backhoe	–	88
Grader	Cat 16	85
Compactor	Vibrating Plate	92
Spreader	Asphalt, Concrete	70
Asphalt Paver	–	89
Product Truck	12-15 Tonne	83
Generator	Diesel	79
Concrete Truck	–	83
Concrete Pump	–	84
Concrete Vibrators	–	80
Air Compressors	–	75
Concrete Saw	–	93
Welders	–	85
Crushing Plant	Primary Crusher	80
Crushing Plant	Secondary Crusher	80
Crushing Plant	Secondary and Master Screen	88
Crushing Plant	Conveyors only	81

- Note: Based on NSW EPA Noise Manual

In the event that unacceptable noise levels have occurred at the Site, works will be immediately instigated to rectify the noise levels in order that it reaches an acceptable quality within the shortest time practicable.

8.8.6 Vibration

Preliminary monitoring and preventative measures

Vibration monitoring undertaken during the five day trial conducted over the period Monday 17 February to Friday 21 February 2003 confirmed the operational vibration level to be below the allowable levels of both the structural and physiological standards in accordance with ISO 2631 (1989) Standard, Evaluation of Human Exposure to Whole Body Vibration Part 2; and the German DIN4150 Standard - Part 3 (1993).

Prior to commissioning of MCD plant, clearing and excavation, Thiess Services shall undertake structural assessments as required of buildings within 100 metres of the Site. Assessments will be conducted by a registered engineer experienced in foundation design and structural engineering. The assessment will list weaknesses or potential weaknesses that could be affected by vibrations from the Site. Residents are to be notified that assessments are conducted at no cost to the property owner.

TS will consider provide necessary bracing or other measures to prevent failure as a result of vibration arising from the MCD plant.

Ongoing monitoring and thresholds

Vibration monitoring will be undertaken if complaints are received from neighbouring residents to verify compliance with thresholds, residents will be notified of monitoring results. Please refer to the Consent Monitoring Table within Appendix 6.

Thresholds as defined in ISO 2631 (1989): Peak Vibration Velocity Limits in Residential Buildings are to be adopted and are:

Continuous Vibrations:

- Day (0730 – 2000) – 0.4 mm/s
- Night (2000 – 0730) – 0.14 mm/s

Transient/Short Duration Vibrations with several occurrences per day:

- Day (0730 – 2000) – 5 mm/s
- Night (2000 – 0730) – 0.5 mm/s

Thresholds for other types of building are as set out in DIN4150 Standard – Part 3 (1993), as displayed in Table 8.11 below:

Table 8.11 - Guideline values of vibration velocity, for evaluating the effects of short-term vibration (DIN 4150)

Type of Structure	Vibration Velocity		
	<10 HZ	10 - 50 Hz	50 – 100* HZ
	Vibration Velocity (mm/s)		
Buildings used for commercial and industrial purposes, and of similar design	20	20 - 40	40 - 50
Dwelling and buildings of similar design and/or use	5	5 - 15	15 - 20
As above	3	8 - 10	8 - 10
* For frequencies above 100HZ, the lower value specified in this column shall be applied			

8.8.7 Equipment Control

All plant used at the site which has the potential of adversely affecting the environment will be operated in a proper manner by competent personnel. All plant will be maintained in a clean and safe condition.

All noise, odour and dust attenuation measures provided for the plant will be in good working order and will be used for the duration of the works.

Controls on the Movement of Vehicles

On account of the presence of contaminated materials at the Site, it is proposed that the following controls be placed on the movement of vehicles from work areas:

- all external surfaces carrying vehicular traffic will be kept free of CMT[2];
- all trucks transporting solid materials off-site will be securely and completely covered immediately after loading the material, to prevent wind blown emissions and spillage. Such covering will be maintained until immediately before unloading the trucks;
- all truck tailgates will be securely fixed prior to loading and immediately after unloading solid material;

[2] Contaminated material as referred to as CMT in Variation Agreement, DDX >200mg/kg; A+D+L/10 >3 mg/kg

- trucks or equipment will only move within designated transportation corridors. No trucks or equipment carrying contaminated materials will be allowed to move across remediated or clean areas except across designated transportation corridors;
- all vehicles transporting materials on-site will be operated in a manner so as to prevent any loss of materials during loading, transport and unloading activities; and
- vehicles leaving the site shall have their wheels and undercarriages cleaned by high-pressure washing so as to prevent soiling of on-site and off-site roadways by dirt or tyre marks. To this end, two wheel washes will be established, as depicted in Figures 8.4.

Equipment Cleaning

The following requirements are proposed in relation to equipment cleaning:

- all equipment that comes in contact with any contaminated material will be washed and cleaned before its removal form the Site;
- equipment working within an excavation area containing contaminated soils may be washed inside the area so that any wash water remains within the excavation. Wash waters will be allowed to naturally dissipate from the excavation along with other ponded water;
- a truck wash or shaker facility will be installed for the effective cleaning of equipment prior to leaving the Site. All equipment that has come in contact with contaminated materials will leave via these controls; and
- vehicles leaving the Site shall have clean wheels and underbodies. A high-pressure washer may be used to clean all plant prior to leaving the Site.

Water used within the wheel wash shall be contained within the facility and, where possible recirculated. Where necessary, excess water will be tested for the SAC and treated as necessary prior to discharge and/or reuse on site for dust suppression in contaminated areas of the Site, but not adjacent to site boundaries.

8.8.8 Revegetation

The revegetation plan will be written in consultation with the TDC Reserves Department and Rob Davidson from the Peer Review Panel. It is anticipated this will be done with input from local residents. Thiess Services will produce the plan detailing how the replanting of coastal species will be achieved upon completion of works following reporting from the Reserves Department. Plants recommended/used for revegetation will be limited to indigenous species with genetic stock from the Tasman Bay Area.

9.0 VALIDATION PLAN

9.1 General

Validation sampling will be undertaken with the objective of demonstrating that the Site has been remediated to a standard suitable for the proposed land uses as per Clean Up Scenario B detailed in Table 1.1. A Site Validation Report will be prepared in accordance with the Guidelines for Reporting on Contaminated Sites in New Zealand, Ministry for the Environment, 2001.

The standard to which the Site will be validated is set by the acceptance criteria defined in Section 7. Approvals will be discussed/issued by the Engineer (refer to section 2.7 Contract document). The SAC is outlined in Appendix 3. As outlined in section 9.3, there will initially be a program of targeted sampling at various locations around the site to determine presence/absence of minor analytes and identify the need to review the information in Appendix 3. Any additional minor analytes included in the SAC will be sampled at a rate of 10% of all samples.

9.2 Validation Sampling

Validation sampling of the excavations, insitu material and the oversize fractions from stockpile will be undertaken by an Environmental Consultant, on Thiess Services behalf, who will be appointed prior to the commencement of the Stage 3 works. The Environmental Consultant will be responsible for the collection of all necessary validation samples. Validation sampling of the treated material will be undertaken by EDL prior to its reinstatement on site.

The methods to be adopted for validation sampling are detailed in the following sections in accordance with Contaminated Site Investigation, Soil sampling, Analysis and Interpretation,Ministry for the Environment, June 2003).

9.2.1 Sample Collection

Sampling will be conducted in compliance with AS 4482.1 – *1997 Guide to the sampling and investigation of potentially contaminated soil.* The standard details collection, handling, containment and transport of samples to prevent cross-contamination. All analyses will be carried out by an IANZ (International Accreditation New Zealand) accredited laboratory as per Resource Consent RM030524- 39).

Dry Excavation Surfaces

Hand Augers are generally used for sample depths less than three (3) meters for both organic and inorganic analytes. When sampling from a hand auger, the outer layer of the sample is pared away to minimise the risk of cross-contamination (when drawing deep clean soil through shallow soil).

Samples will also be recovered by trowel and from excavator bucket returns from dry excavation surfaces.

Samples will be recovered by trowel, hand auger or from excavator bucket returns from dry excavation surfaces.

Excavation Surfaces Under Water

Where water is ponded over excavation surfaces, then samples will be recovered by split tube, piston sampler or 'clam-shell' grab. The particular method used will be that method that best suits the material to be sampled, with a view to minimising sample disturbance.

9.2.2 Validation of Material Remaining In-Situ / Relocating Material Without Treatment

The Stage 1 investigation identified the extent of contamination to a depth of 3m defined by 5 layers. Layer 1 extendes 0-0.5m, layer 2 0.5-1m, layer 3 1-1.5m, layer 4 1.5-2m and layer 5 2-3m. Materials below this depth will require validation during the Stage 3 works. Should contamination extend beyond this 3m depth, this material will be removed until further validation testing confirms that the insitu material falls within the SAC.

One of the purposes of the Stage 1 investigation, was to allow validation of materials that can be classified as meeting the required SAC and can remain *in situ* (i.e., not requiring remedial action) prior to the commencement of Stage 3. Therefore, there would be no need for further quantitative validation of these materials following the remedial works, provided that the Principal considers that there is no reason to believe that contamination of these materials has occurred during the works. Where material was validated as residential on a 15 x 15m basis, then infill sampling at 7.5m centres around the margins of error exceeding residential SAC will be applied to confirm residential classification.

It is anticipated that areas validated as commercial and residential may be required to provide "borrow" material to facilitate the backfilling of the site areas so as to enable the required land use criteria to be met. Included is material classified as residential which will be used to reinstate FCC West and the top 0.5m of FCC East and the Landfill. Where this material is taken from areas that are not adjacent to contaminated cells it will be sampled at a rate of 1 per $100m^3$. If material is sourced from a cell adjacent to a cell that exceeds residential criteria, the excavated material will be sampled on a 1 per $25m^3$ basis.

Material classified as commmercial which is used to reinstate FCC East and the landfill will be sampled at a rate of 1 per $100m^3$.

At all times, efforts will be made to not cross contaminate any of the areas that have been identified as clean. If the Principal has any cause to believe that such contamination has occurred, further validation sampling of these materials will be undertaken as necessary.

Each cell will be validated before backfill and validation sampling required by the Principal for the above or any other reason shall be in accordance with Table 9.1.

Table 9.1 - Basis for validation

SAC	Sampling Density	Basis for Acceptance
Residential (1)	7.5m x 7.5m grid at 0.1 m below floor of excavation, and 1composite sample per wall per layer interval. (minimum of 1 composite sample per wall and/or floor of excavation).	Mean of the floor and wall samples for each cell shall be less than the specified criterion and the maximum value for any one sample point shall be less than 2.5 times the acceptance criterion.
Commercial / Open Space Marine sediments	15m x 15m grid at 0.1m below floor of excavation 1composite sample per wall per layer interval. 1composite sample per wall per layer interval. (minimum of 1 composite sample per wall and/or floor of excavation)	Mean of the floor and wall samples for each cell shall be less than the specified criterion and the maximum value for any one sample point shall be less than 2.5 times the acceptance criterion.

Note (1): Where clean-up or previous sampling has been such that there is a high confidence in the remediation and the actual land use will be residential, sampling density may be on a 15 m x 15 m grid upon the written approval of the Engineer.

9.2.3 Validation of Treated/Screened Materials

These materials shall be validated by sampling and analysis from stockpiles following treatment and/or screening prior to the removal of these materials to their ultimate disposal/reuse location.

The basis for acceptance is that the 95% UCL of the mean concentration of the material shall be less than the target SAC for target OCPs. The number of samples required shall be as derived by the calculation in Appendix D of AS4482.1:1997, or one sample per 25m^3 of stockpiled material whichever is the lesser. If it becomes clear that material will consistently meet the 95% UCL, then this may be reduced to one sample per 100m^3, or a lesser rate pending approval from the Engineer.

9.2.4 Imported Backfill

The validation procedure for imported backfill material (if required) shall comply with Section 4.1.2 of the NSW EPA *Contaminated Sites Sampling Design Guidelines*, September 1995.

For imported fill of known origin (e.g., quarry) with minimal potential for contamination, representative samples shall be collected at source location at a rate of 1 composite (3 subsamples) per 1,000 m^3 plus quality control sampling. For imported fill of unknown or suspect origin, representative samples shall be taken at a rate of 1 composite per 400 m^3 plus quality control sampling. If this sampling should show that contamination might be present at concentrations that exceed the acceptance criteria, then the Engineer may request additional sampling and characterisation of the material or an alternative source of fill will be found.

9.3 Targeted Sampling

To confirm the analytes used in validation, prior to any backfill there will be an additional site characterisation to confirm validation suite for less likely contaminants; indicated as 10% of samples detailed in section 9.4. The investigation will involve 10 targeted pits, 10 random pits and 6 groundwater bores to cover all areas of the site as outlined below.

Targeted Pits: G13, H24, I24, J9, J10, J24, K25, M8, M15 and K9

Random Pits: E16, E18, F13, F15, G19, H18, I22, L9, M12 and N10

Groundwater bores: BH1, BH2, BH3, BH4, BH5 and B9

If for some reason test pits cannot be sampled i.e. not accessible, test pits G26, I25 and K7 may be used.

Samples will be tested for presence and levels of analytes indicated in Appendix 11 as determined by the Site Auditor. Thresholds and analytes were chosen for consideration to protection of the estuary from run off, the need to protect human health and the need to protect groundwater. Subsequent outcomes of the sampling results will be determined by the Engineer.

9.4 Validation Analytes

Samples that are taken to validate materials of class A and E to J as per section 8.2 shall be analysed as follows[3]:

- 100% samples: for OCPs;

- 50% of samples shall also be analysed for Total Petroleum Hydrocarbons (TPH's), and Volatile Chlorinated Hydrocarbons[4], and selected metals (i.e., arsenic, cadmium, chromium, copper, cyanide, lead, manganese, mercury, nickel, selenium and zinc);

- 10% of all samples shall be analysed for the suite of analytes for which Soil Investigation Levels (SILs) for Urban Redevelopment Sites in NSW are listed in Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (Contaminated Sites Section of the Environmental Protection Authority); and

- QA/QC samples shall be taken in accordance with the AS 4482.1-1997 *Guide to the sampling and investigation of potentially contaminated soil Part 1: Non volatile and semi-volatile compounds*.

The additional analytical sampling detailed above will be undertaken on samples that are distributed evenly throughout the site.

Validation of imported filling (if required) shall comply with section 4.1.2 of the NSW EPA Contaminated Sites Sampling Design Guidelines, September 1995.

[3] This may be reviewed following initial targeted sampling as described in Section 9.3.
[4] This will include TCE and PCE. Additionally any odorous samples will be tested for VCH.

Validation of imported filling (if required) will be done for analytes as approved by the Engineer with particular reference to the proposed land use. Sample frequency is outlined in “WP13 Validation Sampling and Analysis”.

9.5 Validation by Inspection

Further to the quantitative validation of materials by chemical analysis referred to above, all materials shall be subject to visual inspection to confirm the absence of contamination and the aesthetic acceptability of the material (odour and visual appearance).

9.6 Validation Approvals

9.6.1 Soils Remaining In Situ

The validation results for these materials will be provided to the Engineer and approval in writing will be obtained from the Engineer prior to backfilling any areas. Approval to commence placement of imported or treated clean soil will be obtained from the Engineer for all areas prior to backfilling. Should the Engineer so require, backfilling will be delayed to allow for quality control testing by another party.

9.6.2 Excavated Materials to be Backfilled/Disposed

The validation results for these materials will be provided to the Engineer and approval in writing will be obtained from the Engineer prior to backfilling on-site, or off-site disposal. Should the Engineer so require, backfilling/ disposal will be delayed to allow for quality control testing by another party.

Wherever possible, the more highly contaminated treated material that meets the SAC will be backfilled as far from marine margins so as to minimise the risk of potential groundwater impacts and preference will be given to placing it under impermeable structures, if possible. At all times during the backfilling process a buffer zone will be maintained so as to ensure on going protection of the aquatic ecosystem.

The extent of the buffer zone is as per Table 7.2.

9.6.3 Crushed Concrete/Hardstand to be Backfilled

Concrete and hardstand will be crushed before backfill. This material will be analysed if necessary as per materials in 9.5.2, to determine absence/presence of any attached and potentially contaminated fines, and the possibility of impreganted contamination in the concrete. Contaminated concrete areas were identified in the Site Characterisation Report February 2001.

9.6.4 Imported Backfill

A validation report will be provided to the Engineer for these materials and approval in writing will be obtained from the Engineer prior to the importation of these materials to the Site. Should the Engineer so require, the importation of this material will be delayed to allow for quality control testing by another party.

9.6.5 Accredited Site Auditor

An independent Site Auditor, accredited with the NSW EPA has been appointed by the Principal to issue a Site Audit statement on completion. This site audit statement will confirm that the objectives of this RAP have been met and that the site is suitable for its proposed land uses.

The Site Auditor plays an integral role in the remediation process and acts independently of both the Principal and the contractor. His role is to review the various management plans and this RAP for their appropriateness, to provide limited supervision and guidance during the works and to review all of the analytical data and validation reports prepared during the works.

10.0 PUBLIC CONSULTATION STRATEGY

10.1 Introduction

For the remediation project to be successfully completed, the consultation process must be effective and efficient. It is anticipated that a degree of support from the community will exist, due to a desire by the community to have a long-standing environmental and community problem dealt with. However, sensitive issues will be involved and the work will take place over an extended timeframe, raising the potential for concerns to arise. This means that the consultation process must be carried out sympathetically to enable the project to receive public support, efficiently gain resource consents, and then be undertaken in a supportive and constructive environment.

In preparing the proposed consultation process described below, the following factors have been taken into consideration:

- the consultation work undertaken to date;
- the location of the site in the heart of a community;
- the importance of the Waimea Inlet as a holiday and tourist destination, as well as an increasingly residential/life style community; and
- the need to keep the general public informed of plans for remediation of the site, including effects on Eves Valley Landfill (if used).

10.2 Consultation Objectives, Scope and Duration

A key goal of the consultation process for this project is to disseminate clear and factual information to minimise the potential for uninformed and irrational objections to the project. Specific objectives include the following:

- make the overall community aware of the project and the intention to remediate the site;
- advise the community of the range of opportunities and stages to comment on the project and be involved in the planning and consent process;
- disseminate information on an ongoing basis;
- provide opportunities for comment;
- respond to comments and requests for information;
- summarise and report comments for the AEE; and
- feed information on issues and concerns back to the investigations and remediation team.

In this way, inappropriate concerns can be identified and 'nipped in the bud' and any focussed opposition can be countered by appropriate presentation at the consent hearing.

The scope of information covered in the consultation needs to include:

- what site work is proposed;
- the timetable and timeframes;
- what effects can be expected;
- how effects will be managed and mitigated;
- the risks to the community; and
- realistic projections of the outcome and end use of the area.

It is essential to the overall success of the project (and the ability to gain workable resource consents) that the consultation does not cease once applications for consents are lodged. The community will require access to factual information as the remediation takes place and to have a means of airing any concerns.

10.3 Consultation Phases

The consultation process has already gone through a number of phases during the Stage 1 works.

- Phase 1 – Consultation Strategy

  A consultation strategy was initially developed, that identified the various groups that would have a specific interest in the works.

- Phase 2 – Formation of Community Interest Groups

  Contact was made with those groups so as to detail the overall objectives of the project and the opportunities for the community's involvement in the process. From these initial meetings, four individual community groups were established, each representing their geographical area in relation to the site. The four groups represent the residents on the three boundaries of the site, namely Tahi St, Aranui Rd and Coutts Place. The fourth group represents the commercial precinct at the north eastern boundary of the site.

  The Mapua Task Force was established by Council. The group comprises project staff, Councillors and community residents. This task force provides a link between the community and the Principal so that community concerns can be addressed.

  The Peer Review Panel (PRP) has also appointed by TDC, with members having expertise in environmental disciplines relevant to the site. The PRP's role is to review, comment and make recommendations on management plans, Proof of Performance and monitoring reports.

- Phase 3 - Investigation and Consenting

  This phase has focused on informing parties of the results of the investigation work carried out, the details of the proposed remediation works, and confirming working procedures and means of mitigation proposed for effects. This phase would have been iterative with the remediation team and the environmental effects assessment, to ensure issues raised through consultation were addressed in the AEE.

- Phase 4 – Remediation

  This phase would involve ongoing reviews by the PRP, and consultation with the general community through the remediation stage to keep them informed of progress and provide an avenue for them to communicate any concerns. This would largely be done through the Community Liaison Group, and meetings with specific interest groups. We would envisage one meeting with the Liaison Group would be held immediately before site work commences, and a further two meetings approximately one and four months after work has started. After this initial period meetings could be held on a six-monthly basis, with the opportunity for meetings to be called on demand as necessary.

10.4 Consultation Methods and Tools

It is proposed that the following methods be used to ensure effective and efficient consultation by maintained throughout the remediation stage of the works (Stage 3).

10.4.1 Consultation Database

A consultation database will be prepared to identify all interested and affected parties. This will be sourced from previous consultation records undertaken as part of the concept design, parties identified by the consent authorities and from the Principal's records. Key parties will include the Tasman District Council (as regulator responsible to grant consents), Department of Conservation and local resident groups. For activities in the coastal marine area, the Maritime Safety Authority, Mapua Boat Club and Hydrographer of the Royal NZ Navy will also need to be advised / consulted. The database will be updated throughout the project and will be used to document all contact. A relational database will be used for this task.

10.4.2 Contact Letter and Phone Call

A letter will be prepared and dispatched to all known parties with an interest in the project. The letter will inform all parties that the remediation project is now proceeding, and identify a project programme and opportunities for public participation. The letter will be drafted for the Principal's approval. This letter would invite the identification of issues that should be considered. Comments received will be provided to the remediation team for consideration. The letter would be preceded with a phone call to directly affected neighbours.

10.4.3 Press Releases

Press releases will be prepared on the project for release through the Principal, at specified times during the project programme, as determined by the Consultation Strategy. It is proposed that any contact with the Press be via the Principal.

10.4.4 Individual and Group Consultation

Individual consultation programmes will be maintained for key interest groups that have been established during Stage 1 of the works.

10.4.5 Community Liaison Group

A community liaison group will be established with whom regular meetings would be held to disseminate information and address concerns or issues. The group would be run by the consultation manager and attended as required by technical specialists. This group would continue through all stages of the project, including the remediation process.

10.4.6 Newsletters

Newsletters will be prepared at specific stages for dissemination of information to the community. The newsletters will advise of the setting up of the Community Liaison Group through which comments can be channelled, and also provide specific information on progress with the project, the consent process, and remediation works as appropriate. Feedback will be sought either in writing, in personal meetings as requested or by phone.

10.4.7 0800 Number

An 0800 number has been established and will be maintained to answer queries on the project and receive comments.

10.4.8 Web Page

Material will be produced for inclusion in the Principal’s web page that will provide a summary of commonly asked questions and answers.

10.4.9 Open Days

A minimum of two open days are proposed where team members would be available to discuss the project and explain the processes, timetable and issues on an individual basis. A suitable local venue will be chosen to maximise informality and mutual information sharing.

10.4.10 Information Board

Mechanisms for informing the general public are also required and include putting up a notice board near to the Site or at the wharf.

11.0 PROJECT MANAGEMENT

11.1 Integrated Management System

11.1.1 Overview

The project will be managed under the umbrella of Thiess Services Integrated Management System.

Thiess Services' Integrated Management System (IMS) has been certified to ISO 9002 "Quality Systems — Model for Quality Assurance in design, development, production, installation and servicing", ISO 14001 "Environmental Management Systems — Specification with guidance for use" and AS/NZS 4801 "Occupational Health and Safety Management Systems" by Quality Assurance Services Pty Limited, a division of Standards Australia.

The IMS is operating in accordance with Policy Manuals TS-QUA-QM101, "Quality Management System", TS-ENV-EM101 "Environmental Management System", and TS-OHS-SM01 "Health and Safety Management System".

Applicable System Procedures describe the controls to be exercised to ensure conformance to specified system requirements.

System Procedures are included in "TS Management System Procedures Manual", TS-SYS-QM002, and "Health, Safety and Environment Manual" TS-OHS-001 and are implemented via a site-specific Management Plan which is developed for each project. The various components of the IMS are shown in Figure 11.1.

11.1.2 System Implementation

The Management Plan takes into account relevant statutory requirements, specified contractual requirements, and includes the activities of all suppliers and sub-contractors who are required to conform either to effective quality, safety and environmental management systems already operating, or to System Procedures defined by Thiess Services. A detailed Management Plan for the project will be completed prior to commencing Stage 3 of the works.

Where amendment to Systems Procedures is of a minor nature and does not warrant the re-writing of the procedure, then such amendments may be included as addenda to the Management Plan.

Work Procedures are prepared for those work activities where the absence of such a work procedure may have an adverse effect on quality, safety or the environment. Inspection and Test Plans (ITPs) are developed to address specific quality/contractual requirements in support of the Work Procedures.

Work Procedures and the relevant Inspection and Test Plans will be issued to the Principal and project staff directly responsible for the particular work activity.

Site personnel are charged with ensuring that the specified quality, safety and environmental requirements, have been achieved by the adherence to the Work Procedures, ITPs and/or the completion of Inspection Checklist Reports (ICRs) or Inspection and Test Reports (ITRs), and associated safety documentation.

The Project Manager, after appropriate inspection and analysis, determines whether or not compliance with the specified quality requirements have been achieved and if so completed and sign off the relevant ICR or ITR.

Where compliance with quality, safety or environmental requirements has not been achieved, the Project Manager will ensure that appropriate corrective action is implemented under System Procedures TS-QUC-SP05 “Control of Nonconforming Products and Services” and/or TS-SYS-SP04, “System Corrective Action”.

11.1.3 Approach to Occupational Health and Safety Management

The IMS includes a three-tiered safety assurance system based on a risk management philosophy, which satisfies the requirements of AS/NZS 4360 and AS4801.

The three-tiered approach allows the combination of mandatory “duty of care” procedures and site-specific work procedures.

The first tier is a concise document outlining the structure and general principles of the system. This tier is formatted to meet the requirements of AS/NZS/ISO 9001. Central to this tier are specific authorities and responsibilities for all key functions pertaining to health and safety.

Tier 2 contains System Procedures. These procedures are deemed mandatory on all projects. The 20 System Procedures define the minimum actions required to be implemented to meet duty of care responsibilities. The procedures have been developed at a corporate level to address what, how, when and, where steps are performed and by whom. Where applicable they detail the materials, equipment and documents to be used and how they are to be controlled.

Central to the second tier are the following procedures:

- “Risk Management” (TS-OHS-SP019);
- “Preparation & Control of Safe Work Procedures” (TS-OHS-SP017);
- “Health and Safety Planning” (TS-OHS-SP012); and
- “Health, Safety & Environmental Auditing” (TS-OHS-SP010).

Together these procedures ensure all activities are:

- assessed for risk;
- have documented work procedures established;
- form part of the overall project safety plan; and
- implemented and followed as required.

Tier 3 contains Safe Work Procedures. These procedures are required for all tasks that include hazards and work activities of a moderate to high risk.

Currently the manual promotes 17 standard Safe Work Procedures. These procedures may be applied directly or modified to suit the individual operation as long as the existing document is maintained as the minimum standard.

Where Safe Work Procedures do not exist, Project Managers are required to develop them in accordance with TS-OHS-SP017 "Preparation & Control of Safe Work Procedures".

A site-specific Health and Safety Plan has been prepared as part of the integrated Management Plan. The Health and Safety Plan formalises the applicability of procedures on a site-specific basis and is the benchmark by which safety is implemented. The Plan includes consideration of the following aspects:

- Health and Safety Policy;
- identification of all statutory requirements and industry Code(s) of Practice that address health and safety (e.g. Health and Safety Guidelines for the Cleanup of Contaminated Sites, OSH, Department of Labour, 1994) that the works must comply with;
- the names and responsibilities of the personnel who will have responsibility for health and safety on the Site;
- an assessment of all identified hazards, exposure pathways and procedures for controlling significant hazards;
- the description of the site work zones that will be set up to control the risk to personnel on site and minimise the transfer of contaminants to surrounding contaminated areas of the Site;
- training, induction and supervision of employees;
- requirements for procedural and personal monitoring including the medical surveillance programme that will be implemented;
- personal protective equipment requirements;
- decontamination procedures;
- procedures for management and disposal of the contractor's wastes;
- procedures for recording, reporting and investigating accidents and incidents;
- emergency response procedures;
- prohibited activities;
- procedures for protecting the health and safety of subcontractors, visitors and the public;
- contact details for emergency medical services and hospital route maps; and
- health and safety rules, and procedures applicable to the works.

All additional issues/incidents relating to Occupational Health and Safety will be referred back to New Zealand OSH guidelines to ensure that there is consistency in our approach to site based management of Health and Safety issues.

11.1.4 Approach to Environmental Management

Thiess Services' Environmental Management System satisfies the requirements of ISO 14001 and provides a management framework/strategy to effectively manage those operational activities considered to have an adverse impact on the environment.

The principle objective of the system is to ensure that there will be no detrimental effects on the environment caused by any discharges or emissions from a workplace.

All aspects of the proposed operations as they impact on the environment have been assessed for their significance and appropriate day-to-day and continuous improvement control strategies developed.

Key procedures applied by the company in assessing and developing environmental management practices include:

- "Determination of Environmental Impacts, Objectives and Targets" (TS-ENV-SP01); and
- "Environmental Management Planning and Risk Management" (TS-ENV-SP03).

11.2 Project Management Structure

Figure 11.2 depicts the organisation structure proposed for the project.

11.3 Reporting

During the course of the works monthly reports will be submitted to the Engineer. The report will be presented to the Engineer by the seventh working day of the month and will include:

- a full safety report listing man hours worked on site for the month and to date and all incidents, and accidents for both TS employees and all subcontractors. The safety report will include full accident and near-misses reports on any lost time accident. Monthly safety audit results and updates of hazard identification as the project progresses will be included;
- an updated programme and comment on items behind programme and proposed action to get the project back on programme. This shall also include work off site;
- update supply issues with comment on purchasing and supply as it affects items critical to the program;
- construction progress report detailing work carried out during the month, problems encountered and solutions adopted;
- copies of Quality Assurance documents, test results, material certificates and details of non-conformance forms or similar and a report on corrective action taken;

- details of the Contractor's and Subcontractors, personnel and plant;
- copies of the Contractor's Daily Record Sheets;
- summary of contract instructions, e.g., Site Instructions, Variations, Requests for Information etc;
- photographs of the month's work;
- financial summary including -
  - Estimate of the value of work completed to date
  - Value of work completed and validated to date
  - Value of work claimed for the month
  - Estimated final contract value
  - List of variations separated into approved and unapproved;
- methodology statements for works proposed in the following month. These methodology statements shall include (and where appropriate reference the RAP) -
  - overall quality assurance procedures
  - description of the remediation processes
  - material supply arrangements
  - safety procedures
  - test procedures;
- details of notifiable inspections or testing proposed for the following month; and
- compliance performance with resource consents, including measures or remedial measures taken to ensure resource consent compliance, inspections or requirements from District Council officers, applications for and issue of consents and permits.

11.3.1 Close-out Reporting

On completion of the Contract, the TS will prepare a close-out report to incldue CAD drawings of as-built location, dimensions, and details of remediated areas. Details to be reported are:

- finished surface levels;
- validation sampling locations and depths;
- site grid over the Site;
- mean and 95% UCL concentrations of all residual contaminants in the different land use areas by depth intervals;

- location, thickness and depth of all hardfill buried on the Site;
- test locations for all geotechnical testing carried out; and
- locations and details of all new or relocated services, and the known location of all abandoned and left in services.

All information identifdied aboved shall be referenced to NZ Map Grid co-ordinates at an accuracy of ±20mm vertical and ±100mm horizontal

The report shall also include schedule of the quanitities of all materials that have been classified, the locations (in accordance with the site grid) on the Site of the source materials and, if appropriate, the ultimate disposal locations of these materials on the Site.

In addition the Close-out Report shall contain all consent compliance monitoring results.

12.0 PROGRAMME OF WORKS

Based on estimated volumes it is anticipated that the works will take approximately 18 months from commencement to final site validation. A detailed programme will be provided to the Principal which will be updated as required.

13.0 LIMITATIONS

This RAP has been prepared for use by the Principal who has commissioned the works in accordance with the Principal's Project Requirements. The advice herein relates only to this project and all results, conclusions and recommendations made should be reviewed by a competent and experienced person with experience in environmental matters, before being used for any purpose. Thiess Services (TS) accepts no liability for use or interpretation by any person or body. This report should not be reproduced, or amended in any way without prior approval by TS.

The RAP has been prepared on the basis of information obtained from previous investigations undertaken at the Site by others. A further site characterisation was undertaken by TS as part of the Contract in October 2001 with a view to providing a more detailed understanding of the insitu conditions relating to site contamination and to clarify the extent of the remediation works. The RAP has been updated following this characterisation.

Whilst the quality and accuracy of the original investigations is unknown, the Site Characterisation has provided a represenative analysis of the insitu conditions at the site. Furthermore, it is the nature of contaminated site investigations that the degree of variability in site conditions cannot be known completely and no sampling and analysis programme can eliminate all uncertainty concerning the condition of a site. Professional judgement must be exercised in the collection and interpretation of data.

The work has been conducted in good faith in accordance with TS understanding of the Principal's Project Requirements and generally accepted best current practice for environmental consulting.

No other warranty, expressed or implied is made as to the information and professional advice included in this report. It is not intended for other parties, other uses, or to be used out of context. This report should not be copied or quoted for other purposes except in full.

APPENDIX

Appendix 1[5]
Site Investigation Analytical Data

[5] Results include those from 2001 Woodward and Clyde study (referenced as 5 or 6 digit sample numbers with a letter prefix), and 1996 data (generally referenced with 1 or 2 digit sample numbers) samples collected as part of the AEE. The 2001 results are used as basis for site contamination plan.

TABLE 1A - FCC EAST, CONTAMINANT CONCENTRATIONS, 0-0.5 M

TREATMENT

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
L20	38	0-0.5m	1	0.05	0.05	0.55	0.61	0.19	0.89	0.46	3.4	4.94
L21	39	0-0.5m	1	1	1	1.1	2.20	1	8	12	64	85
J20	40	0-0.5m	1	0.05	0.05	0.05	0.11	0.05	0.09	0.05	0.15	0.34
K20	41	0-0.5m	1	2.5	2.5	4.9	7.65	2.5	52	48	270	372.5
J20	42	0-0.5m	1	2.5	2.5	11	13.75	10	61	66	420	557
J21	43	0-0.5m	1	2.5	2.5	11	13.75	23	120	73	790	1006
I21	44	0-0.5m	1	0.5	0.5	5.2	5.75	3.7	31	23	160	217.7
I21	45	0-0.5m	1	2.5	2.5	13	15.75	18	52	54	240	364
K22	46	0-0.5m	1	0.05	0.05	8.4	8.46	4.1	130	75	540	749.1
I23	47	0-0.5m	1	5	5	17	22.50	49	95	97	920	1161
J24	48	0-0.5m	1	0.5	0.5	1.4	1.95	0.96	0.86	0.18	26	28
K23	49	0-0.5m	1	1	1	1.6	2.70	2.6	54	46	250	352.6
L23	50	0-0.5m	1	5	5	8.1	13.60	0.14	9.3	21	120	150.44
J25	51	0-0.5m	1	0.05	0.05	0.97	1.03	0.19	25	5.5	52	82.69
K25	52	0-0.5m	1	0.05	0.05	0.14	0.20	0.05	0.38	0.05	1.4	1.88
L24	53	0-0.5m	1	0.05	0.05	0.14	0.20	0.05	0.12	0.05	0.2	0.42
J23	56	0-0.5m	1	2.5	4.1	6.5	10.85	26	75	31	380	512
J23	57	0-0.5m	1	0.05	0.25	0.74	1.00	1.3	18	6.1	56	81.4
K24	58	0-0.5m	1	0.25	0.25	1.1	1.38	0.28	6.2	0.25	6.9	13.63
G24	G241260	0-0.5	1	0.05	0.2	0.1	0.31		1.6	1.2	19	21.8
H21	H211354	0-0.5	1	4.4	0.3	10	10.74		91	12	210	313
H22	H221611	0-0.5	1	0.51	4.6	9.2	13.85		22	13	180	215
H23	H231266	0-0.5	1	0.05	0.05	0.05	0.11		0.2	0.1	1.8	2.1
H24	H241596	0-0.5	1	14	63	530	594.40		560	18	1700	2278
I21	I211662	0-0.5	1	0.05	0.05	1.2	1.26		22	3.8	95	120.8
I22	I221353	0-0.5	1	0.05	0.05	1	1.06		3.6	1.8	40	45.4
I23	I231637	0-0.5	1	0.05	0.05	2.6	2.66		4.6	4	97	105.6
I24	I241345	0-0.5	1	0.05	0.05	0.5	0.56		0.8	0.2	14	15
I25	I251320	0-0.5	1	0.05	0.05	0.05	0.11		1.2	0.3	3.6	5.1
J21	J211290	0-0.5	1	0.4	0.05	0.6	0.69		18	2.2	98	118.2
J22	J221642	0-0.5	1	0.05	0.05	0.2	0.26		5.6	1.6	110	117.2
J23	J231302	0-0.5	1	13	1.4	2.4	5.10		27	5.8	490	522.8
J23	J231307	0-0.5	1	11	0.6	2.2	3.90		20	5.2	480	505.2
J24	J241625	0-0.5	1	0.51	0.51	3.4	3.96		210	3.8	45	258.8
J25	J251314	0-0.5	1	0.05	0.05	0.3	0.36		1.8	0.4	46	48.2
K23	K231632	0-0.5	1	0.05	0.05	0.05	0.11		0.2	0.05	2.6	2.85
K24	K241308	0-0.5	1	0.05	0.05	0.05	0.11		0.1	0.05	1.4	1.55
K25	K251620	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
H23	M1	0	1	0.2		0.5	0.52	5.2	1.1		2.7	9
H23	M2	0-1.0	1	0.01		0.01	0.01	0.01	0.01		0.01	0.03
I24	M3	0	1	3.3		0.5	0.83	1.5	2.6		6.2	10.3
I24	M4	0-1.0	1	0.5		0.5	0.55	1.9	11		62	74.9
I25	M5	0	1	0.2		0.5	0.52	0.1	0.1		0.1	0.3
I25	M6	0-1.0	1	0.2		0.5	0.52	0.2	3.3		3	6.5
H24	M8	0	1	1.3			0.13	0.32	0.11		0.77	1.2
H24	M9	0-1.0	1	11			1.10	20	101		809	930
n				46	38	44	46	27	46	38	46	46
mean				1.9	2.6	15.0	16.7	6.4	40.2	16.6	191.7	249.3
st dev				3.5	10.2	79.6	87.2	11.5	90.0	25.7	325.9	421.1
t value				1.7	1.7	1.8	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				6.8	6.2	6.6	6.8	5.2	6.8	6.2	6.8	6.8
95% UCL				2.8	5.5	36.0	39.1	10.2	62.4	23.9	275.6	353.3

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
F19	29	0-0.5m	1	0.05	0.05	0.14	0.20	1	1.5	1.5	5.7	9.7
G25	G251591	0-0.5	1	0.51	0.51	2.6	3.16		27	6.6	190	223.6
G26	G261333	0-0.5	1	0.05	0.05	0.4	0.46		3.4	3	38	44.4
H25	H251339	0-0.5	1	0.6	0.1	2.6	2.76		14	4.4	99	117.4
H26	H261327	0-0.5	1	0.05	0.05	0.05	0.11		0.2	0.05	0.4	0.65
I26	I261616	0-0.5	1	0.05	0.05	0.1	0.16		3.8	1.4	6.8	12
G22	G221248	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
I20	I201362	0-0.5	1	0.1	0.05	1.2	1.26		4.6	4.6	38	47.2
K20	K201284	0-0.5	1	0.05	0.05	0.6	0.66		4.4	14	36	54.4
K21	K211680	0-0.5	1	0.05	0.05	0.6	0.66		4.2	2.6	100	106.8
K22	K221296	0-0.5	1	0.05	0.05	0.05	0.11		0.8	1.8	19	21.6
G19	30	0-0.5m	1	0.05	0.05	0.07	0.13	0.23	1.5	0.36	6.4	8.49
H19	31	0-0.5m	1	0.05	0.05	0.05	0.11	0.05	0.05	0.05	0.18	0.33
H19	H191368	0-0.5	1	0.05	0.05	0.05	0.11		0.4	0.05	0.3	0.75
H20	H201667	0-0.5	1	0.05	0.05	0.1	0.16		0.8	2.2	13	16
I18	I181374	0-0.5	1	0.05	0.05	0.2	0.26		0.5	0.2	2.6	3.3
I19	35	0-0.5m	1	0.05	0.05	2.2	2.26	0.08	0.99	0.05	4	5.12
J17	34	0-0.5m	1	0.05	0.05	5.3	5.36	0.11	7.1	0.82	22	30.03
J18	J181720	0-0.5	1	0.05	0.05	0.05	0.11		0.6	0.8	9.4	10.8
J19	36	0-0.5m	1	0.5	0.5	0.5	1.05	0.5	0.5	0.5	0.5	2
J19	J191278	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
J20	J201673	0-0.5	1	0.1	0.05	0.05	0.11		1	0.5	13	14.5
K18	K181272	0-0.5	1	0.05	0.05	0.05	0.11		1.2	2.2	20	23.4
K19	K191685	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
L19	37	0-0.5m	1	0.05	0.05	0.94	1.00	0.05	1.7	0.76	9.9	12.41
n				25	25	25	25	7	25	25	25	25
mean				0.1	0.1	0.7	0.8	0.3	3.2	1.9	25.4	30.6
st dev				0.2	0.1	1.2	1.3	0.4	5.8	3.0	43.7	50.8
t value				1.7	1.7	1.8	1.8	1.7	1.7	1.7	1.7	1.8
sqrt sample No				5.0	5.0	5.0	5.0	2.6	5.0	5.0	5.0	5.0
95% UCL				0.2	0.1	1.2	1.3	0.5	5.2	3.0	40.6	48.4

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
E19	E191745	0-0.5	1	0.05	0.05	0.05	0.11		0.2	3.2	5	8.4
E20	E201230	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.3	0.1	0.45
E21	E211657	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.2	0.3	0.55
F18	F181752	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
F19	F191218	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
F20	F201740	0-0.5	1	0.05	0.05	0.05	0.11		0.3	1.4	4	5.7
F21	F211242	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
F22	F221603	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.1	0.2
F23	F231254	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
G18	G181224	0-0.5	1	0.05	0.05	0.1	0.16		0.1	0.2	1.4	1.7
G19	G191735	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.1	0.5	0.65
G21	G201236	0-0.5	1	0.05	0.8	1.6	2.41		0.2	0.5	5	5.7
G23	G231601	0-0.5	1	0.05	0.05	0.05	0.11		0.1	0.05	1.2	1.35
H18	H181726	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.2	0.5	0.75
H18	H181727	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.1	0.4	0.55
I17	33	0-0.5m	1	0.05	0.05	1.3	1.36	0.09	0.17	0.35	8.4	9.01
I19	I191690	0-0.5	1	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
n				17	17	17	17	1	17	17	17	17
mean				0.1	0.1	0.2	0.3	0.1	0.1	0.4	1.6	2.1
st dev				0.00	0.18	0.47	0.62	#DIV/0!	0.08	0.79	2.47	3.04
t value				1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74
sqrt sample No				4.123	4.123	4.123	4.123	1.000	4.123	4.123	4.123	4.123
95% UCL				0.1	0.2	0.4	0.6	#DIV/0!	0.1	0.7	2.6	3.4

TABLE 1B - FCC EAST, CONTAMINANT CONCENTRATIONS, 0.5-1 M

TREATMENT

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
G23	G232602	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.3	0.4
H23	M2	0-1.0	2	0.01		0.01	0.01	0.01	0.01		0.01	0.03
H24	H242597	0.5-1.0	2	1	36	12	48.10		72	5.2	660	737.2
H24	M9	0-1.0	2	11			1.10	20	101		809	930
I23	I232638	0.5-1.0	2	0.05	0.05	1	1.06		2.4	1.6	55	59
I23	47	0.5-1m	2	0.05	0.6	3.5	4.11	7	5.7	8.9	71	92.6
I24	I242346	0.5-1.0	2	0.3	2.8	17	19.83		36	4	510	550
I24	M4	0-1.0	2	0.5		0.5	0.55	1.9	11		62	74.9
I25	I252321	0.5-1.0	2	0.05	0.05	0.4	0.46		2	1.4	24	27.4
J22	J222643	0.5-1.0	2	1	0.05	0.05	0.20		8.8	0.4	61	70.2
J23	57	0.5-1m	2	52	10	63	78.20	780	230	1000	9400	11410
J23	56	0.5-1m	2	1.2	1.9	9.2	11.22	96	16	43	260	415
J24	J242626	0.5-1.0	2	5.01	5.01	5.01	10.52		210	12	4000	4222
J25	J252315	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
J25	51	0.5-1m	2	0.24	0.05	0.35	0.42	0.05	4.9	0.05	8.8	13.8
K22	46	0.5-1m	2	0.09	0.5	3	3.51	2.5	37	45	1200	1284.5
K24	K242309	0.5-1.0	2	1.4	0.2	1.4	1.74		29	6.2	720	755.2
K24	58	0.5-1m	2	0.2	0.42	0.4	0.84	0.53	6	0.05	1.6	8.18
K25	52	0.5-1m	2	0.05	0.05	0.08	0.14	0.05	0.19	0.06	0.79	1.09
L24	53	0.5-1m	2	0.05	0.05	0.18	0.24	0.09	0.05	0.05	0.47	0.66
n				20	17	19	20	11	20	17	20	20
mean				3.7	3.4	6.2	9.1	82.6	38.6	66.4	892.2	1032.6
st dev				11.7	8.8	14.6	19.8	233.0	67.5	241.0	2198.5	2623.9
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				4.5	4.1	4.4	4.5	3.3	4.5	4.1	4.5	4.5
95% UCL				8.2	7.1	11.9	16.7	203.0	64.5	166.5	1734.8	2038.3

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
G25	G252590	0.5-1.0	2	0.51	0.51	2.8	3.36		11	3.6	180	194.6
H25	H252340	0.5-1.0	2	0.3	0.05	0.05	0.13		0.05	0.2	1	1.25
I26	I262617	0.5-1.0	2	0.2	0.05	0.3	0.37		7.2	0.5	2.4	10.1
H19	31	0.5-1m	2	0.31	0.05	0.05	0.13	0.05	0.05	0.05	1	1.15
H20	H202668	0.5-1.0	2	0.05	0.05	0.6	0.66		1	1.6	11	13.6
H21	H212355	0.5-1.0	2	29	0.05	12	14.95		69	3	63	135
H21	H212359	0.5-1.0	2	33	0.2	12	15.50		62	4	32	98
H22	H222612	0.5-1.0	2	0.05	0.05	0.5	0.56		0.6	0.7	9.4	10.7
I18	I182375	0.5-1.0	2	0.05	0.05	0.2	0.26		0.05	0.05	2	2.1
I19	35	0.5-1m	2	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
I20	I202363	0.5-1.0	2	0.05	0.05	0.3	0.36		0.7	1.2	11	12.9
I21	I212663	0.5-1.0	2	0.8	0.05	3.6	3.73		9.2	7	94	110.2
I21	45	0.5-1m	2	1	1	3	4.10	2.5	8.6	14	110	135.1
I21	44	0.5-1m	2	0.05	0.11	2.4	2.52	1.7	7.1	8.2	63	80
I22	I222354	0.5-1.0	2	0.4	0.05	0.3	0.39		1.6	0.5	14	16.1
I22	I222357	0.5-1.0	2	0.1	0.05	0.8	0.86		2	0.4	19	21.4
J17	34	0.5-1m	2	0.05	0.05	1.9	1.96	0.06	0.38	0.77	8.1	9.31
J18	J182721	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.2	1.4	1.65
J19	36	0.5-1m	2	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
J20	J202675	0.5-1.0	2	0.05	0.05	0.05	0.11		0.5	0.2	4.4	5.1
J20	J202676	0.5-1.0	2	0.05	0.05	0.05	0.11		2.2	0.3	4.8	7.3
J20	40	0.5-1m	2	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
J21	J212291	0.5-1.0	2	2	0.05	0.3	0.55		12	0.7	34	46.7
J21	43	0.5-1m	2	1	1	4.3	5.40	5.2	6.6	21	150	182.8
J23	J232303	0.5-1.0	2	0.05	0.05	1	1.06		3.2	1.8	67	72
K18	K182273	0.5-1.0	2	0.05	0.05	0.05	0.11		0.8	1	23	24.8
K20	K202285	0.5-1.0	2	0.05	0.05	0.05	0.11		0.7	2	11	13.7
K20	41	0.5-1m	2	0.55	0.05	0.39	0.50	0.16	3	2.4	19	24.56
K21	K212681	0.5-1.0	2	0.05	0.05	0.1	0.16		0.05	0.1	4	4.15
K22	K222297	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.6	0.7
L19	37	0.5-1m	2	0.05	0.05	2.6	2.66	0.13	4.9	2.7	20	27.73
L20	38	0.5-1m	2	0.06	0.05	2.3	2.36	0.49	2.1	1.5	8.5	12.59
L21	39	0.5-1m	2	0.05	0.05	0.18	0.24	0.05	0.44	1.1	6.8	8.39
n				33	33	33	33	12	33	33	33	33
mean				2.1	0.1	1.6	1.9	0.9	6.6	2.5	29.6	39.0
st dev				7.5	0.2	2.9	3.7	1.6	15.6	4.4	44.7	55.0
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				5.7	5.7	5.7	5.7	3.5	5.7	5.7	5.7	5.7
95% UCL				4.3	0.2	2.5	3.0	1.6	11.2	3.8	42.9	55.3

RESIDENTIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
E18	E181212	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
G20	G202237	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
E19	E192747	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.6	0.7
E19	E192748	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.7	0.5	1.25
F19	29	0.5-1m	2	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
F20	F202741	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.3	0.4
F21	F212243	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
F22	F222602	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.2	0.2	0.45
F23	F232255	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
G17	28	0.5-1m	3	0.05	0.05	0.21	0.27	0.05	0.05	0.05	0.27	0.42
G18	G182225	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
G19	30	0.5-1m	2	0.05	0.05	0.05	0.11	0.07	0.11	0.1	1.2	1.48
G21	G212653	0.5-1.0	2	0.05	0.05	0.05	0.11		0.3	0.05	0.05	0.4
G24	G242261	0.5-1.0	2	0.05	0.05	0.05	0.11		0.05	0.05	0.4	0.5
G26	G262334	0.5-1.0	2	0.05	0.05	0.2	0.26		0.7	1.2	11	12.9
H18	32	0.5-1m	2	0.05	0.05	0.07	0.13	0.05	0.09	0.05	0.43	0.62
I17	33	0.5-1m	2	0.05	0.05	0.74	0.80	0.08	0.74	0.36	3.9	5.08
n				17	17	17	17	5	17	17	17	17
mean				0.1	0.1	0.1	0.2	0.1	0.1	0.2	1.2	1.6
st dev				0.0	0.0	0.2	0.2	0.0	0.2	0.3	2.7	3.1
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	2.8
sqrt sample No				4.1	4.1	4.1	4.1	2.2	4.1	4.1	4.1	4.1
95% UCL				0.1	0.1	0.2	0.2	0.1	0.2	0.3	2.3	3.7

TABLE 1C - FCC EAST, CONTAMINANT CONCENTRATIONS, 1-1.5 M

TREATMENT

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
H24	H243598	1.0-1.5	3	3.2	80	26	106.32		150	15	580	745
I23	47	1-2m	3	0.05	0.63	3.5	4.14	6.6	14	25	150	195.6
I23	I233639	1.0-1.5	3	0.05	0.05	0.5	0.56		0.7	0.4	10	11.1
I24	I243347	1.0-1.5	3	18	2.6	160	164.40		46	10	200	256
I24	I243351	1.0-1.5	3	12	2.4	160	163.60		160	9.2	4300	4469.2
I25	I253322	1.0-1.5	3	0.51	36	35	71.05		13	9.2	300	322.2
J23	56	1-2m	3	2.5	1.4	9.9	11.55	95	89	50	300	534
J23	57	1-2m	3	1	2.9	7.5	10.50	8.2	41	48	400	497.2
J24	48	1-2m	3	1	0.62	3	3.72	5.5	10	17	370	402.5
J24	J243627	1.0-1.5	3	5.01	5.01	220	225.51		2100	100	55000	57200
J24	J243628	1.0-1.5	3	5.01	5.01	190	195.51		1600	71	44000	45671
J25	51	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.29	0.05	0.68	1.07
J25	J253316	1.0-1.5	3	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
K23	49	1-2m	3	0.87	1	1.5	2.59	1	9.3	10	160	180.3
K24	58	1-2m	3	170	1.7	3.3	22.00	3.1	80	9	140	232.1
K24	K243310	1.0-1.5	3	0.51	0.51	0.51	1.07		38	2.8	660	700.8
K25	52	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	0.13	0.28
L23	50	1-2m	3	0.05	0.05	0.8	0.86	0.05	1.2	1.3	11	13.55
L24	53	1-2m	3	0.05	0.05	0.06	0.12	0.05	0.07	0.05	0.32	0.49
n				19	19	19	19	10	19	19	19	19
mean				11.6	7.4	43.2	51.8	12.0	229.1	19.9	5609.6	5864.9
st dev				38.7	19.4	75.4	77.8	29.3	579.3	27.8	15604.4	16203.8
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				4.4	4.4	4.4	4.4	3.2	4.4	4.4	4.4	4.4
95% UCL				26.8	15.0	73.0	82.5	27.9	457.8	30.9	11770.6	12262.5

COMMERCIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
H19	31	1-2m	3	0.05	0.05	0.05	0.11	0.15	0.05	0.05	1	1.25
G26	G263335	1.0-1.5	3	0.05	0.05	0.4	0.46		0.4	0.6	4.4	5.4
I26	I263618	1.0-1.5	3	0.1	0.05	0.05	0.11		0.4	0.05	0.4	0.85
H21	H213356	1.0-1.5	3	0.2	0.05	0.2	0.27		4	0.5	1	5.5
I21	45	1-2m	3	0.05	0.05	0.13	0.19	0.14	0.43	0.53	3.6	4.7
I21	44	1-2m	3	0.11	0.05	0.34	0.40	0.05	0.36	0.22	2.1	2.73
I21	I213664	1.0-1.5	3	0.8	0.05	1.4	1.53		4.2	1.4	41	46.6
I22	I223355	1.0-1.5	3	0.05	0.05	0.6	0.66		2.6	1.6	52	56.2
J20	42	1-2m	3	1.3	0.05	2	2.18	0.81	9.6	10.6	95	116.01
J20	40	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	0.16	0.31
J20	J203677	1.0-1.5	3	0.05	0.05	0.05	0.11		0.05	0.05	0.8	0.9
J21	43	1-2m	3	0.07	0.05	0.65	0.71	0.67	1.7	4	34	40.37
J21	J213292	1.0-1.5	3	6.8	0.05	0.6	1.33		50	2.2	220	272.2
J22	J223644	1.0-1.5	3	0.05	0.05	0.05	0.11		4.2	0.5	7.8	12.5
J23	J233304	1.0-1.5	3	0.05	0.05	0.05	0.11		0.1	0.1	2.4	2.6
K22	46	1-2m	3	0.05	0.05	0.52	0.58	0.5	3.7	10	70	84.2
n				16	16	16	16	7	16	16	16	16
mean				0.6	0.1	0.4	0.6	0.3	5.1	2.0	33.5	40.8
st dev				1.7	0.0	0.5	0.6	0.3	12.2	3.4	57.8	70.8
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				4.0	4.0	4.0	4.0	2.6	4.0	4.0	4.0	4.0
95% UCL				1.3	0.1	0.7	0.8	0.5	10.3	3.5	58.1	71.0

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
F19	29	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
H20	H203669	1.0-1.5	3	0.05	0.05	0.1	0.16		0.3	0.6	5.8	6.7
I19	35	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
I20	I203363	1.0-1.5	3	0.05	0.05	0.1	0.16		0.2	0.2	3.2	3.6
J19	36	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
K18	K183274	1.0-1.5	3	0.05	0.05	0.2	0.26		0.5	1.6	31	33.1
K20	41	1-2m	3	0.48	0.65	0.59	1.29	0.37	3.5	2.2	17	23.07
K20	K203286	1.0-1.5	3	0.05	0.05	0.05	0.11		0.05	0.6	0.8	1.45
K21	K213682	1.0-1.5	3	0.05	0.05	0.4	0.46		0.5	0.5	10	11
L19	37	1-2m	3	0.05	0.05	0.62	0.68	0.06	1.1	0.58	4	5.74
L20	38	1-2m	3	0.05	0.05	0.28	0.34	0.05	0.25	0.17	0.87	1.34
L21	39	1-2m	3	0.05	0.05	0.24	0.30	0.07	0.37	0.41	3.8	4.65
F19	29	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
F20	F203742	1.0-1.5	3	0.05	0.05	0.05	0.11		0.05	0.05	0.2	0.3
G17	28	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
G17	28	0.5-1m	3	0.05	0.05	0.21	0.27	0.05	0.05	0.05	0.27	0.42
G19	30	1-2m	3	0.05	0.05	0.08	0.14	0.3	1	0.28	1.7	3.28
G23	G233603	1.0-1.5	3	0.05	0.05	0.05	0.11		0.2	0.05	0.5	0.75
H18	32	1-2m	3	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
I17	33	1-2m	3	0.05	0.05	0.34	0.40	0.05	0.33	0.16	1.2	1.74
J17	34	1-2m	3	0.05	0.05	0.54	0.60	0.05	0.15	0.26	2.2	2.66
n				21	21	21	21	14	21	21	21	21
mean				0.1	0.1	0.2	0.3	0.1	0.4	0.4	4.2	5.1
st dev				0.1	0.1	0.2	0.3	0.1	0.8	0.6	7.3	8.2
t value				1.8	2.8	3.8	4.8	5.8	6.8	7.8	8.8	9.8
sqrt sample No				4.6	4.6	4.6	4.6	3.7	4.6	4.6	4.6	4.6
95% UCL				0.1	0.2	0.4	0.6	0.3	1.6	1.3	18.3	22.7

TABLE 1D - FCC EAST, CONTAMINANT CONCENTRATIONS, 1.5-2 M

TREATMENT

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
H24	H244599	1.5-2.0	4	1.8	29	16	45.18		92	13	530	635
I23	47	1-2m	4	0.05	0.63	3.5	4.14	6.6	14	25	150	195.6
I23	I234640	1.5-2.0	4	0.05	0.05	0.05	0.11		0.1	0.05	1.4	1.55
I24	I244348	1.5-2.0	4	0.6	0.7	9.2	9.96		13	0.8	33	46.8
J23	56	1-2m	4	2.5	1.4	9.9	11.55	95	89	50	300	534
J23	57	1-2m	4	1	2.9	7.5	10.50	8.2	41	48	400	497.2
J23	J234305	1.5-2.0	4	0.05	0.05	0.1	0.16		0.3	0.1	5.4	5.8
J24	48	1-2m	4	1	0.62	3	3.72	5.5	10	17	370	402.5
J24	J244630	1.5-2.0	4	5.01	5.01	16	21.51		370	22	11000	11392
J25	51	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.29	0.05	0.68	1.07
K23	49	1-2m	4	0.87	1	1.5	2.59	1	9.3	10	160	180.3
K24	58	1-2m	4	170	1.7	3.3	22.00	3.1	80	9	140	232.1
K24	K244311	1.5-2.0	4	5.01	5.01	5.01	10.52		180	13	5700	5893
K25	52	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	0.13	0.28
L23	50	1-2m	4	0.05	0.05	0.8	0.86	0.05	1.2	1.3	11	13.55
L24	53	1-2m	4	0.05	0.05	0.06	0.12	0.05	0.07	0.05	0.32	0.49
n				16	16	16	16	10	16	16	16	16
mean				11.8	3.0	4.8	8.9	12.0	56.3	13.1	1175.1	1252.0
st dev				42.2	7.1	5.5	12.1	29.3	97.9	16.3	2968.0	3062.2
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				4.0	4.0	4.0	4.0	3.2	4.0	4.0	4.0	4.0
95% UCL				30.1	6.1	7.1	14.2	28.1	98.8	20.2	2466.2	2584.0

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
H21	H214357	1.5-2.0	4	0.2	0.05	1	1.07		3.8	0.2	1.8	5.8
G25	G254593	1.5-2.0	4	0.05	0.05	0.1	0.16		0.2	0.1	2	2.3
I21	45	1-2m	4	0.05	0.05	0.13	0.19	0.14	0.43	0.53	3.6	4.7
I21	44	1-2m	4	0.11	0.05	0.34	0.40	0.05	0.36	0.22	2.1	2.73
I21	I214665	1.5-2.0	4	0.3	0.05	0.1	0.18		0.3	0.1	3	3.4
I22	I224355	1.5-2.0	4	0.05	0.05	0.1	0.16		0.3	0.2	8.2	8.7
J20	42	1-2m	4	1.3	0.05	2	2.18	0.81	9.6	10.6	95	116.01
J20	40	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	0.16	0.31
J21	43	1-2m	4	0.07	0.05	0.65	0.71	0.67	1.7	4	34	40.37
J21	J214293	1.5-2.0	4	0.05	0.05	0.3	0.36		4.6	0.4	53	58
J22	J224645	1.5-2.0	4	0.51	0.51	0.51	1.07		0.51	0.51	0.51	1.53
n				11	11	11	11	5	11	11	11	11
mean				0.2	0.1	0.5	0.6	0.3	2.0	1.5	18.5	22.2
st dev				0.4	0.1	0.6	0.6	0.4	3.0	3.2	30.5	36.3
t value				1.7	2.7	3.7	4.7	5.7	6.7	7.7	8.7	9.7
sqrt sample No				3.3	3.3	3.3	3.3	2.2	3.3	3.3	3.3	3.3
95% UCL				0.4	0.2	1.1	1.5	1.3	8.0	9.0	99.0	128.9

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D+0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DDX
F19	29	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
K20	41	1-2m	4	0.48	0.65	0.59	1.29	0.37	3.5	2.2	17	23.07
K20	K204287	1.5-2.0	4	0.05	0.05	0.05	0.11		0.05	0.4	1.2	1.65
K21	K214683	1.5-2.0	4	0.05	0.05	0.05	0.11		0.05	0.05	0.1	0.2
K22	46	1-2m	4	0.05	0.05	0.52	0.58	0.5	3.7	10	70	84.2
L20	38	1-2m	4	0.05	0.05	0.28	0.34	0.05	0.25	0.17	0.87	1.34
L21	39	1-2m	4	0.05	0.05	0.24	0.30	0.07	0.37	0.41	3.8	4.65
G17	28	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
G19	30	1-2m	4	0.05	0.05	0.08	0.14	0.3	1	0.28	1.7	3.28
H18	32	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
H19	31	1-2m	4	0.05	0.05	0.05	0.11	0.15	0.05	0.05	1	1.25
I17	33	1-2m	4	0.05	0.05	0.34	0.40	0.05	0.33	0.16	1.2	1.74
I19	35	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
J17	34	1-2m	4	0.05	0.05	0.54	0.60	0.05	0.15	0.26	2.2	2.66
J19	36	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
L19	37	1-2m	4	0.05	0.05	0.62	0.68	0.06	1.1	0.58	4	5.74
F19	29	1-2m	4	0.05	0.05	0.05	0.11	0.05	0.05	0.05	1	1.15
n				17	17	17	17	15	17	17	17	17
mean				0.1	0.1	0.2	0.3	0.1	0.6	0.9	6.4	8.0
st dev				0.1	0.1	0.2	0.3	0.1	1.2	2.4	16.8	20.3
t value				1.8	2.8	3.8	4.8	5.8	6.8	7.8	8.8	9.8
sqrt sample No				4.1	4.1	4.1	4.1	3.9	4.1	4.1	4.1	4.1
95% UCL				0.1	0.2	0.4	0.7	0.3	2.6	5.4	42.3	56.3

TABLE 1E - FCC EAST, CONTAMINANT CONCENTRATIONS, 2-3 M

COMMERCIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
H24	H245600	2.0-3.0	5	0.05	0.05	0.05	0.11		0.05	0.05	0.6	0.7
I24	I245349	2.0-3.0	5	0.05	0.05	0.3	0.36		0.3	0.05	1.6	1.95
J23	B31	2-2.5	5	0.01	0.046	4.5	4.55	0.3	43.8	8.6	47.3	100
J24	J245631	2.0-3.0	5	0.51	1.2	7.6	8.85		55	2.8	400	457.8
K24	K245312	2.0-3.0	5	0.51	0.51	0.51	1.07		6.2	0.51	200	206.71
n				5	5	5	5	1	5	5	5	5
mean				0.2	0.4	2.6	3.0	0.3	21.1	2.4	129.9	153.4
st dev				0.3	0.5	3.3	3.7	#DIV/0!	26.3	3.6	171.7	190.1
t value				1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
sqrt sample No				2.2	2.2	2.2	2.2	1.0	2.2	2.2	2.2	2.2
95% UCL				0.5	0.8	5.5	6.2	#DIV/0!	43.9	5.6	279.1	318.6

RESIDENTIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D+0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DDX**
H21	H215358	2.0-3.0	5	0.2	0.05	0.4	0.47		0.5	0.05	1	1.55
I26	I265620	2.0-3.0	5	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
I22	I225356	2.0-3.0	5	0.05	0.05	0.2	0.26		0.5	0.1	10	10.6
I23	I235641	2.0-3.0	5	0.05	0.05	0.05	0.11		0.2	0.05	2.2	2.45
J21	B30	2.0-3.0	5	0.004	0.002	0.002	0.00	0.008	0.027	0.006	0.07	0.111
J21	J215294	2.0-3.0	5	0.05	0.05	0.05	0.11		0.05	0.05	0.1	0.2
J23	J235306	2.0-3.0	5	0.05	0.05	0.05	0.11		0.05	0.05	0.05	0.15
K21	K215684	2.0-3.0	5	0.05	0.05	0.05	0.11		1	0.05	0.05	1.1
n				8	8	8	8	1	8	8	8	8
mean				0.1	0.0	0.1	0.2	0.0	0.3	0.1	1.7	2.0
st dev				0.1	0.0	0.1	0.1	#DIV/0!	0.3	0.0	3.4	3.6
t value				1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
sqrt sample No				2.8	2.8	2.8	2.8	1.0	2.8	2.8	2.8	2.8
95% UCL				0.1	0.1	0.2	0.3	#DIV/0!	0.5	0.1	4.0	4.4

TABLE 2A - FCC WEST, CONTAMINANT CONCENTRATIONS, 0-0.5 M

TREATMENT

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
G13	G131551	0-0.5	1	0.51	1.6	0.51	2.2		29	0.51	510	539.5
J10	J101570	0-0.5	1	0.05	0.05	0.8	0.9		14	5.8	23	42.8
J12	18	0-0.5m	1	2.5	2.5	2.5	5.3	16	380	600	3600	4596.0
K10	K101174	0-0.5	1	0.05	0.05	0.4	0.5		10	3	20	33.0
n				4	4	4	4	1	4	4	4	4
mean				0.8	1.1	1.1	2.2	16.0	108.3	152.3	1038.3	1302.8
st dev				1.2	1.2	1.0	2.2	#DIV/0!	181.4	298.5	1723.3	2208.1
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0
95% UCL				1.8	2.1	1.9	4.1	#DIV/0!	264.7	409.7	2524.6	3207.4

COMMERCIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
G11	G111545	0-0.5	1	0.05	0.05	0.05	0.1		0.4	0.05	0.2	0.7
G11	25	0-0.5m	1	0.05	0.05	0.22	0.3	0.58	0.67	0.07	1	2.3
G12	G121156	0-0.5	1	0.05	0.05	0.05	0.1		0.3	1.4	8.6	10.3
G14	G141118	0-0.5	1	0.05	0.05	0.4	0.5		2	2	20	24.0
H13	H131206	0-0.5	1	0.05	0.05	0.05	0.1		2.2	0.05	2.2	4.5
I11	I111564	0-0.5	1	0.05	5.6	2.2	7.8		7.8	3.8	39	50.6
I13	I131585	0-0.5	1	0.05	0.05	0.1	0.2		0.5	0.9	6.8	8.2
H10	24	0-0.5m	1	0.05	0.05	0.92	1.0	0.54	3.2	1.4	15	20.1
H11	26	0-0.5m	1	0.05	0.05	0.05	0.1	0.27	1.1	0.36	4	5.7
H11	H111162	0-0.5	1	0.05	0.05	0.05	0.1		2.2	0.2	0.4	2.8
H12	2	0-0.5m	1	0.05	0.17	28	28.2	0.59	1	0.32	4	5.9
H12	H121559	0-0.5	1	0.05	0.05	1.6	1.7		0.2	0.2	2	2.4
H15	H151082	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.05	0.05	0.2
I10	I101200	0-0.5	1	0.05	0.05	0.05	0.1		12	0.6	10	22.6
I12	I121150	0-0.5	1	0.05	0.05	0.4	0.5		4.2	2.2	41	47.4
J11	J111168	0-0.5	1	0.05	0.05	0.1	0.2		3.2	0.9	4	8.1
J12	J121720	0-0.5	1	0.05	0.05	0.1	0.2		1.6	0.8	4	6.4
I14	I141112	0-0.5	1	0.05	1	0.8	1.8		110	2.2	1	113.2
J13	J131124	0-0.5	1	0.05	0.05	0.05	0.1		0.7	1.2	10	11.9
J14	J141715	0-0.5	1	0.05	0.05	0.05	0.1		1	0.4	0.2	1.6
J15	J151088	0-0.5	1	0.05	0.05	0.6	0.7		0.5	0.5	2.2	3.2
K10	22	0-0.5m	1	0.25	0.25	2.8	3.1	1.57	4	0.25	1.8	7.6
K11	K111580	0-0.5	1	0.05	0.05	0.1	0.2		1.8	1.8	6.2	9.8
K12	14	0-0.5m	1	0.05	0.05	0.17	0.2	1	0.76	0.68	5.3	7.7
K13	13	0-0.5m	1	0.05	0.05	0.29	0.3	2.1	1.5	0.65	11	15.3
K13	K131705	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.4	0.3	0.8
K15	K151710	0-0.5	1	0.05	1.4	2	3.4		0.3	0.4	4	4.7
K9	21	0-0.5m	1	0.05	0.05	0.27	0.3	0.74	4.2	0.05	4.7	9.7
K12	17	0-0.5m	1	0.25	0.25	0.4	0.7	1.3	10	0.47	5	16.8
K12	K121150	0-0.5	1	0.05	0.05	0.2	0.3		2.6	0.4	5	8.0
K13	59	0-0.5m	1	0.05	0.05	1.2	1.3	0.22	0.2	0.39	1.7	2.5
K14	K141106	0-0.5	1	0.05	0.05	0.05	0.1		1	0.6	0.1	1.7
L15	L151094	0-0.5	1	0.05	110	24	134.0		33	2.4	100	135.4
M14	7	0-0.5m	1	2.5	71	51	122.3	5.3	50	4.8	35	95.1
M15	M151539	0-0.5	1	0.05	4.6	13	17.6		2	3.6	21	26.6
N14	9	0-0.5m	1	0.1	0.1	0.41	0.5	1.1	0.21	0.18	1.5	3.0
N15	8	0-0.5m	1	0.5	1.5	10	11.6	2.4	2.2	1.5	13	19.1
L10	L101507	0-0.5	1	0.05	0.05	0.3	0.4		38	25	52	115.0
L11	L111180	0-0.5	1	0.05	0.05	0.05	0.1		0.2	0.2	0.6	1.0
L12	L121700	0-0.5	1	0.05	0.05	0.05	0.1		1.2	1	55	57.2
L13	L131132	0-0.5	1	0.05	0.05	0.05	0.1		0.3	0.4	3.4	4.1
M10	M101185	0-0.5	1	4	0.05	0.3	0.8		14	5	12	31.0
M12	M121144	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.7	0.2	1.0
M9	19	0-0.5m	1	0.25	0.25	0.28	0.6	1	1.6	0.25	2.6	5.5
N10	N101515	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.05	0.05	0.2
N11	11	0-0.5m	1	0.05	0.05	0.05	0.1	0.77	0.14	0.06	0.68	1.7
N11	N111194	0-0.5	1	0.05	0.05	0.1	0.2		25	0.7	51	76.7
N9	12	0-0.5m	1	0.5	0.5	0.5	1.1	2.2	4.6	1.8	15	23.6
n				48	48	48	48	16	48	48	48	48
mean				0.2	4.1	3.0	7.1	1.4	7.4	1.5	12.2	21.5
st dev				0.7	18.7	9.0	26.0	1.2	18.3	3.7	19.6	32.9
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				6.9	6.9	6.9	6.9	4.0	6.9	6.9	6.9	6.9
95% UCL				0.4	8.7	5.2	13.5	1.9	11.9	2.4	16.9	29.5

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G15	G151735	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.1	0.1	0.3
H14	H141730	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.05	0.1	0.2
I15	I151741	0-0.5	1	0.05	0.05	0.1	0.2		0.4	0.3	1	1.7
I15	I151742	0-0.5	1	0.05	0.05	0.2	0.3		0.5	0.4	2	2.9
L14	L141711	0-0.5	1	0.05	0.05	0.3	0.4		0.4	0.5	2.8	3.7
M11	M111526	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.5	0.3	0.9
M13	M131534	0-0.5	1	0.05	0.05	0.05	0.1		0.1	1	0.8	1.9
M14	M141100	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.4	0.05	0.5
N12	N121528	0-0.5	1	0.05	0.05	0.1	0.2		0.05	0.7	0.4	1.2
N13	10	0-0.5m	1	0.05	0.05	0.05	0.1	1.1	0.13	0.05	0.35	1.6
N13	N131138	0-0.5	1	0.05	0.05	0.05	0.1		0.05	0.3	0.05	0.4
n				11	11	11	11	1	11	11	11	11
mean				0.1	0.1	0.1	0.2	1.1	0.2	0.4	0.7	1.4
st dev				0.0	0.0	0.1	0.1	#DIV/0!	0.2	0.3	0.9	1.1
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				3.3	3.3	3.3	3.3	1.0	3.3	3.3	3.3	3.3
95% UCL				0.1	0.1	0.1	0.2	#DIV/0!	0.3	0.5	1.2	2.0

TABLE 2B - FCC WEST, CONTAMINANT CONCENTRATIONS, 0.5-1 M

TREATMENT

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G13	G132556	0.5-1.0	2	0.51	18	60	78.1		160	19	1700	1879.0
J10	J102571	0.5-1.0	2	5.01	13	43	56.5		1500	850	42000	44350.0
J10	J102572	0.5-1.0	2	5.01	14	48	62.5		2000	650	47000	49650.0
J10	55	0.5-1m	2	1	3	54	57.1	72	67	260	2500	2899.0
J10	55	0-0.5m	2	0.05	0.05	0.82	0.9	0.21	7	0.32	10	17.5
K10	22	0.5-1m	2	0.25	0.05	2.7	2.8	0.84	3.6	0.05	7.7	12.2
K9	21	0.5-1m	2	0.1	0.05	0.46	0.5	0.86	4.5	0.65	26	32.0
n				7	7	7	7	4	7	7	7	7
mean				1.7	6.9	29.9	36.9	18.5	534.6	254.3	13320.5	14120.0
st dev				2.3	7.8	27.2	34.0	35.7	844.6	356.0	21370.1	22540.2
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				2.6	2.6	2.6	2.6	2.0	2.6	2.6	2.6	2.6
95% UCL				3.2	12.0	47.5	59.0	49.1	1082.7	485.3	27189.0	28747.8

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G11	25	0.5-1m	2	0.05	0.05	0.08	0.1	0.24	0.19	0.07	0.57	1.1
G12	G122157	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	1	5.6	6.7
G14	G142119	0.5-1.0	2	0.05	0.05	0.05	0.1		0.7	0.6	6	7.3
H13	H132207	0.5-1.0	2	0.05	0.05	0.05	0.1		0.2	0.05	0.2	0.5
I10	23	0.5-1m	2	0.5	0.5	3.1	3.7	0.82	3.7	3	23	30.5
I11	27	0.5-1m	2	0.5	0.5	1.3	1.9	2.5	3.7	2.4	2.6	11.2
I13	I132586	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	0.3	1.4	1.8
H10	24	0.5-1m	2	0.05	0.05	0.54	0.6	1.1	2.9	1.2	9.7	14.9
H11	H112163	0.5-1.0	2	0.05	0.05	0.05	0.1		1.2	0.1	0.05	1.4
H11	26	0.5-1m	2	0.05	0.5	0.05	0.6	0.09	0.2	0.08	1.2	1.6
H12	H122560	0.5-1.0	2	0.05	0.2	9	9.2		0.6	0.7	12	13.3
H12	2	0.5-1m	2	0.05	0.54	22	22.5	0.51	0.81	0.32	1.5	3.1
I10	I102201	0.5-1.0	2	0.05	0.05	0.05	0.1		0.05	0.2	0.3	0.6
I11	I112565	0.5-1.0	2	0.05	0.05	0.3	0.4		5	2.4	14	21.4
I12	I122151	0.5-1.0	2	0.05	0.05	0.3	0.4		0.2	0.4	1.8	2.4
J11	J112169	0.5-1.0	2	0.05	0.05	0.05	0.1		4.8	0.7	3	8.5
J12	J122721	0.5-1.0	2	0.05	0.05	0.1	0.2		10	1	2.8	13.8
J12	18	0.5-1m	2	1	1	1	2.1	5	36	29	250	320.0
I14	3	0.5-1m	2	0.05	0.05	0.05	0.1	0.09	0.05	0.05	0.47	0.7
J13	J132126	0.5-1.0	2	0.05	0.05	0.2	0.3		0.7	2	9.6	12.3
J15	J152089	0.5-1.0	2	0.05	0.05	0.3	0.4		2	0.9	9.4	12.3
J15	4	0.5-1m	2	0.05	0.05	1	1.1	0.35	0.21	0.07	1.8	2.4
K10	K102175	0.5-1.0	2	3	0.05	0.05	0.4		2.6	0.5	3	6.1
K11	K112581	0.5-1.0	2	0.05	0.05	0.2	0.3		0.9	1.4	5.4	7.7
K12	17	0.5-1m	2	0.05	0.05	0.15	0.2	1.1	4.7	0.05	1.7	7.6
K13	K132706	0.5-1.0	2	0.05	0.05	0.05	0.1		0.05	0.2	0.2	0.5
K13	13	0.5-1m	2	0.05	0.05	0.05	0.1	1.5	0.5	0.32	1.9	4.2
K13	59	0.5-1m	2	0.05	0.05	0.25	0.3	0.05	0.12	0.06	0.52	0.8
K12	14	0.5-1m	2	0.05	0.05	0.11	0.2	0.78	0.89	0.49	3.9	6.1
K14	5	0.5-1m	2	0.05	0.05	0.21	0.3	0.72	1.7	0.05	0.05	2.5
K15	6	0.5-1m	2	0.05	0.05	1	1.1	0.18	0.91	0.11	1.3	2.5
K15	K152711	0.5-1.0	2	0.05	0.05	0.2	0.3		0.05	0.2	0.4	0.7
L10	L102508	0.5-1.0	2	0.05	0.05	0.2	0.3		18	10	27	55.0
L12	L122701	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	0.6	0.8	1.5
L13	L132133	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	0.4	4	4.5
L14	L142713	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	0.2	0.4	0.7
L15	L152095	0.5-1.0	2	0.05	1.8	1.4	3.2		3.6	0.1	3.2	6.9
M14	7	0.5-1m	2	0.09	36	65	101.0	4.3	20	8.1	210	242.4
M15	M152540	0.5-1.0	2	0.05	0.3	6.2	6.5		0.2	0.8	7.6	8.6
M10	M102187	0.5-1.0	2	0.5	0.7	0.4	1.2		24	1.4	4	29.4
M10	M102191	0.5-1.0	2	0.05	0.7	0.4	1.1		23	1.2	5	29.2
M9	19	0.5-1m	2	0.15	0.05	1.3	1.4	4.1	5.3	3.4	26	38.8
N11	N112195	0.5-1.0	2	0.05	0.05	0.05	0.1		0.3	0.05	0.1	0.5
N15	8	0.5-1m	2	0.05	0.11	1.3	1.4	0.36	0.24	0.2	1.4	2.2
n				44	44	44	44	18	44	44	44	44
mean				0.2	1.0	2.7	3.7	1.3	4.1	1.7	15.1	21.5
st dev				0.5	5.4	10.3	15.5	1.6	7.8	4.6	48.1	59.1
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				6.6	6.6	6.6	6.6	4.2	6.6	6.6	6.6	6.6
95% UCL				0.3	2.4	5.3	7.7	2.0	6.1	2.9	27.4	36.6

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**

RESIDENTIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
I14	I142113	0.5-1.0	2	0.05	0.05	0.05	0.1		0.6	0.05	0.05	0.7
I15	I152743	0.5-1.0	2	0.05	0.05	0.05	0.1		0.2	0.1	0.4	0.7
K12	K122151	0.5-1.0	2	0.05	0.05	0.05	0.1		0.2	0.1	0.05	0.4
L11	L112181	0.5-1.0	2	0.05	0.05	0.05	0.1		0.05	1	0.3	1.4
M13	M132535	0.5-1.0	2	0.05	0.05	0.05	0.1		0.1	1	0.7	1.8
N13	N132139	0.5-1.0	2	0.05	0.05	0.05	0.1		0.05	0.05	0.05	0.2
n				6	6	6	6	0	6	6	6	6
mean				0.1	0.1	0.1	0.1	#DIV/0!	0.2	0.4	0.3	0.8
st dev				0.0	0.0	0.0	0.0	#DIV/0!	0.2	0.5	0.3	0.6
t value				1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
sqrt sample No				2.4	2.4	2.4	2.4	0.0	2.4	2.4	2.4	2.4
95% UCL				0.1	0.1	0.1	0.1	#DIV/0!	0.4	0.8	0.5	1.3

TABLE 2C - FCC WEST, CONTAMINANT CONCENTRATIONS, 1-1.5 M

TREATMENT

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
J10	55	1-2m	3	1	1	2.7	3.8	1.4	7.8	5	140	154.2
J10	J103574	1.0-1.5	3	0.51	17	13	30.1		44	27	180	251.0
K10	K103176	1.0-1.5	3	1.4	0.1	0.2	0.4		9.2	0.4	13	22.6
n				3	3	3	3	1	3	3	3	3
mean				1.0	6.0	5.3	11.4	1.4	20.3	10.8	111.0	142.6
st dev				0.4	9.5	6.8	16.2	#DIV/0!	20.5	14.2	87.2	114.6
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				1.7	1.7	1.7	1.7	1.0	1.7	1.7	1.7	1.7
95% UCL				1.4	15.7	12.2	27.9	#DIV/0!	41.2	25.3	199.7	259.2

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G13	G133553	1.0-1.5	3	0.51	1.2	29	30.3		15	8.4	260	283.4
G14	G143120	1.0-1.5	3	0.05	0.05	0.2	0.3		0.8	1.2	6.2	8.2
I10	23	1-2m	3	0.05	0.05	0.32	0.4	0.12	0.78	0.17	1.8	2.9
I11	27	1-2m	3	0.05	0.11	0.7	0.8	1.2	1.6	1.4	15	19.2
J11	J113170	1.0-1.5	3	0.05	0.4	0.2	0.6		18	2.4	68	88.4
J12	18	1-2m	3	0.05	0.05	0.07	0.1	0.35	1.3	3	23	27.7
J12	J123722	1.0-1.5	3	0.51	0.51	0.51	1.1		14	3	330	347.0
K10	22	1-2m	3	0.05	0.05	0.12	0.2	0.07	0.24	0.05	0.16	0.5
K12	17	1-2m	3	0.05	0.05	0.05	0.1	0.07	0.36	0.05	0.16	0.6
K12	14	1-2m	3	0.05	0.05	0.05	0.1	0.09	0.05	0.05	0.28	0.5
K13	13	1-2m	3	0.05	0.05	0.05	0.1	0.05	0.05	0.05	10	10.2
K13	59	1-2m	3	0.05	0.05	0.05	0.1	0.05	0.05	0.05	1	1.2
K13	K133707	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.05	0.05	0.2
K9	21	1-2m	3	0.05	0.05	0.06	0.1	0.18	1.3	0.05	0.87	2.4
L10	L103509	1.0-1.5	3	0.05	0.05	0.05	0.1		3.8	0.4	8.8	13.0
L13	L133134	1.0-1.5	3	0.05	0.05	0.05	0.1		0.1	0.2	1.2	1.5
M10	20	1-2m	3	0.05	0.05	0.05	0.1	0.08	0.37	0.05	0.19	0.7
K14	5	1-2m	3	0.05	0.05	0.14	0.2	0.48	1.2	0.05	0.41	2.1
L15	L153096	1.0-1.5	3	0.05	6.4	52	58.4		0.7	0.1	4.8	5.6
M14	7	1-2m	3	0.05	100	84	184.0	1.5	6	4.9	27	39.4
M10	M103188	1.0-1.5	3	0.05	19	0.4	19.4		12	3	5.2	20.2
M9	19	1-2m	3	0.05	0.12	0.16	0.3	0.37	6.1	0.05	2	8.5
N15	8	1-2m	3	0.05	0.2	1.7	1.9	0.52	0.22	0.21	1.1	2.1
n				23	23	23	23	14	23	23	23	23
mean				0.1	5.6	7.4	13.0	0.4	3.7	1.3	33.4	38.5
st dev				0.1	21.0	20.6	39.7	0.5	5.6	2.1	84.6	90.0
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				4.8	4.8	4.8	4.8	3.7	4.8	4.8	4.8	4.8
95% UCL				0.1	13.4	15.1	27.7	0.6	5.7	2.0	64.8	71.9

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G11	25	1-2m	3	0.05	0.05	0.05	0.1	0.08	0.11	0.05	0.2	0.4
G12	G123158	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.05	0.3	0.4
H10	24	1-2m	3	0.05	0.05	0.05	0.1	0.18	1.4	0.2	2.8	4.6
H11	26	1-2m	3	0.05	0.05	0.05	0.1	0.05	0.11	0.07	0.71	0.9
H12	2	1-2m	3	0.05	0.08	8.1	8.2	0.1	0.23	0.05	0.96	1.3
I10	I103202	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.05	0.1	0.2
I11	I113566	1.0-1.5	3	0.05	0.05	0.2	0.3		0.7	0.1	1.2	2.0
I12	I123152	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.2	1.2	1.5
I14	3	1-2m	3	0.05	0.05	0.05	0.1	0.11	0.08	0.05	0.59	0.8
I14	I143114	1.0-1.5	3	0.05	0.05	0.05	0.1		2	0.05	0.2	2.3
J13	J133128	1.0-1.5	3	0.3	0.05	0.05	0.1		0.05	0.4	2	2.5
J15	4	1-2m	3	0.05	0.05	0.44	0.5	0.23	0.15	0.05	0.41	0.8
J15	J153090	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.05	0.05	0.2
K15	6	1-2m	3	0.05	0.05	0.48	0.5	0.11	0.39	0.05	0.24	0.8
L12	L123702	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.05	0.1	0.2
L14	L143714	1.0-1.5	3	0.05	0.05	0.05	0.1		0.05	0.1	0.2	0.4
n				16	16	16	16	7	16	16	16	16
mean				0.1	0.1	0.6	0.7	0.1	0.3	0.1	0.7	1.2
st dev				0.1	0.0	2.0	2.0	0.1	0.6	0.1	0.8	1.2
t value				1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No				4.0	4.0	4.0	4.0	2.6	4.0	4.0	4.0	4.0

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
95% UCL				0.1	0.1	1.5	1.5	0.2	0.6	0.1	1.0	1.7

TABLE 2D - FCC WEST, CONTAMINANT CONCENTRATIONS, 1.5-2 M

TREATMENT

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
J10	55	1-2m	4	1	1	2.7	3.8	1.4	7.8	5	140	154.2
J10	J104575	1.5-2.0	4	0.51	13	19	32.1		200	24	750	974.0
K9	21	1-2m	4	0.05	0.05	0.06	0.1	0.18	1.3	0.05	0.87	2.4
n				3	3	3	3	2	3	3	3	3
mean				0.5	4.7	7.3	12.0	0.8	69.7	9.7	297.0	376.9
st dev				0.5	7.2	10.3	17.5	0.9	112.9	12.6	398.5	522.7
t value				1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
sqrt sample No				1.7	1.7	1.7	1.7	1.4	1.7	1.7	1.7	1.7
95% UCL				1.0	12.6	18.5	31.1	1.9	193.2	23.5	732.9	948.7

COMMERCIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G13	G134554	1.5-2.0	4	0.05	0.05	2.2	2.3		0.8	0.5	26	27.3
H12	2	1-2m	4	0.05	0.08	8.1	8.2	0.1	0.23	0.05	0.96	1.3
I11	27	1-2m	4	0.05	0.11	0.7	0.8	1.2	1.6	1.4	15	19.2
J11	J114171	1.5-2.0	4	0.05	0.05	0.1	0.2		0.9	0.3	2.8	4.0
J12	18	1-2m	4	0.05	0.05	0.07	0.1	0.35	1.3	3	23	27.7
J12	J124723	1.5-2.0	4	0.05	0.05	0.05	0.1		1.8	0.4	3.2	5.4
K10	22	1-2m	4	0.05	0.05	0.12	0.2	0.07	0.24	0.05	0.16	0.5
K10	K104177	1.5-2.0	4	0.6	0.05	0.05	0.2		3.4	0.2	5.8	9.4
K12	17	1-2m	4	0.05	0.05	0.05	0.1	0.07	0.36	0.05	0.16	0.6
K13	13	1-2m	4	0.05	0.05	0.05	0.1	0.05	0.05	0.05	10	10.2
K13	59	1-2m	4	0.05	0.05	0.05	0.1	0.05	0.05	0.05	1	1.2
K15	6	1-2m	4	0.05	0.05	0.48	0.5	0.11	0.39	0.05	0.24	0.8
M10	20	1-2m	4	0.05	0.05	0.05	0.1	0.08	0.37	0.05	0.19	0.7
M10	M104189	1.5-2.0	4	0.05	1.4	0.3	1.7		6	0.7	1.2	7.9
M14	7	1-2m	4	0.05	100	84	184.0	1.5	6	4.9	27	39.4
M15	M154542	1.5-2.0	4	0.05	1.4	11	12.4		0.7	1.4	16	18.1
N15	8	1-2m	4	0.05	0.2	1.7	1.9	0.52	0.22	0.21	1.1	2.1
M9	19	1-2m	4	0.05	0.12	0.16	0.3	0.37	6.1	0.05	2	8.5
n				18	18	18	18	12	18	18	18	18
mean				0.1	5.8	6.1	11.8	0.4	1.7	0.7	7.5	10.2
st dev				0.1	23.5	19.7	43.1	0.5	2.2	1.3	9.6	11.5
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				4.2	4.2	4.2	4.2	3.5	4.2	4.2	4.2	4.2
95% UCL				0.1	15.5	14.2	29.7	0.6	2.6	1.3	11.5	15.0

RESIDENTIAL

Grid Ref	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A + D+ 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
G11	25	1-2m	4	0.05	0.05	0.05	0.1	0.08	0.11	0.05	0.2	0.44
G14	G144121	1.5-2.0	4	0.05	0.05	0.05	0.1		0.05	0.05	0.2	0.3
H10	24	1-2m	4	0.05	0.05	0.05	0.1	0.18	1.4	0.2	2.8	4.6
H11	26	1-2m	4	0.05	0.05	0.05	0.1	0.05	0.11	0.07	0.71	0.9
I10	23	1-2m	4	0.05	0.05	0.32	0.4	0.12	0.78	0.17	1.8	2.9
I14	3	1-2m	4	0.05	0.05	0.05	0.1	0.11	0.08	0.05	0.59	0.8
J15	4	1-2m	4	0.05	0.05	0.44	0.5	0.23	0.15	0.05	0.41	0.8
K12	14	1-2m	4	0.05	0.05	0.05	0.1	0.09	0.05	0.05	0.28	0.5
K14	5	1-2m	4	0.05	0.05	0.14	0.2	0.48	1.2	0.05	0.41	2.1
n				9	9	9	9	8	9	9	9	9
mean				0.1	0.1	0.1	0.2	0.2	0.4	0.1	0.8	1.5
st dev				0.0	0.0	0.1	0.1	0.1	0.5	0.1	0.9	1.4
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				3.0	3.0	3.0	3.0	2.8	3.0	3.0	3.0	3.0
95% UCL				0.1	0.1	0.2	0.3	0.3	0.8	0.1	1.4	2.4

TABLE 2E - FCC WEST, CONTAMINANT CONCENTRATIONS, 2-3 M

COMMERCIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
G13	G135555	2.0-2.5	5	0.05	0.1	1.6	1.7		2.2	1.8	56	60.0
J10	J105576	2.0-2.5	5	0.05	0.2	0.5	0.7		2.4	0.7	2	5.1
K10	K105178	2.0-2.5	5	0.2	0.05	0.05	0.1		3	0.1	2.6	5.7
n				3	3	3	3	0	3	3	3	3
mean				0.1	0.1	0.7	0.8	#DIV/0!	2.5	0.9	20.2	23.6
st dev				0.1	0.1	0.8	0.8	#DIV/0!	0.4	0.9	31.0	31.5
t value				2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
sqrt sample No				1.7	1.7	1.7	1.7	0.0	1.7	1.7	1.7	1.7
95% UCL				0.2	0.2	1.8	1.9	#DIV/0!	3.1	2.0	62.3	66.4

RESIDENTIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A + D+ 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
J11	J115172	2.0-2.5	5	0.05	0.05	0.05	0.1		0.3	0.05	0.8	1.2
J12	J125724	2.0-2.5	5	0.05	0.05	0.05	0.1		0.05	0.05	0.4	0.5
M14	B29	2.0-3.0	5	0.004	0.06	0.015	0.075	0.181	0.146	0.039	0.317	0.683
n				3	3	3	3	1	3	3	3	3
mean				0.0	0.1	0.0	0.1	0.2	0.2	0.0	0.5	0.8
st dev				0.0	0.0	0.0	0.0	#DIV/0!	0.1	0.0	0.3	0.3
t value				2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
sqrt sample No				1.7	1.7	1.7	1.7	1.0	1.7	1.7	1.7	1.7
95% UCL				0.1	0.1	0.1	0.1	#DIV/0!	0.3	0.1	0.9	1.2

TABLE 3A - FCC LANDFILL CONTAMINANT CONCENTRATIONS, 0-2 M

TREATMENT

Grid Ref	**Treat Code**	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D, 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
I8	T	16	0-0.5m	1	0.05	0.05	0.21	0.265	0.31	0.78	0.3	1.56	2.95
J8	T	J81504	0-0.5	1	230	4.2	0.1	27.3		8.8	0.4	3	12.2
J9	T	J91507	0-0.5	1	5.01	5.01	28	33.511		660	160	9300	10120
K9	T	K91492	0-0.5	1	0.3	2.4	2.2	4.63		74	4	25	103
I8	T	16	0.5-1m	2	0.05	0.05	0.49	0.545	0.65	1.1	0.05	4.4	6.2
J8	T	J82499	0.5-1.0	2	48	1.4	0.05	6.25		9.8	0.7	3	13.5
K7	T	K72451	0.5-1.0	2	45	0.2	8	12.7		87	9.2	280	376.2
K8	T	15	0.5-1m	2	1.7	0.05	0.19	0.41	0.17	1	0.05	0.86	2.08
K8	T	K82457	0.5-1.0	2	1	0.05	0.3	0.45		14	0.8	1	15.8
K9	T	K92493	0.5-1.0	2	86	6	1.6	16.2		190	5.6	120	315.6
L6	T	L62429	0.5-1.0	2	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
L7	T	L72422	0.5-1.0	2	0.2	0.05	0.4	0.47		41	2.8	98	141.8
L8	T	L82462	0.5-1.0	2	0.05	0.05	0.1	0.155		8.4	0.5	1.2	10.1
L8	T	L82463	0.5-1.0	2	0.05	0.05	0.2	0.255		6.8	0.5	0.6	7.9
L9	T	L92477	0.5-1.0	2	8.4	0.5	0.8	2.14		44	2.8	18	64.8
M5	T	M52437	0.5-1.0	2	0.05	0.2	5.4	5.605		24	2	7.4	33.4
M8	T	M82471	0.5-1.0	2	1	0.05	1	1.15		37	1.6	18	56.6
M9	T	M92402	0.5-1.0	2	0.8	0.3	0.3	0.68		2.8	0.3	1	4.1
I8	T	16	1-2m	3	0.05	0.05	0.1	0.155	0.13	0.47	0.13	0.86	1.59
J8	T	J83500	1.0-1.5	3	31	3	0.05	6.15		6.8	0.2	7.8	14.8
K7	T	K73452	1.0-1.5	3	32	0.2	3.8	7.2		22	2.2	100	124.2
K8	T	15	1-2m	3	0.39	0.05	0.05	0.139	0.06	0.52	0.05	0.4	1.03
K8	T	K83458	1.0-1.5	3	9.6	9.6	11	21.56		67	2.4	47	116.4
K9	T	K93494	1.0-1.5	3	91	4	0.4	13.5		130	79	890	1099
L6	T	L63430	1.0-1.5	3	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
L6	T	L63434	1.0-1.5	3	0.05	0.05	0.05	0.105		0.1	0.05	0.05	0.2
L7	T	L73423	1.0-1.5	3	0.4	0.05	0.4	0.49		28	1.2	7.2	36.4
L8	T	L83465	1.0-1.5	3	17	0.05	0.4	2.15		3.4	0.3	1.4	5.1
L9	T	L93478	1.0-1.5	3	0.5	0.4	0.05	0.5		3.4	0.2	1	4.6
M5	T	M53440	1.0-1.5	3	350	1.2	27	63.2		30	5	40	75
M5	T	M53443	1.0-1.5	3	53	0.05	6.8	12.15		15	3.4	6.2	24.6
M8	T	M83472	1.0-1.5	3	0.1	0.05	0.5	0.56		84	15	2000	2099
M9	T	M93403	1.0-1.5	3	0.6	0.2	0.3	0.56		4.8	0.2	3	8
I8	T	16	1-2m	4	0.05	0.05	0.1	0.155	0.13	0.47	0.13	0.86	1.59
J8	T	J84501	1.5-2.0	4	4	0.6	0.05	1.05		1.8	0.05	2.4	4.25
K7	T	K74454	1.5-2.0	4	3.2	0.05	0.1	0.47		1.2	0.2	3.2	4.6
K8	T	15	1-2m	4	0.39	0.05	0.05	0.139	0.06	0.52	0.05	0.4	1.03
K8	T	K84459	1.5-2.0	4	15	1.8	16	19.3		110	2.8	36	148.8
K9	T	K94495	1.5-2.0	4	37	29	1.2	33.9		130	120	1200	1450
L6	T	L64431	1.5-2.0	4	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
L7	T	L74424	1.5-2.0	4	0.05	0.05	0.05	0.105		0.5	0.05	0.3	0.85
L8	T	L84466	1.5-2.0	4	85	0.05	0.5	9.05		21	2	17	40
L9	T	L94479	1.5-2.0	4	2	0.7	2.8	3.7		16	2.2	16	34.2
M5	T	M54441	1.5-2.0	4	0.05	0.2	0.2	0.405		2.4	0.3	0.5	3.2
M6	T	M64410	1.5-2.0	4	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
M8	T	M84473	1.5-2.0	4	0.2	0.1	0.4	0.52		29	1.6	20	50.6
M9	T	M94404	1.5-2.0	4	0.2	0.05	0.05	0.12		1.6	0.1	0.5	2.2
n					47	47	47	47	7	47	47	47	47
mean					24.7	1.5	2.6	6.6	0.2	40.9	9.2	303.9	354.0
st dev					62.7	4.5	6.2	12.2	0.2	101.5	30.5	1387.1	1507.9
t value					1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
sqrt sample No					6.9	6.9	6.9	6.9	2.6	6.9	6.9	6.9	6.9
95% UCL					40.0	2.6	4.1	9.6	0.3	65.7	16.6	643.4	723.1

COMMERCIAL

Grid Ref	Treat Code	Sample No	Depth	Depth Code	Lindane	Aldrin	Dieldrin	Total A,D, 0.1L	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	Total DD(*X*)
K7	C	K71450	0-0.5	1	0.05	0.05	1	1.055		6.8	1.2	26	34
K8	C	15	0-0.5m	1	1	1	18	19.1	3.6	99	3.8	42	148.4
K8	C	K81456	0-0.5	1	0.3	0.05	0.1	0.18		7	0.2	0.2	7.4
L6	C	L61428	0-0.5	1	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
J9	C	J92508	0.5-1.0	2	0.05	0.05	1.8	1.855		11	3.6	55	69.6
J9	C	J93509	1.0-1.5	3	0.05	0.05	0.05	0.105		0.05	0.05	0.5	0.6
J9	C	J94510	1.5-2.0	4	0.05	0.05	0.3	0.355		5.4	0.5	13	18.9
L7	C	L71421	0-0.5	1	0.05	0.05	0.05	0.105		0.1	0.05	0.05	0.2
L8	C	L81461	0-0.5	1	0.05	0.05	0.05	0.105		0.4	0.05	0.2	0.65
L8	C	L8P468	0-0.5	1	28	0.05	0.2	3.05		13	1	5	19
L9	C	L91476	0-0.5	1	820	0.1	0.7	82.8		57	1.6	120	178.6
M5	C	M51436	0-0.5	1	0.05	0.05	0.8	0.855		4.6	0.5	1.4	6.5
M6	C	M61407	0-0.5	1	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
M7	C	M71415	0-0.5	1	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
M8	C	M81470	0-0.5	1	0.1	0.05	0.4	0.46		11	1	7.2	19.2
M9	C	M91400	0-0.5	1	0.05	0.05	0.05	0.105		0.8	0.2	0.6	1.6
n					16	16	16	16	1	16	16	16	16
mean					53.1	0.1	1.5	6.9	3.6	13.5	0.9	17.0	31.6
st dev					204.6	0.2	4.4	20.8	#DIV/0!	26.7	1.2	32.2	54.9
t value					1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No					4.0	4.0	4.0	4.0	1.0	4.0	4.0	4.0	4.0
95% UCL					143.7	0.2	3.4	16.1	#DIV/0!	25.3	1.4	31.2	55.9

TABLE 3B - FCC LANDFILL CONTAMINANT CONCENTRATIONS, 2-3 M

RESIDENTIAL

Grid Ref	**Sample No**	**Depth**	**Depth Code**	Lindane	Aldrin	Dieldrin	**Total A,D, 0.1L**	4,4'-DDE	4,4'-DDD	DDD isomer	4,4'-DDT	**Total DD(*X*)**
J8	J85502	2.0-2.5	5	5.6	0.7	0.05	1.31		2.4	0.05	1.4	3.85
J9	J95511	2.0-2.5	5	0.05	0.05	0.05	0.105		0.2	0.05	1.2	1.45
K7	K75453	2.0-2.5	5	0.1	0.05	0.05	0.11		0.7	0.05	1	1.75
K8	K85460	2.0-2.5	5	0.05	0.05	0.05	0.105		1.4	0.05	0.05	1.5
K9	K95496	2.0-2.5	5	0.05	0.05	0.05	0.105		2.2	0.3	7.6	10.1
L6	L65432	2.0-2.5	5	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
L7	L75425	2.0-2.5	5	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
L8	L85467	2.0-2.5	5	17	0.05	0.05	1.8		0.8	0.05	1.2	2.05
L9	L95480	2.0-2.5	5	0.4	0.05	0.05	0.14		1.2	0.05	0.2	1.45
M5	M55442	2.0-2.5	5	0.05	0.05	0.05	0.105		1	0.05	0.2	1.25
M8	M85474	2.0-2.5	5	0.1	0.05	0.05	0.11		1.2	0.1	0.4	1.7
M9	M95405	2.0-2.5	5	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
M8	M86475	2.5-3.0	6	0.05	0.05	0.05	0.105		0.05	0.05	0.05	0.15
n				13	13	13	13	0	13	13	13	13
mean				1.8	0.1	0.1	0.3	#DIV/0!	0.9	0.1	1.0	2.0
st dev				4.8	0.2	0.0	0.6	#DIV/0!	0.8	0.1	2.0	2.7
t value				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
sqrt sample No				3.6	3.6	3.6	3.6	0.0	3.6	3.6	3.6	3.6
95% UCL				4.2	0.2	0.1	0.6	#DIV/0!	1.3	0.1	2.0	3.3

Appendix 2

Screening Trial Results

APPROXIMATE LOCATION OF SCREENING TRIALS

PLATE 1: SCREENING TRIAL 1 (<5mm SIZE)

PLATE 2: SCREENING TRIAL 1 (5-20mm SIZE)

PLATE 3: SCREENING TRIAL 1 (20-65mm SIZE)

PLATE 4: SCREENING TRIAL 1 (>65mm SIZE)

PLATE 5: SCREENING TRIAL 2 (<5mm SIZE)

PLATE 6: SCREENING TRIAL 2 (5-20mm SIZE)

PLATE 7: SCREENING TRIAL 2 (20-65mm SIZE)

PLATE 8: SCREENING TRIAL 2 (>65mm SIZE)

PLATE 9: SCREENING TRIAL 3 (<5mm SIZE)

PLATE 10: SCREENING TRIAL 3 (5-20mm SIZE)

PLATE 11: SCREENING TRIAL 3 (20-65mm SIZE)

PLATE 12: NOT APPLICABLE

PLATE 13: SCREENING TRIAL 4 (<5mm SIZE)

PLATE 14: SCREENING TRIAL 4 (5-20mm SIZE)

PLATE 15: SCREENING TRIAL 4 (20-65mm SIZE)

PLATE 16: SCREENING TRIAL 4 (>65mm SIZE)

Sample No	DDX mg/kg	DDX ug/L
ST12A	74	6
ST12B	59.4	6
ST12C	228.6	7
ST12D	117	6
ST12E	55	4
n	5	5
mean	106.80	5.80
st dev	72.36	1.10
t value	1.80	2.80
sqrt sample No	2.24	2.24
95% UCL	164.92	7.17

Sample No	DDX mg/kg	DDX ug/L
ST21A	1361	13
ST21B	1075	20
ST21C	1380	15
ST21D	1141	35
ST21E	951	13
n	5	5
mean	1181.60	19.20
st dev	185.56	9.28
t value	1.80	2.80
sqrt sample No	2.24	2.24
95% UCL	1330.64	30.81

Sample No	DDX mg/kg	DDX ug/L
ST31A	801	15
ST31B	815.4	15
ST31C	643.4	14
ST31D	611.4	12
ST31E	664	12
n	5	5
mean	707.04	13.60
st dev	94.37	1.52
t value	1.80	2.80
sqrt sample No	2.24	2.24
95% UCL	782.83	15.50

Sample No	DDX mg/kg	DDX ug/L
ST41A	160.4	9
ST41B	200.4	7
ST41C	148	8
ST41D	147.6	6
ST41E	301.2	15
n	5	5
mean	191.52	9.00
st dev	65.00	3.54
t value	1.80	2.80
sqrt sample No	2.24	2.24
95% UCL	243.73	13.42

Appendix 3
Soil Acceptance Criteria

SOIL ACCEPTANCE CRITERIA FOR SOIL AND SEDIMENT CONTAMINANTS AT FCC

Substance	Residential[1] (mg/kg)	Open space[1,2] (mg/kg)	Commercial (mg/kg)[1,2]	Marine sediments[7] (mg/kg)
Arsenic	30[3]	200	500	20
Boron	3[3] (sol)	6,000	15,000	
Cadmium	3	40	100	1.5
Chromium (III)	600[3]	24%	60%	
Chromium (VI)	9[3]	200	500	80
Copper	130[6]	2,000	5,000	65
Cyanide (complexed)	20[9]	1,000	2,500	
Cyanide (free)	50[9]	500	1250	
Lead	300	600	1500	50
Manganese	500	3,000	7,500	
Methyl Mercury	10	20	50	
Mercury (inorganic)	1	30	75	0.15
Nickel	60	600	3,000	21
Sulphur	600	600	600	
Zinc	200	14,000	35,000	200
Aldrin + dieldrin +10% lindane	3[4]	60[4]	60[4]	0.01[4]
Chlordane	50	100	250	0.0005
DDX (DDD, DDT, DDE)	5[4]	200[4]	200[4]	0.01[4]
Heptachlor	10	20	50	
PAHs	20	40	100	
Benzo(a)pyrene	0.27[5]	25[5]	25[5]	0.430
Phenol	40[9]	17,000	42,500	
PCBs (total)	10	20	50	0.023
Total Petroleum hydrocarbons in sandy silt C7-C9 C10-C14 C15-C36	500[5] 510[5] NA[5,8]	500[5] 2,200[5] NA[5,8]	500[5] 2,200[5] NA[5,8]	

Guideline notes

The soil values without notation are from National Environmental Protection Council (NEPC) Assessment of Site Contamination Schedule B(1) “Guidelines on Investigation Levels for Soil and Groundwater” Table 5A Soil Health Investigation Levels or the interim urban Ecological Levels (which ever is lowest).

The commercial and recreational values apply to soil below 0.5 m depth. Surface soil should comply with the residential values.

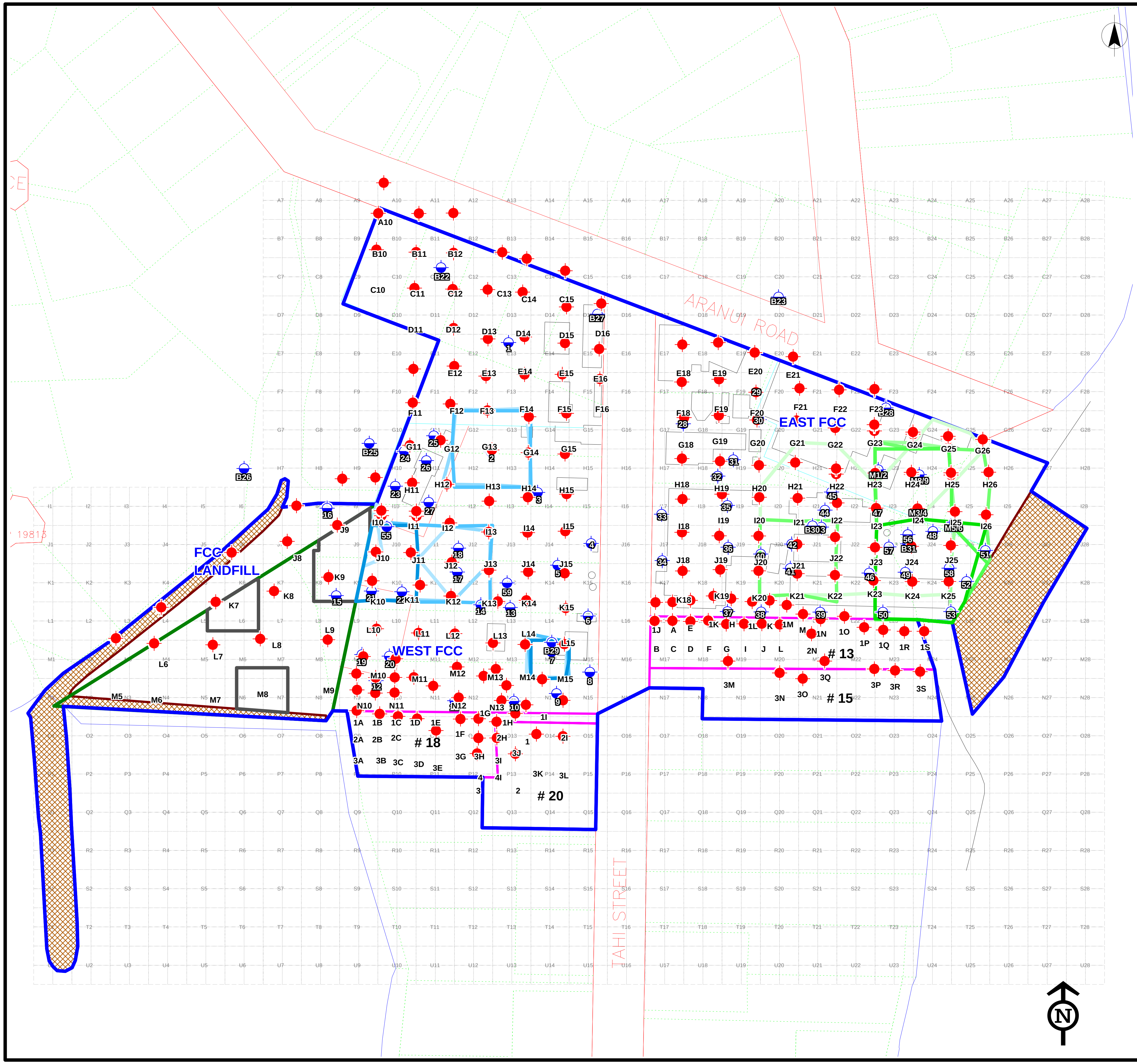
Health and Environmental Guidelines for selected Timber Treatment chemicals. Ministry of Health, Ministry for the Environment, June 1997.

Risk based acceptance criteria for FCC Mapua, Egis 2001.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Ministry for the Environment, August 1999.
Ministry for the Environment draft revised copper value, June 2003.*Amended March 2004
The marine sediment guidelines are ISQG-Low from ANZECC 2000.
NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
Ecotox values, RIVM, Technical Evaluation of the Intervention Values for Soil/Sediment and Groundwater, February 2001.

Appendix 4

Contamination Location Plan



Mapua Site Layout - All Layers

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

All Layers Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

2001 Sample Locations for All Layers

- All Samples

1996 Woodward-Clyde Sample Locations for All Layer

- All Samples

Areas with DDX > 200 Or ADL > 60

	Landfill Site	West Site	East Site
Layer 1			
Layer 2			
Layer 3			
Layer 4			
Layer 5			

Tasman District Council

Contract 514:
Remediation of the FCC Site
All Layers -
Removal Areas (DDX > 200)
Including Woodward-Clyde 1996 Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	2
Date	March 2002		

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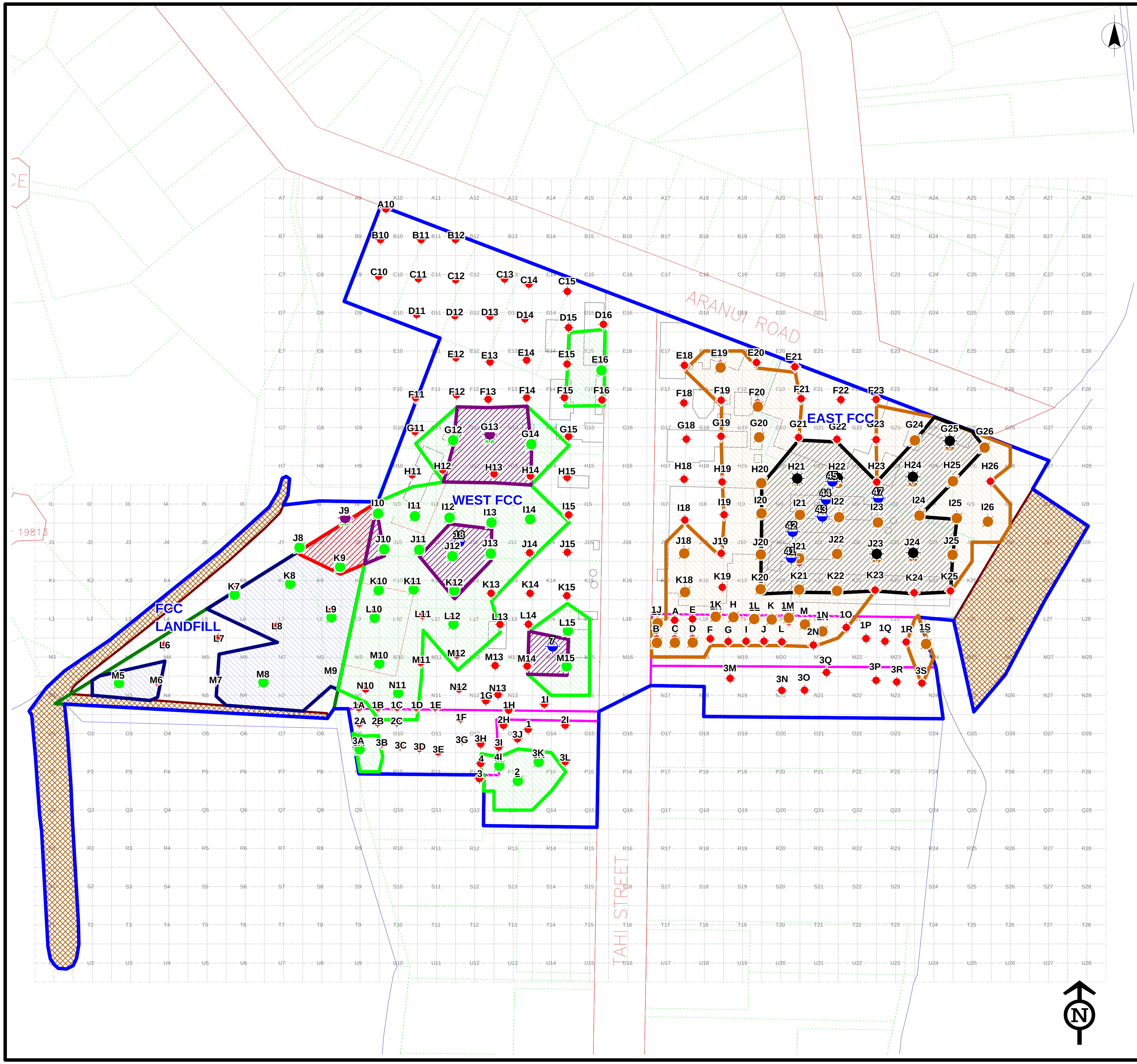

Mapua Site Layout - Layer 1

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 1 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	3
Date	March 2002		

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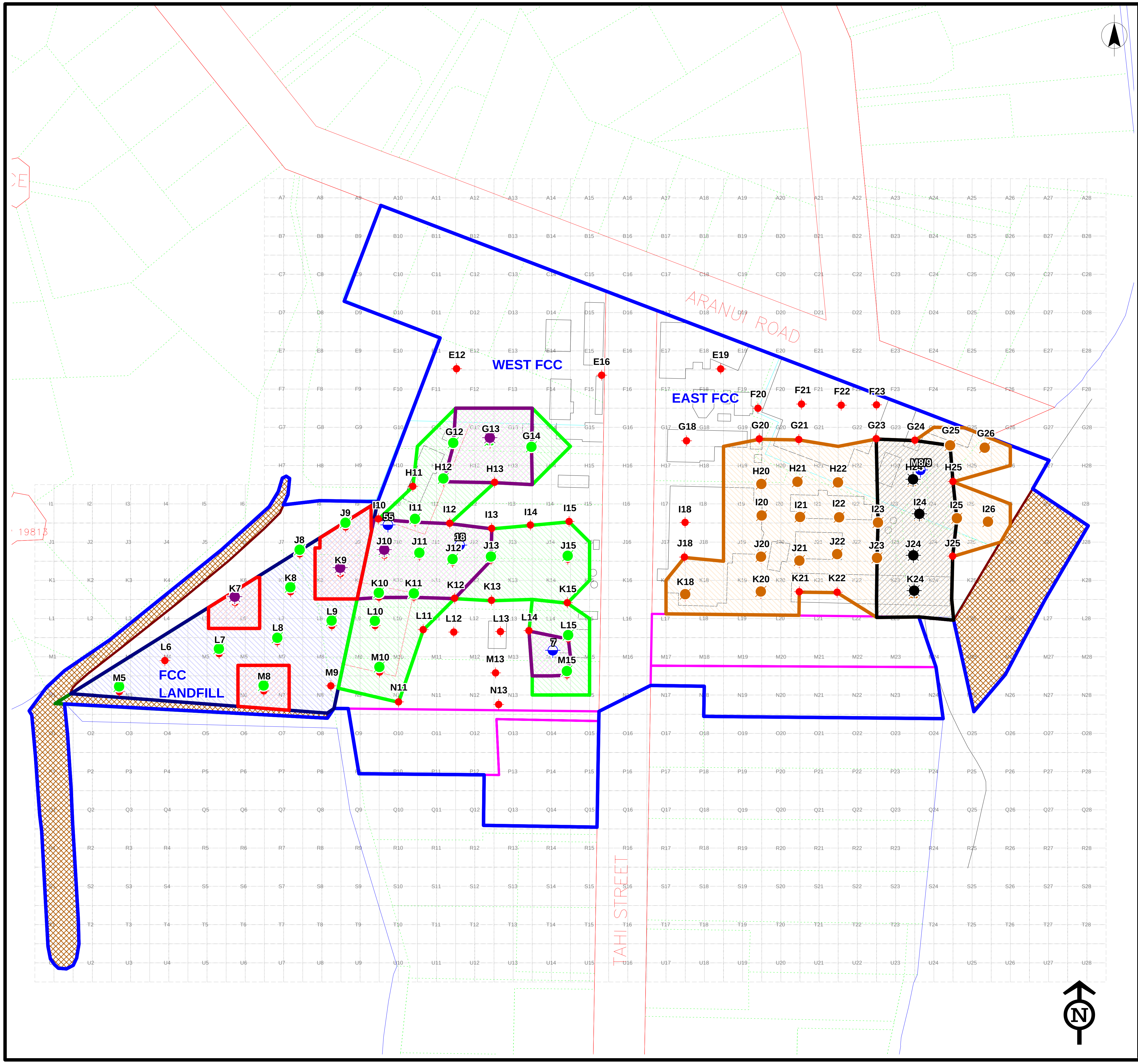

Mapua Site Layout - Layer 2

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 2 Map Legend

Cadastral Property boundaries
The Site
Neighbouring Properties
Landfill Area
Marine Sediments
Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

DDX < 5 Or A+D+(L/10) < 3

East Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

West Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

East Site
West Site
Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

East Site
West Site
Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	4
Date	March 2002		

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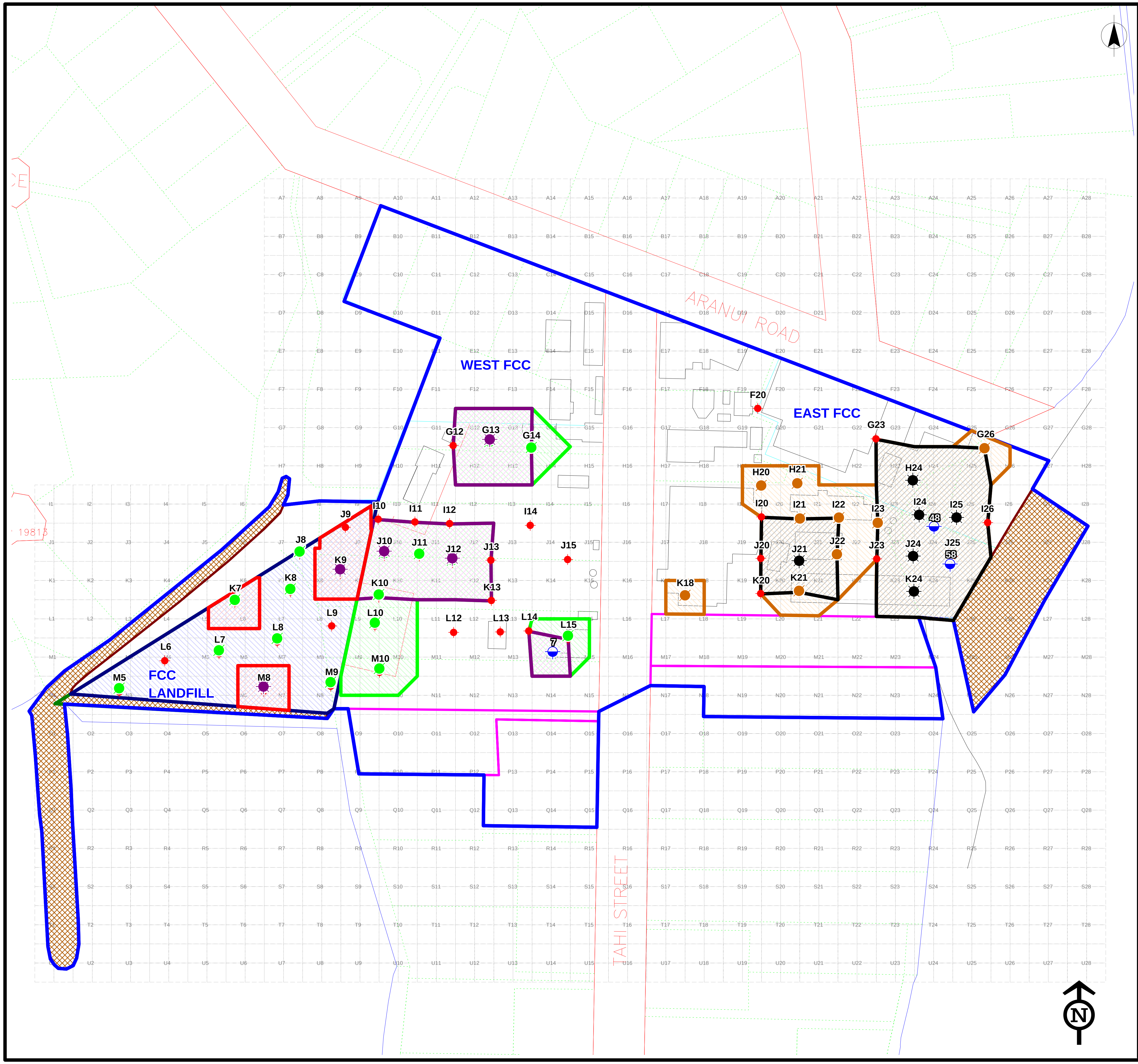

Mapua Site Layout - Layer 3

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 3 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	4
Date	March 2002		

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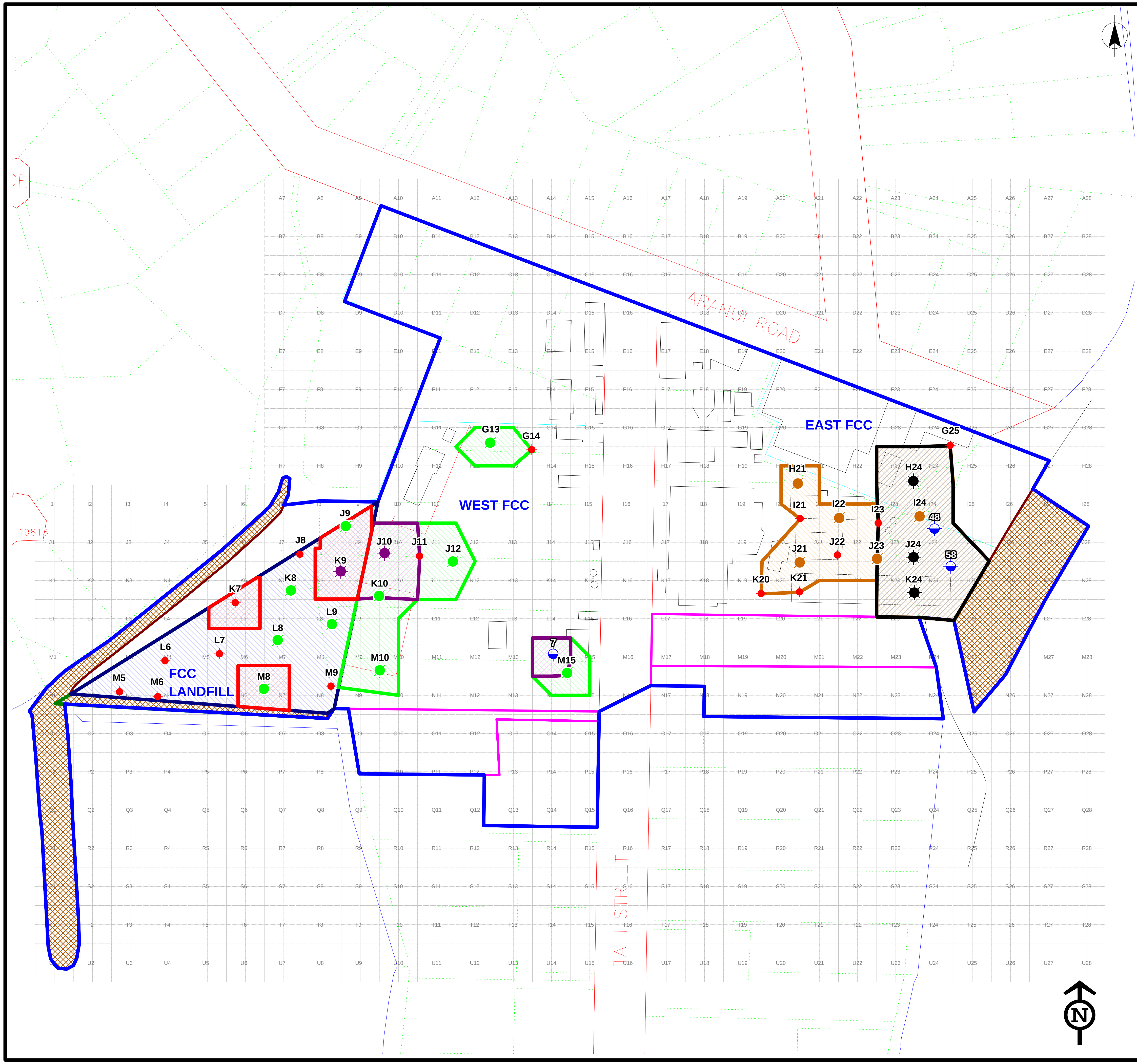


Mapua Site Layout - Layer 4

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 4 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

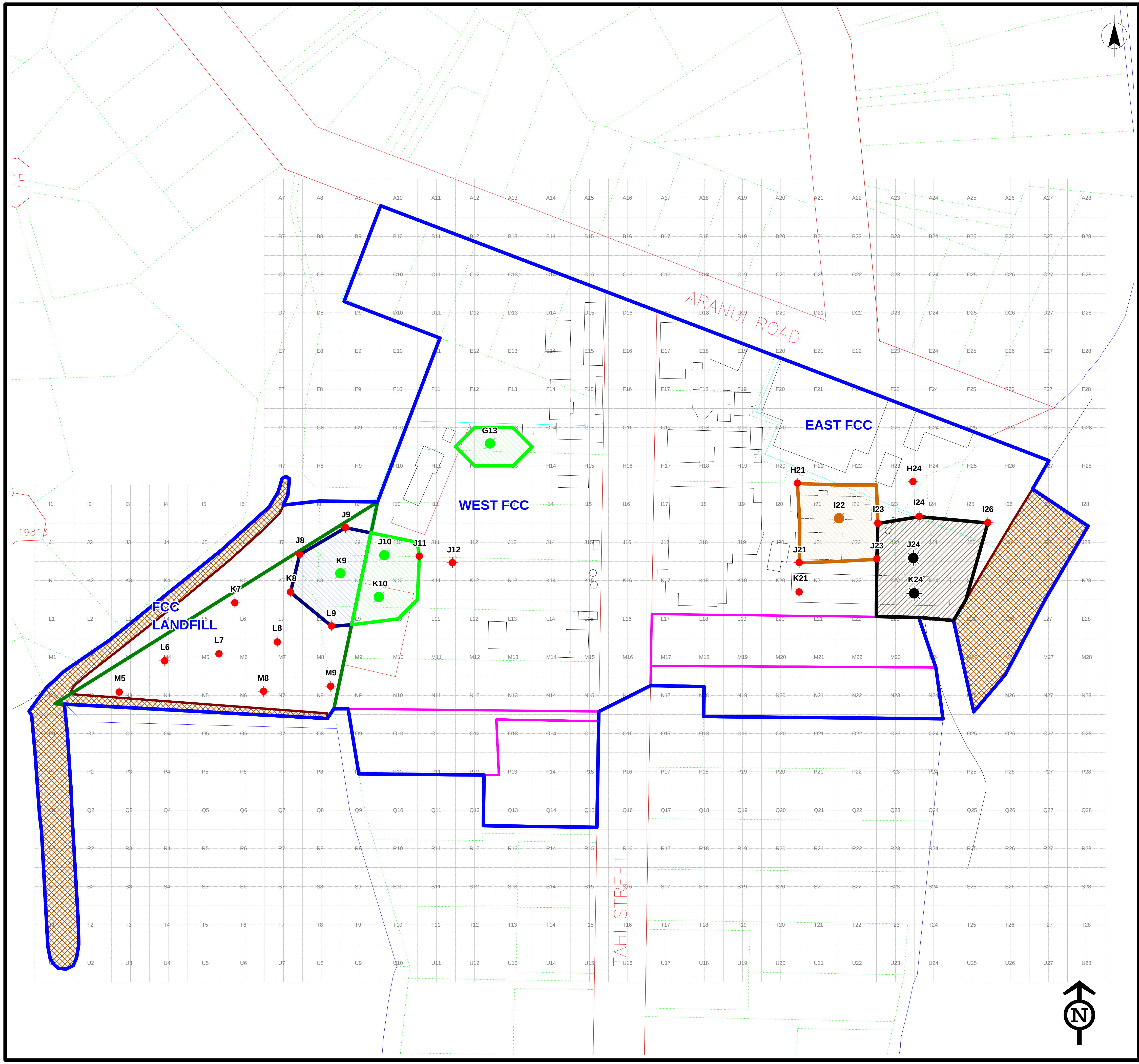
Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	4
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\Mapua_2002_20m2.wor



Mapua Site Layout - Layer 5

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 5 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 5 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	3
Date	March 2002		

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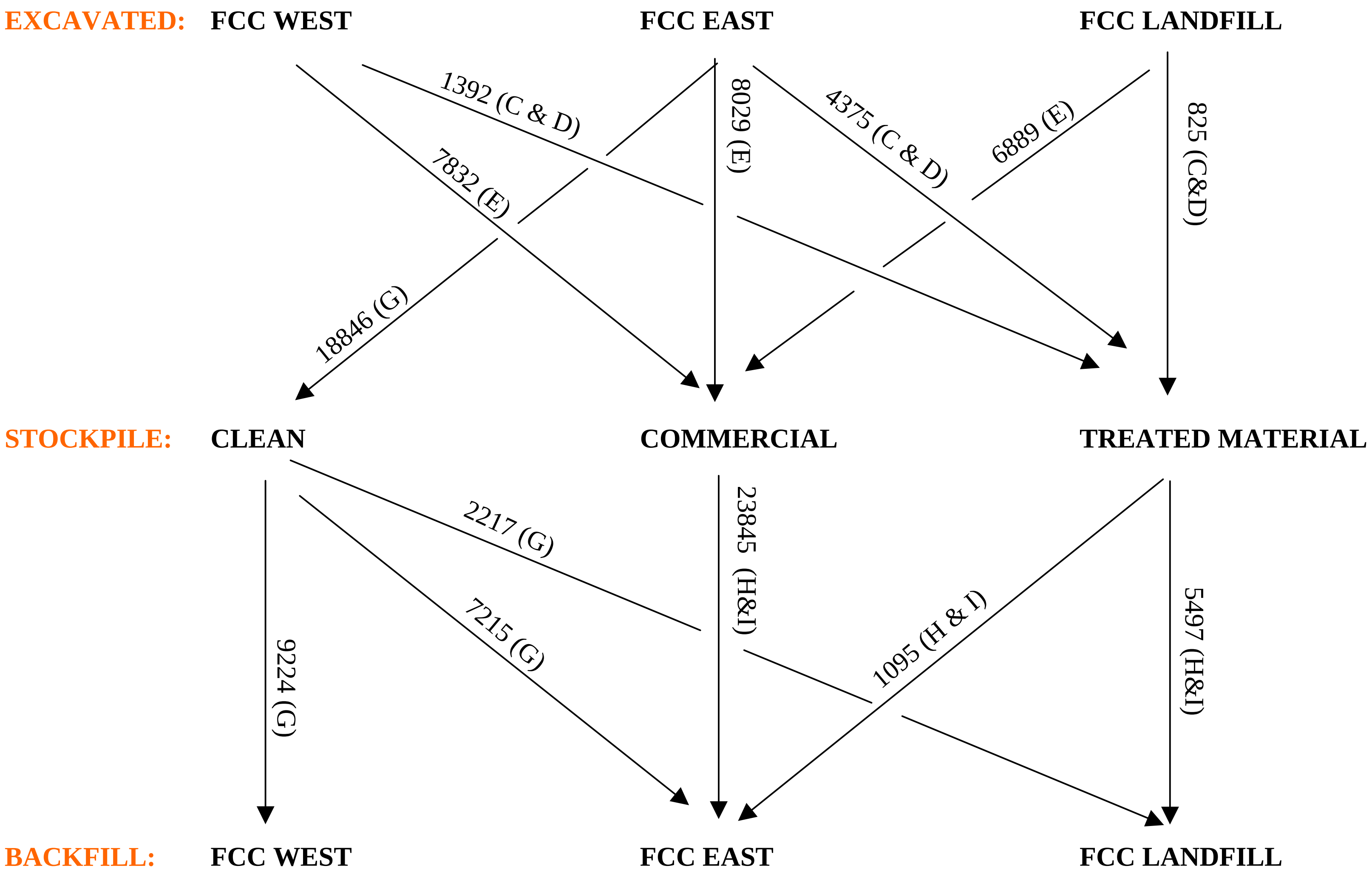
Appendix 5
Mass Balance



Classification as per Table 8.1 and 8.2. C: Soil, sediment and fill requiring excavation and treatment; D: Material below groundwater requiring excavation and treatment; E: Soil and sediment that may be excavated and backfilled at depth; G: Suitable as backfill above 500 mm; H: Suitable as backfill below 500 mm; I: Suitable as backfill below groundwater level

Volumes based on "Review of Treatment Volumes, Mapua FCC Site March 2002, Table 1 and Appendix 1"

Appendix 6
Consent Monitoring Program

Appendix 6 FCC Mapua Monitoring Regime

MEDIUM	LOCATION	REFERENCE	THRESHOLDS	PROGRAM / FREQUENCY
Air	Three high volume sampler north, south of site boundary and location TBC	WP03 Air Quality Management RM030523- 24, 26, 28, 29, 37	TSP <80 $\mu g/m^3$ above background, 24 hour average	Samples collected daily[6]
Air	Beyond site boundary, dust deposition gauges	WP03 Air Quality Management RM030523- 24, 26, 27, 37	Deposited particulate 4 g/m^2/month. Chemical (as per WP 4.4.2) composition and deposition	Monthly
Air	North end of site boundary	WP03 Air Quality Management RM030523- 24i, 25, 26, 28, 29, 37	PM_{10}	PM_{10} daily for the first month[1]
Air	Observation beyond site boundary	WP03 Air Quality Management RM030523- 19, 37	Odour, dust, particulate, smoke, ash or fume that is noxious, dangerous offensive or objectionable beyond boundary	Not specified
Air		WP03 Air Quality Management RM030523- 30-36	HI Index calculation	Monthly for first 3 months then frequency depending on results

[6] Samples will be taken on at least 10 days of maximum site remediation operations to determine percentage of TSP that is PM10 material contributed by the project. If it is greater than 30% then, monitoring schedule reviewed (RM030523-26).

MCD emissions	Stack	WP03 Air Quality Management RM030523- 21, 22, 23	Particulate emissions >20mg/m^3; chemical Chemical composition and deposition (as per WP03 4.4.4)	Weekly intervals for the first month (when treating most contaminated material, at least 75% of max capacity), monthly for the next three months and six monthly
MCD emissions	Stack	WP03 Air Quality Management RM030523- 21, 22, 23	3 samples on 3 events for dioxins, furans, PCBs and HCB and particulate fractions of PM10	First month
MCD emissions	Desktop modelling	WP03 Air Quality Management RM030523- 21, 22, 23	Dispersion modelling assessment	After 1 month, then 6 month thereafter
Site noise	At boundary	WP10 Noise Management and Screening RM030521- 24, 29	As per WP10 Table 1	Weekly for first month at 75% operational capacity Monthly for next 6 months 6 monthly thereafter
Site noise	At boundary	WP10 Noise Management and Screening RM030521-24, 29	As per WP10 Table 1	Following complaint
Plant	At boundary	WP10 Noise Management and Screening RM030521-24	As per WP10 Table 1	Before starting on site 6 months after operation

Vibration/houses	Surrounding residents as requested. Buildings within 100m	WP06 General On-site Excavations WP07 Detailed Excavation WP12 Vibration Management RM030521-39	Structural Assessments	Residents If requested and/or if within 100m of site: Prior to works Completion of works
Vibration	5 sample locations TBC (incl. 1 north and 1 south of site)	WP12 Vibration Management RM030521- 32, 33, 34	WP 12 Table 1 As per WP 12 4.3.3	Weekly during first month whilst operating at least at 75% of max capacity Monthly for next 6 months 6 monthly thereafter
Vibration/houses	Residence of complaint	WP06 General On-site Excavations WP07 Detailed Excavations WP12 Vibration Management RM030521- 32, 33, 34, 35, 36	Vibration monitoring as per WP 12 4.3.3	Following complaint
Water tanks	13 Tahi St, 21 Tahi St, 23 Tahi St, 23b Tahi St and 31 Aranui Rd	WP03 Air Quality Management RM030521- 19, 20, 21, 22	Drinking Water Standards for New Zealand 2000; chemicals as per WP03 4.4.3	Prior to and at completion of works
Groundwater	BH1, BH2, BH3, BH4, BH5, BH9	WP05 Water Management RM030524- 23, 24, 25, 27, 28	Chemical as per WP05 4.6.3, thresholds as per WP05 Table 2	Prior to works Monthly basis
Groundwater	Private bores 13 Tahi St, 17 Tahi St, 26 Tahi St and 36 Tahi St	WP05 Water Management RM030524-28	Chemical as per WP05 4.6.3 Thresholds as per WP05 Table 2	3-monthly intervals

Groundwater	Areas where activities alter flow and quality (eg dewatering etc)	WP05 Water Management RM030524-31 RM030527- 20	Groundwater levels and usage	Prior to and on completion of activity
Groundwater	At pump	WP05 Water Management RM030527- 20	Location, rate, duration of pumping	During dewatering activities
Stormwater	Stormwater retention basins	WP05 Water Management RM030526- 20, 21	As per WP05 Table 3	Prior to discharge
Surface/Receiving Marine Waters	Surface/Receiving Waters	WP05 Water Management RM030524 –36, RM030526-20, 21, 22 RM030527-22	As per WP05 Table 3	First 10 minutes during 6 storm events per year
Surface/Receiving Marine Waters	Surface/Receiving Waters	WP06 General Excavations RM030521- 45 RM030522- 19	Visible Turbidity in waters	During excavation
Marine fauna and sediment	Sediment, targeted treatment areas	WP08 Marine Management RM030522-19	Macroinvertebrate and sediment study	Prior to works, on completion Every 2 months for 6 months after completion Six monthly for 36 months
Shoreline	Shoreline	WP08 Marine Management RM030522- 24	Shoreline profile surveys every 20 metres	Prior to works, on completion, after completion

Backfill	Screening	WP09 Backfill and Compaction Section 4.1	>150mm >2% vegetative matter >5% by weight under 10mm (for material below water table)	Prior to being placed as backfill, recorded during screening.
Backfill at depths	Stockpiles Insitu material Following treatment	WP09 Backfill and Compaction RM030521- Att. 1	SAC WP09 Fill Placement Table 1	Prior to excavation? Prior to backfill After treatment
Compaction/soil density	Insitu (commercial/residential areas)	WP09 Backfill and Compaction	95% Std Max Dry Density WP09 Table 3	After placement and compaction not less than: 1 test per $200m^3$ distributed reasonably evenly throughout full depth and area; or 1 test per layer or 200mm thickness and/or 1 per $1000m^2$.
Compaction/soil Density	Confined operations (filling behind structures)	WP09 Backfill and Compaction	95% Std Max Dry Density WP09 Table 3	After placement and compaction 1 test per 2 layers per $50m^2$
Compaction/soil density	Service trenches	WP09 Backfill and Compaction	95% Std Max Dry Density WP09 Table 3	After placement and compaction 1 test per 2 layers per 40 liner metre
Insitu material	Insitu residential classification	WP13 Validation Sampling and Analysis SAC, RM030521- Att. 1	SAC, WP13 4.4 Analytes as per WP13 Sect 4.6	7.5m x 7.5m grid at 0 – 0.3m depth interval (min of 5 samples per excavation (floor and walls))

Insitu material	Insitu commercial classification	WP13 Validation Sampling and Analysis SAC, RM030521- Att. 1	SAC WP13 4.4 Analytes as per WP13 Sect 4.6	15m x 15m grid at 0 – 0.3m depth interval (min of 5 samples per excavation (floor and walls))
MCD treated material	Post treatment	WP01 Proof of Performance SAC, RM030521- Att. 1	SAC WP01 3.4.2	1 per $20m^3$ by EDL to optimise performance Samples provided to laboratory- after $25m^3$, after $75m^3$, after $108m^3$.
Imported fill, known origin	At source	WP13 Validation Sampling and Analysis SAC, RM030521- Att. 1	SAC WP13, 4.5	1 composite (3 sub samples) per $1000m^3$ plus quality control samples.
Imported- suspect origin	At source	WP13 Validation Sampling and Analysis	SAC WP 13, 4.5	1 composite per $400m^3$ plus quality control samples
Waste export	Desktop/recorded	WP11 Hazardous Substance Management RM03521-56	Waste transfer manifest	When material leaves site

Appendix 7
Excavation Plan

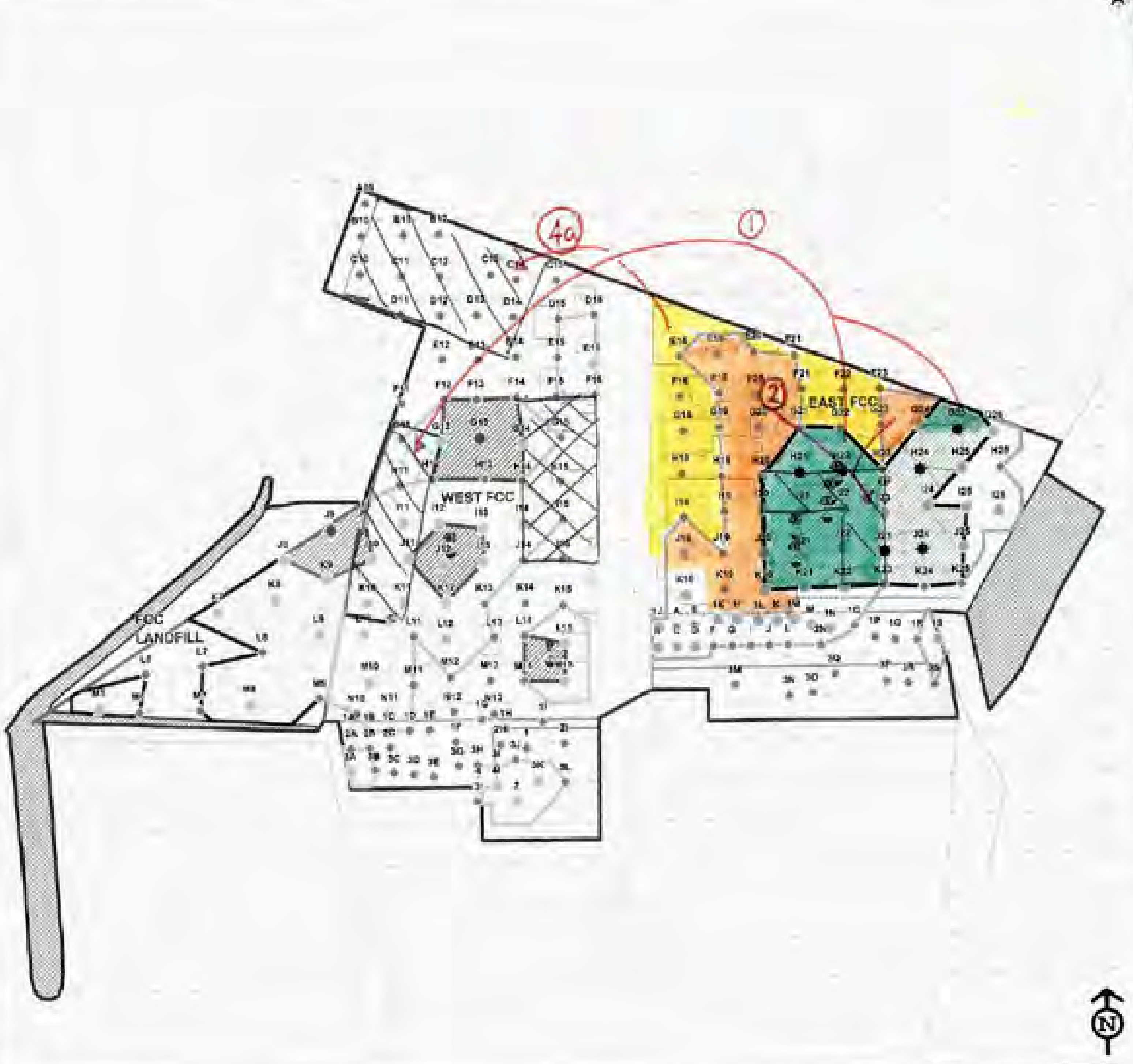
Item	Process	Description	Iwi Monitor Req'd	Layer	Excavate	Screen	Haul Internal	Haul Between	Backfill	Hours
1	Excavate to treat	Move surface >200 from FCC East to treatment stockpile	Y	1	1	1		1		49.50
2	Excavate to stockpile	Move surface 5-200 from NW corner within East to stockpile over removed >200	Y	1	1		1			40.18
3	"	"	Y	2	1		1			40.18
4a	Excavate to stockpile	Move clean from north west end of east to stockpile north end of west	Y	1	1			1		41.25
4b	"	"	Y	2	1			1		75.00
4c	"	"	Y	3	1			1		97.50
4d	"	"	Y	4	1			1		97.50
4e	"	"	Y	5	1			1		195.00
5	Excavate to stockpile	>200 from East to treat	Y	3	1	1		1		18.00
6a	Excavate to stockpile	Move 5-200 from SW corner of west to east to replace material moved in 1 and 4	N	1	1			1	1	30.00
6b	"	"	N	2	1			1		18.75
6c	"	"	N	3	1			1		18.75
6d	"	"	N	4	1			1		13.13
6e	"	"	N	5	1			1		5.44
7	Excavate to backfill	Move surface 5-200 from east to backfill east at depth	N	1						
8	Excavate to backfill	remove 5-200 from east to backfill north end of east	Y	1	1		1	1		13.13

Item	**Process**	**Description**	**Iwi Monitor Req'd**	**Layer**	Excavate	Screen	Haul Internal	Haul Between	Backfill	Hours
11	Excavate to backfill	remove 5-200 from east to backfill north end of east and allow clean access below	Y	2	1		1			11.25
16	"	"	Y	3	1		1			3.21
9	Excavate to treat	Move >200 from east end of east to treatment stockpile to depth	Y	1						
13	"	"	Y	2	1	1		1		40.50
14	"	"	Y	3	1	1		1		56.25
15	"	"	Y	4	1	1		1		45.00
16	"	"	Y	5	1	1		1		54.00
10	Excavate to stockpile	Move clean from east end of east to stockpile north end of west	N	1	1			1		3.75
12	"	"	Y	2				1		
17	"	"	N	3	1			1		7.50
18	"	"	N	4	1			1		18.75
20	Excavate to backfill	remove 5-200 from west residents to backfill east	N	1	1			1	1	11.25
21	Excavate to backfill	remove 5-200 from east residents to backfill east	N	1	1			1	1	15.00
22a	Excavate to backfill	remove 5-200 from west to backfill east	N	1	1			1	1	7.50
22b	"	"	N	2	1			1	1	7.50
22c	"	"	N	3	1			1	1	3.75
23	Excavate to Stockpile	move clean to access 5-200 below	N	3	1				1	3.75

Item	Process	Description	Iwi Monitor Req'd	Layer	Excavate	Screen	Haul Internal	Haul Between	Backfill	Hours
25	Excavate to backfill	remove 5-200 from west to backfill east	N	4	1			1	1	3.75
24a	Excavate to stockpile	remove >200 from east side of west to treatment stockpile	N	1	1	1	1			4.50
24b	"	"	N	2	1	1	1			4.50
24c	"	"	N	3	1	1	1			4.50
24d	"	"	N	4	1	1	1			4.50
26	Excavate to treat	remove >200 from east side corner of landfill to treatment stockpile	N	1	1	1	1			11.25
28	Excavate to stockpile/backfill	remove 5-200 from landfill to backfill landfill and access material beneath	N	1	1				1	3.21
32	Excavate to stockpile/backfill	remove 5-200 from landfill to backfill landfill and access material beneath	N	1	1				1	3.21
36	Excavate to stockpile/backfill	remove 5-200 from landfill to backfill landfill and access material beneath	N	1	1				1	3.21
27	Excavate to stockpile/backfill	Excavate 5-200 from landfill to direct backfill landfill	N	1	1				1	22.50
29	Excavate to treat	Remove >200 from landfill below 5-200 to treatment	N	2	1	1	1			11.25

Item	Process	Description	Iwi Monitor Req'd	Layer	Excavate	Screen	Haul Internal	Haul Between	Backfill	Hours
30	"	"		3	1	1	1			11.25
31	"	"		4	1	1	1			11.25
	"	"								
33	Excavate to treat	remove contaminated material from west end of landfill to treatment stockpile	N	2	1	1	1			6.75
34	"	"	N	3	1	1	1			6.75
35	"	"	N	4	1	1	1			6.75
37	Excavate to treat	remove contaminated material from west end of landfill to treatment stockpile	N	2	1	1	1			6.75
38	"	"	N	3	1	1	1			6.75
39	"	"	N	4	1	1	1			6.75
40	Excavate to stockpile/backfill	Excavate 5-200 to direct backfill landfill	N	1	1				1	3.21
41a	Excavate to treat	remove >200 from central west to treatment stockpile	Y	1	1	1	1			16.00
41b	"	"		2	1	1	1			16.00
41c	"	"		3	1	1	1			16.00
42	Excavate to treat	remove >200 from central west to treatment stockpile and to access material below	N	1	1	1	1			9.00
43	Excavate to backfill	Excavate 5-200 from west to backfill east and to access material below	Y	1	1			1	1	28.13

Item	Process	Description	Iwi Monitor Req'd	Layer	Excavate	Screen	Haul Internal	Haul Between	Backfill	Hours
44	Excavate to backfill	Excavate 5-200 from west to backfill east and allow access to >200 below	N	2	1			1	1	15.00
45	Excavate to backfill	Excavate 5-200 from west to backfill east	Y	2	1			1	1	13.13
46	Excavate to treat	remove >200 from west end of west to treatment stockpile and to access material below	N	2	1	1	1			29.25
47	Excavate to treat	remove >200 from west end of west to treatment stockpile	N	3	1	1	1			31.50
48	Excavate to backfill	Excavate 5-200 from west to backfill east	N	4	1			1	1	9.38
49	Excavate to backfill	Excavate 5-200 from west to backfill east		4	1			1	1	5.63
52	"	"		5	1			1	1	11.25
50	Excavate to treat	remove >200 from west end of west to treatment stockpile		4	1	1	1			11.25
51	Excavate to backfill	Excavate 5-200 from west to backfill east		5	1			1	1	10.33
				TOAL						1406.71



Mapua Site Layout - Layer 1

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 1 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

P Russell		
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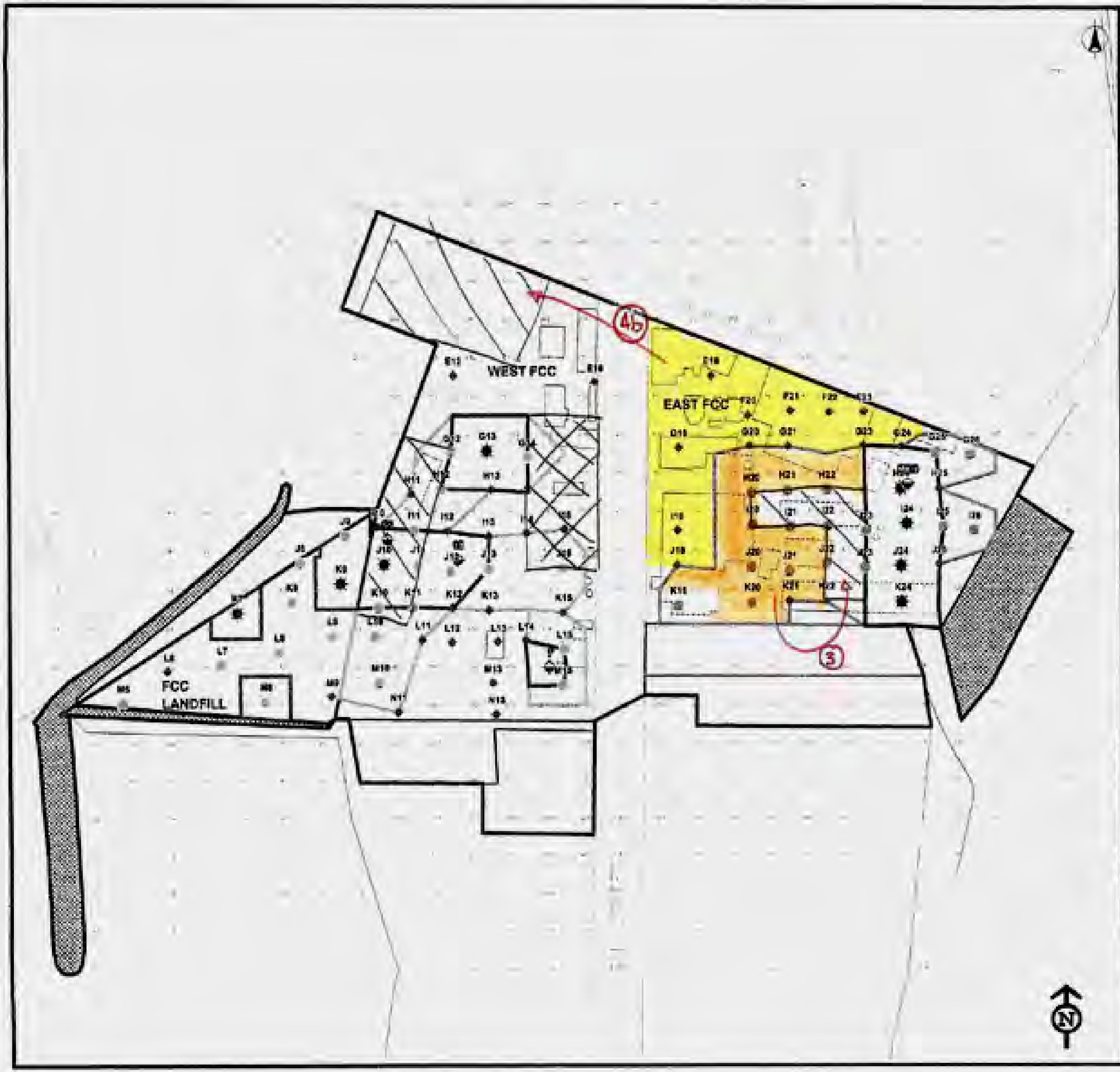
March 2002		



Mapua Site Layout - Layer 2

NOTE:

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Layer 2 Map Legend

Cadastral Property boundaries

- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

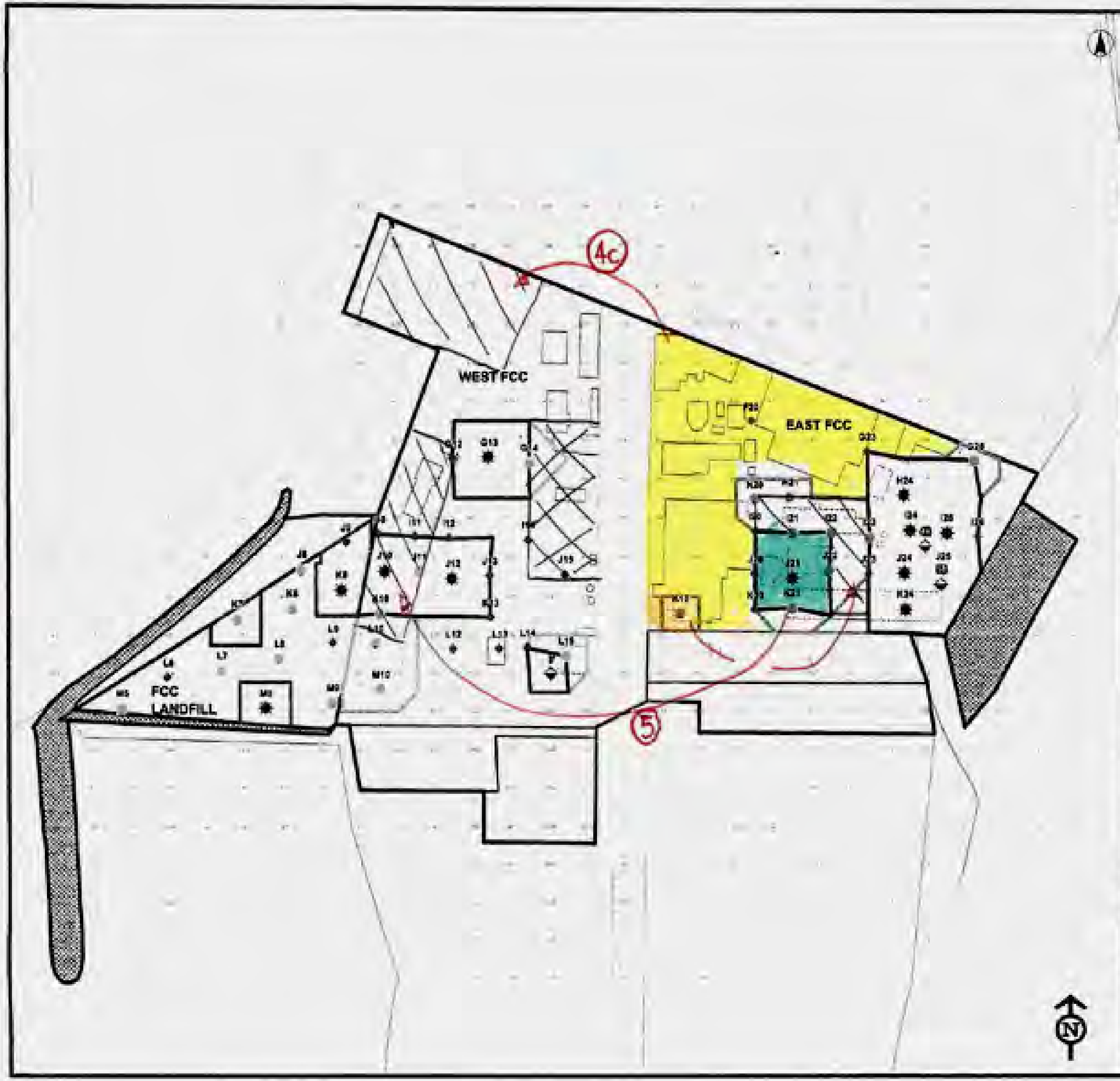
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	Revision	4
Date	March 2002		



Mapua Site Layout - Layer 3

NOTE:

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Layer 3 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

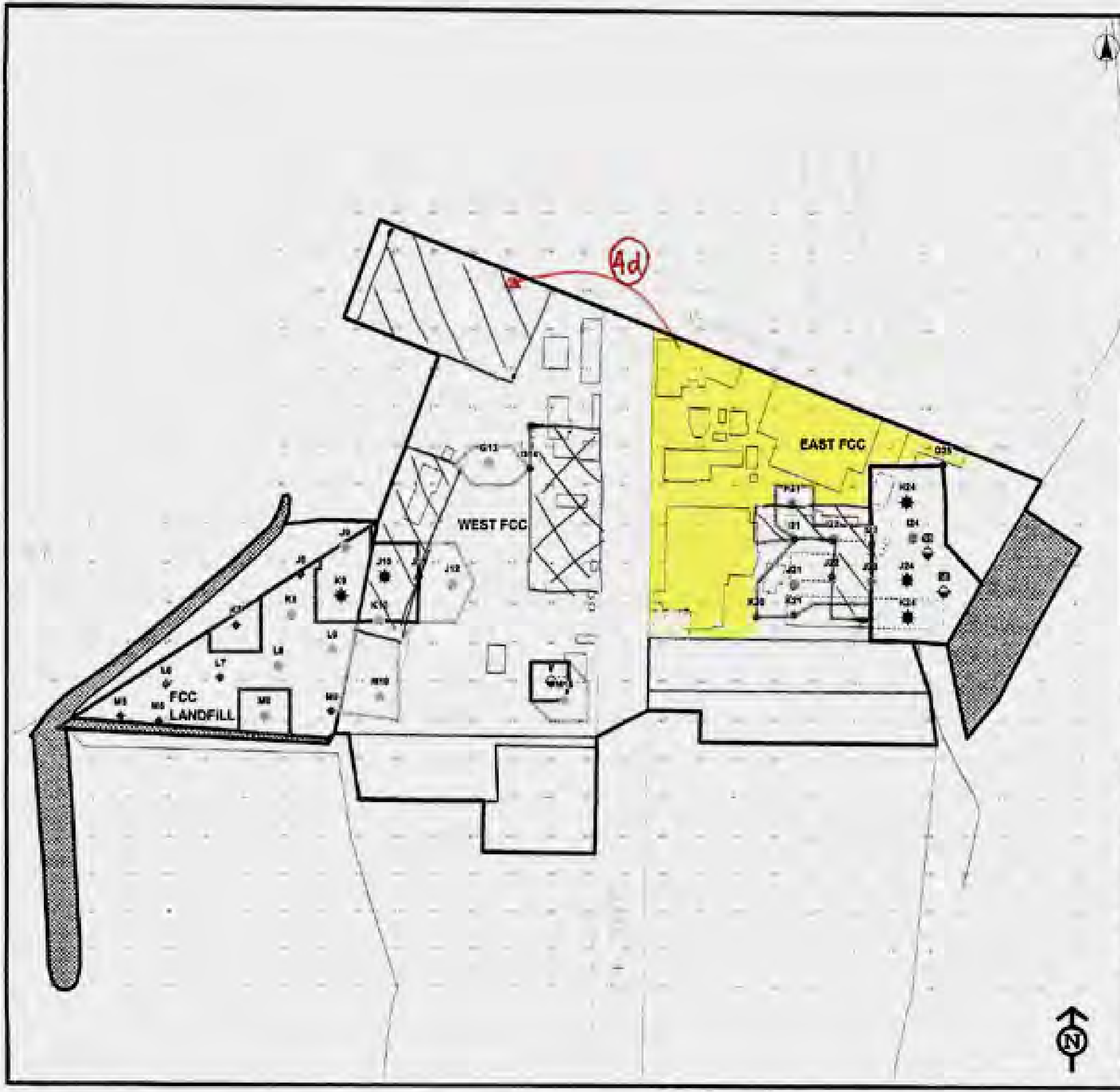
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL		
Approved P Russell			
Scale 1:1,500		Revision 4	
Date March 2002			



Mapua Site Layout - Layer 4

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 4 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marina Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

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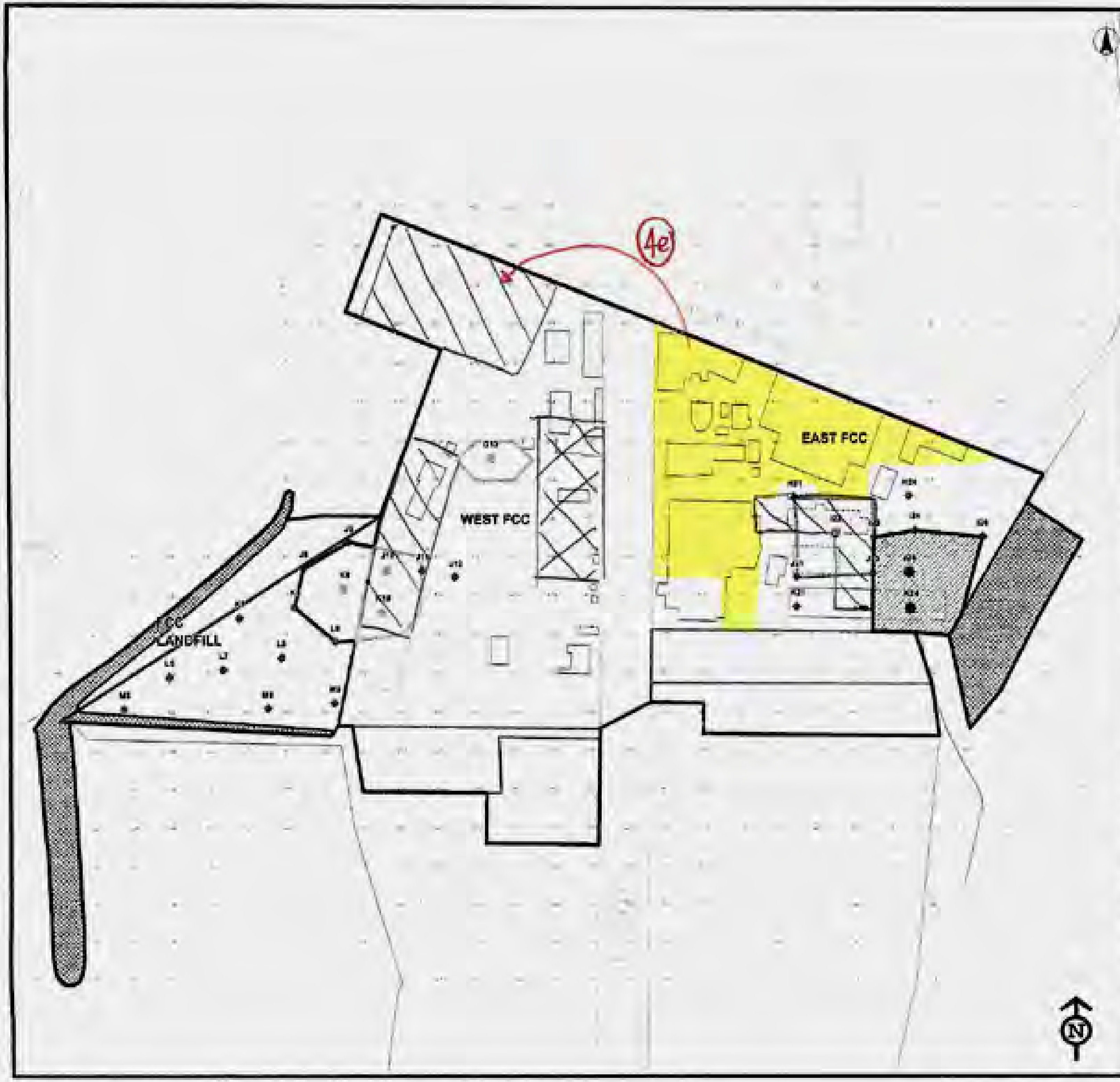
Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn: SR	Checked: PL		
Approved: P Russell			
Scale: 1:1,500		Revision: 4	
Date: March 2002			



Mapua Site Layout - Layer 5

NOTE:

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Layer 5 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
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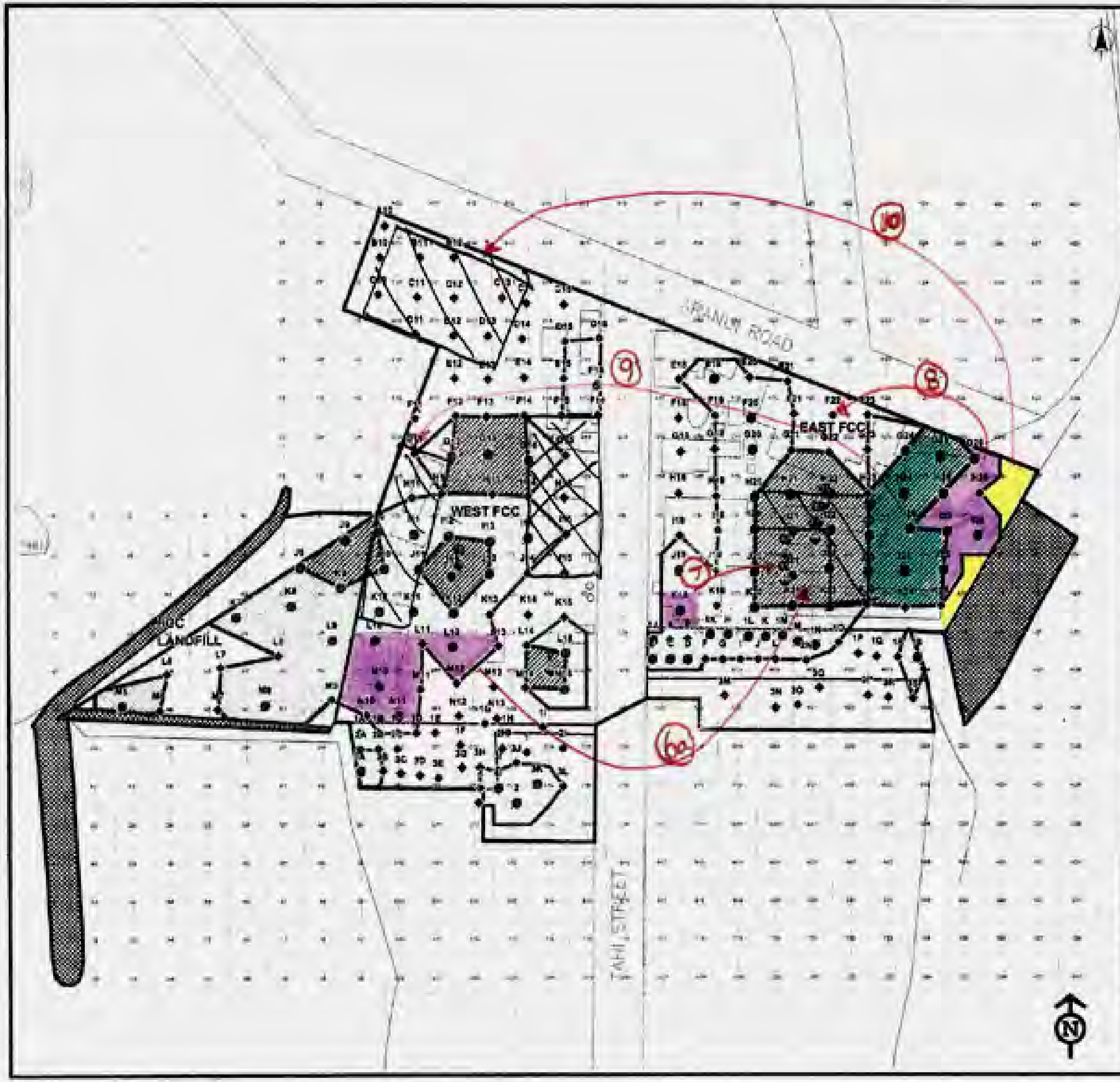
LAYER 5 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL		
Approved P Russell			
Scale 1:1,500		Revision 3	
Date March 2002			



Mapua Site Layout - Layer 1

NOTE:

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Layer 1 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
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Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

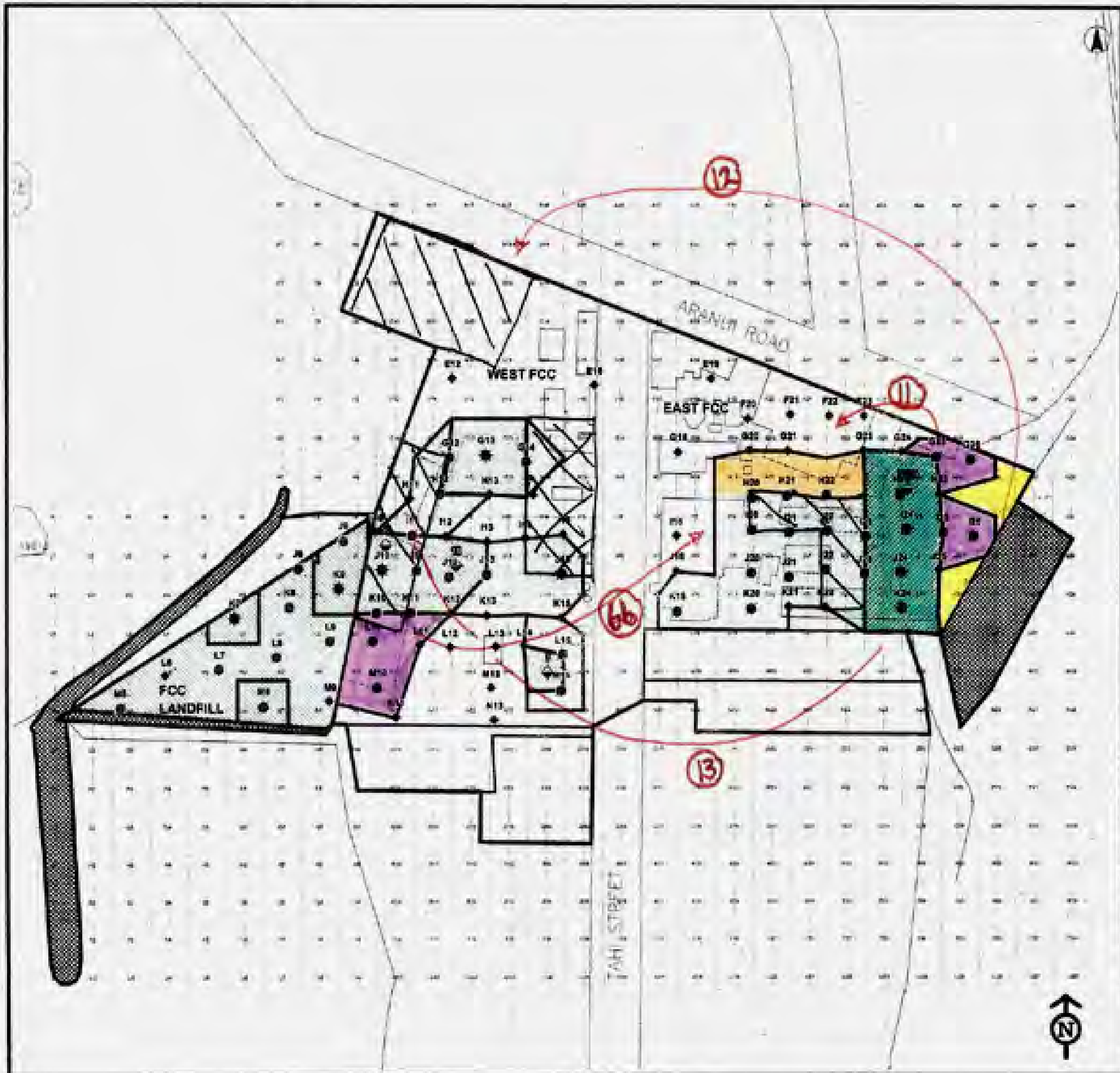
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR		PL	
P Russell			
1:1,500			
March 2002		3	



Mapua Site Layout - Layer 2

NOTE:

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Layer 2 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR	PL
P Russell	
1:1,500	
March 2002	4

Mapua Site Layout - Layer 3

NOTE:

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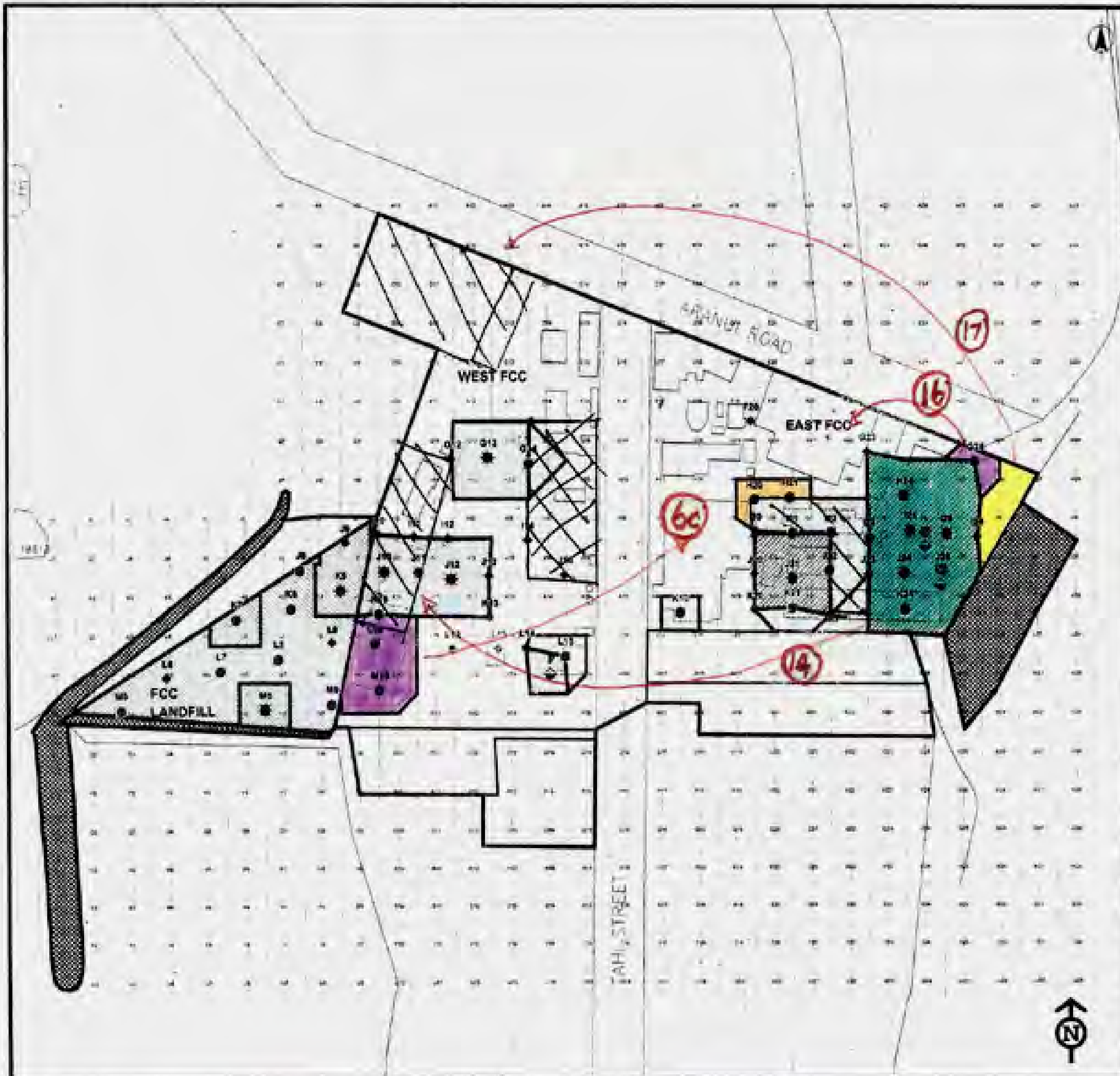


Layer 3 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

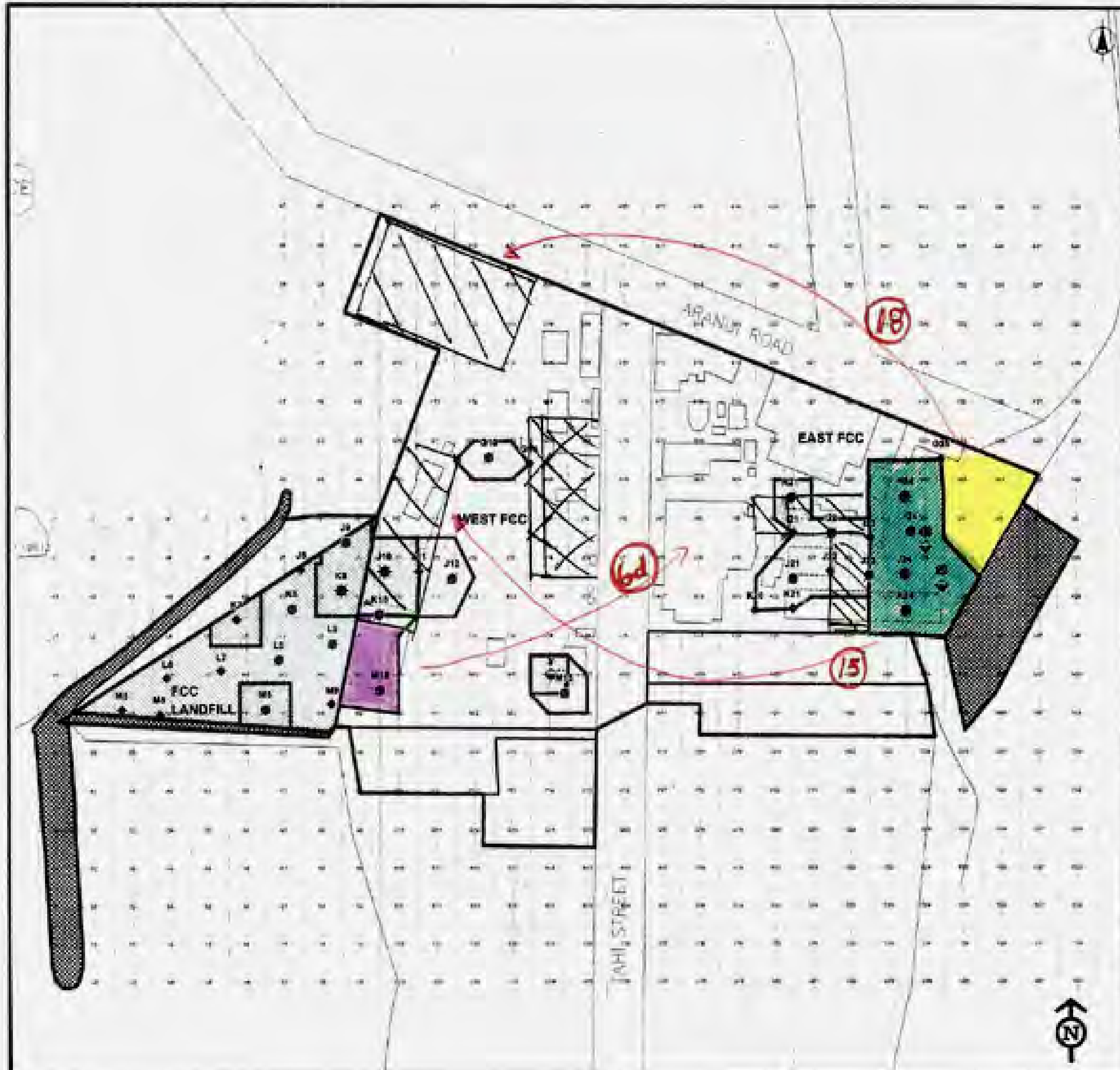
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR		PL	
Approved	P Russell		
Scale	1:1,500	Revision	4
Date	March 2002		



Mapua Site Layout - Layer 4

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Layer 4 Map Legend

Cadastral Property boundaries

- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

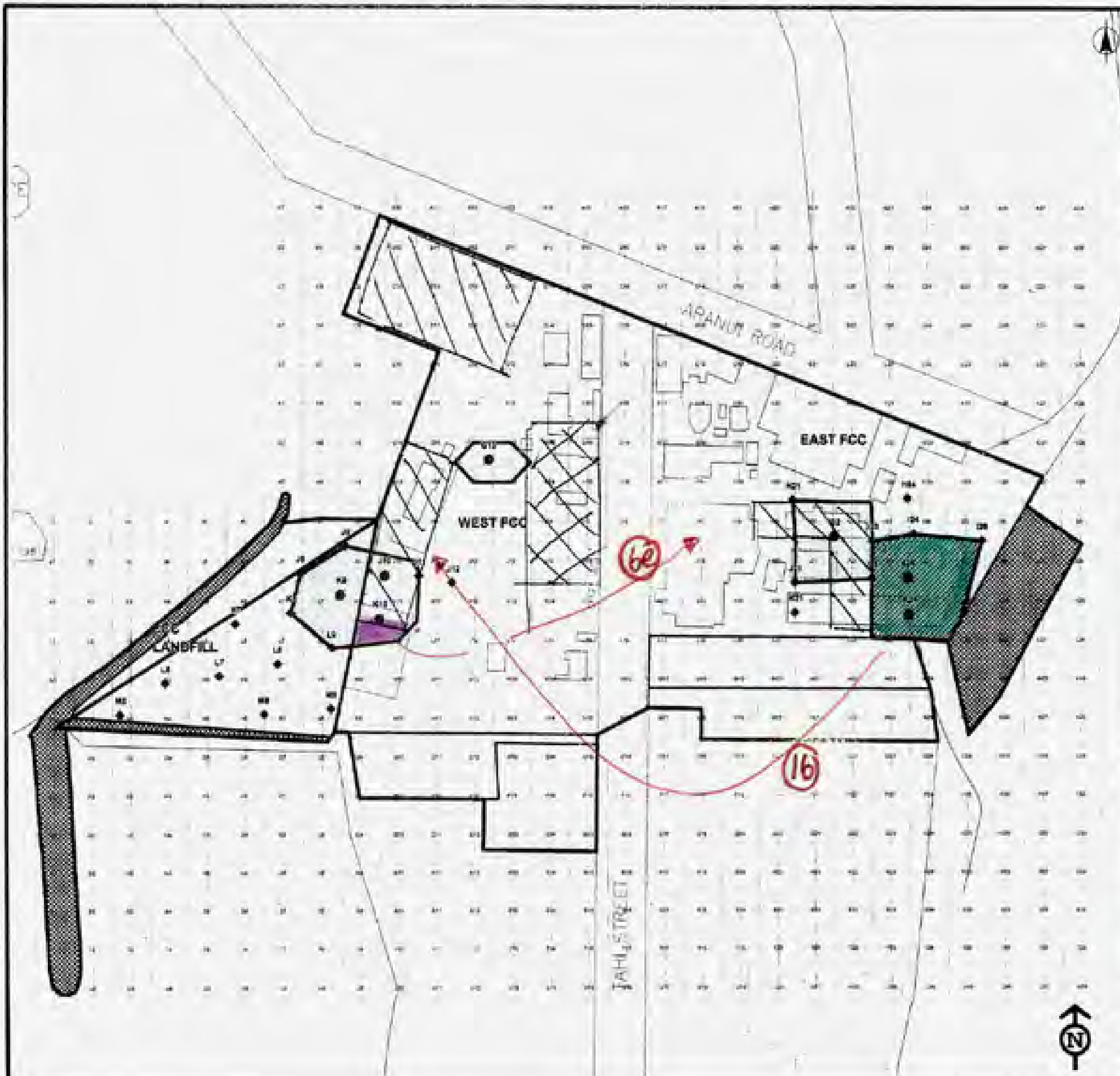
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Check PL		
Approved P Russell			
Scale 1:1,000		Revision 4	
Date March 2002			



Mapua Site Layout - Layer 5

NOTE:
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Layer 5 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

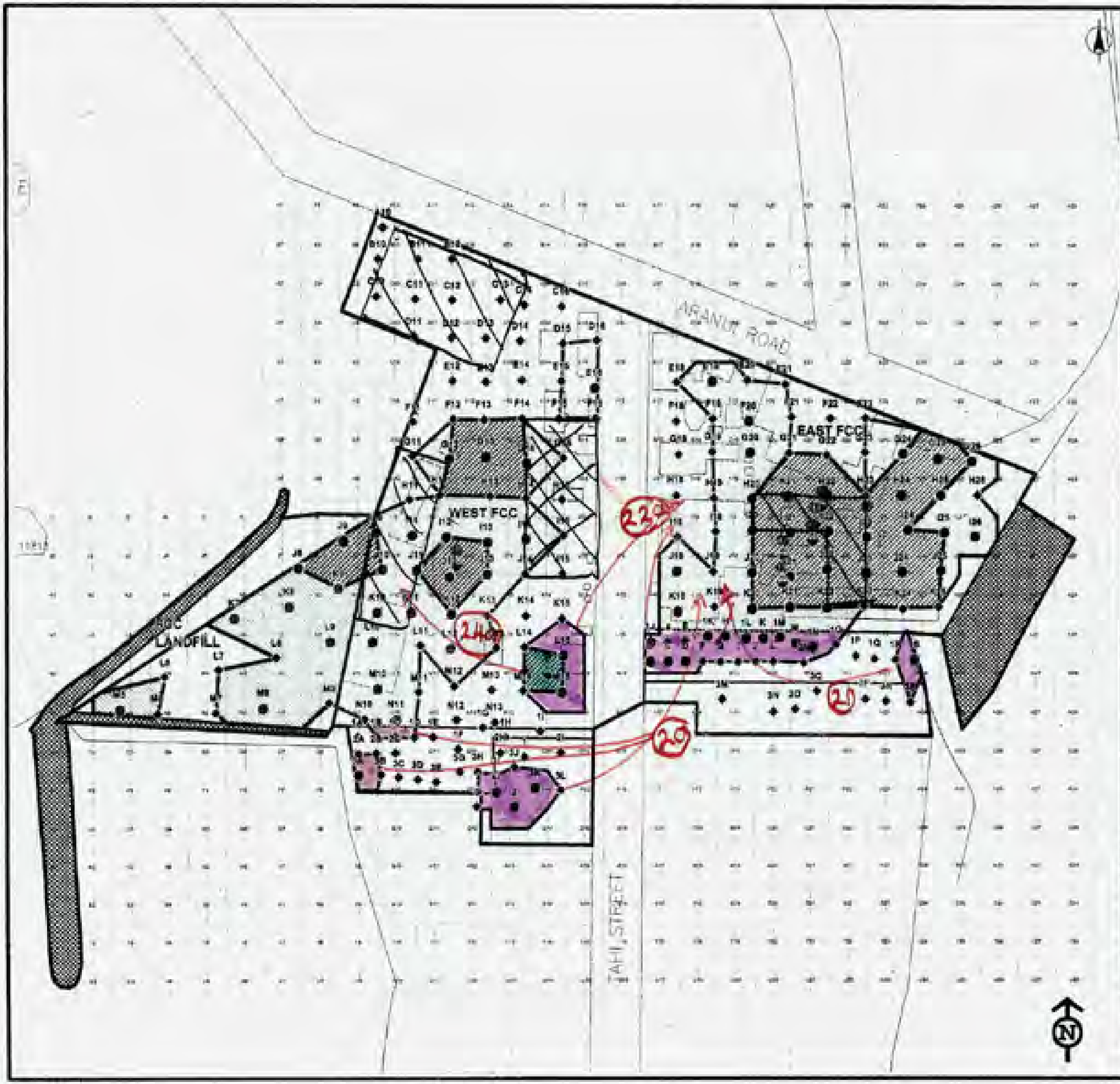
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 5 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

P Rutsel
1:1,500
March 2002
3



Mapua Site Layout - Layer 1

NOTE:

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Layer 1 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

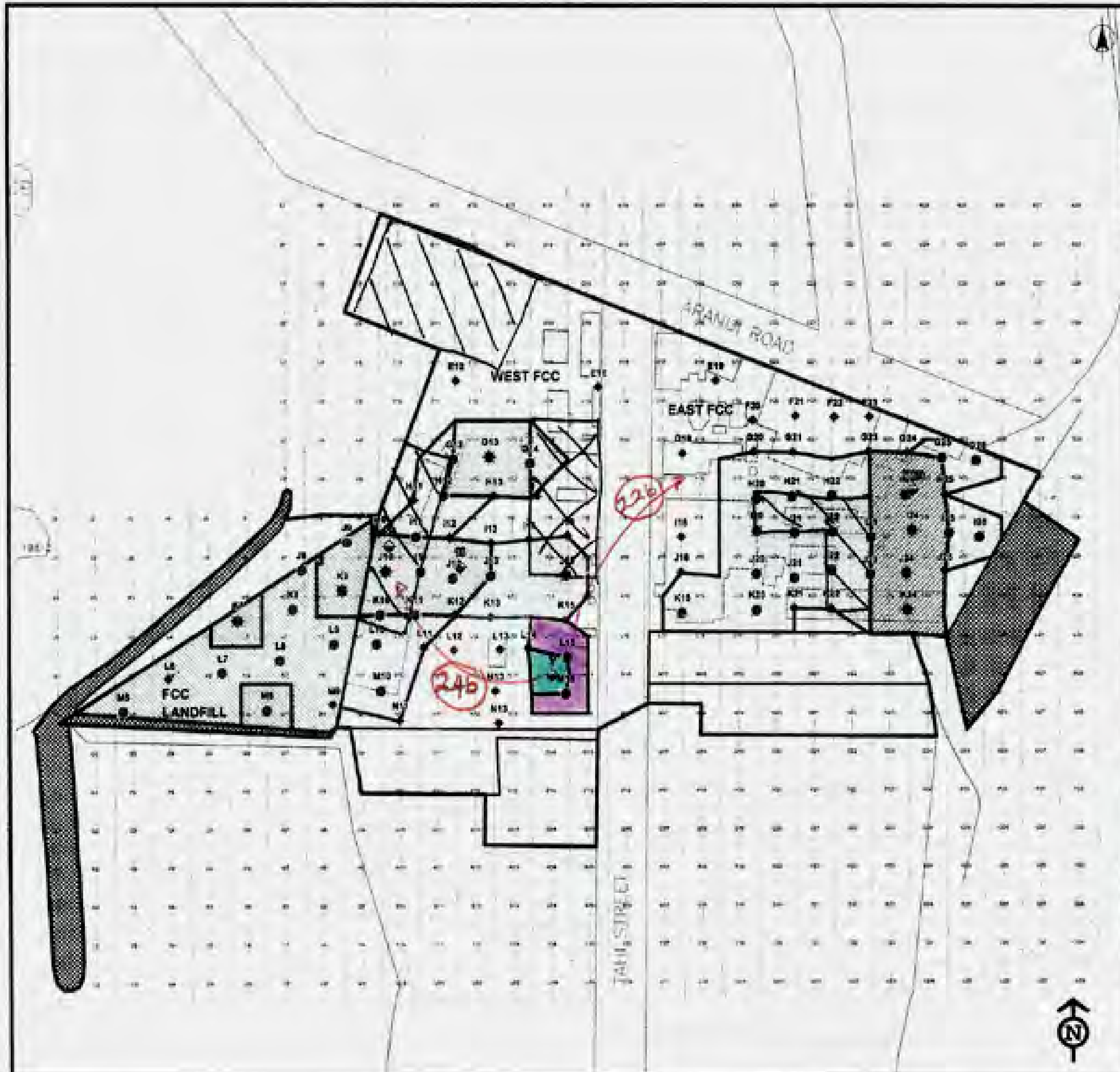
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL		
Approved P Russell			
Scale 1:1,500		Revision	
Date March 2002		3	



Mapua Site Layout - Layer 2

NOTE:

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Layer 2 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

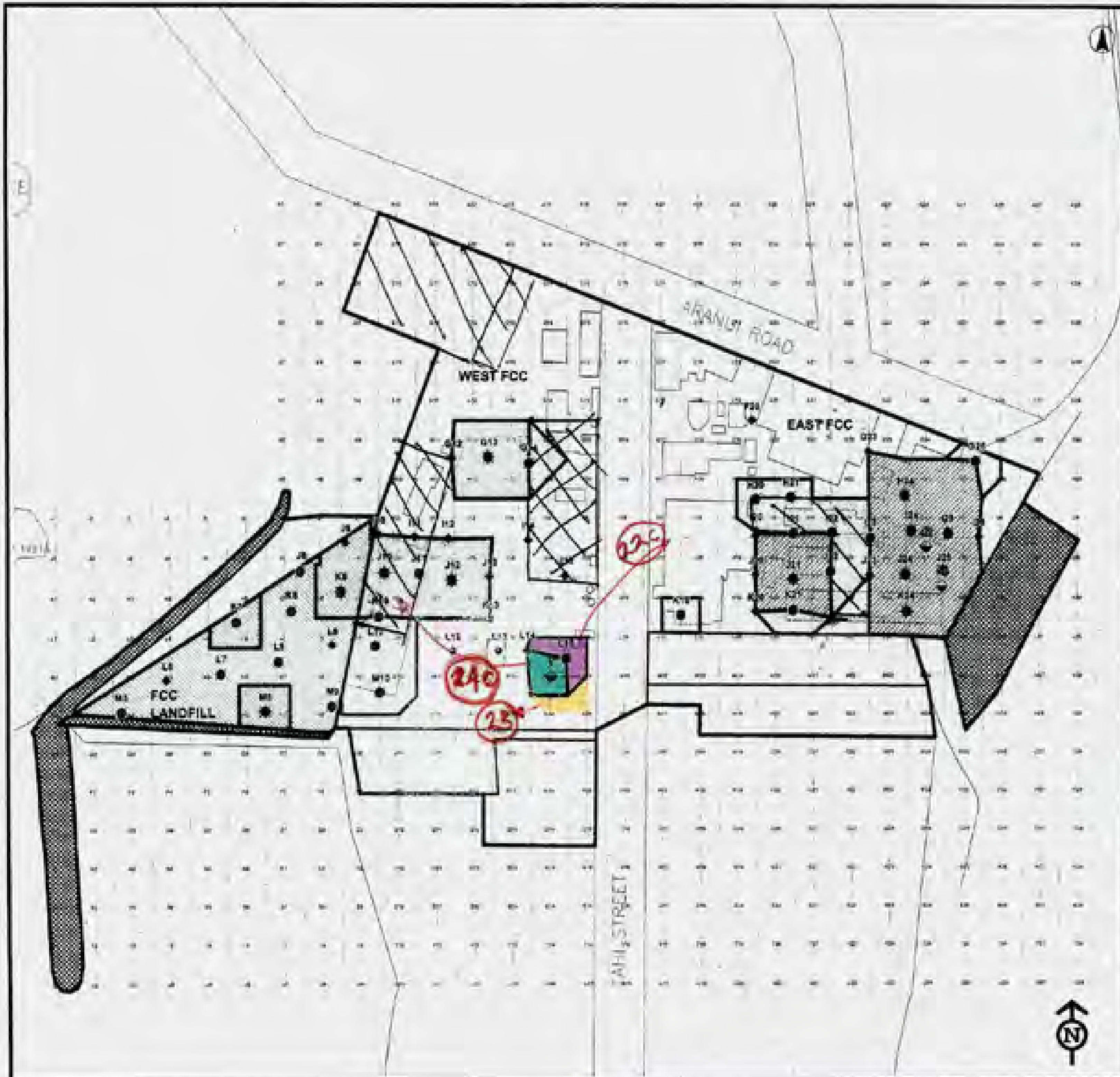
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL
Approved	P Russell
Scale 1:1,500	Revision 4
Date March 2002	



Mapua Site Layout - Layer 3

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Layer 3 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

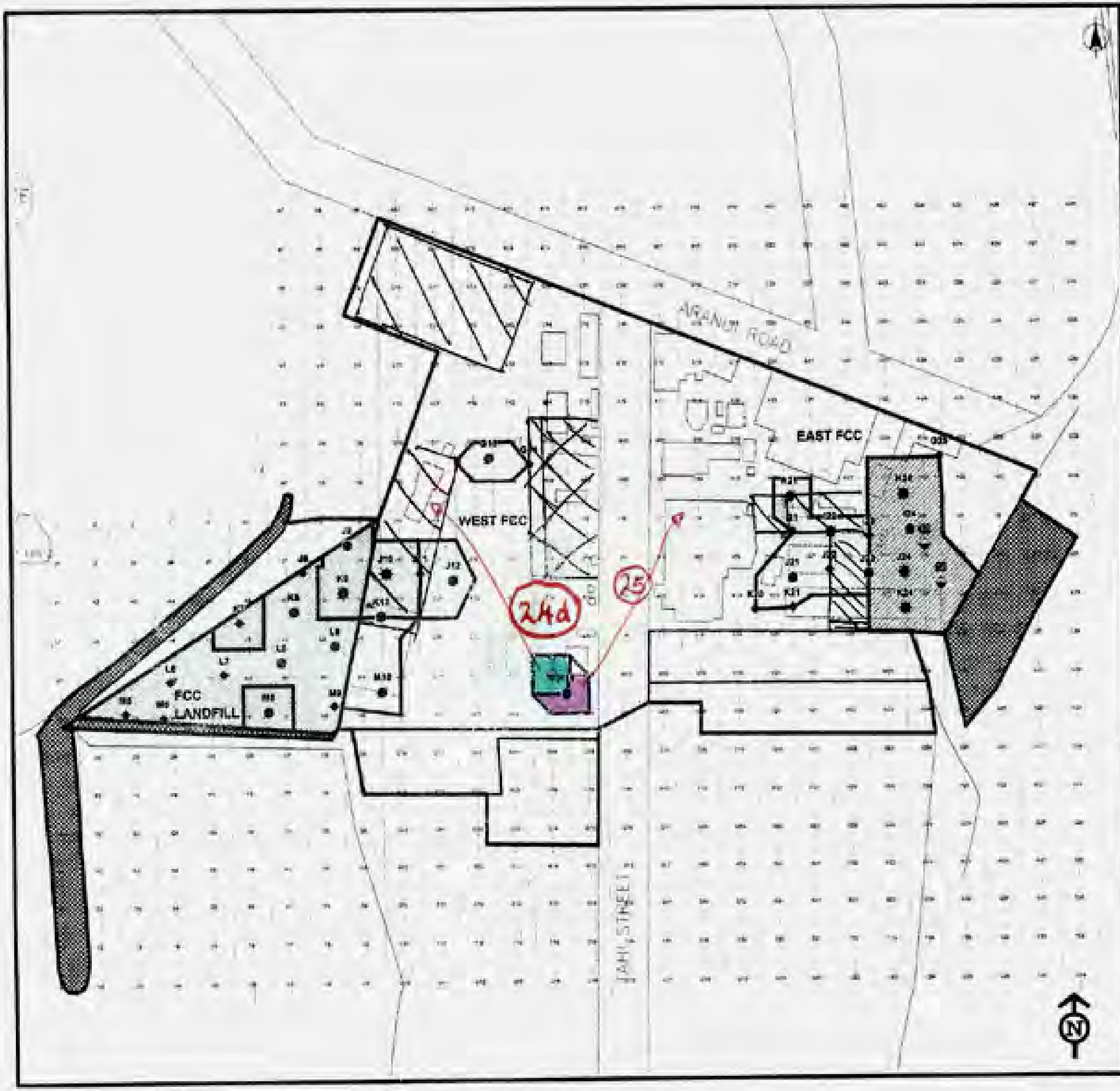
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn: SR	Date: PL		
Approved: P Rossiter			
Scale: 1:1,000		Revision: 4	
Date: March 2002			



Mapua Site Layout - Layer 4

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Layer 4 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

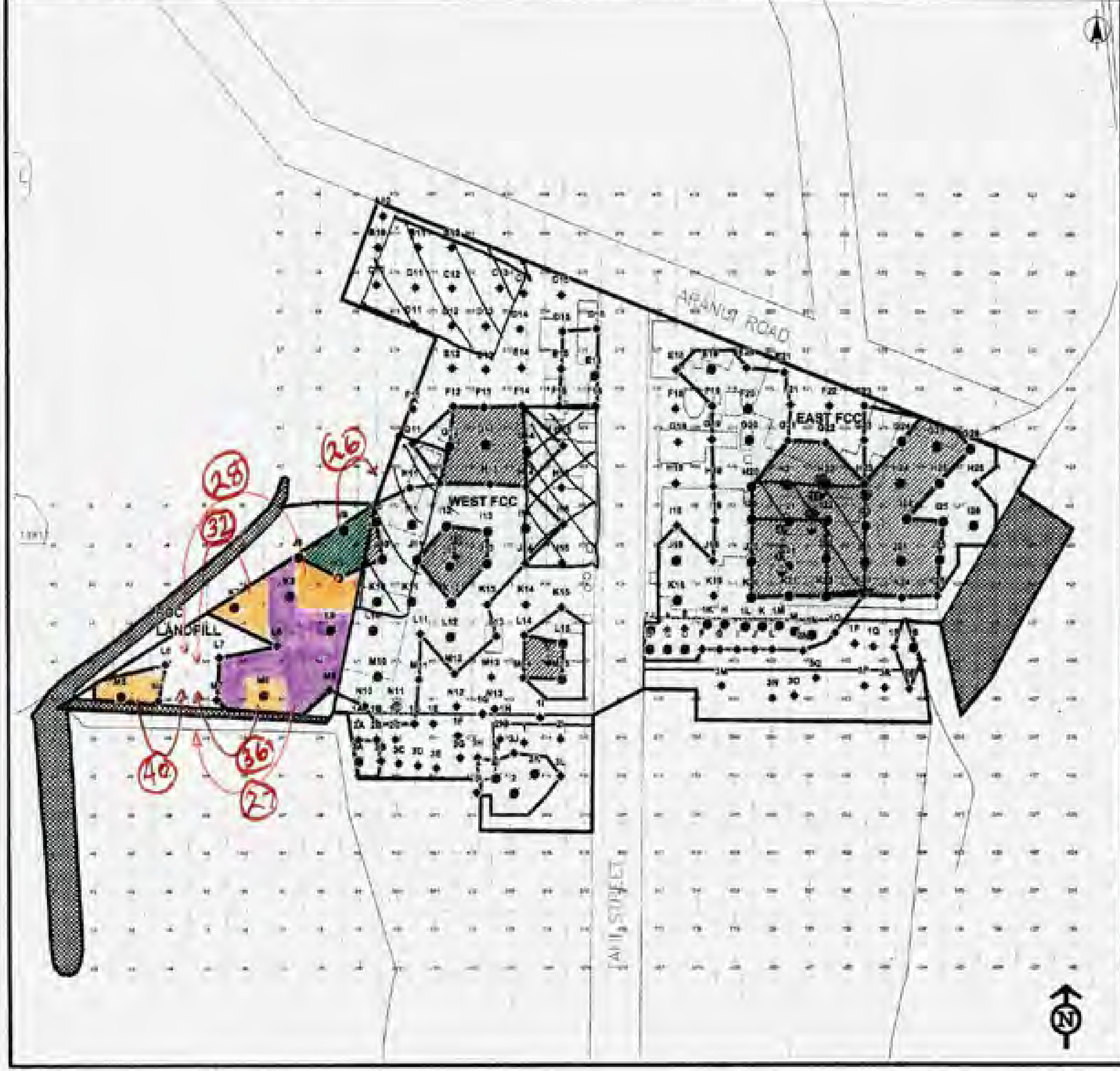
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL		
Approved P Russell			
Scale 1:1,500		Revision 4	
Date March 2002			



Mapua Site Layout - Layer 1

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Layer 1 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

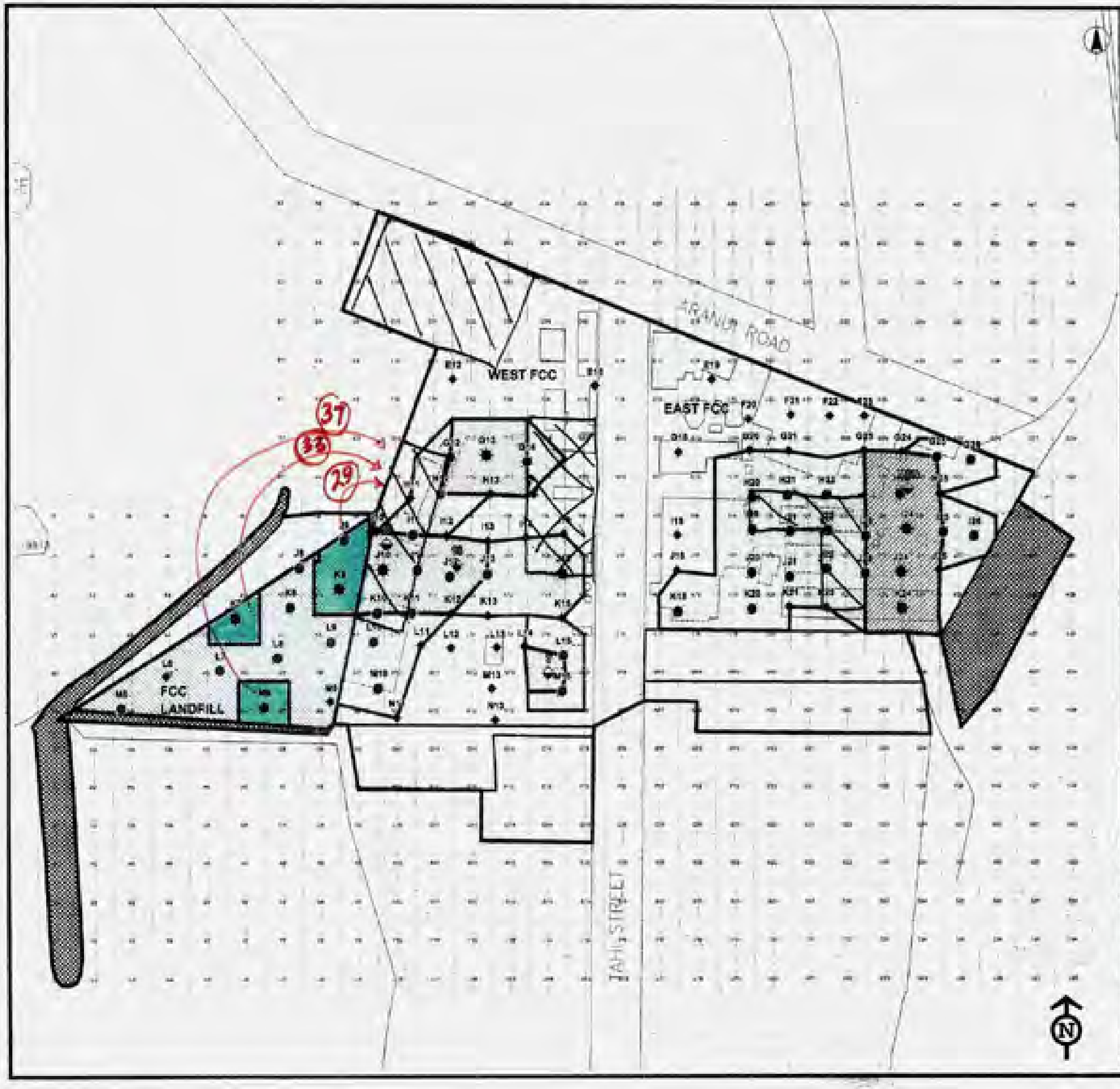
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Checked PL		
Approved P Russell			
Scale 1:1,500		Drawing No. 3	
Date March 2002			



Mapua Site Layout - Layer 2

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Layer 2 Map Legend

Cadastral Property boundaries
The Site
Neighbouring Properties
Landfill Area
Marine Sediments
Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
DDX < 5 Or A+D+(L/10) < 3

East Site
DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

West Site
DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
East Site
West Site
Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
East Site
West Site
Landfill Site

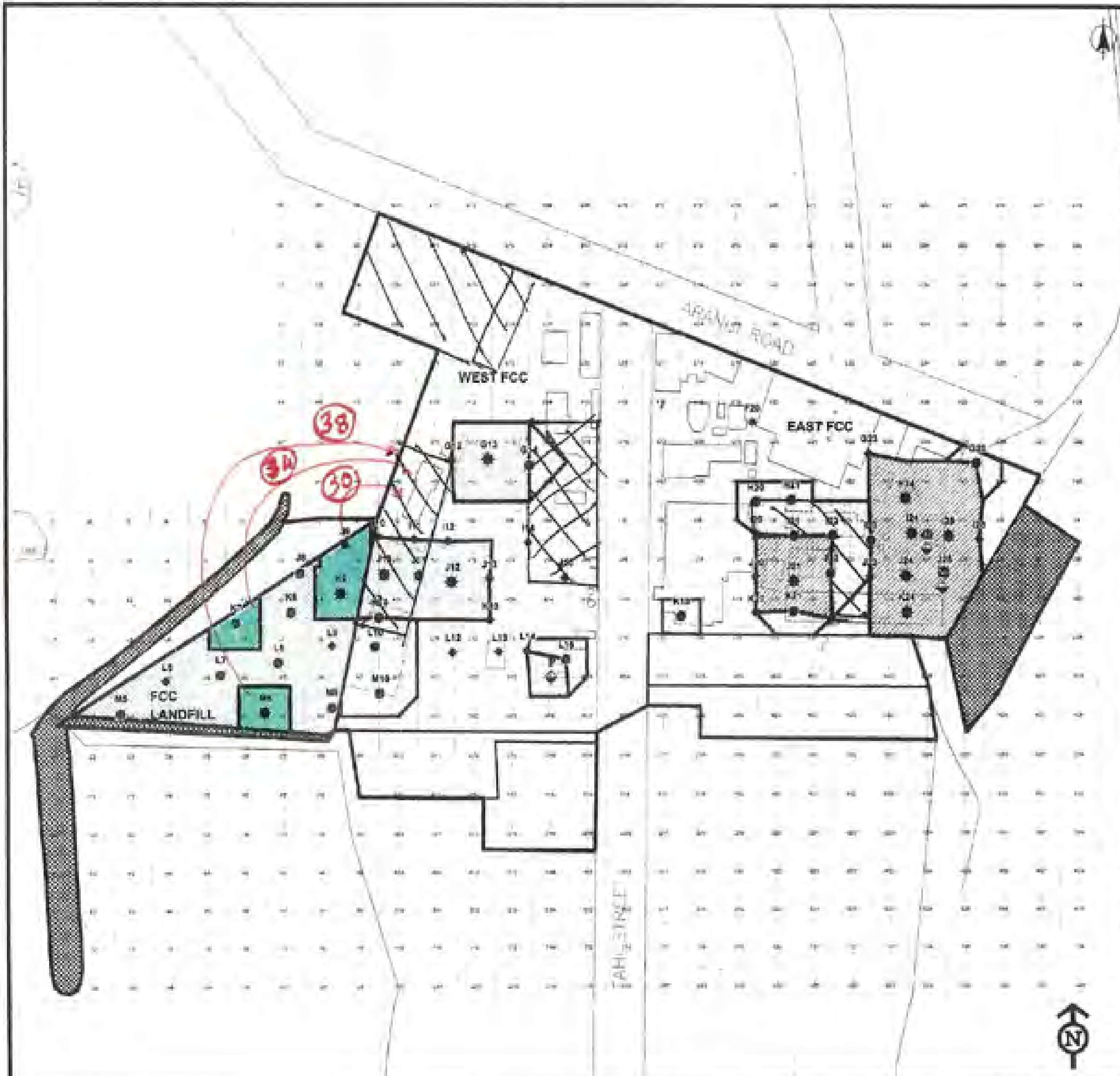
1996 Woodward-Clyde Sample Locations for Layer
DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR	PL
-	P Russell
1:1,500	
March 2002	4



Mapua Site Layout - Layer 3

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Layer 3 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

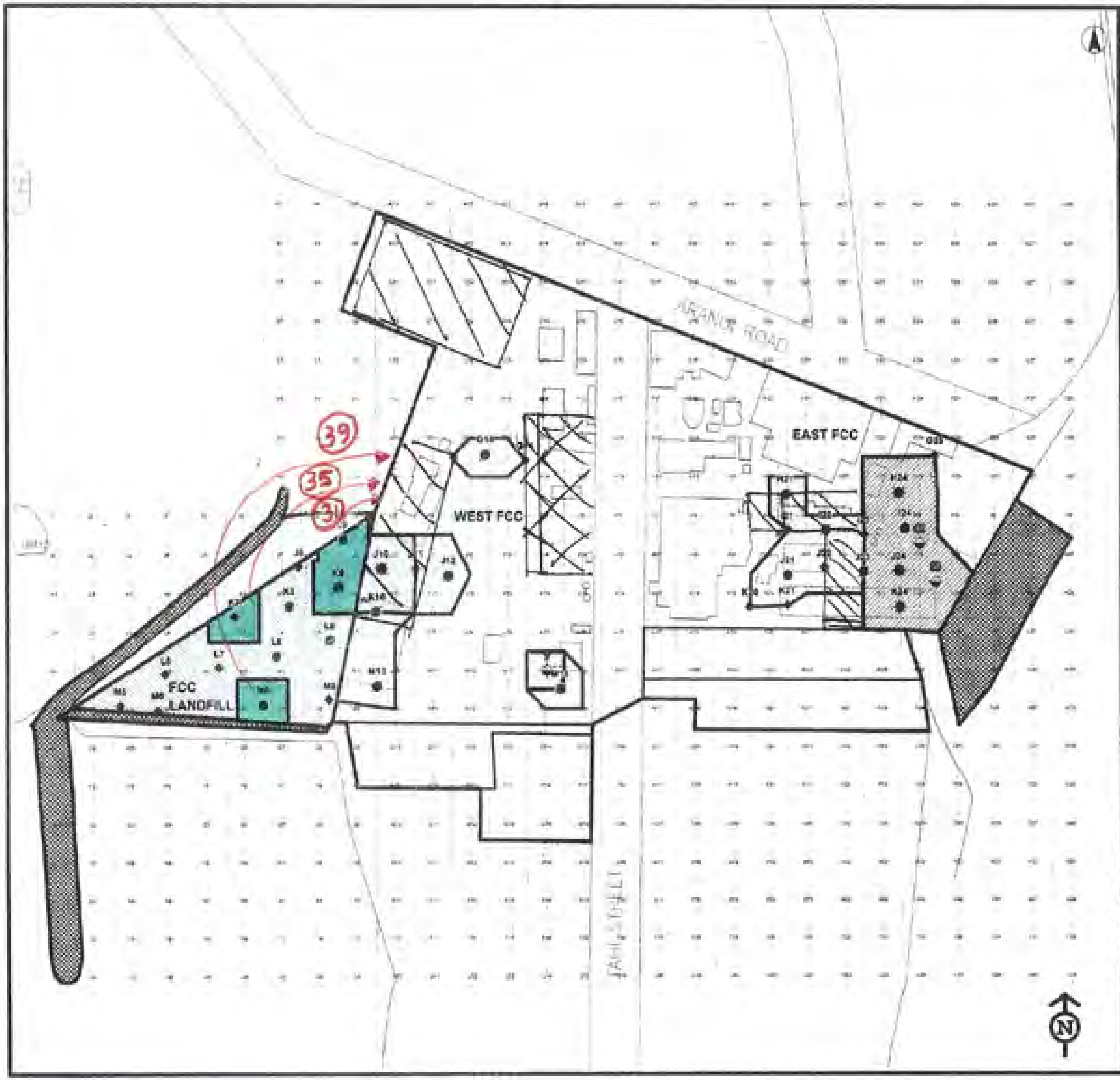
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Chkd PL		
Approved P Rossiter			
Scale 1:1,500		Revision 4	
Date March 2002			



Mapua Site Layout - Layer 4

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Layer 4 Map Legend

Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer
- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

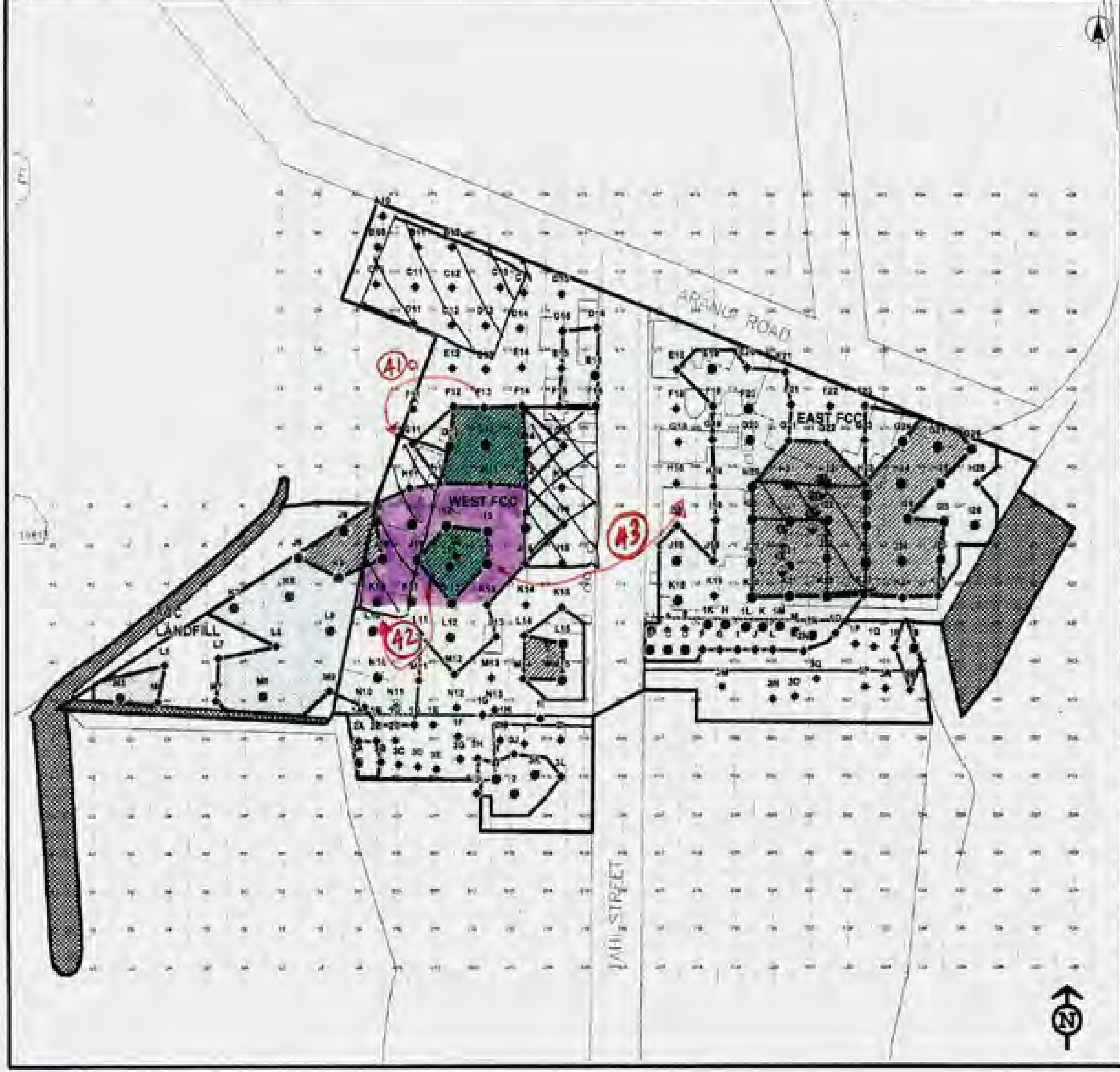
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Check PL		
Approved P Russell			
Scale 1:1,500		Revision	4
Date March 2002			



Mapua Site Layout - Layer 1

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Layer 1 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site
- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)
- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)
- East Site
- West Site
- Landfill Site

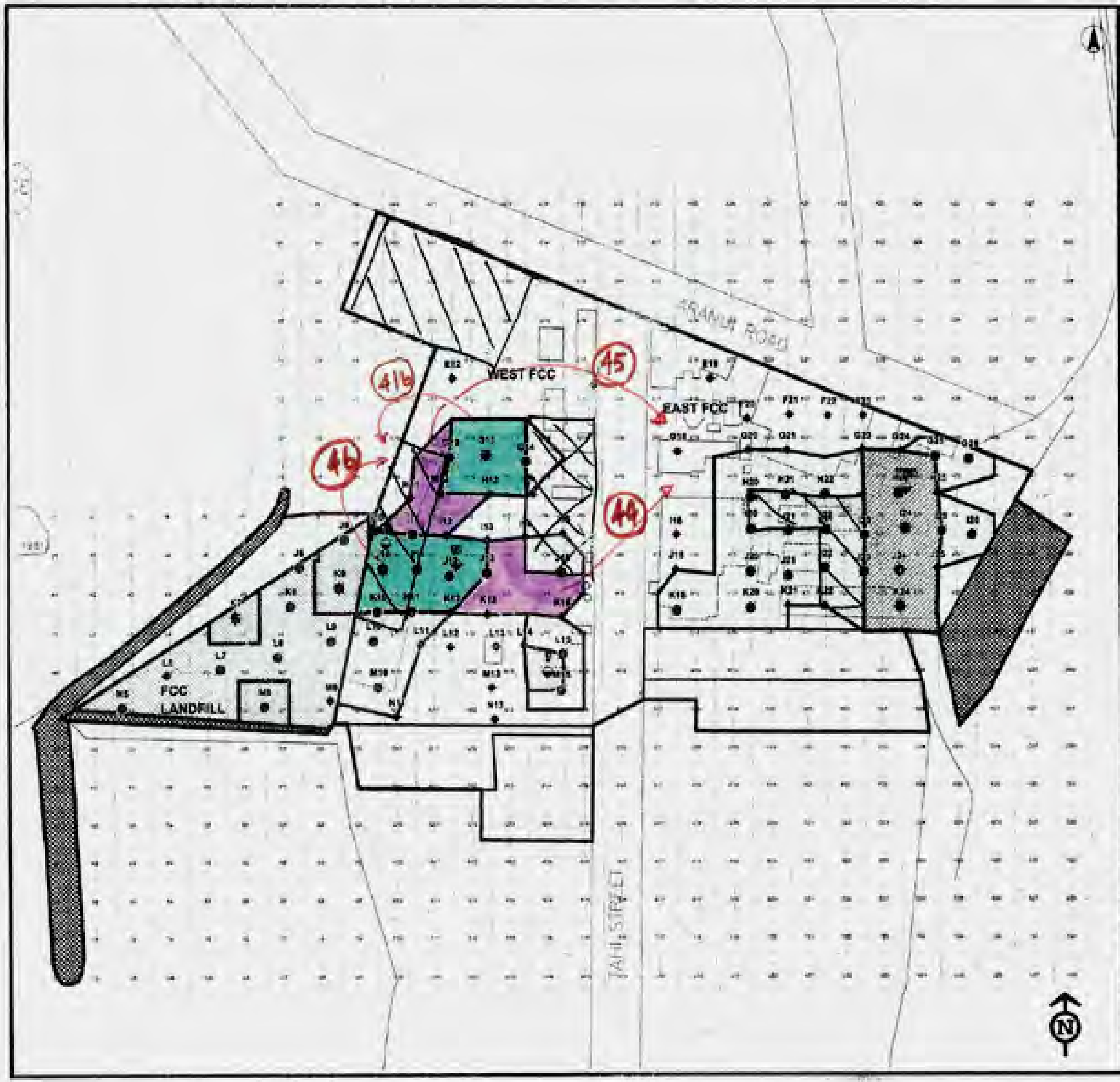
1996 Woodward-Clyde Sample Locations for Layer
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Checked	PL
Approved	P Russell		
Scale	1:1,600	Revision	3
Date	March 2002		



Mapua Site Layout - Layer 2

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Layer 2 Map Legend

Cadastral Property boundaries
The Site
Neighbouring Properties
Landfill Area
Marine Sediments
Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

DDX < 5 Or A+D+(L/10) < 3

East Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

West Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

East Site
West Site
Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

East Site
West Site
Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

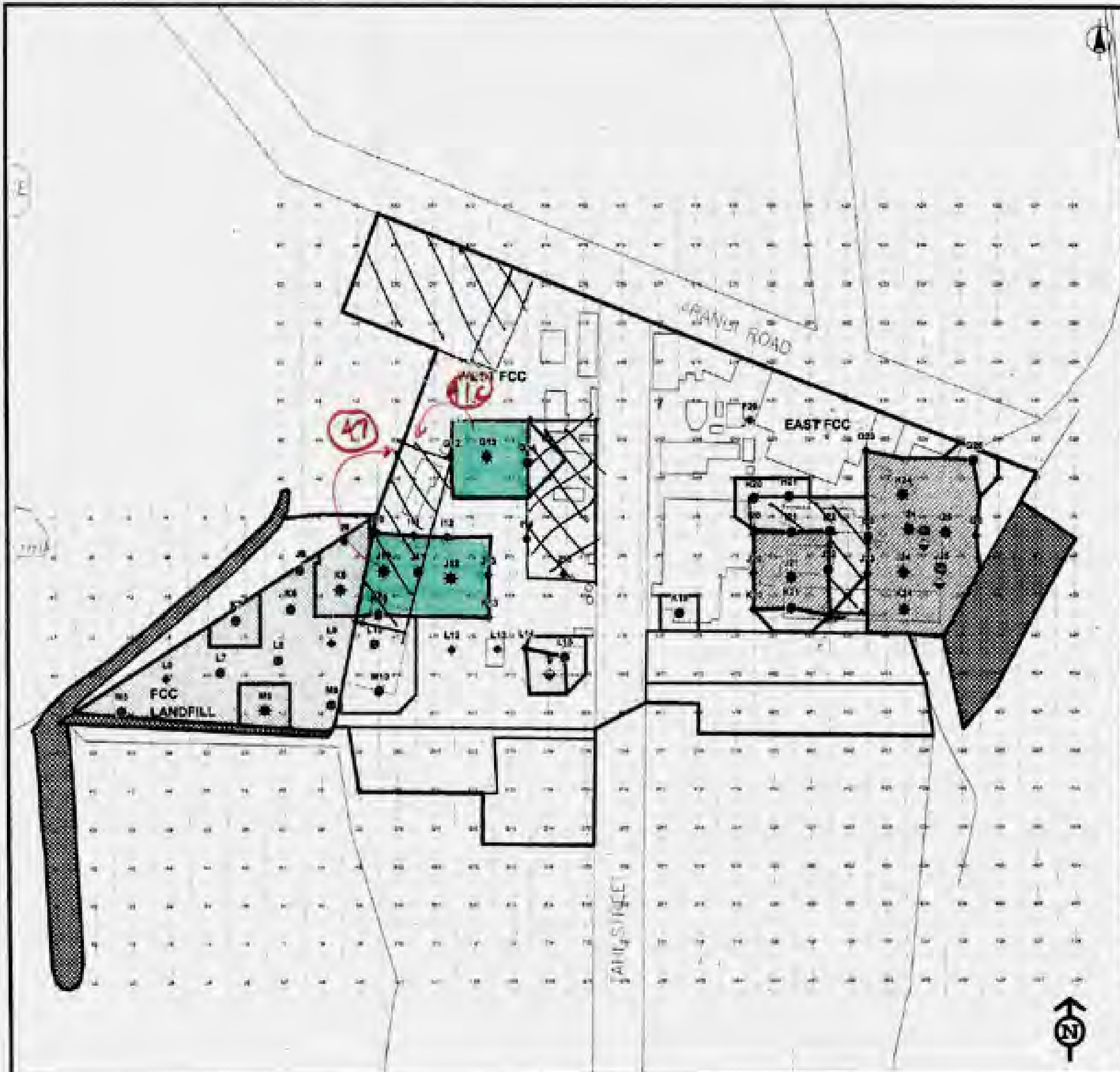
DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR	PL		
Approved	P Russell		
Scale	1:1,500	Revision	
Date	March 2002	4	



Mapua Site Layout - Layer 3

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 3 Map Legend

Cadastral Property boundaries

- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments

Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

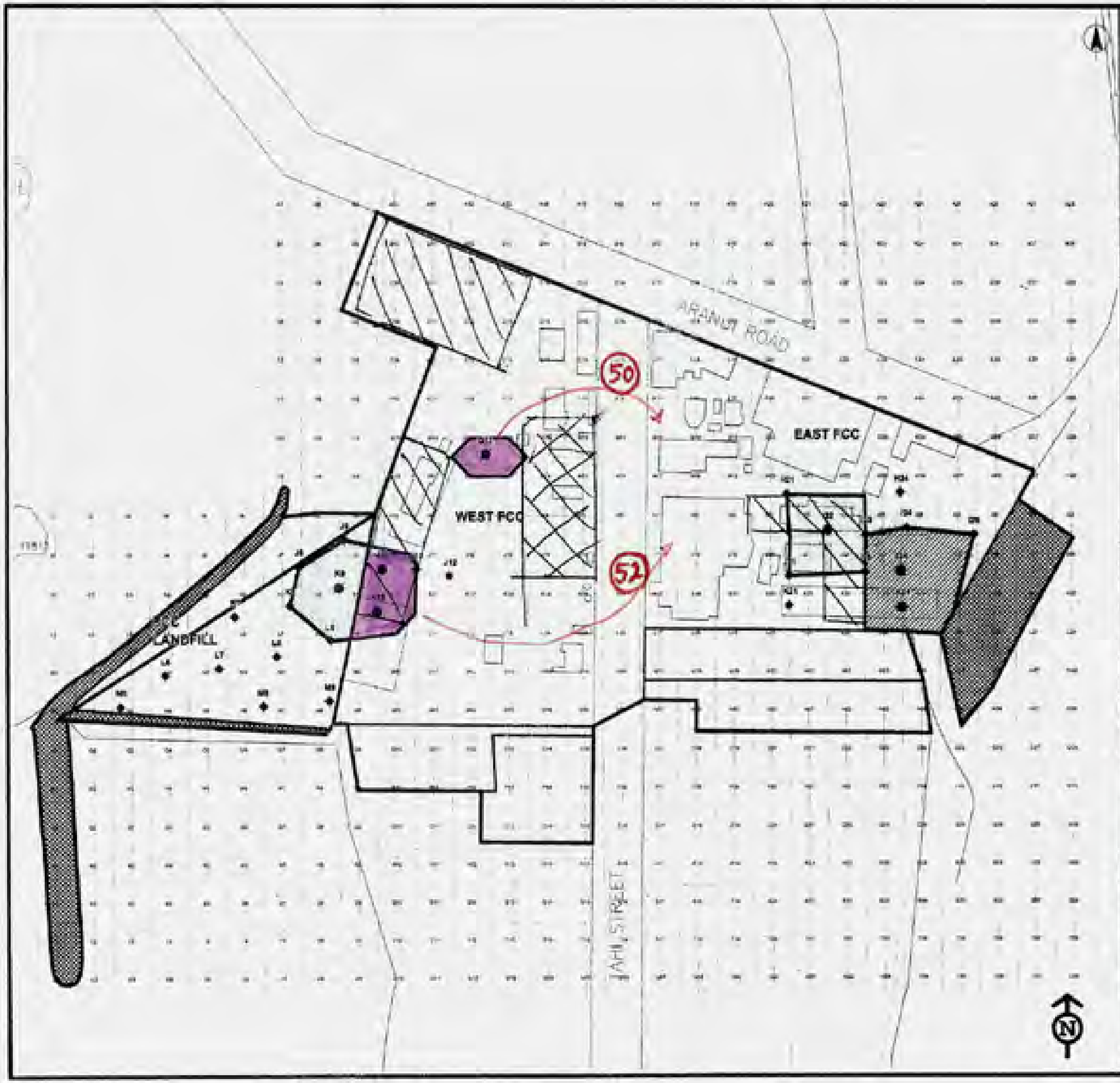
- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

SR		PL	
P Rosset			
1:1,500		4	
March 2002			



Mapua Site Layout - Layer 5

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 5 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

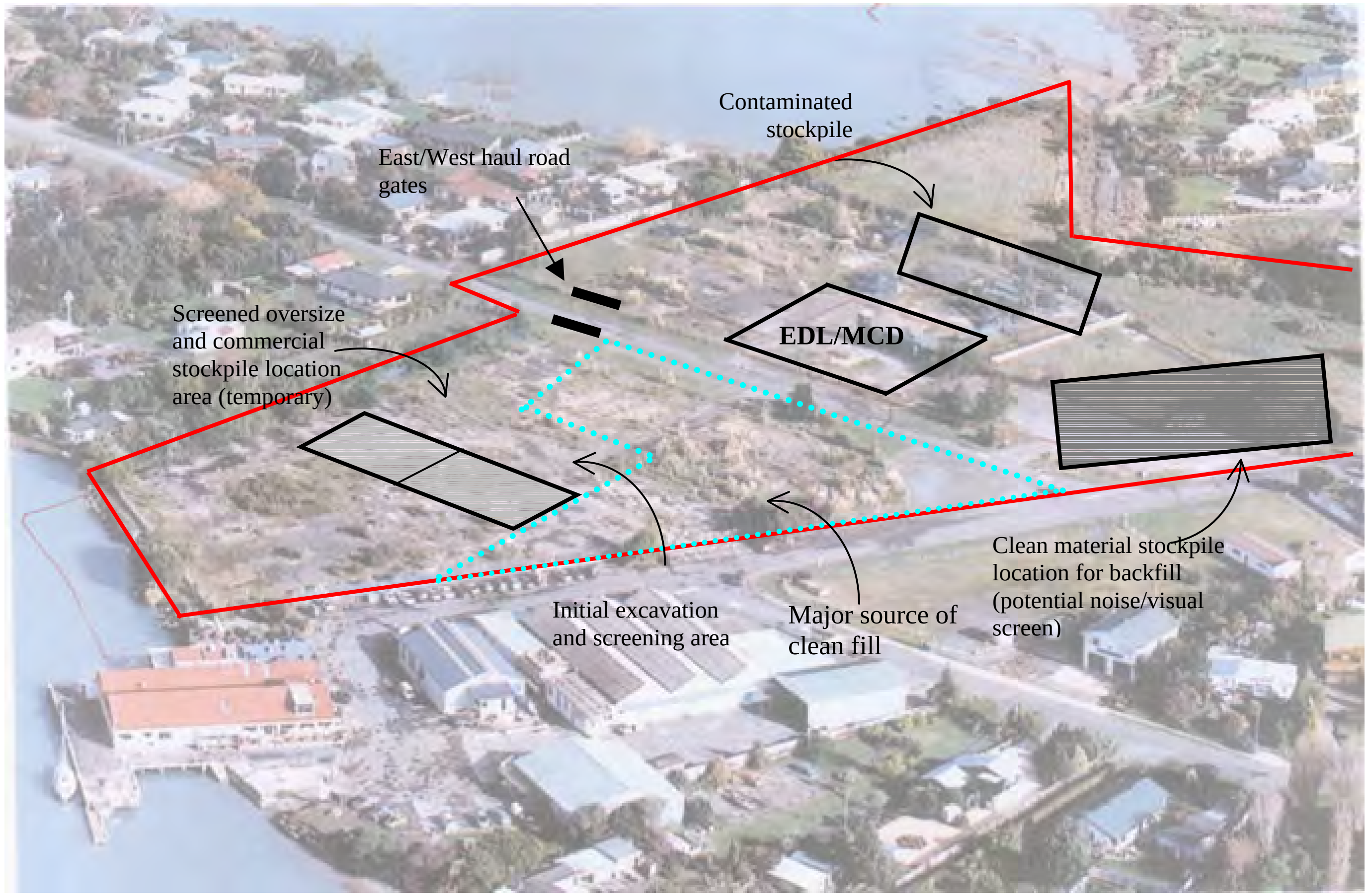
TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 5 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

	SR		PL
	P Russell		
	1:1,300		3
	March 2002		

Appendix 8
Proposed stockpile locations


Contaminated stockpile
East/West haul road gates
EDL/MCD
Screened oversize and commercial stockpile location area (temporary)
Initial excavation and screening area
Major source of clean fill
Clean material stockpile location for backfill (potential noise/visual screen)

Appendix 9
Eves Valley Landfill Acceptance Criteria

Table A2: Summary of criteria for chemical contaminants in non-liquid waste classification (See also Table 6 in Section 3.4.3.)

Waste classification[1]	Criteria[2] for classification (any of the alternative options given)	Comments
Inert	1. **SCC test values** ≤ CT1.	TCLP test not required.
	2. **TCLP test values** ≤ TCLP1 <u>and</u> **SCC test values** ≤ SCC1.	
	3. **TCLP test values** ≤ TCLP1 <u>and</u> **SCC test values** > SCC1 <u>and</u> immobilisation[3] is EPA approved.	Without EPA approval of immobilisation, classify as solid, industrial or hazardous.
Solid	1. **SCC test values** ≤ CT2.	TCLP test not required.
	2. TCLP1 < **TCLP test values** ≤ TCLP2 <u>and</u> **SCC test values** ≤ SCC2.	
	3. TCLP1 < **TCLP test values** ≤ TCLP2 <u>and</u> **SCC test values** > SCC2 <u>and</u> the immobilisation[3] is EPA approved.	Without EPA approval of immobilisation, classify as industrial or hazardous.
Industrial	1. **SCC test values** ≤ CT3.	TCLP test not required.
	2. TCLP2 < **TCLP test values** ≤ TCLP3 <u>and</u> **SCC test values** ≤ SCC3.	
	3. **TCLP test values** ≤ TCLP3 <u>and</u> SCC2 < **SCC test values** ≤ SCC3.	
	4. TCLP2 < **TCLP test values** ≤ TCLP3 <u>and</u> **SCC test values** > SCC3 <u>and</u> immobilisation [3] is EPA approved.	Without EPA approval of immobilisation, classify as hazardous.
Hazardous	1. **TCLP test values** > TCLP3.	Store or treat waste as appropriate.
	2. **TCLP test values** ≤ TCLP3 <u>and</u> **SCC test values** > SCC3 <u>and</u> immobilisation is not EPA approved.	Store or treat waste as appropriate.

Notes:

1. See also the general rules relating to waste classification (listed earlier in Part 5) for other criteria that must be satisfied before the waste can be classified.
2. These criteria apply to each toxic and ecotoxic contaminant present in the waste (see Tables A3 and A4).
3. In certain cases the EPA will consider specific conditions, such as the segregation of such waste from all other types of waste in a monofill or a monocell, in order to achieve a greater margin of safety against a possible failure of the immobilisation in the future. Information about the construction and operation of a monofill/monocell is available in the *Draft Environmental Guidelines for Industrial Waste Landfilling,* (EPA 1998a).

Worked examples of this assessment and classification process are given later in this part of the Appendix.

See additional contaminants for tables A3 and A4 gazetted 3 August 2001.

Table A3: Contaminant threshold values for waste classification of non-liquid wastes without doing the leaching test[1]

	Maximum values of *total concentration* for classification **without** TCLP.			
Contaminant	**Inert waste**	**Solid waste**	**Industrial waste**	**CAS registry number**
	CT1 (mg/kg)	CT2 (mg/kg)	CT3 (mg/kg)	
Arsenic	10	100	400	
Benzene	1	10	40	71-43-2
Benzo(a)pyrene[2]	0.08	0.8	3.2	50-32-8
Beryllium	2	20	80	
Cadmium	2	20	80	
Carbon tetrachloride	1	10	40	56-23-5
Chlorobenzene	200	2000	8000	108-90-7
Chloroform	12	120	480	67-66-3
Chromium (VI)[3]	10	100	400	
m-Cresol	400	4000	16000	108-39-4
o-Cresol	400	4000	16000	95-48-7
p-Cresol	400	4000	16000	106-44-5
Cresol (total)	400	4000	16000	1319-77-3
Cyanide (amenable)[4]	7	70	280	
Cyanide (total)	32	320	1280	
2,4-D	20	200	800	94-75-7
1,2-Dichlorobenzene	8.6	86	34.4	95-50-1
1,4-Dichlorobenzene	15	150	600	106-46-7
1,2-Dichloroethane	1	10	40	107-06-2
1,1-Dichloroethylene	1.4	14	56	75-35-4
Dichloromethane	17.2	172	688	75-09-2
2,4-Dinitrotoluene	0.26	2.6	10.4	121-14-2
Ethylbenzene	60	600	2400	100-41-4
Fluoride	300	3000	12000	
Lead	10	100	400	
Mercury	0.4	4	16	
Methyl ethyl ketone	400	4000	16000	78-93-3
Molybdenum	10	100	400	
Nickel	4	40	160	
Nitrobenzene	4	40	160	98-95-3
C6-C9 petroleum hydrocarbons	N/A[6]	N/A[6]	N/A[6]	–
C10-C36 petroleum hydrocarbons	N/A[6]	N/A[6]	N/A[6]	–
Phenol (non-halogenated)	28.8	288	1152	108-95-2
Polychlorinated biphenyls[5]	N/A[6]	N/A[6]	N/A[6]	1336-36-3

Table A3: Contaminant threshold values for waste classification of non-liquid wastes without doing the leaching test[1]

Contaminant	Maximum values of *total concentration* for classification **without** TCLP. Inert waste CT1 (mg/kg)	Solid waste CT2 (mg/kg)	Industrial waste CT3 (mg/kg)	CAS registry number
Polycyclic aromatic hydrocarbons (total)[5]	N/A[6]	N/A[6]	N/A[6]	–
Scheduled chemicals[5]	N/A[6]	N/A[6]	N/A[6]	Refer to Appendix 5
Selenium	2	20	80	
Silver	10	100	400	
Styrene (vinyl benzene)	6	60	240	100-42-5
1,1,1,2-Tetrachloroethane	20	200	800	630-20-6
1,1,2,2-Tetrachloroethane	2.6	26	104	79-34-5
Tetrachloroethylene	1.4	14	56	127-18-4
Toluene	28.8	288	1152	108-88-3
1,1,1-Trichloroethane	60	600	2400	71-55-6
1,1,2-Trichloroethane	2.4	24	96	79-00-5
Trichloroethylene	1	10	40	79-01-6
2,4,5-Trichlorophenol	800	8000	32000	95-95-4
2,4,6-Trichlorophenol	4	40	160	88-06-2
Vinyl chloride	0.4	4	16	75-01-4
Xylenes (total)	100	1000	4000	1330-20-7

Notes to Table A3:

1. For organic and inorganic chemical contaminants not listed in Table A3, contact the EPA for disposal requirements. Note that aluminium, barium, boron, chromium (0 and III oxidation states), cobalt, copper, iron, manganese, vanadium and zinc have deliberately not been listed in this table and need not be tested for.
2. There may be a need for the laboratory to concentrate the sample to achieve the TCLP limit value for benzo(a)pyrene with confidence.
3. These limits apply to chromium in the +6 oxidation state only.
4. Analysis for cyanide (amenable) is the established method used to assess potentially leachable cyanide. Other methods may be considered by the EPA if it can be demonstrated that these methods yield the same information.
5. Scheduled chemicals, polycyclic aromatic hydrocarbons and polychlorinated biphenyls are assessed by using SCC1, SCC2 and SCC3. No TCLP analysis is required.
6. N/A means not applicable, but, see Table A4 for SCC criteria.

See additional contaminants for tables A3 and A4 gazetted 3 August 2001.

Table A4: Leachable concentration (TCLP) and total concentration (SCC) values for non-liquid waste classification[1]

	Maximum values for *leachable concentration* **and** *total concentration* when used **together.** Inert waste	Solid waste	Industrial waste	

Contaminant	Leachable concentration	Total concentration	Leachable concentration	Total concentration	Leachable concentration	Total concentration	**CAS registry number**
	TCLP1 (mg/L)	SCC1 (mg/kg)	TCLP2 (mg/L)	SCC2 (mg/kg)	TCLP3 (mg/L)	SCC3 (mg/kg)	
Arsenic	0.5	500	5.0[2]	500	20	2000	
Benzene	0.05	18	0.5[2]	18	2	72	71-43-2
Benzo(a)pyrene[3]	0.004[3]	1	0.04[4]	10	0.16	23	50-32-8
Beryllium	0.1	100	1.0[5]	100	4	400	
Cadmium	0.1	100	1.0[2]	100	4	400	
Carbon tetrachloride	0.05	18	0.5[2]	18	2	72	56-23-5
Chlorobenzene	10	3600	100[2]	3600	400	14400	108-90-7
Chloroform	0.6	216	6[2]	216	24	864	67-66-3
Chromium (VI)[7]	0.5	1900	5[2]	1900	20	7600	
m-Cresol	20	7200	200[2]	7200	800	28800	108-39-4
o-Cresol	20	7200	200[2]	7200	800	28800	95-48-7
p-Cresol	20	7200	200[2]	7200	800	28800	106-44-5
Cresol (total)	20	7200	200[2]	7200	800	28800	1319-77-3
Cyanide (amenable)[8,9]	0.35	300	3.5[8]	300	14	1200	
Cyanide (total)[8]	1.6	5900	16[8]	5900	64	23600	
2,4-D	1	360	10[2]	360	40	1440	94-75-7
1,2-Dichlorobenzene	0.43	155	4.3[2]	155	17.2	620	95-50-1
1,4-Dichlorobenzene	0.75	270	7.5[2]	270	30	1080	106-46-7
1,2-Dichloroethane	0.05	18	0.5[2]	18	2	72	107-06-2
1,1-Dichloroethylene	0.07	25	0.7[2]	25	2.8	100	75-35-4
Dichloromethane	0.86	310	8.6[2]	310	34.4	1240	75-09-2
2,4-Dinitrotoluene	0.013	4.68	0.13[2]	4.68	0.52	18.7	121-14-2
Ethylbenzene	3	1080	30[6]	1080	120	4320	100-41-4
Fluoride	15	10000	150[6]	10000	600	40000	
Lead	0.5	1500	5[2]	1500	20	6000	
Mercury	0.02	50	0.2[2]	50	0.8	200	
Methyl ethyl ketone	20	7200	200[2]	7200	800	28800	78-93-3
Molybdenum	0.5	1000	5[6]	1000	20	4000	
Nickel	0.2	1050	2[6]	1050	8	4200	
Nitrobenzene	0.2	72	2[2]	72	8	288	98-95-3
C6-C9 petroleum hydrocarbons[14]	N/A[14]	650	N/A[14]	650	N/A[14]	2600	–
C10-C36 petroleum hydrocarbons[14]	N/A[14]	5000	N/A[14]	10000	N/A[14]	40000	–

Table A4: Leachable concentration (TCLP) and total concentration (SCC) values for non-liquid waste classification[1]

Contaminant	Maximum values for *leachable concentration* **and** *total concentration* when used **together.** Inert waste: Leachable concentration TCLP1 (mg/L)	Inert waste: Total concentration SCC1 (mg/kg)	Solid waste: Leachable concentration TCLP2 (mg/L)	Solid waste: Total concentration SCC2 (mg/kg)	Industrial waste: Leachable concentration TCLP3 (mg/L)	Industrial waste: Total concentration SCC3 (mg/kg)	CAS registry number
Phenol (non-halogenated)	1.44	518	14.4[10]	518	57.6	2073	108-95-2
Polychlorinated biphenyls [11]	N/A[11]	2	N/A[11]	<50	N/A[11]	<50	1336-36-3
Polycyclic aromatic hydrocarbons(total)[11,12]	N/A[11]	200	N/A[11]	200	N/A[11]	800	-
Scheduled chemicals[11, 13]	N/A[11]	1	N/A[11]	<50	N/A[11]	<50	Refer to Appendix 5
Selenium	0.1	50	1[2]	50	4	200	
Silver	0.5	180	5.0[2]	180	20	720	
Styrene (vinyl benzene)	0.3	108	3[6]	108	12	432	100-42-5
1,1,1,2 – Tetrachloroethane	1	360	10[2]	360	40	1440	630-20-6
1,1,2,2-Tetrachloroethane	0.13	46.8	1.3[2]	46.8	5.2	187.2	79-34-5
Tetrachloroethylene	0.07	25.2	0.7[2]	25.2	2.8	100.8	127-18-4
Toluene	1.44	518	14.4[10]	518	57.6	2073	108-88-3
1,1,1-Trichloroethane	3	1080	30[2]	1080	120	4320	71-55-6
1,1,2-Trichloroethane	0.12	43.2	1.2[2]	43.2	4.8	172.8	79-00-5
Trichloroethylene	0.05	18	0.5[2]	18	2	72	79-01-6
2,4,5-Trichlorophenol	40	14400	400[2]	14400	1600	57600	95-95-4
2,4,6-Trichlorophenol	0.2	72	2[2]	72	8	288	88-06-2
Vinyl chloride	0.02	7.2	0.2[2]	7.2	0.8	28.8	75-01-4
Xylenes (total)	5	1800	50[15]	1800	200	7200	1330-20-7

Notes to Table A4:

1. For organic and inorganic chemical contaminants not listed in Table A4, contact the EPA for disposal requirements. Note that aluminium, barium, boron, chromium (0 and III oxidation states), cobalt, copper, iron, manganese, vanadium and zinc have deliberately not been listed in this table and need not be tested for.
2. USEPA final rule for TCLP levels (USEPA 1990a).
3. There may be a need for the laboratory to concentrate the sample to achieve the TCLP limit value for benzo(a)pyrene with confidence.
4. Calculated from: *Hazardous Waste: Identification and Listing; Proposed Rule* (USEPA 1995).
5. Calculated from: DiMarco & Buckett (1996); Imray & Langley (1996).

6. Calculated from: *Australian Drinking Waters Guidelines* (NHMRC 1994).
7. These limits apply to chromium in the +6 oxidation state only.
8. *Land Disposal Restrictions for Newly Identified and Listed Hazardous Wastes and Hazardous Soil; Proposed Rule* (USEPA 1993)
9. Analysis for cyanide (amenable) is the established method used to assess the potentially leachable cyanide. Other methods may be considered by the EPA if it can be demonstrated that these methods yield the same information.
10. Proposed level for phenol and toluene (USEPA 1990b).
11. Scheduled chemicals, polychlorinated biphenyls and polycyclic aromatic hydrocarbons are assessed by using SCC1, SCC2 and SCC3. No TCLP analysis is required.
12. Polycyclic aromatic hydrocarbons (total) is assessed as the total concentration of 16 USEPA Priority Pollutant PAHs, as follows:

PAH name	CAS Registry No.	PAH name	CAS Registry No.
Acenaphthene	83-32-9	Chrysene	218-01-9
Acenaphthylene	208-96-8	Dibenzo(a,h)anthracene	53-70-3
Anthracene	120-12-7	Fluoranthene	206-44-0
Benzo(a)anthracene	56-55-3	Fluorene	86-73-7
Benzo(a)pyrene	50-32-8	Indeno(1,2,3-cd)pyrene	193-39-5
Benzo(b)fluoranthene	205-99-2	Naphthalene	91-20-3
Benzo(ghi)perylene	191-24-2	Phenanthrene	85-01-8
Benzo(k)fluoranthene	207-08-9	Pyrene	129-00-0

13. Refer to Technical Appendix 5 for a list of chemicals regulated under the Scheduled Chemical Wastes Chemical Control Order 1994.
14. Petroleum hydrocarbons are assessed only by total concentration (SCC1, SCC2 or SCC3). Approximate range of petroleum hydrocarbon fractions: petrol C6-C9, kerosene C10-C18, diesel C12-C18, and lubricating oils above C18. Laboratory results are reported as four different fractions: C6-C9, C10-C14, C15-C28, C29-C36. The results of total petroleum hydrocarbons (C10-C36) analyses are reported as a sum of the relevant three fractions.
15. Calculated from *Guidelines for Drinking-Water Quality* (World Health Organisation 1993).

Worked examples of non-liquid-waste assessment and classification

The examples below assume that you either know or have determined the *total concentration* of each chemical contaminant in your waste. In other words, you are at Step 5 or beyond in the flow diagram shown earlier in this part of the Appendix. The tables show the test results that you have to hand.

Legend for all tables

N/D means not determined.

N/A means not applicable.

Example 1

You have waste that has been tested and you have the following results:

Chemical	*Total concentration*	*Leachable*	Is *immobilisation* of	Provisional

contaminant	***(SCC)*** (mg/kg)	***concentration (TCLP)*** (mg/L)	**contaminant EPA-approved?** (yes/no)	**classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, then
- if your waste meets all of the criteria of being *non-liquid*, and
- if your waste meets all of the criteria of not capable of environmentally significant physical, chemical and biological transformation (see Definitions and Glossary),

then your waste can have a final classification of *inert waste*.

Example 2

Let us assume that nickel is also present in your waste:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	N/D	N/A	Solid

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the total concentration of nickel is greater than its CT1 maximum value of 4 but less than its CT2 maximum value of 40 in Table A3, your provisional classification can be solid.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *solid waste*.

However, if you would like to be able to see if you may classify your waste as *inert waste*, then you need to determine the *leachable concentration* of nickel. (S*ee* Examples 3 and 4.)

Example 3

This is the same as example 2, except that you chose to determine the leachable concentration (TCLP) for nickel and you got a value of 0.16:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.16	N/A	Inert

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is less than its TCLP1 maximum value of 0.2 and the total concentration of nickel is less than its SCC1 maximum value of 1050 in Table A4, your provisional classification can be inert.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, then
- if your waste meets all of the criteria of not capable of environmentally significant physical, chemical and biological transformation (see Definitions and Glossary), and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *inert waste*.

Example 4

This is the same as example 2, except that you chose to determine the leachable concentration (TCLP) for nickel, and this time you got a value of 0.25:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *solid waste*.

Example 5

This is the same as example 3, except that your waste is soil and now you also have 2325 mg/kg arsenic present, with a leachable concentration of 0.11 mg/L:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.16	N/A	Inert
Arsenic	2325	0.11	Yes	Inert

Since the total concentration of cadmium is less than its CT1 value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is less than its TCLP1 maximum value of 0.2 and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be inert.

Although the total concentration of arsenic exceeds its SCC3 maximum value in Table A4, its immobilisation is EPA-approved, and therefore you may classify it according to its leachable concentration of 0.11, which is less than its TCLP1 maximum value in Table A4, so your provisional classification is inert.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, then
- if your waste meets all of the criteria of not capable of environmentally significant physical, chemical and biological transformation (see Definitions and Glossary), and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *inert waste*.

Example 6

Same as example 5, except that your leachable concentration result for arsenic is 4.3 mg/L:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.16	N/A	Inert
Arsenic	2325	4.3	Yes	Solid

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is less than its TCLP1 maximum value of 0.2 and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be inert.

Although the total concentration of arsenic exceeds its SCC3 maximum value in Table A4, its immobilisation is EPA-approved, and therefore you may classify it according to its leachable concentration of 4.3, which is greater than its TCLP1 maximum value of 0.5 but less than its TCLP2 maximum value of 5.0 in Table A4, so your provisional classification is solid.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *solid waste*.

Example 7

Same as example 5, except that your leachable concentration result for arsenic is 6.2 mg/L:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.16	N/A	Inert
Arsenic	2325	6.2	Yes	Industrial

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is less than its TCLP1 maximum value of 0.2 and the total concentration of nickel is less than its SCC1 maximum value of 1050 in Table A4, your provisional classification can be inert.

Although the total concentration of arsenic exceeds its SCC3 maximum value in Table A4, its immobilisation is EPA-approved, and therefore you may classify it according to its leachable concentration of 6.2, which is greater than its TCLP2 maximum value of 5.0 but less than its TCLP3 maximum value of 20 in Table A4, so your provisional classification is industrial.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *industrial waste*.

Example 8

Same as example 5, except that your leachable concentration result for arsenic is 26.3 mg/L:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.16	N/A	Inert
Arsenic	2325	26.3	Yes	Hazardous

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is less than its TCLP1 maximum value of 0.2 and the total concentration of nickel is less than its SCC1 maximum value of 1050 in Table A4, your provisional classification can be inert.

Although the total concentration of arsenic exceeds its SCC3 maximum value in Table A4, its immobilisation is EPA-approved, and therefore you may classify it according to its leachable concentration of 26.3, which, however, is greater than its TCLP3 maximum value of 20 in Table A4, so your provisional classification is hazardous.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants,

then your waste must have a final classification of *hazardous waste*.

Example 9

Same as example 4, except that you have mercury as well:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid
Mercury	5.7	N/D	N/A	Industrial

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Since the total concentration of mercury is greater than its CT2 maximum value of 4 and is less than its CT3 maximum value of 16 in Table A3, your provisional classification can be industrial.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *industrial waste*.

However, if you would like to be able to see if you are able to classify your waste as *solid waste*, then you need to determine the *leachable concentration* of mercury. (See examples 10, 11 and 12.)

Example 10

Same as example 9, except that you have determined the leachable concentration of mercury and got 0.17:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid
Mercury	5.7	0.17	N/A	Solid

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Since the leachable concentration of mercury is greater than its TCLP1 maximum value of 0.02 but less than its TCLP2 maximum value of 0.2, and the total concentration of mercury is less than its SCC2 maximum value of 50 in Table A4, your provisional classification can be solid.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *solid waste*.

Example 11

Same as example 10, except that you have determined the leachable concentration of mercury and got 0.22:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid
Mercury	5.7	0.22	N/A	Industrial

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Since the leachable concentration of mercury is greater than its TCLP2 maximum value of 0.2 but less than its TCLP3 maximum value of 0.8, and the total concentration of mercury is less than its SCC2 maximum value of 50 in Table A4, your provisional classification can be industrial.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants, and
- if your waste meets all of the criteria of being *non-liquid*,

then your waste can have a final classification of *industrial waste*.

Example 12

Same as example 4, except that you have selenium, and you have determined its leachable concentration and got 5.1:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid
Selenium	146	5.1	N/A	Hazardous

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Since the leachable concentration of selenium is greater than its TCLP3 maximum value of 4 (and in spite of the fact that the total concentration of selenium is less than its SCC3 maximum value of 200 in Table A4), your provisional classification can be hazardous.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants,

then your waste can have a final classification of *hazardous waste*.

You must treat or store the waste.

Example 13

Same as example 10, except that you have beryllium as well:

Chemical contaminant	***Total concentration (SCC)*** (mg/kg)	***Leachable concentration (TCLP)*** (mg/L)	**Is *immobilisation* of contaminant EPA-approved?** (yes/no)	**Provisional classification**
Cadmium	1.2	N/D	N/A	Inert
Lead	3.2	N/D	N/A	Inert
Nickel	25.3	0.25	N/A	Solid
Mercury	5.7	0.17	N/A	Solid
Beryllium	423	0.89	No	Hazardous

Since the total concentration of cadmium is less than its CT1 maximum value of 2.0 in Table A3, your provisional classification can be inert.

Since the total concentration of lead is less than its CT1 maximum value of 10 in Table A3, your provisional classification can be inert.

Since the leachable concentration of nickel is greater than its TCLP1 maximum value of 0.2 but less than its TCLP2 maximum value of 2, and the total concentration of nickel is less than its SCC2 maximum value of 1050 in Table A4, your provisional classification can be solid.

Since the leachable concentration of mercury is greater than its TCLP1 maximum value of 0.02 but less than its TCLP2 maximum value of 0.2, and the total concentration of mercury is less than its SCC2 maximum value of 50 in Table A4, your provisional classification can be solid.

The leachable concentration of beryllium is greater than its TCLP1 maximum value of 0.1 and less than its TCLP2 maximum value of 1; however, since the total concentration of beryllium is greater than its SCC3 maximum value of 400 in Table A4, and its immobilisation is not approved by the EPA, your provisional classification can be hazardous.

Now you must also apply the rules given earlier in this part of the Appendix, that is:

- you must classify the waste according to the highest classification given to any of the contaminants,

then your waste can have a final classification of *hazardous waste*.

You may now apply to the EPA with supporting technical documentation to have the immobilisation of beryllium approved. This can result in two possibilities:

- If the immobilisation of beryllium is approved by the EPA, then according to its leachable concentration it will be assessed as solid; therefore the waste sample may be classified as *solid waste* (since solid is the highest classification for any contaminant), as long as the waste meets the criteria of being *non-liquid.*

- If the immobilisation of beryllium is not approved by the EPA, the waste must be classified as *hazardous waste* and, therefore, must be treated or stored.

Appendix 10
Final Site Contours

SURVEYED	DESIGNED	DRAWN
CHECKED	APPROVED	

MWH

Tasman District Council

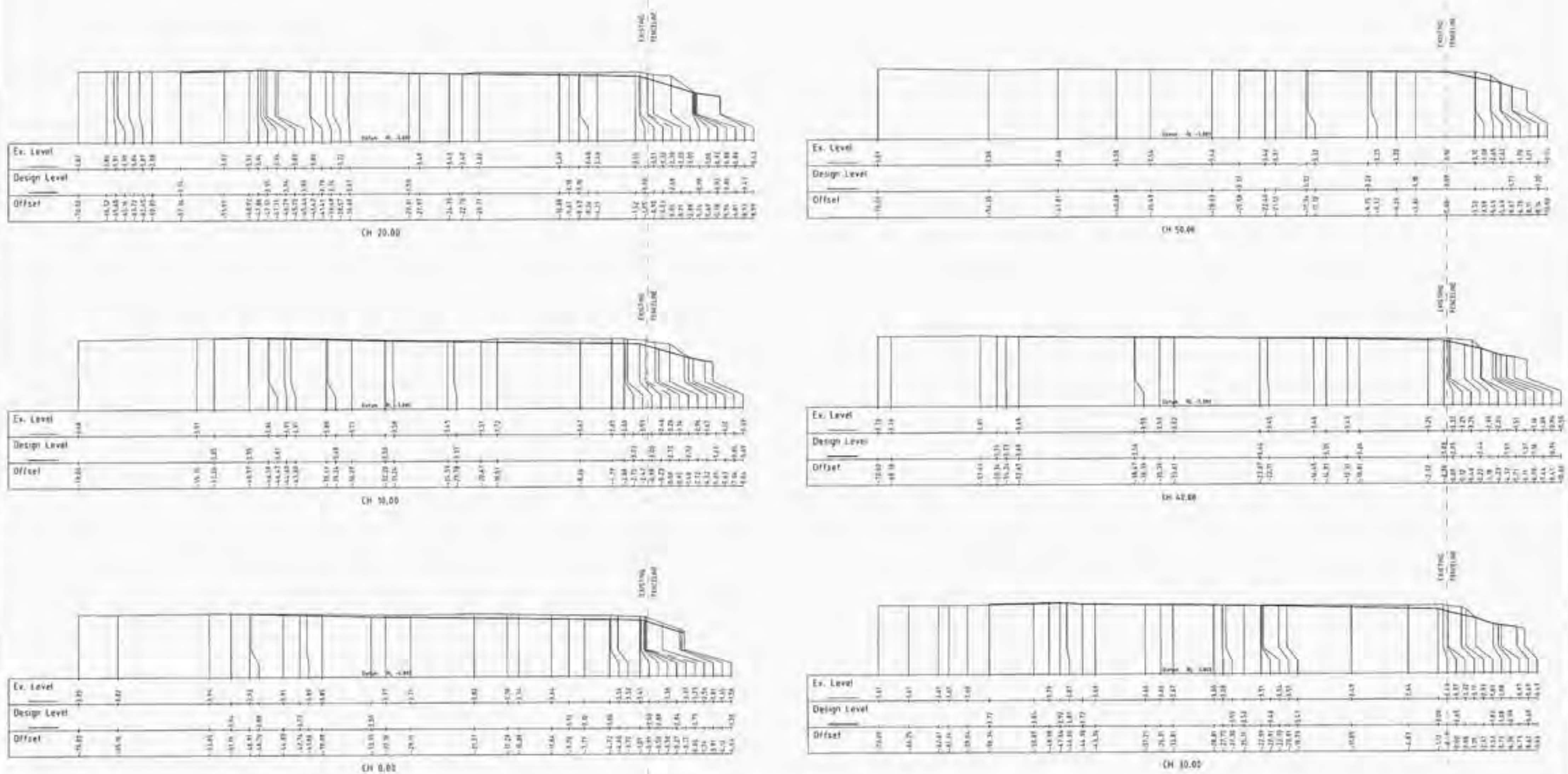
MAPUA F.C.C. SITE

FINAL SITE CONTOURS

FOR CONSTRUCTION

24 MARCH 2004

1939/1 | 01 | 1



CROSS SECTIONS
1 : 250

Job Number		
TAB/DWG SERVER	NELSON	
XREFS		
FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN		
CHECKED		
APPROVED		

AMENDMENTS | INITIAL CHECKED | DATE | INITIAL APPROVED | DATE

MWH

Tasman District Council

MAPUA F.C.C. SITE

CROSS SECTIONS

FOR CONSTRUCTION

24 MARCH 2004

SCALES (A1) AS SHOWN

1939/1 | 02 | 1

Appendix 11
Analytes and Criteria for Targeted Sampling

Table A: Analytes and Thresholds

ANALYTE	CRITERION[7] (mg/kg)
Inorganics	
Ph	-
Arsenic	30
Beryllium	63
Cadmium	3
Chromium (Hexavalent)	3
Chromium (Trivalent	600
Copper	130
Cyanide (Complex) Ph>=5	50
Lead	300
Mercury	1
Nickel	60
Selenium	5
Tin	50
Zinc	200
PAH	
Benzo(A)Pyrene	0.27
MAH	
Benzene	1
Toluene	130
Ethyl Benzene	50
Xylene	25
Total Petroleum Hydrocarbons	
C6 - C9	-
C10 - C14	500
C15 - C28	510
C29 - C36	-
Chlorinated Volatile Hydrocarbons	
1,1,1 - Trichloroethane	2.0
1,1,1 - Trichloroethane	1200
1,1,2,2 -Tetrachloroethane	0.003
1,1,2,2 -Tetrachloroethane	0.41
1,1,2 - Trichloroethane	0.02
1,1,2 - Trichloroethane	0.73
1,1 - Dichloroethane	2.3

7 There are multiple thresholds for particular analytes due to variable considerations (i.e. risks associated with human health may differ than that for migration to groundwater) hence variable limits.

1,1 - Dichloroethane	510
1,2 (Cis)-Dichloroethene	0.4
1,2 (Cis)-Dichloroethene	4.3
1,2 (Trans) - Dichloroethene	0.7
1,2 (Trans) - Dichloroethene	6.1
1,2,3-Trichloropropane	0.005
1,2,-Dichloroethane	0.02
1,2,-Dichloroethane	0.28
1,2-Dichloropropane	0.03
1,2-Dichloropropane	0.34
Bromodichloromethane	0.6
Bromodichloromethane	0.82
Bromoform	0.8
Bromoform	6.2
Chloroform	0.6
Chloroform	3.6
Dichloromethane	0.4
Dichloromethane	10
Hexachlorobutadiene	2.0
N-Propylbenzene	240
Tetrachloroethene	0.06
Tetrachloroethene	1.5
Trichloroethene	0.06
Trichloroethene	0.053
Chlorinated Benzenes	
1,2,4-Trichlorobenzene	5
1,2-Dichlorobenzene	17
1,4-Dichlorobenzene	2
Chlorobenzene	1
Phenols And Cresols	
Pentachlorophenol (PCP)	-
Organochlorine Pesticides And Chlorinated Herbicides	
Aldrin + Dieldrin	3
	3
Chlordane	10
Ddx (Ddd, Ddt,Dde)	5
Endosulfan	18
Endrin	10
Heptachlor	23
Heptachlor	0.11
Heptachlor Epoxide	0.7
Hexachlorobenzene	2
Hexachloroethane	0.5
Lindane (Gamma HCH)	-
Methoxychlor	160
2,4,5-Trichloro-Phenoxyacetic Acid	610
2,4-Dichlorophenoxyacetic Acid	690

Organophosphorus Pesticides	
Atrazine	2.2
Captan	140
Carbaryl	6,100
Chlorpyrifos	180
Diazinon	55
Malathion	1,200
Simazine	4.1
Polychlorinated Biphenyls	0.22

FIGURES

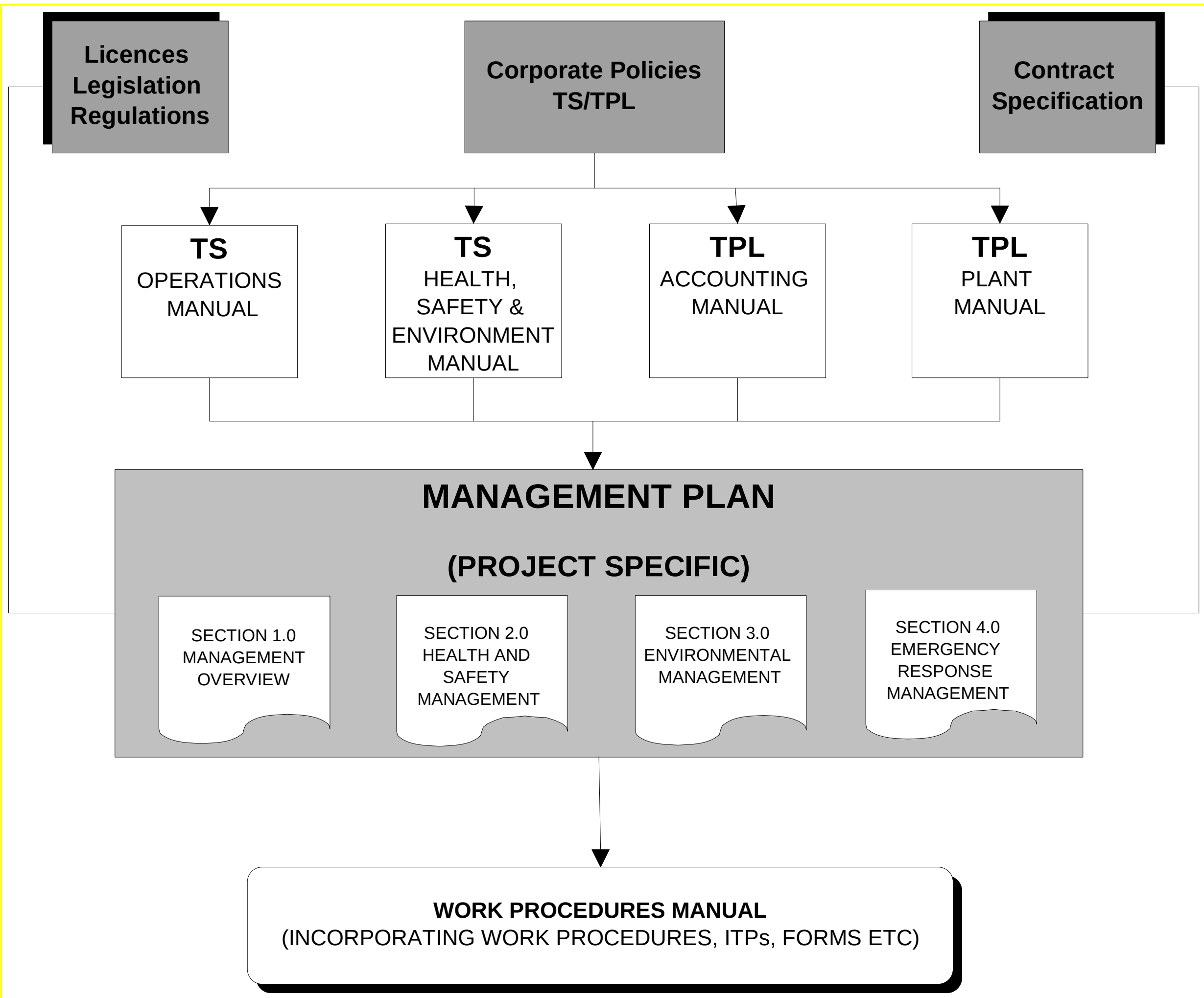


Figure 11.1 Thiess Services Integrated Management System.

Thiess Services Pty Ltd operates within the boundaries of an integrated management system. The relationship of the Management Plan with Standard System Procedures (corporate generic System Procedures) is as illustrated above

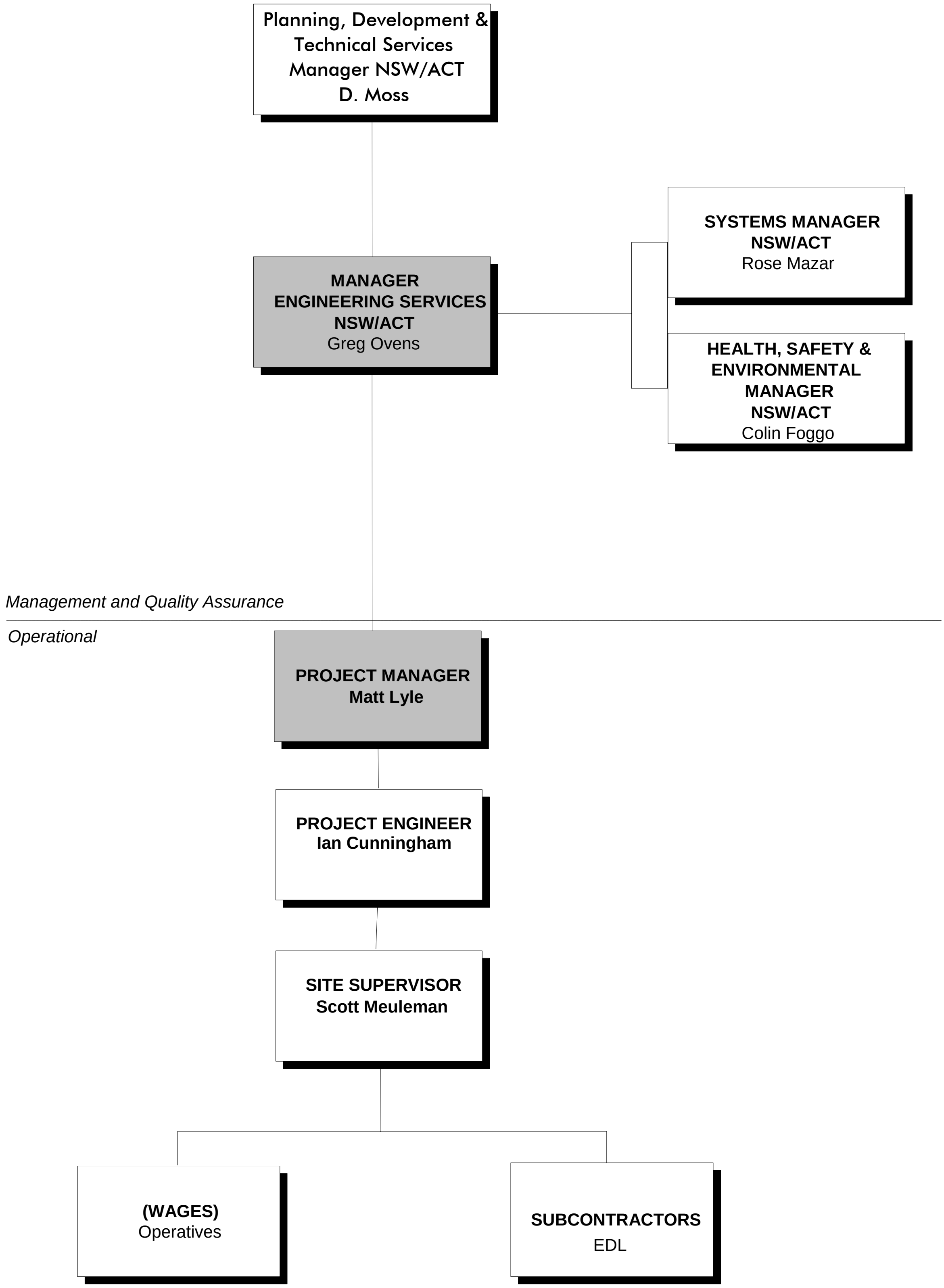


Figure 11.2 FCC Mapua Remediation Project Organisational Chart

REMEDIAL ACTION PLAN
&
MANAGEMENT PLAN

JULY 2005

Fruitgrowers Chemical Company
Mapua Site

Ministry for the
Environment
Manatū Mō Te Taiao

LIMITATION CLAUSE

This combined Remedial Action Plan (RAP) and Management Plan has been prepared for use by the Ministry for the Environment (MfE) and approved subcontractors and should not be reproduced, or amended in any way without the express approval of the relevant MfE project manager.

The RAP has been prepared on the basis of information obtained from several previous investigations undertaken at the site by various organisations and contractors. The results of these past studies (which include work carried out by Thiess Environmental Services in October 2001), has provided what is considered to be a relatively sound understanding of the in situ site conditions and remediation requirements. The proposed remedial approach is, however, bounded by the inherent limitations of contaminated site investigations, the degree of variability in site conditions and poor historic records of onsite activities at FCC, and thus the RAP (and Management Plan) must be treated as a guide and living document.

Prepared in July 2005 by the
Ministry for the Environment
Manatū Mō Te Taiao
PO Box 10-362, Wellington, New Zealand
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Ministry for the Environment
Manatū Mō Te Taiao

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Appendix 1	Work Plan 1: Project Management & Reporting
Appendix 2	Work Plan 2: Clearing and Demolition Works
Appendix 3	Work Plan 3: Air Quality Management
Appendix 4	Work Plan 4: Erosion and Sedimentation Control
Appendix 5	Work Plan 5: Water Management
Appendix 6	Work Plan 6: General Onshore Excavation Works
Appendix 7	Work Plan 7: Detailed Excavation in Adjacent Properties
Appendix 8	Work Plan 8: Marine Excavation Works
Appendix 9	Work Plan 9: Backfill and Compaction
Appendix 10	Work Plan 10: Noise Management and Screening
Appendix 11	Work Plan 11: Hazardous and Waste Substances Management
Appendix 12	Work Plan 12: Vibration Management
Appendix 13	Work Plan 13: Validation Sampling and Analysis
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Appendix 19	Contamination Area Plans for Levels 1–5
Appendix 20	Mapua Bibliography

Tables

1 Introduction

This combined Remedial Action Plan (RAP) and Management Plan (jointly referred to as the 'RAP') has been prepared by the Ministry for the Environment (MfE) for the remediation of the Fruitgrowers Chemical Company (FCC) site located at Mapua, New Zealand. This RAP details the remedial actions required by contractors in response to MfE's project requirements and subsequent resource management consent conditions (RM030521, RM030522, RM030523, RM030524, RM030525, RM030526, RM030527) generated from a consent hearing that took place in August 2003. This document is based on the preliminary RAP and series of 'work plans' developed by Thiess Services Pty Limited (issued July 2004) under contract to MfE. Contract service providers undertaking work on this remedial project are listed in Table 1.1 below.

Table 1.1: List of service providers and description of service as of July 2005

Contractor/key stakeholders	Stakehold/Service
Ministry for the Environment (MfE)	Consent owner/project and site management
Tasman District Council (TDC)	Consent authority/land owner
EMS	Site management
Highway Stabilisers Environmental (HSE)	Civil works – contracted to undertake civil works on site
Taylors Contracting Limited (TCL)	
Environmental Decontamination Limited (EDL)	Soil remediation - Company processing contaminated soils using mechano-chemical processing plant
Hills Laboratories	Laboratory conducting environmental validation analysis
GHD (Australia)	Site Auditors
MWH	Site Engineer

The site location and site layout are shown in Figures 1.1 -1.3. For the purposes of this RAP the FCC (west and east) sites, the FCC landfill, the contaminated marine sediments and contaminated areas of the neighbouring properties are collectively referred to as the 'site'.

Soil and groundwater at the site are affected by organochlorine pesticide (OCP) contamination. The FCC landfill contains wastes from the operation of the FCC sites and soil, sediments and groundwater in this location are also contaminated. Contaminated stormwater, groundwater and dust from the site have discharged to the Waimea Inlet, resulting in contamination of estuarine sediments, tidal waters and marine sediments in close proximity to the site. Soil on some neighbouring properties has also been contaminated by discharges from the site.

The Ministry for the Environment (hereafter referred to as the 'principal') require that the site be remediated to the 'clean-up scenarios' described in Table 1.4.

A number of studies have been carried out by the Tasman District Council (TDC) and later by Thiess Services, involving assessment of the degree and extent of contamination, assessment of the risk to human health and the ecosystem associated with this contamination, and reviews of remediation options.

1.1 Document Structure

The RAP document is structured into 10 chapters which are summarised in Table 1.2 below. The initial chapters include background information relating to the site, past contamination studies and an overview of the remedial approach and resource consent requirements. Chapters 6, 7 & 8 refer to operational cleanup of the site and associated monitoring requirements. These chapters make reference to a series of 18 ‘Work Plans’ (WP) which detail specific remedial and monitoring activities (Appendices 1 to 18). These work plans are listed in Table 1.3.

Table 1.2: Summary of Report Structure

Chapter	Title	Description
1	Introduction	Report introduction
2	Site Identification & History	Overview of site location & history
3	Contamination Studies	Overview of previous contamination studies
4	Remediation Approach	Overview of remediation approach
5	Resource Consents	Overview of resource consent requirements
6	Remediation Works Methodology	Overview of works methodology
7	Environmental Protection & Monitoring	Overview of environmental protection & monitoring
8	Project Management	Overview of project management and reporting requirements
9	Appendices	Appendices containing work plans and additional supporting information

Table 1.3: Work plans

Appendix	Work plan	Work plan title
1	WP1	Project Management & Reporting
2	WP2	Clearing and demolition works
3	WP3	Air quality management
4	WP4	Erosion and sedimentation control
5	WP5	Water management
6	WP6	General Onshore Excavation Works
7	WP7	Detailed Excavation in Adjacent Properties
8	WP8	Marine excavation works
9	WP9	Backfill and compaction
10	WP10	Noise management and screening
11	WP11	Hazardous and waste substances management
12	WP12	Vibration management
13	WP13	Validation sampling and analysis
14	WP14	Traffic control
15	WP15	Site access and works control
16	WP16	Health and safety Management
17	WP17	Occupational Health monitoring
18	WP18	Communications strategy

1.2 Scope of work

This RAP describes the works required to remediate the site in accordance with the clean-up scenario outlined in Table 1.4. The project work has been scheduled to be carried out in three stages which are outlined in the following sections.

1.2.1 Stage 1: Detailed planning and resource consent applications

The primary objectives of Stage 1 were:

- for the site to be further characterised (in terms of the extent of contamination and nature of onsite materials) to aid in the revision and finalisation of the Remedial Action Plan (RAP) in accordance with the proposed Clean Up Criteria
- to revise the quantities for each of the work items listed in the Schedule of Prices to the principal's approval
- to assess the resource consent requirements for the works and prepare an 'Assessment of Environmental Effects Report'
- submit the relevant resource consent applications for all activities required by Stage 3 and any long term resource consents required for the management of the site subsequent to clean-up of the site
- to respond to all Section 92 requests for further information resulting from the resource consent applications for the works
- to obtain all other statutory approvals for the clean-up activities proposed and the clean-up of the site.

1.2.2 Stage 2: Environmental permitting and establishment of conditions for Stage 3

The primary objectives of this stage were to:

- present cases for various resource consents at the Commissioner Hearing
- evaluate the hearing decision and advise on any effects on Stage 3 – Site remediation
- finalise the conditions for Stage 3 of the contract; and (if necessary) prepare an appeal to the decision of the hearing committee at the Environment Court hearing
- undertake a proof of performance (PoP) trial of the mechano-chemical dehalogenation (MCD) treatment process (section 4.2).

The specific objectives of the PoP trial were to confirm whether or not:

- the process complied with all conditions stipulated within the resource management consents
- the treatment of the contaminated material met the relevant soil acceptance criteria (SAC) at a minimum rate of 108 m^3/week

- the treatment process can achieve a target ‘Destruction Removal Efficiency’ (DRE) of not less than 90%
- expected environmental and safety parameters such as noise, air emissions, odour, vibration and material handling were compliant with relevant legislation and resource consent requirements.

1.2.3 Stage 3: Site remediation

Stage 3 is presently being undertaken and will involve the supply of all equipment, materials, plant, and consumables and the remediation of the site in accordance with Table 1.4. This shall include, but not necessarily be limited to, the following:

- mobilisation to site including the design, delivery, installation and testing of all equipment to be used for the treatment of contaminated soils and sediments to meet acceptable residual standards as specified by the consent
- establishment of a referencing system so that each area and depth of the site that is subject to clean-up or validation can be easily referenced and all excavated material can be tracked on a daily basis to the ultimate disposal location of this material
- break-out, excavation, cleaning, crushing and/or disposal of concrete foundations, disused subsurface drains and services, building slabs and asphalt paving, some of which may be contaminated
- excavation, treatment and reinstatement (onsite) of contaminated soils and sediments from the FCC west and east sites, the FCC landfill and contaminated neighbouring properties that adjoin the site
- excavation, treatment (as necessary) and disposal of general refuse and debris which has been landfilled on the site and more particularly in the FCC landfill, including waste building material, corrugated iron, drums, paper, plastic and timber, some of which will be mixed with waste pesticide materials and contaminated soils
- removal of contaminated sediments from the adjacent estuarine areas and the invert of the drain along the western boundary of the FCC landfill, drying (as necessary) and backfilling in areas of the site designated for recreational use
- backfilling and compaction of treated soils, where these have been validated as suitable for this purpose (this may involve processing and moisture conditioning to make the soils suitable for the purpose)
- site levelling, grading, surfacing, drainage and re-vegetation
- all associated validation testing and monitoring as required under the resource consents
- close-out reporting

The works will also include all ancillary works and services required for the execution of the project, e.g. connections to, and supply of, power, water and any other service utilities, supply of raw materials consumed by the treatment process, personnel and plant and equipment, decontamination facilities, surface and groundwater control and all other measures required for environmental and health and safety protection.

1.3 Proposed future land use

Based on contaminant levels, local community needs and TDC planning requirements, the site will be remediated to incorporate several different 'end land uses' as defined in Table 1.4 below.

Table 1.4: Potential end land uses for Mapua FCC site

Site	Potential Land use
East (of Tahi Street)	Commercial
West (of Tahi Street)	Residential
FCC landfill	Recreational
Marine sediments	Aquatic ecosystem protection
Neighbouring properties	Residential

The principal engaged Egis Consulting (now GHD) to develop site specific risk-based soil and sediment acceptance criteria (SAC) for the various land use scenarios. Table 1.5 summarises the results of this assessment for the key organochlorine contaminants of concern. A full list of SAC for the Mapua site is provided in WP13- Validation & Sampling (Appendix 13).

Table 1.5: Soil/sediment acceptance criteria (SAC)

Land use	Depth (m)	DDX (total DDT, DDD, DDE) (mg/kg)	Aldrin + dieldrin + 10% lindane (mg/kg)
Residential	All	5*	3*
Commercial	0–0.5 Below 0.5	5* 200*	3* 60*
Recreational	0–0.5 Below 0.5	5* 200**	3* 60**
Aquatic Ecosystem protection	All	0.01	0.01

Notes:

* Based on protection of the offsite environment through rainfall run off. This will also be protective of human health and groundwater.

** Based on protection of groundwater.

1.4 Objectives and minimum outcomes

The principal's objectives for this project are to: *remediate the site to standards acceptable for intended purposes with the minimum of ongoing restrictions*. More specifically the requirements of the remediation are that:

- the various sub-sites must be remediated to the clean-up standards listed in Tables 1.4 & 1.5 of this document and as per the Soil Acceptance Criteria (WP13: Appendix 13).
- the land after remediation must be acceptable for its proposed use, and the nature and composition of the residual material in any part of the site must not adversely affect future users of the site or the environment, given the range of activities that can be expected to take place at the site
- the contaminated soils must not be blended or diluted with soil containing lower concentrations of contamination to make the material acceptable for offsite disposal or for retention on any part of the site with out the express permission of the principal
- the soils and sediments containing concentrations of contaminants, which exceed the acceptance criteria defined by the principal for the selected clean-up scenario, must be either treated prior to return to the site or appropriately disposed of offsite
- there shall be no disposal of soils, sediments, rubble, refuse or any other materials excavated from the site to any offsite location other than the Eves Valley Landfill and all disposal at this site shall be in accordance with the Landfill's requirements
- the proposed remediation must involve some degree of treatment of soils so that there is a reduction in the total mass of contaminants
- Where possible the final recontoured land must mimic natural topographic conditions and blend in with the surrounding landscape.
- All areas of the site will be capped with layer of 'clean soil' (DDX<5ppm) of a depth of at least 0.5m
- Contaminated marine sediments at FCC East and West will be removed and replaced with approved material that meets the SAC for aquatic ecosystem protection and matches as closely as possible marine sediments that already exist as part of the natural beach and marine sediments of the Waimea Inlet.

2 Site Identification and History

2.1 Site location

Mapua township (Figure 1.1) is situated on a 2 km wide peninsula, which forms the northwest side of one of the sea entrances to the Waimea Inlet (Figure 1.2). Rabbit Island forms the southeast side of the entrance. A flat coastal plain exists on the eastern side of the Mapua peninsula, decreasing in width to the north where it terminates in steep cliffs rising to 40 m at Ruby Bay. The Seaton Valley stretches northwest from this coastal plain. To the west of the coastal plain the land rises to approximately 100 m above sea level.

The site is located on the southeast edge of Mapua township at the base of a small peninsula, which is approximately 250 m wide (Figure 1.2). This peninsula extends into the Waimea Inlet and terminates in Grossi Point. Tahi Street runs down the middle of this peninsula with areas on either side generally inclining to the Waimea Inlet away from Tahi Street.

2.2 ~~2.2~~ Site description

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The site covers a total area of approximately 5.06 hectares including land and marine excavation areas. The FCC east and FCC west sites historically contained the facilities used for pesticide formulation and storage. Parts of the FCC east site were reclaimed from the Mapua Channel. Wastes from the FCC operations were disposed of in reclamation of the Waimea Inlet on the western boundary of the FCC west site, i.e. the FCC landfill.

Lime and Marble, a company that was located on FCC east, processed non-toxic materials such as lime, calcite and dolomite. All of the buildings used by FCC and Lime and Marble during the operation of the site have been removed (Figure 1.3).

2.2.1 Vegetation

Prior to site clearing the vegetation at the FCC site was highly modified and its distribution largely determined by the presence of buildings, foundations and/or sealed areas. The FCC east site was almost exclusively paved, and was bounded by a discontinuous margin of trees including scrubby conifers, magnolia, eucalyptus, ngaio, and introduced grasses. The vegetation on the eastern boundary was slightly denser and included several large, healthy ngaio and pohutakawa, and a variety of introduced shrubs.

The FCC west site was characterised by a mixture of damaged pavement and rough pasture, and was again bounded by an intermittent margins of trees including eucalypts, and several large conifers in the south-western corner of the site.

The FCC landfill site remains covered by rough pasture and is bounded by a strip of mixed scrub between the landfill edge and the high tide zone, containing blackberry, gorse and other species.

Figure 1.1 Location of Mapua Township, Tasman Distract, New Zealand

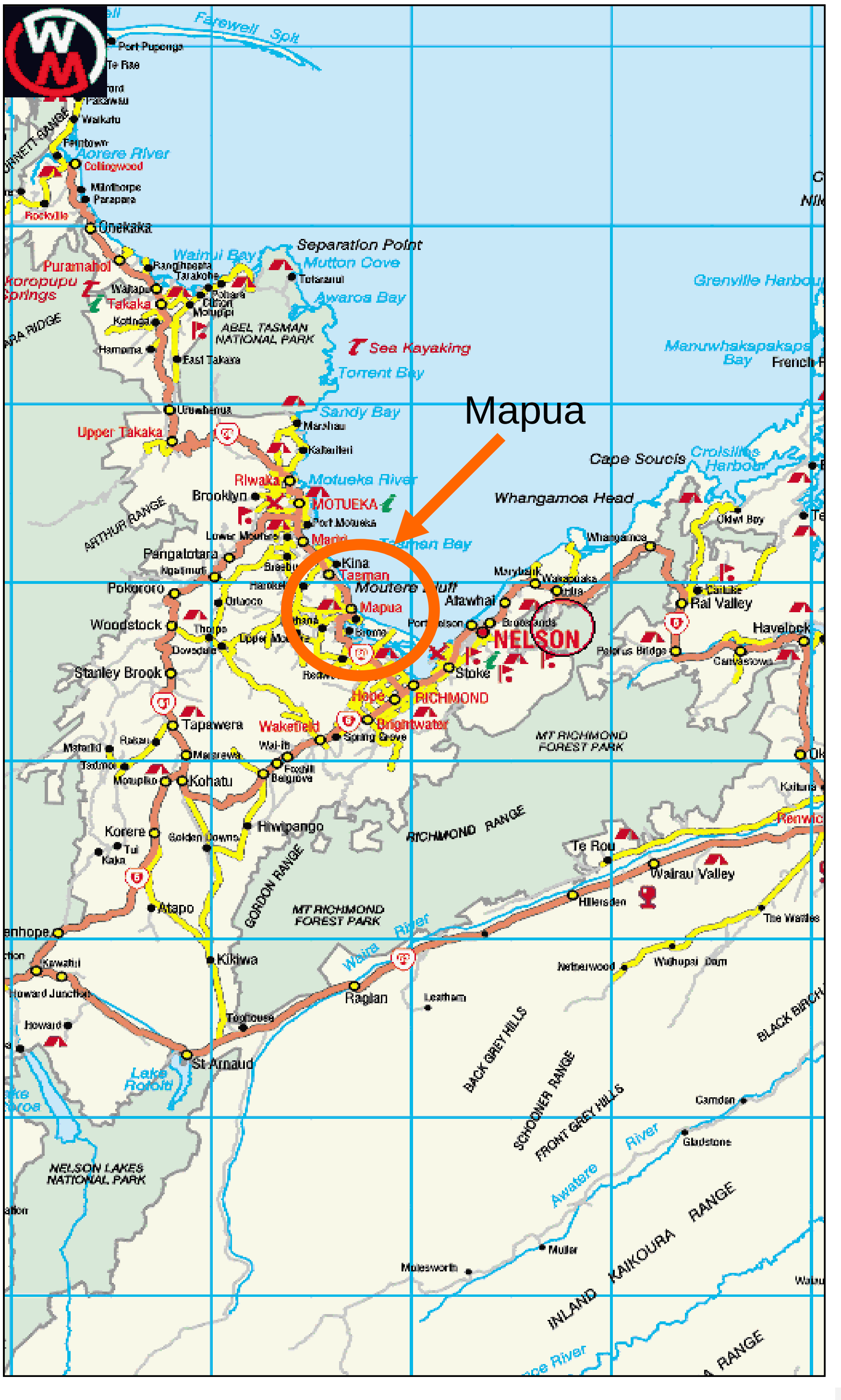


Figure 1.2 FCC Site on Mapua Peninsula

Figure 1.3 Aerial Photograph of FCC Mapua Site.

2.2.2 Geology

The geology in the vicinity of the site consists of Moutere Gravel, Tahunanui Sand, and Rabbit Island Gravel. The Moutere Gravel outcrops on the western boundary of the site and extends below the Tahunanui Sand and Rabbit Island Gravel under the site itself. The Moutere Gravel is clay-bound alluvial gravel. The Tahunanui Sand and Rabbit Island Gravel are marine sand and gravel that were deposited as storm beach ridges.

Drilling at the site indicates that the marine sands and gravels extend from ground surface to between 3.6 m and 8.5 m below ground surface. The sand is grey, fine to medium grained and contains shell and wood fragments. The gravel is grey, well-rounded, medium grained, and has a sandy matrix. The clay-bound gravel found below the marine sediments consists of medium to coarse-grained weathered clasts in a clay matrix.

2.2.3 Hydrogeology

Shallow groundwater is present at the site within the marine sands and gravels described above. Across the site, the water table varies from approximately 0.9 m to 2.6 m below ground surface. The elevation of the water table ranges from approximately 2.5 m above mean sea level in the north-western part of the site to approximately 0.9 m above mean sea level in the eastern part of the site. Marine sands and gravels at the site are underlain by the Moutere Gravels, a clay-bound gravel unit of fluvial origin.

The saturated thickness of the marine sands and gravels varies across the site from less than 2 m to approximately 8.4 m, based on the limited number of site borings that penetrate to the Moutere Gravels and July 1996 water levels. The direction of groundwater flow across the site in the marine sands and gravels is generally from northwest to southeast or south. Groundwater flow is generally toward the Waimea Inlet to the east and south, but this flow direction appears to be modified in the vicinity of the FCC landfill by an open drain located along the western edge of the FCC landfill. This drain extends for at least part of its length beneath the water table and collects groundwater and discharges it to the Waimea Inlet, hence resulting in groundwater flow towards the drain from the adjacent portion of the site. Horizontal groundwater gradients at the site range from 0.003 in the central part of the site to 0.02 in the southern area of the FCC landfill (based on water table contours for July 1996).

The water table fluctuates seasonally (up to 0.5 m) and in response to tides. Annual groundwater level highs are expected to occur during the winter months when precipitation is highest. Tidal fluctuations in the marine sands and gravels appear to be rapidly attenuated with distance, and tidal influence appears to be restricted to less than 35 m from Waimea Inlet. No tidal fluctuations were observed on the west side of the site, with the nearest monitored well located approximately 30 m from the Inlet.

The aquifer properties of the marine sands and gravels have been estimated from two injection tests carried out at the site. The transmissivity values estimated from these tests were 100 m^2/day and 280 m^2/day. The specific yield of the aquifer is expected to be in the range of 0.2 to 0.3, a typical range for unconfined sediments.

The water levels and hydraulic properties of the Moutere Gravels that underlie the marine sands are similar to those measured in the overlying sands and gravels in June 1996. However, conductivity for the Moutere Gravels (approximately 0.01 m/day) is much lower than in the overlying sands and gravels. Recharge to the marine sands and gravels are expected to be predominantly from rainfall infiltration and from upward flow from the Moutere Gravels.

2.3 Site history

Fruitgrowers Chemical Company (FCC) first started operation in a cool store in Mapua in 1932 producing spraying oils and lime sulphur for the horticultural industry. In 1938 FCC bought a lime quarry on Takaka Hill and established the company Lime and Marble.

During the 1940s the production of lime sulphur was replaced by organo-mercury compounds. Lead arsenate and arsenicals were also stored at the site. In 1945 FCC introduced micronising (an air mill process to reduce particle sizes for spraying). Organochlorine pesticides were the main products micronised. These included DDT, dieldrin, and DDD. Organophosphorous pesticide formulation was introduced in 1958. Over the years the persistent organochlorine pesticides were gradually replaced by the less persistent organophosphorous pesticides such as malathion and azinphos (refer section 3.3).

The FCC operations continued to expand from the 1960s to the 1980s. Herbicides (hormone and non-hormone), insecticides, fungicides, and animal remedies were formulated onsite. In 1978 a total of 124 chemicals were used by FCC to produce 84 different formulations.

The FCC operations ceased in February 1988. This followed an unsuccessful appeal to the Planning Tribunal to expand chemical manufacture at Mapua to include copper-chrome arsenate production. Lime and Marble continued operating on its land for a period, principally using it for mineral storage. This property was eventually transferred to Mintech NZ Ltd.

Reclamation and landfilling of low spots and edges of the Waimea Inlet on the boundaries site appears to have been undertaken in the 1950s, as evidenced by aerial photographs. The nature of the fill material is not clear, but Ministry of Transport records indicate that it is likely to have included waste materials from the FCC operations. These reclamations were eventually vested in the former Nelson Harbour Board and leased back to the two companies. The TDC inherited this vested land as the successor authority to the Nelson Harbour Board.

In May 1992 a 60 m long clay cut-off wall was installed along the southern side of the FCC landfill to reduce leachate movement into the Waimea Inlet.

2.4 Contaminant types

The following contaminants have been identified during past site characterisation studies; inorganic material (heavy metals), total petroleum hydrocarbons (TPH), organochlorine pesticides, chlorinated hydrocarbon herbicides, chlorophenoxyacetic acid herbicides, and volatile organic compounds (VOCs). The contaminants most likely to be encountered onsite are listed in Table 2.1.

The major contaminants of concern are organochlorine pesticides (OCPs) which are present in parts of the site at levels that exceed relevant guidelines. The OCPs that are present include DDT (and its breakdown products), lindane, dieldrin and aldrin, all of which are potentially toxic, persistent chemicals that bioaccumulate in fatty tissue.

The chemistry of the different OCPs is variable, but generally they have low solubility in water, and bind in preference to non-polar organic matter in soils and dusts, and the waxy layer of leaves. They will generally only be present in water if the concentration in the adjacent soils is high. Due to their chemistry, the main pathway of concern for humans is ingestion, rather than inhalation or dermal absorption.

DDT is highly toxic to many invertebrates and fish, and has the potential to be acutely and chronically toxic to humans. Acute toxicity would require the ingestion of 10 mg of DDT per kg of body weight, which usually only occurs with unsafe occupational handling of pesticide formulations. The extent s of chronic low-level exposure is dependent on concentration and the availability of pathways.

Dieldrin and aldrin are analogous neurotoxins. In mammals they act as nervous system stimulants and are stored unchanged primarily in fatty tissues. In humans dieldrin and aldrin are readily absorbed through the skin, the gastroenteric tract and the respiratory tract. They are acutely toxic to humans at doses as low as 0.2 mg/kg of body weight. However, as with DDT acutely toxic doses usually only occur with inappropriate occupational handling of pesticide formulations. The effects of chronic low-level exposure include amnesia, loss of body weight and degenerative changes in the liver as well as general stimulant effects to the central nervous system.

Lindane (*gamma-Hexachlorcyclohexane* or *g-BHC*), was commonly used for the treatment of wood inhabiting beetles and seeds but was also used to control insects of the foliage of fruit trees. It is less soluble than dieldrin and aldrin but will still accumulate slightly in fish and shellfish. Short-term exposure to lindane may cause high body temperature or pulmonary oedema, whilst long-term exposure may lead to liver and kidney damage. Like dieldrin and aldrin, lindane can be readily absorbed through the skin, the gastroenteric tract and the respiratory tract.

Table 2.1: Identified contaminants at Mapua FCC site

Group	Substance	General toxilogical information
Inorganics	Asbestos	Proven human carcinogen
Heavy metals	Chromium (Cr)	Proven human carcinogen
	Arsenic (As)	Proven human carcinogen
	Lead (Pb)	Central nervous and reproduction system hazard
	Cadmium (Cd)	Suspected human carcinogen and kidney toxin
	Mercury (Hg)	Toxic to nervous system and other organs
Organochlorine pesticides OCPs)	DDT	Central nervous system hazard, headaches, nausea
	DDD	Central nervous system hazard, headaches, nausea
	DDE	Central nervous system hazard, headaches, nausea
	Aldrin	Central nervous system hazard, headaches, nausea
	Dieldrin	Central nervous system hazard, headaches, nausea
	Lindane	Central nervous system hazard, headaches, nausea
	Phenoxy acid herbicides (2,4 D: 2,4,5 T)	Central nervous system hazard, headaches, nausea
Organophosphorus	Mevinphos	Central nervous system, depression, headaches, nausea
Pesticides (OPPs)	Dichlorovos	Central nervous system, depression, headaches, nausea
	Hexamethyl-phosphoramide	Central nervous system, depression, headaches, nausea
	Various Others	Central nervous system, depression, headaches, nausea

3 Contamination Studies

3.1 Overview of previous contamination investigations

Several contamination investigations on the site, surrounding marine sediments and adjacent residential lots have been previously undertaken. These investigations have included both preliminary investigations and more detailed assessments such as that undertaken by Thiess Environment Services during Stage 1 works (section 3.2). Typically the objectives of previous studies have focused on the following objectives:

- to determine the nature and extent of contamination present on the site as a result of past and current activities
- to assess whether any contamination present would pose a risk to human health
- to assess whether any contamination on the site has the potential to impact on the surrounding environment.

Full details of the sampling that was undertaken and the results that were obtained as part of the Stage 1 investigations can be found in Thiess's original RAP document. Results of the investigations undertaken prior to this highlighted the following.

3.1.1 FCC east and west soil contamination

In 1996 Woodward-Clyde conducted a number of investigations focused on soil contamination. A total of 63 soil sample locations were investigated and 41 of them exhibited concentrations of organochlorine pesticides (OCPs) above residential use criteria, and 15 locations exhibited concentrations above commercial use criteria. The concentration of organochlorine pesticides was generally found to decrease with depth. However, in some locations, particularly in the 1–2 m depth range, greater contaminant levels were identified at depth. These locations are typically within filled/reclaimed areas or alternatively where bulk storage facilities were located.

Concentrations of other organic compounds and inorganic compounds were generally found to be at background concentrations. Elevated (above background) levels of mercury, sulphur, organophosphorous pesticides and phenoxy acid herbicides were, however, identified at four locations.

In summary, the observed pattern and distribution of soil contamination on the FCC sites was found to correlate with historical site activities. Contamination was typically found in areas used for intensive chemical handling and bulk storage, and within stormwater drains and low lying areas.

3.1.2 FCC landfill soil contamination

A wide range of wastes are known to have been deposited in the FCC landfill and contaminant levels were anticipated to be relatively high. Based on this premise, none of the previous investigations focused on sampling and characterising materials from within the FCC landfill area.

3.1.3 Marine Sediments

Sediment samples have been collected from the Waimea Inlet on a number of occasions and analysed for a range of potential contaminants. Samples were collected by FCC (1977), Nelson Marlborough Regional Council (June 1983 and January 1991), Mintech (1993) and TDC (January 1993, December 1995 and June/ July 1996).

The most comprehensive sampling programmes were undertaken in January 1993 and July 1996. In January 1993, sediment samples were collected from eight sites south of the FCC landfill and four sites east of the site. At each location, a sediment sample was taken from a depth range of 0–0.5 m. The 1993 samples were analysed for a range of metals and organochlorine pesticides.

The results of the marine sediment sampling indicate that contamination of marine sediment is predominantly by organochlorine pesticides, particularly DDT and its metabolites, and to a lesser extent dieldrin. The highest concentrations of organochlorine pesticides were found in sediments adjacent to two stormwater discharge points, namely the surge chamber in the Mapua Channel and drainage channels in the tidal flats to the south of the FCC landfill.

Organochlorine pesticide concentrations appear to decrease significantly with depth. Samples collected from depths greater than 0.25 m showed significantly lower concentrations than shallower samples from the same locations. Most sediment samples collected below 0.25 m did not contain excessive contaminant levels. Organochlorine pesticide concentrations appear to decrease rapidly with distance along the shoreline away from these stormwater discharge points, particularly in the sediments to the south of the FCC landfill. Similarly, concentrations of organochlorine pesticides appear to decrease significantly with distance from the discharge point towards the low tide mark.

3.1.4 Soil Contamination in Neighbouring properties

Initial investigations indicated that the topsoil on properties at numbers 13 and 18 Tahi Street has organochlorine pesticide contamination exceeding residential criteria. Stage 1 site characterisation also investigated contamination levels at 15 and 20 Tahi Street.

OCP levels above residential SAC were observed within the upper 300–500 mm of stratum. The extent of contamination at street numbers 15, 18 and 20, however, is limited to isolated hotspots. At 13 Tahi St (a section that forms a common boundary line in the SE region of the FCC east site), contamination has been demonstrated over approximately 50 percent of the property. This includes two areas of planted grape vines, the driveway into the property, and the area at the north eastern boundary of the property adjacent to the Waimea Inlet. Remediation of 13 Tahi St will be included in Phase 3 of the cleanup operation at Mapua. Grape vines will be removed and stored for reinstatement and the surface 500mm of the soil profile will be excavated in designated areas and replaced with soil that meets the SAC for residential soils. Existing fencing, rough ground cover and a small shed will be removed and replaced during this remedial activity.

Subsequent to the completion of the Stage 1 site characterisation, the contaminated fill on No. 20 was excavated and stockpiled on the FCC west site by TDC. This was undertaken as the owner was selling the property prior to the commencement of the Stage 3 works. The excavation was validated and backfilled as part of this work.

3.1.5 Groundwater Contamination

The investigations indicate that groundwater quality up-gradient of the FCC landfill has not been affected by contaminants found on the site. Metal and organochlorine pesticides levels were, however, found to exceed guidelines for the protection of aquatic ecosystems and the recreational water quality down-gradient of the cut-off wall. The TDC believes that this indicates that either (1) contaminants are escaping the cut-off wall, or (2) the contamination is a residue of contaminated groundwater discharges from the FCC landfill prior to the installation of the cut-off wall.

The investigations indicated that groundwater quality up-gradient of the FCC east site has not been impacted FCC’s past activities. The investigations also indicated that both metals and organochlorine pesticides in groundwater may be discharging to the Mapua Channel in concentrations in excess of guidelines for the protection of aquatic ecosystems and the recreational water quality guidelines. Chlorobenzene may also be discharging in concentrations in excess of the guidelines for the protection of aquatic ecosystems but below the recreational water quality guidelines.

Ground water on site is monitored through a series of six boreholes on site and four residential bores along Tahi St (Figure 1.2). Bores on site are sampled and analysed for range of contaminants (as detailed in resource consent RM03024) on a monthly basis, while offsite bores are monitored on a quarterly basis. This monitoring program is scheduled to continue throughout the duration of remediation activities and for a limited period post remediation.

3.2 Stage 1 investigations

Further investigations undertaken during Stage 1 works were aimed at providing confidence in the feasibility and outcome of the site clean-up. Broadly the investigations included:

- characterisation of the site material (in terms of contamination status, geotechnical properties and treatability) to facilitate the design of remediation and validation strategies
- screening trials on *in situ* materials to determine treatment and backfill volumes
- MCD trials to assess process performance for highly contaminated materials.

The objectives and scope of these investigations for the site are further outlined below.

3.2.1 Objectives

The investigations conducted during Stage 1 of the works were undertaken in October 2001 to provide consistent and reliable contaminant and physical property data to facilitate design requirements for the MCD plant and remediation approach. The aim of the site investigation was to characterise the nature and distribution of contamination on the FCC site to facilitate planning and execution of site remediation. The scope of the investigation included:

- excavation, sampling and logging of test pits on a 15 m grid across the FCC east and FCC west sites and on a 23 m grid in the FCC landfill
- sampling and logging of test bores on a nominal 7.5 m grid on residential Lots 13 and 15 south of FCC east and residential Lots 18 and 20 south of FCC west
- installation and sampling of five new groundwater monitoring wells
- sampling and analysis of concrete at 25 locations across the sites
- validation sampling on a 7.5 m grid over parts of site thought to be clean (mainly the northern part of FCC west, referred to herein as FCC north)
- surveying of all investigation locations
- compilation, interpretation and reporting of the investigation results.

The results of the 2001 investigation were combined with data from previous studies to estimate the degree of contamination and volumes of contaminated materials. The most critical determination was to ascertain the volume of OCP contaminated, as this is the most difficult (and expensive) material to treat.

3.2.2 Summary of Stage 1 characterisation results

Characterisation investigations at the former FCC site at Mapua have revealed a pattern of contamination consistent with the known history of activity at the site.

Widespread contamination exists at various depths below the east and west FCC and landfill sites with a general pattern of decreasing contamination extent with increasing depth. Soil contamination located in the eastern end of the east FCC site and the landfill reflects filling practices in these areas, with zones of higher contamination at the depths where the most contaminated fill was placed. The portion of the west FCC site, north of the boundary fence, that is mostly paddocks has been shown to be largely clear of subsurface contamination apart from a localised area around the former laboratory. Soil contamination at levels exceeding residential guidelines has been found in unpaved areas on three residential properties bordering the southern end of the west and east FCC sites. Number 13 Tahi Street has been shown to have significant levels of soil contamination in unpaved areas across the whole site. Sampling of the residential properties has not excluded the possibility that contamination exists on other properties further to the south.

Sampling of concrete materials at the site revealed that significant concrete contamination is limited to four areas, namely the former pesticide and prills manufacturing buildings, the solutions mixing plant and the dangerous goods store.

Groundwater contamination was detected in four of the five newly installed groundwater monitoring wells installed at the site. These values will provide a baseline with which to compare results following site remediation however further water level and groundwater chemistry data could be collected prior to any site remediation. This information would allow the assessment of current groundwater contamination across the site and the groundwater flow direction and receiving environment for the contaminated groundwater. Measurements of groundwater levels in selected wells over tidal cycles would also provide useful information about the groundwater behaviour.

3.3 Contaminated material volumes

Following the completion of the Stage 1 site characterisation, Thiess Services and Montgomery Watson (MWH) reassessed material class volumes based on Table 1.4 cleanup scenario.

For the purpose of estimating treatment volumes it was assumed that only material exceeding the commercial soil acceptance criteria will be treated. The revised *in situ* volumes are presented below in Table 3.1.

Table 3.2 indicates that the total quantities of materials requiring treatment various locations across the site. The table indicates that approximately 6200 m^3 of screened materials will require treatment to meet SAC.

Table 3.1: Volume estimates of material greater than commercial SAC pre-screening

Gross treatment quantity	Revised in situ volume (m^3)
FCC east	6,537
FCC west	2,416
FCC landfill	2,750
Total	**11,703**

Table 3.2: Volume estimates of material post screening requiring MCD treatment

Net treatment quantity	MWH revised volume (m^3)
FCC east	4,249
FCC west	1,087
FCC landfill	825
Total	**6,161**

3.3.1 Volume Balance

In 2004 a volume balance diagram was formulated (Figure 3.1). This volume balance effectively summarises the proposed flow of materials on and off site. It should be noted that the diagram refers to unscreened volumes. In addition the diagram has not been updated to accommodate the revised material volumes as detailed in Tables 3.1 & 3.2 above.

This volume balance is expected to change during the course of the remedial activities, given that the original contaminated soil volumes were estimates (based on preliminary sampling) and that operational changes may impact the flow of materials across the site. Updated volume balances will be undertaken as required throughout the course of the project.

Figure 3.1 Pre-Excavation Volume Balance for FCC Mapua Site (MWH 2004).

4 Remediation Approach

4.1 Introduction

A detailed review was undertaken to assess those soil remedial approaches that were considered viable within the constraints defined by the principal's objectives and minimum outcomes. Those technologies that were considered to be potentially applicable from a technical and commercial standpoint to cleanup the contaminated soils are listed below:

- Mechano-Chemical Dehalogenation (MCD): a process developed by EDL (Environmental Decontamination Limited) that involves the processing of soil in the presence of proprietary additives
- Thermal desorption and destruction: processes that utilise heat (either directly or indirectly) to volatilise organics from the soil, followed by destruction, in which the organics are either oxidised or chemically dehalogenated
- Ex-situ bioremediation: processes that rely on the use of naturally occurring or introduced bacteria (and other life forms) to biologically degrade organic compounds.

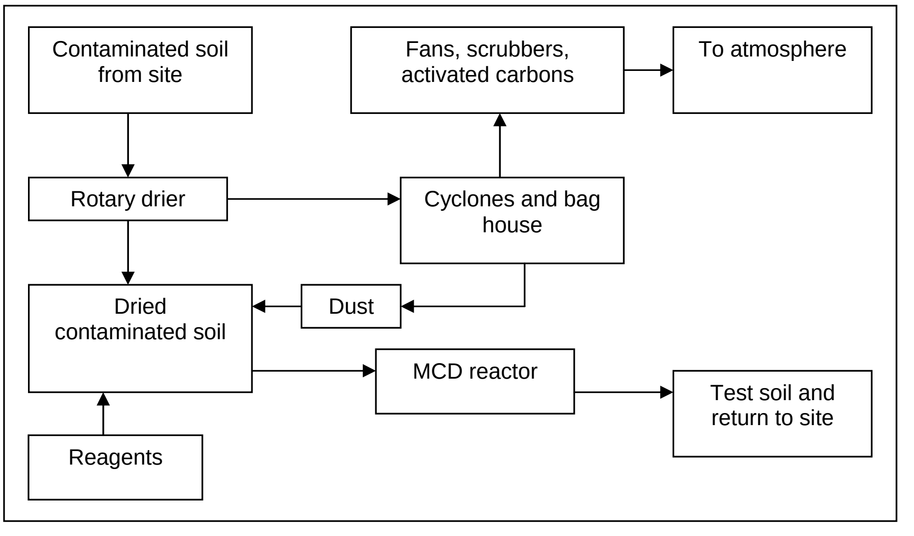
Based on the assessment it was concluded that only mechano-chemical dehalogenation (MCD) and indirect thermal desorption (ITD) were commercially viable technologies for the remediation of soils and sediment from the site. Whilst each technology is capable of reliably delivering treatment to the required standard, the affordability of the MCD process as compared to ITD largely dictated its use at the Mapua site.

4.2 Mechano-chemical dehalogenation (MCD) process

The MCD process involves the dechlorination of organic compounds by the inputs of mechanical energy, as impact forces, in the presence of proprietary additives (electron and hydrogen donors).

Laboratory, pilot plant and full scale demonstration plant trials have confirmed the irreversible, reductive destruction of the persistent organic pesticides in soils such as those found at the Mapua site. As expected, production rates depend on the initial contaminant concentration of the in-feed material. EDL began pilot plant trials in mid 1999 with the aim of optimising the dehalogenation process. Numerous trials were conducted in the development of the MCD process, testing the effectiveness of different catalysts for the destruction of the contaminants present in the Mapua soil. Several different catalysts were found to be effective with the final selection coming down to a balance between reactivity and cost.

Figure 4.1. Simplified process flow diagram for the MCD process.



In the MCD reactor the contaminated material and added reagents are subject to mechanical impact energy provided by grinding media in rotating cylinders.

Following trials of the MCD Plant as part of the Stage 1 works the following advantages and potential limitations of the MCD Plant are summarised in Table 4.1.

Table 4.1: MCD Process advantages

Advantages	Potential Limitations
Production rates are relatively high at up to 3T/hr.	The material must be dried to prevent clogging of the plant.
The system is relatively compact and mobile.	Noise and vibration emissions could be a problem in residential areas and have been engineered out.
The process is relatively inexpensive.	Destruction efficiencies and throughput may be reduced for high concentrations (>1000mg/kg).
The process is relatively robust and can treat a range of organic compounds.	Soil containing high clay contents may require amendment with coarse material for treatment.
The process is relatively robust and can treat a range of matrix types.	Treated material is very fine and has to be reconstituted by mixing with coarse material.

In accordance with the project objectives an agreed target destruction removal efficiency (DE) for organochloride pesticides (OCP) contaminants is required. For the purpose of calculation only DDX, lindane, dieldrin and aldrin are considered. The target DE will be between 90% and 95% and measured in accordance with the procedure presented below. The DE will be tracked on a continuous basis in order to adjust treatment parameters to ensure the target is achieved (Appendix 13: Workplan 13 – Validation Sampling and Analysis).

4.3 Location of the treatment facility

Significant community consultation was undertaken with respect to the siting of the MCD treatment plant, with both the site and the Eves Valley Landfill (EVL) and Mahana sites considered. The advantages of locating the treatment facility at Mapua site included:

(1) minimisation of haulage costs and impacts from truck movements,

(2) eliminates need to obtain resource consents for treatment facility at EVL,

(3) limits environmental impacts to immediate vicinity of site.

While the treatment facility at either the Eves Valley Landfill or the Mahana sites was considered to allow remediation works to proceed in the most straightforward manner, consultation with the community indicated that the impacts associated with additional vehicle movements to and from the landfill were unacceptable. The disadvantages associated with onsite treatment were considered manageable, and as such the decision was made to treat the material onsite.

5 Resource Consents

In accordance with Stage 1 activities of the remediation project, relevant resource consent applications were submitted to facilitate Stage 3 activities and the effective clean up of the Site. Given the varied remediation activities, and location of the site (adjacent to residential housing, and the marine environment) several resource consents were required to facilitate clean up operations. Table 5.1 lists the various resource consents that were granted in October 2003 and provides an overview of the purpose of each consent. The table also provides a broad overview of consent requirements and relevant activities. Further details relating to resource consent compliance monitoring is provided in section 7.3.

Table 5.1: Resource consents granted and summary of Consent purpose and requirements

Resource consent reference	Purpose	Requirements
RM030521 **General**	Pertains to disturbance of the land for the purposes of remediating the site. It includes the construction of buildings, MCD plant, holding ponds and barriers. It covers operation of the MCD plant in hazardous area and under conditions that may exceed hazardous facility thresholds outlined in the Tasman Resource Management Plan.	Consent requirements include conditions relating to: *Rainwater (potable water supplies); Noise; Vibration; Hazardous Substances; Building Assessments; Screening; Earthworks; Revegetation*; *Vehicles; Lighting*, *Certification; Waste Manifests; Final Validation and Site Management*.
RM030522 **Coastal Marine**	Pertains to the disturbance of the coastal marine area surrounding the FCC site due to the excavation and removal of contaminated marine sediments. It includes provision for the removal/construction of stormwater outfalls and the discharge of water, stormwater, contaminants and sediment to the marine environment.	Consent requirements include conditions relating to: *Macroinvertebrate and Sediment Loading; Timing of Excavation; Noise; Revegetation; Roading; Management and Validation*.
RM030523 **Air**	Pertains to the discharge of contaminants to air within acceptable limits from the excavation and screening operations, and proposed MCD treatment plant. These discharges include odour, dust and treatment plant emissions	General conditions include that (1) there shall be no "*odour, dust, particulate, smoke, ash or fume caused by discharge from the site…*[that is deemed]…. *noxious, dangerous or objectionable beyond the boundary'* and (2) the consent holder must also use best practice techniques to minimise fugitive dust from the site. Specific consent requirements include conditions relating to: *MCD plant operation; Site monitoring; Total Hazard Index; and Site Works.*
RM030524 **Water**	Pertains to the discharge contaminants to land (including sediments, soils, wash water, stormwater, diverted groundwater) during works and to discharge residual contaminants following remediation.	General conditions include that (1) the release of contaminants to land will be minimised, (2) avoid increasing the contaminant above levels specified in the Soil Acceptance Criteria (SAC) (3) soils shall comply to SAC and (4) the SAC will be defined as General Conditions. Specific consent requirements include conditions relating to: *Groundwater; Stormwater; and Sampling Protocol.*
RM030525 **Sediment Discharge**	Pertains to the discharge of sediments meeting Soil Acceptance Criteria (SAC) to groundwater.	General conditions include that (1) discharged sediments will meet SAC. Specific consent requirements include conditions relating to: *Groundwater; and Sampling Protocols.*
RM030526 **Stormwater**	Pertains to the diversion and discharge of stormwater	Consent requirements include conditions relating to; *Stormwater Discharge, Quality and Monitoring.*
RM030527 **Divert Groundwater**	Pertains to the taking (interception) and diversion of groundwater.	Consent requirements include conditions relating to: *Dewatering; Water Quality; and Monitoring*

Table Notes: The regulatory authority and licence holder for each of the consents is TDC and MfE respectively. Each of the Consents is valid for 4 years and will accordingly expire in October 2007.

6 Remediation Works Methodology

6.1 Introduction

This chapter provides an overview of the proposed remediation works methodology. In this chapter (and subsequent chapters) references are made to 'Work Plans' (WP) which provide operational details for specific remedial activities (Appendices 1 to 18).

In summary the physical remediation of the site can be summarised in the following 3 steps;

- ***Site clearance*** - removal of buildings, concrete and subsurface drainage structures
- ***Soil assessment and treatment*** - soils across the site are assessed in terms of their contamination levels and are either; (i) left *in situ*, (ii) excavated and relocated, or (iii) excavated, screened and MCD treated.
- ***Recontouring and revegetation*** - required drainage structures will be installed and the site will be compacted, recontoured and revegetated in keeping with the intended land use.

The excavation and validation procedures are further summarised in Figure 6.1.

6.2 Material classification system

In accordance with the resource consent requirements and to facilitate the location of discrete classes of contaminated materials on the site (based on soil acceptance criteria – SAC) the sampling grid pattern established for the site characterisation has been used to name individual 'cells' (15 by 15 metres) within the site.

These cells have been assigned an alphanumeric name by assigning a letter (A to N) to a given row (based on its longitudinal position) and a number (1 to 26) to a column (based on its' latitudinal position) as per Map 1 (Appendix 19). The material within each cell has been further delineated by depth, with each layer classified against the soil acceptance criteria (SAC). These 'layers' have been assigned a number 1 through to 5 as per Table 6.1.

Table 6.1: Cell layer depths and volumes

Layer	Depth (m)	In situ cell volume (m^3)
1	0.0–0.5	112.5
2	0.5–1.0	112.5
3	1.0–1.5	112.5
4	1.5–2.0	112.5
5	2.0–3.0	225

This classification system effectively identifies the probable degree of contamination at any given location within the site to a depth of 3.0 m and thus provides an indication of handling and processing requirements (Appendix 19: Maps 1–6). Handling and treatment protocols will depend on the material's in situ contamination classification and the level of contamination of underlying strata. The excavation and validation procedures are summarised in Figure 6.1 below.

6.3 Validation sampling protocols and soil acceptance criteria

6.3.1 Overview

As identified in Table 1.4, the site may be used for a variety of purposes including recreational, commercial and residential use. For the purposes of this RAP, it is assumed that for the residential scenario, there will be access to underlying soils and that the growing of produce will be possible onsite.

The soil acceptance criteria for contaminants other than OCPs (including additives and by-products of the treatment process) have been set at levels to ensure that the land will be suitable for its proposed use. A complete soil acceptance criteria (SAC) has been developed for the Mapua site and is included in Work Plan 13 – Validation Sampling & Analysis (Appendix 13).

6.3.2 Validation sampling protocols

Validation sampling will be undertaken as per the protocols detailed in WP13 – Validation Sampling and Analysis Plan (Appendix 13). As detailed in Table 6.2 several validation sampling protocols have been developed for the site.

Table 6.2: Types of Validation Sampling

Type of Validation	Purpose of Validation
(1) Pre-assessment of Contaminant Levels	This type of validation is generally carried out on *in situ* soil material prior to excavation relocation and/or treatment and is designed to assess contaminant levels and to determine treatment/handling requirements
(2) Pre-assessment of Marine sediments	This type of validation will be carried out on *in situ* marine sediments to assess contaminant levels and to determine treatment/handling requirements
(3) Imported soil materials	To confirm that imported materials (materials derived from offsite) are suitable for intended land uses as per relevant SAC.
(4) Assessment of MCD treated materials	To demonstrate that soil materials have been remediated to a standard suitable for the proposed end land uses in accordance with relevant Soil Acceptance Criteria (SAC). Additionally, sampling is undertaken to determine destructive efficiency (DRE) of the MCD plant.
(5) Validation of remediated areas, including marine sediments	To demonstrate that soil materials have been remediated to a standard suitable for the proposed end land uses in accordance with relevant SAC. Walls and floors of excavated areas *in situ* will be validated to confirm all contaminated material has been removed.
(6) Validation of marine sediments	To demonstrate that marine sediments have been remediated to meet assigned SAC for the marine environment.
(7) Exported materials	Some material that may leave the site includes greenwaste and rubbish transported to Eves Valley Landfill. This material will be validated as required by both the nature of the material and the receiving environment requirements.

[Note – this will be consistent with the Table in WP13]

6.3.3 Validation analysis

All validation sampling will be carried out by a fully certified IANZ laboratory using standard analytical procedures. Sampling requirements are outlined in WP13 (Appendix 13).

6.3.4 Accredited site auditor

An independent site auditor, accredited with the NSW EPA has been appointed by the principal to issue a site audit statement on completion. This site audit statement will confirm that the objectives of this RAP have been met and that the site is suitable for its proposed land uses.

The site auditor plays an integral role in the remediation process and acts independently of both the principal and the contractor. His role is to review the various management plans and this RAP for their appropriateness, to provide limited supervision and guidance during the works and to review all of the analytical data and validation reports prepared during the works.

6.4 Civil remediation operations - Overview

6.4.1 Onshore excavation

Prior to commencing bulk earthwork excavations, all surface hard stand areas were excavated, and hauled to a designated hardstand stockpile area in preparation for crushing operations (WP2 – Clearing and demolition: Appendix 2). Crushed concrete will be reused onsite in accordance with its contamination status. Contaminated material will be isolated, crushed to suitable size and treated (WP13 – Validation Sampling and Analysis: Appendix 13).

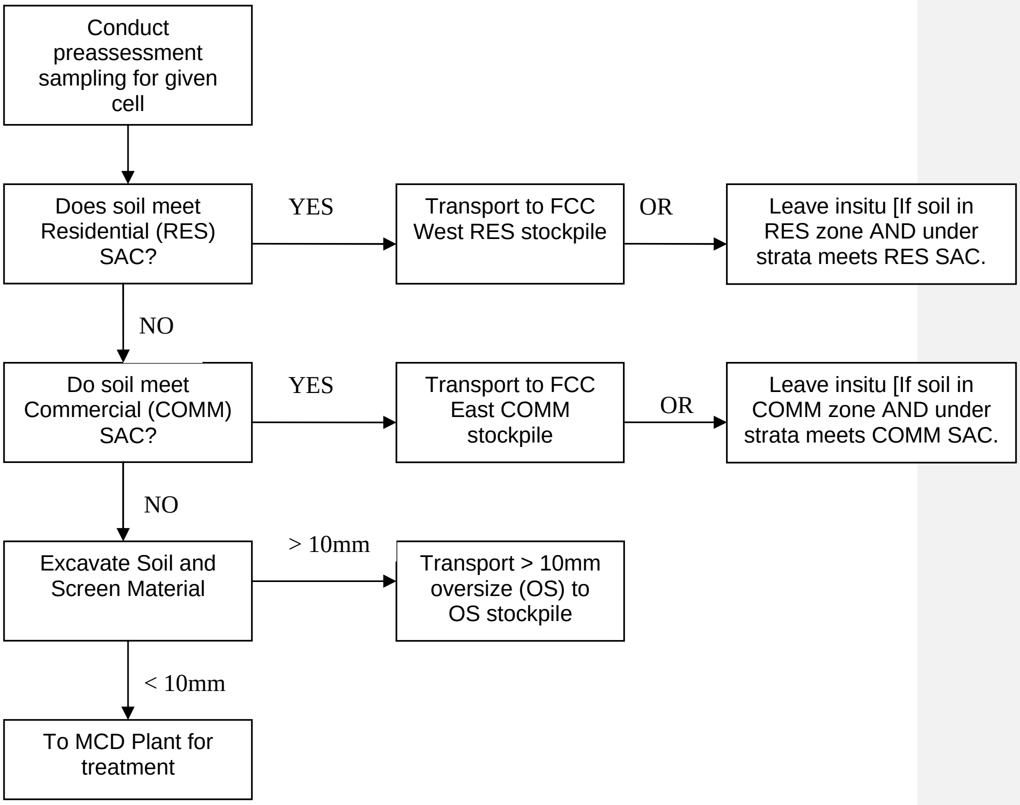
Excavation will be undertaken using 20–40 T tracked hydraulic excavators. To facilitate the recovery of discrete classes of material, the location of each cell will be marked on the ground by survey pegs and/or marker paint and the excavation activities supervised at all times to ensure discrete layer removal.

The excavation will be undertaken on a cell-by-cell basis corresponding to the pre-excavation classification. Materials other than rock or hardstand requiring treatment and/or relocation will be loaded directly from the excavators to tip trucks for haulage to temporary stockpiles which will undergo validation testing. These temporary stockpiles will be maintained by rubber tyred front-end loader(s) and covered to minimise fugitive dust generation (section 7.4.3).

General refuse that is excavated and cannot be re-used onsite will be cleared of contaminated soil, validated as per WP13 and then transported to Eves Valley Landfill. All refuse sent to Eves Valley Landfill will meet the relevant Landfill Acceptance Criteria and any relevant transport regulations if required.

Detailed procedures for onshore excavation activities are provided in WP6 – General Onshore Excavation Works (Appendix 6). Onshore excavation procedures for materials requiring treatment and/or relocation is summarised by Figure 6.1.

Figure 6.1 – Flowchart summarising soil excavation and handling protocols at Mapua



6.4.2 Marine excavation

Prior to commencing offshore excavation works a macroinvertebrate and sediment quality survey will be undertaken, as well as a shoreline profile survey as detailed in WP8 (Marine Excavation Works: Appendix 8). Relevant stakeholders are also to be notified of the commencement of works within the specified timeframe.

Marine sediments will be excavated from the eastern margin of the site within the Mapua channel and immediately south of the FCC landfill within the Waimea Inlet. Sediments from these locations will be transferred to adjacent dry land, stockpiled, allowed to dewater prior to soil criteria testing (WP8 – Marine Excavation Works: Appendix 8). Providing the sediments meet relevant soil criteria, these sediments will be used as backfill below depths of 0.5 m and will be compacted as per criteria outlined in WP9 (Backfill and Compaction: Appendix 9).

A similar method of excavation will be used offshore near the FCC landfill. Because sediments are scheduled for removal up to 100 m offshore, a gravel access road may be required to facilitate excavator and/or truck access.

As per terrestrial excavation activity, if any koiwi, taonga or other cultural/archaeological materials of significance are discovered the *Archaeological Protocol and Procedures* detailed in WP 6 (Appendix 6) shall be implemented.

6.4.3 Soil screening operations

As described in hydrogeology section 2.2.3 of this RAP, contaminated soil materials are likely to contain varying but significant volumes of ‘clean’ oversize (> 10 mm) material within a fine-grained contaminated matrix. Contaminated material is screened using a commercial unit fitted with a hopper, conveyor belt and vibrating screens to remove ‘clean’ oversize materials down to 10 mm diameter. Bulky goods such as drums, pipes and other materials will be removed by ‘hand’ and where necessary cleaned to remove contaminated fines (WP6 – General Onshore Excavation: Appendix 6).

Where possible, screened oversize materials will be maintained in stockpiles adjacent to screening plant to minimise handling requirements and dust generation. Prior to remixing all oversize materials must undergo validation testing and where necessary must be re-screened to remove excess contaminated fines.

6.4.4 Washing of debris and bulky solid waste

In the case where debris and bulky wastes (recovered from the excavation and sorting process) have appreciable quantities of adhering fine material, this material will be removed either manually, or by high pressure water-blasting. Water-blasting activities must be undertaken within a bunded area within the stockpile processing area. Wash- water will be contained onsite and managed in accordance with WP5 – Water Management Plan (Appendix 5).

Cleaned material will remain onsite until an approved disposal option has been identified by the site manager and a waste transfer manifest completed (WP6 – General Onshore Excavation: Appendix 6).

6.4.5 Pure Product – Bulk deposits of pesticide

In the event of exposure of intact or semi-intact containers (e.g. metal drums) during excavation activities, the operator will ensure that a spotter is used to help ensure that the containers are removed with minimal further damage. This is to help minimise further release of concentrated contaminants to the surrounding environment. If appreciable quantities of ‘pure product’ (bulk quantities of liquid or solid pesticides) are exposed, and when MCD treatment of the materials is not viable, the ‘pure product’ must be isolated and an appropriate offsite disposal method identified after consultation with the site manager.

Isolation procedures will typically involve storage or containment within a covered bunded area the risk of further release and must meet OSH/engineering requirements as identified by the site engineer. Such an area must be clearly sign-posted.

6.4.6 Imported Hazardous Materials

Hazardous materials imported on site for remediation activities must be handled and stored in accordance with the WP 11 – Hazardous and Waste Substances Plan (Appendix 11).

6.4.6 Archaeological relicts, koiwi and taonga

The TDC and the Ministry for the Environment recognise the potential significance of the FCC site and accordingly commissioned archaeological assessment of the site. Results of this work indicate that some archaeological material exists onsite. An authority pursuant to Section 14 of the *Historic Places Act* 1993 to modify or damage part of these sites for the purposes of the remediation has been obtained from the New Zealand Historic Places Trust (Authority 2004/08).

As part of the archaeological assessment, an imprecise ‘sensitivity map’ has been prepared identifying those areas of the site where it is *likely* that archaeological material may be present, and those areas where it is *possible*, *less likely* and *unlikely* (Appendix 6). An iwi monitor will be present for all excavations in areas that are deemed *likely* or *possible* as per the iwi protocol.

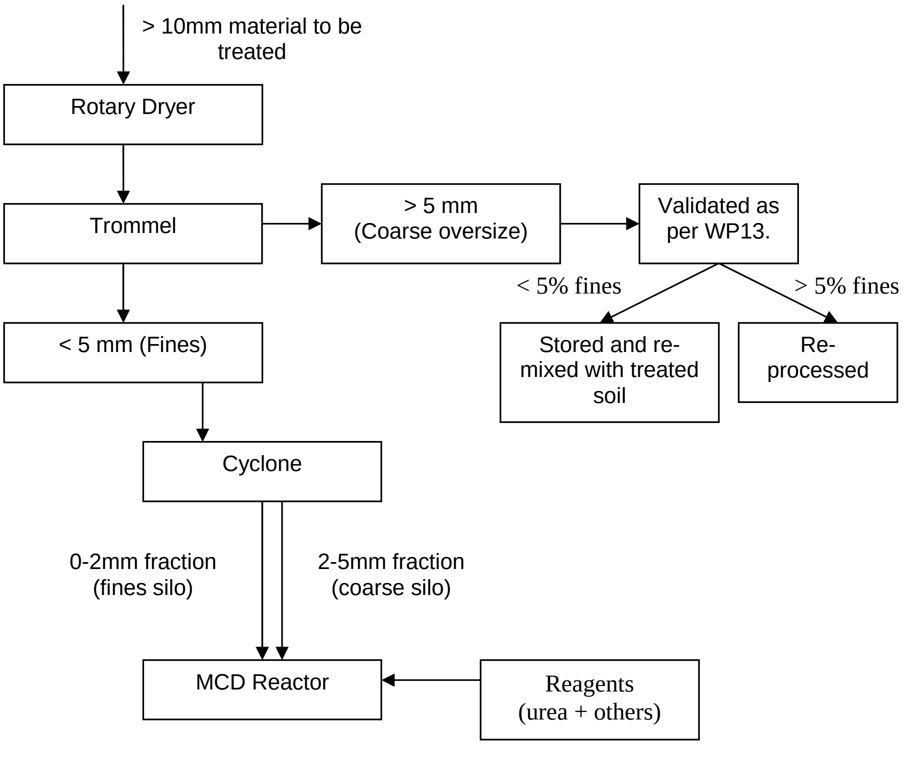
If any koiwi, taonga or other cultural/archaeological material of significance is discovered in any of the works during excavation activities, the procedure as outlined in ‘*Archaeological Protocol and Procedures*’ shall be implemented (WP6: Appendix 6).

6.5 Treatment of contaminated materials

Contaminated soils materials requiring treatment (i.e. DDX > 200 ppm or ADL > 60 ppm) are screened and the fine fraction (<10mm) transferred to the EDL storage area. Contaminated fines (feed soil) are transported from the bulk contaminated materials stockpile (CMS) to a small stock pile (~100 m^3) within the MCD plant’s storage shed which houses the hopper (plant feed). This material is feed to hopper via front-end loaders as required.

The process for the handling of treated material through the plant is shown in Fig 6.2.

Figure 6.2 – Flowchart summarising treatment processes and flows at Mapua



6.5.1 Coarse fraction

After drying, the feed soil is screened to produce a potentially clean oversize fraction (> 5 mm) and a contaminated fraction. The coarse fraction is transported via conveyor to a collection bin for validation and then returned to the oversize stockpiles if clean. In the event that the oversize material is non-compliant (in terms of commercial SAC), it must be crushed and returned to the MCD plant for treatment as per WP13 – Validation Sampling and Analysis Plan (Appendix 13).

6.5.2 Fine fraction

The dried fine fraction is conveyed to a fines storage silo from where it is fed into the MCD reactor via enclosed auger/screw conveyors. In the reactor the contaminated material is exposed to extreme mechanical action as a result of the vibration of thousands of steel balls. The energy provided in this environment activates the OCP decomposition reaction and accordingly 'decontaminates' the soil.

6.5.3 Treated soil handling

Treated soil exiting the base of the reactor is passed into a pug mill, with a sprayer unit to moisten the material and suppress dust. Treated soil is then stockpiled (within daily batches) prior to validation, remixing with oversize materials and backfilling. In the event that the treated soil fails the validation criteria, it will be retreated as per WP13 – Validation Sampling and Analysis Plan (Appendix 13).

6.6 Backfilling & Recontouring operations

Soil recovered from the sorting and treatment operations will be used to backfill and recontour the site as per WP9 – Backfill and Compaction Plan (Appendix 9). Compaction will be carried out to the specifications in Table 6.3 using suitably weighted excavators and/or rollers. In inaccessible areas compaction will be carried out using mechanical hand tampers or vibrators to attain the specified compaction levels.

Table 6.3: Backfill soil property requirements and compaction specifications

Recreational land use	Residential and commercial land use
Roller/track compaction to site engineer's satisfaction	95% standard maximum dry density and to site engineer's satisfaction
Meet relevant soil acceptance criteria (SAC)	Meet relevant soil acceptance criteria (SAC)
Be free of material greater than 500 mm in size	Be free of material greater than 150 mm in size
Exhibit physical properties enabling an adequate state of compaction	Contain 2% vegetative matter or less Exhibit physical properties enabling an adequate state of compaction

6.6.1 Testing for compaction

Compaction will be checked by standard maximum dry density tests and field density tests for materials other than sand, or by the density index and field density tests for sands in accordance with Table 6.3. Sampling protocols and frequencies are detailed in WP9 – Backfill and Compaction Plan (Appendix 9).

6.6.2 Finished surface of earthworks

On completion the site will be graded in accordance with contours detailed on drawings 1939/1/01 and 1939/1/02 attached in Appendix 9 (WP9 – Compaction and Fill). It is recognised that there may be the need to raise the levels of the FCC landfill above the pre-existing levels to accommodate relocated material and to potentially realign the drain along the western edge to accommodate riparian planting (TDC may have input into design as project progresses).

It is proposed that all areas be graded and finished surfaces will be smooth, compacted as specified, and free from irregular surface features. Grading will include contours to natural or constructed drainage channels, and will not result in depressions likely to pond water.

6.6.3 Revegetation of final contoured surface

The revegetation plan will be written in consultation with the TDC Reserves Department and Rob Davidson from the Peer Review Panel. It is anticipated this will be done with input from local residents. A subcontractor will produce the plan detailing how the replanting of coastal species will be achieved upon completion of works following reporting from the Reserves Department. Plants recommended/used for revegetation will be limited to indigenous species with genetic stock from the Tasman Bay Area.

7 Environmental Protection and Monitoring

7.1 Overview

The FCC site provides a challenging remediation scenario for a number factors including; (1) the nature of distribution of contamination on site, (2) the wide and varied nature of remediation activities on site, (3) the close proximity of the FCC site to residential and commercial buildings and (4) the close proximity of the marine environment. The main potential environmental impacts/hazards on site are summarised in Table 7.1 below.

Table 7.1: Potential environmental impacts from remediation activities and contaminated soils at Mapua

Potential Impact	Description
Biohazard	Sources: The soil contaminants present at Mapua include a range of inorganic pollutants (heavy metals), and a suite of persistent organic pollutants (POPs) as discussed in section 2.4. There is a significant risk to contractors and the wider community associated with the skin contact and ingestion of contaminated soils. Dispersal of contaminants may arise during excavation, transportation, screening and treatment activities
Dust, Odour & Emissions	Sources: Fugitive dust, odours and emissions may be derived by excavation, transportation, screening and treatment activities on site. The dispersal of heavy metals and POPs through fugitive dust and stack emissions from the treatment plant are probable vectors for contaminant dispersal.
Noise	Sources: Operation of vehicles (trucks, excavators and loaders), crushing and screening plant, and the MCD treatment plant provide possible sources of nuisance and hazardous noise levels
Vibration	Sources: Operation of vehicles (trucks, excavators and loaders), crushing and screening plant, and the MCD treatment plant provide possible sources of nuisance vibration.
Contaminated discharge & Sediments	Sources: Excavation surfaces, soil erosion of de-vegetated soil surfaces, exposed stockpiles, and wind blown dust form potential sources of sediment that may adversely impact groundwater, marine and aquatic environments
Operational hazards	Sources: Day-to-day operational remediation activities on site provide a varied source of hazards such as operational vehicles, screening, crushing and treatment plant, treatment additives, fuel handling, electricity, handling of contaminated materials, volatile substances etc

Environmental control measures, designed to protect the environment during general remediation works and extreme weather events, will be implemented progressively in accordance with the works programme and prevailing weather conditions. Materials and equipment used for protecting the environment will be present and operating at all times during the works in sufficient quantities to ensure that all likely contingencies and weather conditions can be properly managed in a short timeframe.

These works will include but are not limited to:

- installation, operation and maintenance of stormwater retention basins, covers over existing stormwater pits, bunding, silt fences and straw bale barriers
- installation, operation and maintenance of groundwater control measures comprising cut-off barriers
- installation and operation of systems and work methods designed to control air emissions and dust from the works
- installation and maintenance of protective fences.

7.2 Consultative environmental management approach

Mitigation of the effects of the works will not be limited to physical measures. The manner in which the works are undertaken, coupled with a flexible programme will also be key mitigating features of the remediation. We recognise the impacts the works may have on the commercial activities adjacent to the site, as well as the impacts on neighbouring residents. A flexible and co-operative approach to the works on boundary will be adopted in consultation with the residents so that their concerns are adequately addressed.

A key element of this co-operative approach is open communication with the adjoining residents and a willingness on their part to communicate their concerns to us in a proactive manner. Methods to mitigate the effects of the works by way of a flexible approach will include but are not limited to:

- undertaking works on the north eastern corner of the site during the winter months if possible
- maintaining vegetative cover and boundary fences along the southern boundaries of FCC east and west for as long as possible so as to provide a natural screen to the site
- completing the excavation to the southern boundaries in consultation with the neighbours needs
- locating the screening and crushing plants as far as practical from site boundaries to minimise effects
- undertaking noise, dust and vibration monitoring during the works and reporting results in accordance with the resource management consent conditions
- adjusting and/or ceasing works if prevailing wind carries dust and/or odour beyond site boundaries.

7.3 Resource consent compliance monitoring

Each of the resource consents have numerous general and specific conditions that must be adhered to during the course remediation operations. The specific conditions are detailed in resource consents RM030521 (General), RM030522 (Coastal Marine), RM030523 (Air), RM030524 (Water), RM030525 (Sediment Discharge), RM030526 (Stormwater), RM030527 (Divert Groundwater).

7.4 Air quality management

A key objective is to conduct site works in a manner that ensures ambient air quality complies with statutory requirements and that nuisance odours are minimised. The resource consent conditions call for substantive levels of emission monitoring to be undertaken at the commencement of the remedial works and throughout the duration of the project (WP3 – Air Quality Management: Appendix 3).

7.4.1 Ambient air quality monitoring programme

As detailed in WP3 – Air Quality Management (Appendix 3), an air quality monitoring programme has been implemented that complies with the requirements set out in the resource consent conditions. The programme for ambient air quality can be summarised as follows:

- ambient sampling will occur at the three sites determined by the resource consent, namely
    - North/east of the site boundary (representative of closest residential neighbours)
    - South/west of the site boundary (representative of closest residential neighbours)
    - General background location that best represents ambient conditions
- high volume samplers run on a continuous basis at the sites listed above to determine Total Suspended Particulate (TSP) levels and PM_{10} levels as well as “puff’ samples for organic vapours
- dust deposition gauges at the sites listed above to measure dust deposition rates

In addition personal sampling pumps fitted with reactive tubes targeted to respond to key contaminants.

The weather recording station will provide information to site personnel on the prevailing wind direction and strength.

7.4.2 Total Hazard Index

Results from the above ambient testing will be used to calculate a Total Hazard Index that will assess the risk of exposure for all the contaminants that can potentially be discharged from the site. This assumes the risk from both Inhalation (high volume data) and Ingestion (dust data). Described further in WP3 - Air Quality Management Plan: Appendix 3.

Included in the calculation is the assumption that a child may eat 100mg/soil per day over the duration of the project and the potential inhalation rate of material.

7.4.3 MCD plant air quality monitoring programme

Emission test from the discharge stack of the MCD plant shall be undertaken at weekly intervals for the first month of operation and then at three-monthly intervals as detailed in WP3 – Air Quality Management Plan: Appendix 3.

7.4.3 Dust and odour control overview

While dust generation and dispersal can not be totally eliminated at any site, it is possible to substantially reduce emissions using a combination of practical management steps outlined in Table 7.2 and further detailed in WP3 – Air Quality Management (Appendix 3).

Table 7.2: Summary of dust and odour control management techniques at FCC site

Method	Description
Appropriate rates of progress	Dust and odour generation is generally proportional to the rate at which excavation and related haulage/stockpiling processes are undertaken. Furthermore dust generation from such activities is likely to be exacerbated when adverse climatic conditions (such as high winds) prevail. During the progress of excavation, haulage and stockpiling works will be tailored to optimise the performance of air quality mitigation activities with a view to prevailing weather conditions
Controls on vehicle movement	Dust generation and dispersion associated with vehicle movement will be minimised by the location of haulage and access tracks as far as is practicably possible away from site boundaries, and by limiting traffic speeds.
Minimisation of open excavation areas	When practically achievable, excavation of single full depth pass will be done to minimise area of contaminated soil exposed to the atmosphere. In addition, clean-up/trimming of the base of excavations will be undertaken concurrently with bulk excavation.
Excavation faces	Odour and dust control from excavated faces will be minimised by the use of odour suppressants and watering. Covering of excavation faces is generally considered impractical during excavation activities.
Covering of stockpiled material	Stockpiles will be maintained at a size that allows for appropriate dust and odour management. If necessary, stockpiles will be covered with high-density polyethylene (HDPE) sheeting. Sheets will be welded to provide a continuous barrier to the migration of odours and dust. Covers will be securely held down by either weighting or a cover mesh, appropriately secured to the stockpile foot.
Dust suppression by watering	Water will be used to temporarily suppress dust generation in operational areas. To be effective water must be regularly applied and/or chemical stabilisation agents must added. Watering techniques at the FCC site will include mobile *water carts* and *sprinkler systems* (both fixed and mobile).
Boundary wind barriers and screening	Wind barriers placed at boundary fences and intermittently across the site will help reduce the dust generation and dispersion by: (1) reducing wind speed at the soil surface (2) reducing evaporation (thereby enhancing the effectiveness of water based dust suppression techniques) (3) acting as a barrier to course particle transport.

7.5 Water management

7.5.1 Overview

Onsite water management is covered by WP4 – Erosion and Sedimentation Control (Appendix 4) and WP5 – Water Management (Appendix 5).

Water shall be managed using a hierarchical management approach. The methods in order of highest preference are:

1. Prevent surface water and groundwater from mixing with contaminated materials or contaminated water. Any sediment discharged to groundwater is to meet SAC.
2. Direct surface water via bunds etc to sedimentation basins for reuse onsite or discharge to bay.
3. Remove water from an area where it is mildly impacted and reuse for dust suppression or increasing soil moisture content.
4. Remove water from the MCD process and treat in the site waste water treatment plant for discharge surface water control system (WP5 –Water Management: Appendix 5)

An overview of the principle management techniques is provided in Table 7.3 below.

Table 7.3: Summary of FCC Mapua onsite water management

Method	Description
Control of surface water runoff	The works will be developed to prevent surface water from being contaminated. Surface water runoff will be controlled onsite by intercepting and redirecting runoff in a controlled manner by appropriate means including the use of temporary bunds, diversion drains, ditches, straw bales and silt fences. The environmental control measures for managing surface water runoff will be installed progressively as works proceed.
Controls on the existing stormwater system	To minimise the likelihood of sediment-laden run off contaminating natural water courses or estuaries, existing stormwater pits and pipes will sealed-off prior to the commencement of any earthworks in the area. Such work will typically involve placement of a concrete or clay plug/seal within pits.
Controlling surface runoff from outside work areas	Where necessary works will be undertaken to prevent surface water from entering work areas by the construction of perimeter drainage control measures. These diversion works shall include but not be limited to temporary bunds, diversion drains and ditches.
Controlling surface runoff within work areas	Temporary bunds and/or diversion drains will be constructed around all excavations to prevent surface water runoff from entering the excavations. Disposal of surface runoff within the work areas will be accomplished by either: • directing the surface run-off to stormwater retention basins which shall be constructed as part of the works and/or • allowing surface runoff water that collects in depressions on the site to naturally evaporate and/or infiltrate. The surface water runoff that is contained in work areas shall be tested and treated prior to discharge in accordance with relevant resource consents.
Stormwater retention basins	Stormwater retention basins will be designed and constructed to control all surface water flows from disturbed areas and to store peak runoff as required by the relevant guidelines. All surface water runoff from rehabilitated areas will be directed into the stormwater basin system. The water that is contained in stormwater retention basins areas shall be tested and treated prior to reuse or discharge in accordance with required resource consent conditions.

7.5.2 Spill response plan

A spill response plan has been developed and is included in WP11 – Hazardous and Waste Substances Management Plan (Appendix 11). The procedures specified in the spill response plan are designed to minimise the impact of any contaminant releases, which may occur during the works. This plan will cover issues that include but are not limited to: fuel/oil spills; contaminated material spills; barging operations/plant working over water; contaminated water release; works within the estuary; and spills which may affect neighbouring properties or residents.

Materials and equipment to be used for spill response purposes will be present and in an operational state at all times during the works in sufficient quantities to ensure that all likely contingencies can be properly managed in a timely manner.

7.6 Noise management

The works will be undertaken in such a manner to ensure that the levels of noise generated onsite are within the limits acceptable to the relevant regulatory authorities as detailed in WP10 – Noise Management Plan (Appendix 10). All site works shall be designed and undertaken to ensure that, whenever practicable, noise from those activities does not exceed the noise limits as detailed in Table 1 (WP10: Appendix 10). Sound levels shall be measured and assessed in accordance with the provisions of NZS6803:1999 *Acoustics – Construction Noise.*

7.6.1 Noise control measures

A series of simple noise control measures (e.g. limiting plant operation hours, erecting sound screens and controlling movement of excavation plant) will be utilised throughout the duration of the works. Noise control measures are fully detailed in WP10 – Noise Management Plan (Appendix 10).

7.6.2 Noise monitoring programme

An ambient noise monitoring programme will be conducted throughout the period of the works. The purpose of the monitoring programme will be to monitor compliance with noise emission standards at the boundaries of the property, and to demonstrate that site works are not adversely impacting the surrounding community (WP10 – Noise Management Plan: Appendix 10).

In the event that unacceptable noise levels have been identified onsite, works will be immediately instigated to rectify the noise levels in order that they reach acceptable levels within the shortest time practicable.

7.7 Vibration management

Vibration monitoring is being undertaken to facilitate safe and efficient remediation of the site as detailed in WP12 – Vibration Management (Appendix 12). Feedback from local residents will be used to verify compliance with thresholds, and residents will be notified of monitoring results. Monthly monitoring will be undertaken within the first six months of operation and six-monthly thereafter.

7.8 Traffic Control

To minimise the environmental impact of site vehicles and excavation plant, a series of controls has been implemented and are detailed in WP14 – Traffic Control (Appendix 14). This plan involves simple measures such as minimising vehicle movement within contaminated zones, covering of loads, limiting traffic speeds and where necessary cleaning vehicles leaving the site.

7.9 Site Access

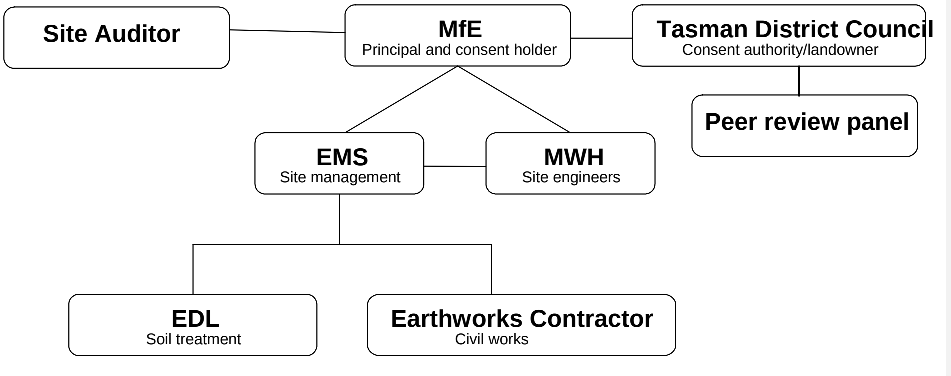
The site has been fully fenced to prevent public access to the site and excavation areas. Controlled entry of site personnel and subcontractors is strictly enforced as per WP15 – Site Access & Works Control (Appendix 15).

8 Project Management

8.1 Overview

The Ministry for the Environment (Sustainable Industries Group) has overall responsibility for management of the site. A site engineer and site manager have been contracted to manage day to day activities on the site. A schematic of the relationships between key management stakeholders is presented in Figure 8.1 below. Project management procedures are outlined in a project management and reporting plan (WP1: Appendix 1).

Figure 8.1: Organisational structure for Mapua project



8.2 Reporting

During the course of the remediation several types of reporting will be carried out including weekly work plans, monthly, quarterly and final closeout reports. Reporting requirements are further detailed in WP1 – Project Management & Reporting Plan: Appendix 1.

8.3 Information management

As a government department the Ministry for the Environment (MfE) is legally required to keep accurate records of the work undertaken at Mapua. MfE has proven systems and processes in place to help manage information, and all staff and subcontractors are under obligation to maintain accurate, complete, comprehensive records of Mapua project work. A summary of the information management protocols used by MfE is provided in Table 8.1.

Table 8.1: MfE information management protocols

Information type	Description
General	The Ministry filing system is based on a functional classification structure. The classification structure is exactly the same for both the hard copy (physical) filing system, and the electronic filing system that the ministry maintains. All electronic files are stored on the Ministry's centralised server which is backed up on a daily basis.
Reports	Hard copies of monthly and quarterly reports are to be held on File within the MfE library and available for public access. Copies of weekly work plans will also be held on physical file and as soft copy.
Contracts	Hard copies of contracts are maintained on physical file and as soft copy format.
Managing email	All email relating to the project should be clearly labelled and archived on the MfE server.
General correspondence	All incoming correspondence is date stamped and kept on physical file.
Validation and environmental monitoring data	Validation reports, quarterly validation reports and environmental monitoring data will be maintained by MfE on file and in the MfE library.

8.4 Public Communications Strategy

8.4.1 Overview

During the remediation process a communications strategy will be used to keep the general public, local community and key stakeholders updated on progress and relevant remediation issues as they arise. This will involve ongoing consultation with the local community through the remediation stage to keep them informed of progress and provide an avenue for them to communicate any concerns. This would largely be done through the Mapua Residents and Ratepayers monthly meetings and meetings with specific interest groups.

Residents Newsletter and media releases will also be used to inform the public and local residents of progress.

Comment [JF1]:

8.4.2 Consultation methods and tools

It is proposed that the following methods be used to ensure effective and efficient consultation be maintained throughout the remediation stage of the works (Stage 3) (Table 8.2). Full details of the communications strategy is provided in WP18 (Appendix 18).

Table 8.2: Summary of FCC Mapua site communication and consultation techniques

Strategy	Description
0800 number	An 0800 number (0800 FCC SITE) has been established and will be maintained to answer queries on the project and to receive comments, complaints and compliments.
Resident and Ratepayer Meetings	Regular attendance at the local resident and ratepayer meetings held in the Mapua Hall. Information will be provided and all queries or questions will be answered.
Press releases	Press releases will be prepared on the project for release through the principal, at specified times during the project programme, as determined by the consultation strategy. Any contact with the press be via the principal or via the EMS site manager.
Individual and group consultation	Individual consultation programmes will be maintained for key interest groups that have been established during Stage 1 of the works.
Newsletters	Newsletters will be prepared at specific stages for dissemination of information to the community. The newsletters will also provide specific information on progress with the project, the consent process, and remediation works as appropriate. Feedback will be sought either in writing, in personal meetings as requested or by phone.
Web page	Material will be produced for inclusion in the principal's web page that will provide a summary of commonly asked questions and answers.
Fact Sheets	A series of fact sheets outlining site health & safety, and environmental and remedial activities will also be prepared for public release.
Open days	Open days are proposed where team members would be available to discuss the project and explain the processes, timetable and issues on an individual basis. A suitable local venue will be chosen to maximise informality and mutual information sharing.
Information board	Mechanisms for informing the general public include the placement of a notice-board adjacent to the FCC Mapua site office on the corner of Tahi Street.

8.5 Occupational Health and Safety Management

8.5.1 FCC Mapua health and safety plan

A site-specific health and safety plan (WP16 – Occupational Health and Safety: Appendix 16) has been developed for the FCC Mapua remediation project. The health and safety plan formalises the applicability of procedures on a site-specific basis and is the benchmark by which safety is implemented. The plan includes consideration of numerous issues ranging from decontamination procedures to relevant statutory requirements and industry code(s) of practice.

All additional issues/incidents relating to occupational health and safety will be referred back to New Zealand OSH guidelines to ensure that there is consistency in our approach to site-based management of health and safety issues.

8.5.2 Health monitoring plan

A health monitoring programme (WP17 – Health Monitoring Plan: Appendix 17) has been implemented onsite to monitor the adequacy of the measures in the health and safety plan, with respect to OCP levels (Appendix 17). Feedback of monitoring results conducted under this plan will be used to make adjustments to the health and safety plan procedures as required.

9 Appendices

Appendix 1	Work Plan 1: Project Management & Reporting
Appendix 2	Work Plan 2: Clearing and Demolition Works
Appendix 3	Work Plan 3: Air Quality Management
Appendix 4	Work Plan 4: Erosion and Sedimentation Control
Appendix 5	Work Plan 5: Water Management
Appendix 6	Work Plan 6: General Onshore Excavation Works
Appendix 7	Work Plan 7: Detailed Excavation in Adjacent Properties
Appendix 8	Work Plan 8: Marine Excavation Works
Appendix 9	Work Plan 9: Backfill and Compaction
Appendix 10	Work Plan 10: Noise Management and Screening
Appendix 11	Work Plan 11: Hazardous and Waste Substances Management
Appendix 12	Work Plan 12: Vibration Management
Appendix 13	Work Plan 13: Validation Sampling and Analysis
Appendix 14	Work Plan 14: Traffic Control
Appendix 15	Work Plan 15: Site Access and Works Control
Appendix 16	Work Plan 16: Health and Safety Management
Appendix 17	Work Plan 17: Occupational Health Monitoring
Appendix 18	Work Plan 18: Communications Strategy
Appendix 19	Contamination Area Plans for Levels 1–5
Appendix 20	Mapua Bibliography

Appendix 1:

Work Plan 1 – Project Management & Reporting

Version	Date
1	14 July 2005
2	8 Dec 2006

Contents

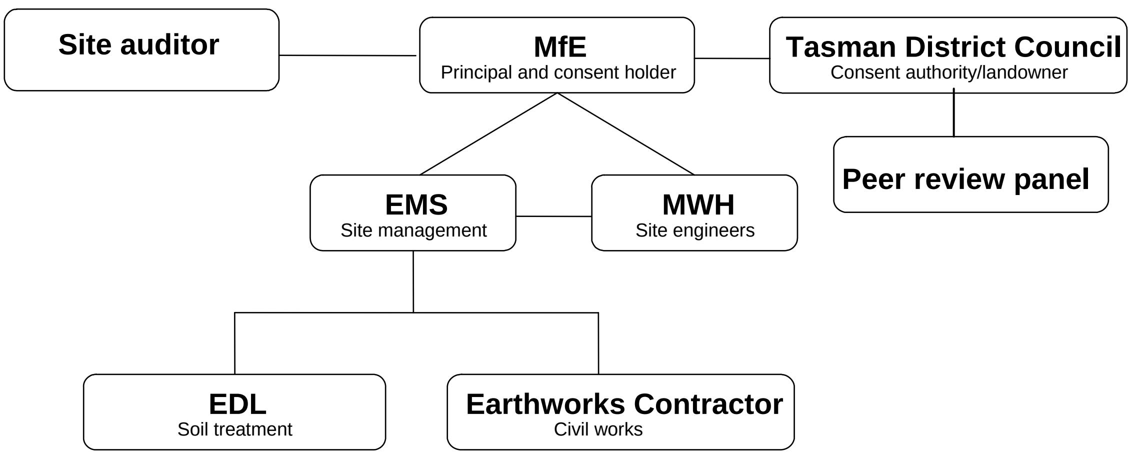
Appendix 1: Work Plan 1 – Project Management & Reporting

1 Overview

The Ministry for the Environment has overall responsibility for management of the site. A site engineer and site manager have been contracted to manage day to day activities on the site. A schematic of the relationships between key management stakeholders is shown in Figure 1 below. This plan includes an overview of the relevant statutory requirements, reporting structure, specified contractual requirements, and the activities of primary suppliers and subcontractors.

The principle objective of the project management plan is to ensure that there will be no detrimental effects on the environment (and/or personnel) caused by any work practice, discharge or emission from the site. All aspects of the proposed operations as they impact on the environment have been assessed for their significance and appropriate day-to-day and continuous improvement control strategies developed. Site personnel are charged with ensuring that the specified quality, safety and environmental requirements have been achieved by the adherence to the Remedial Action Plan and associated Management Plans.

Figure 1: Organisational structure for Mapua project



2 Reporting

During the course of the remediation several types of reporting will be carried out including a weekly workplan, monthly environmental monitoring reports and the final close-out validation report. Standard templates for each report will be used where possible.

2.1 Weekly report

The site manager will co-ordinate weekly work plan meetings between the onsite managers of earth works contractors and EDL. The weekly work plans will be forwarded to the principal by the site manager.

2.2 Monthly report

The project manager will be responsible for the preparation and submission of a monthly report to the Compliance Officer by the seventh working day of the month. This monthly report will be held on file within the MfE library. The monthly report will include a summary of the environmental monitoring and be available in the Mapua library for public reference.

2.4 Close-out report including the Validation Report

On completion of the contract, the Principal or designated principal's representative will prepare a close-out report to include CAD drawings of as-built location, dimensions, and details of remediated areas. The Close-out report shall also include the details of the site validation.

The report shall also include a schedule of the quantities of all materials that have been classified, the locations (in accordance with the site grid) on the site of the source materials and, if appropriate, the ultimate disposal locations of these materials on the site. In addition the close-out report shall contain all consent compliance monitoring results.

The Close-out Report and As-built drawings shall be provided within two months of the award of Practical Completion for Stage 3 of the Contract.

3 Information management

The resource consents (General conditions) require MfE to keep accurate records of the work undertaken at Mapua. MfE has systems and processes in place to help us manage information, and all staff and subcontractor's are under obligation to maintain accurate, complete, comprehensive records of Mapua project work.

3.1 Managing documents

The Ministry filing system is based on a functional classification structure. The classification structure is exactly the same for both the hard copy (physical) filing system, and the electronic filing system that the Ministry maintains.

3.1.1 Reports & Contracts

Hard copies of monthly reports are to be held on file within the MfE library. Hard copies of short and long-form contracts are held on file.

3.2 Managing email

All email relating to the project should be clearly labelled and archived.

3.3 Managing electronic files

The Ministry filing system is based on a functional classification structure. All electronic files are stored on the Ministry's centralised server which is backed up on a daily basis.

Appendix 2:

Work Plan 2 – Clearing and Demolition Works

Version	Date
1	14 July 2005
2	11 Dec 2006

Contents

Appendix 2: Work Plan 2 – Clearing and Demolition Works

1 Purpose and scope

The purpose of this procedure is to describe the demolition works procedure to be followed on the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Responsibilities

Responsibility for implementation of all aspects of this plan lies with the Ministry for the Environment (MfE). The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring activities lies with MfE and the site manager. Functional responsibility for field activities lies with the site manager.

4.2 Sequence of operations

Demolition works associated with existing concrete pavement, stockpiled concrete, disused subsurface drains and services, building slabs, asphalt paving and any other solid debris on the site will be carried out in accordance with the specifications and all associated legislation and requirements and minimising associated dust, noise and vibrations (RM030521-10a; RM030522-10a; RM030523-10a; RM030524-10a; RM030525-10a; RM030526-10a; RM030527-10a). Sequence of works are as follows:

1. Designate a specific location for the concrete crushing plant including the set up and general parameters, such as hours of operation and dust suppression.
2. Prior to commencing clearing and demolition works at the boundaries, consultation will occur with owner and occupiers concerning sequence/timing of works.

3. Existing vegetation at site boundaries shall be retained for as long as possible (RM030521-41). Where appropriate, trees, stumps and structures shall be removed by grubbing.
4. Holes remaining will be backfilled as per Backfill & Compaction work plan.
5. Concrete will be broken up and hauled to mobile crusher. Crusher location in consideration of surrounding properties and noise restrictions.
6. Volume of material crushed will be measured and recorded to determine approximate cubic volume of each slab.
7. Reinforced/rebar concrete will be removed and crushed to < 150 mm.
8. Crushed concrete stockpiles will be tested for contaminant concentrations.
9. A waste transfer manifest will be completed for any waste materials that leave the site.

4.3 Work methods

1. A number of environmental controls will be implemented during breaking up and crushing of concrete. Dust control measures including water cart/spray will be employed to limit dust generation (Consent RM030523/20). Where possible, demolition operations will be conducted away from site boundary to limit vibration transmission. Noise attenuation screens will be erected if appropriate to avoid noise effects that would otherwise be deemed to have a significant impact on neighbouring properties.
2. Grubbing operations are to be carried out to a depth of 1.5 m below the natural surface; or 2.5 m below the top of the final material zone, whichever is greater. Holes remaining after trees, stumps and structures have been grubbed are to be backfilled to prevent ponding.
3. Concrete will be broken up to suitable size for re-burial (if suitable) and/or removal.
4. After concrete has been broken up and validated, it may be reused for hardstand fill in areas to reduce waste such as carparks depending on validation results. Other material will be treated as required and used as hardstand in other suitable areas where material meets SAC. Validation as detailed in WP13 (Appendix 13).

4.4 Types of equipment

1. Truck and trailer/semi-trailer.
2. 20-30T excavator with concrete nibbler.
3. Mobile crushing and screening plant.

4.5 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

5 References

1. Resource consent/conditions RM030521-10a, 41, 56; RM030522-10a; RM030523-10a; RM030524-10a; RM030525-10a; RM030526-10a; RM030527-10a.
2. Contract specification.

6 Attachments

Not applicable to this procedure.

Appendix 3:

Work Plan 3 – Air Quality Management

Version	Date
1	14 July 2005
2	6 May 2007

Contents

Tables

Appendix 3: Work Plan 3 – Air Quality Management

1 Purpose and scope

The purpose of this procedure is to describe the procedure for the management of the air quality at the remediation of the FCC site at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Record of Changes

During the period of development of this RAP changes relevant to air quality management have been documented below in Table 1 -

Table 1: Recent changes relevant to air quality management

Date	Event	Change
23 March 2007	Temperature of Dryer	Temperature monitor for the dryer located at the outlet. Investigations into better understanding of temperature profile, possible emissions and use of carbon filter to capture those emissions with the assistance of the Peer Review Panel experts. Change to Consent RM030523 Condition 22 to monitor temperature at the outlet of the dryer.

5 Procedural text

5.1 Objectives

The objectives of this Air Quality Management Plan are to satisfy and specifically to:

- meet or exceed relevant resource consent conditions (RM030521-10e; RM030522-10e; RM030523-10e; RM030524-10e; RM030525-10e; RM030526-10e; RM030527-10e)
- ensure there are no odour, dust, smoke, ash or fumes discharged from the site that may be noxious, dangerous, offensive or objectionable beyond the boundary of the site. As such best practicable options to minimize fugitive dust from the site shall include but are not limited to wet suppression, minimizing storage pile heights, use of temporary covers, mobile wind breaks at working faces, and restricting vehicle speeds (RM030523-19, 20, 37)
- define the control measures to be implemented during the works to mitigate against dust and gaseous emissions from the works (RM030523-20)
- set out procedures for air quality monitoring
- set out procedures for community liaison and complaints handling
- define the responsibilities of personnel within MfE in regard to the implementation of the plan.

5.2 Potential emission sources

If not adequately controlled, unacceptable air emissions may be generated by a number of activities including:

- excavation/loading of contaminated and uncontaminated materials
- transportation of material onsite and offsite
- active stockpiling operations
- demolition and crushing operations
- inactive stockpiles
- exposed surfaces
- water bodies
- reuse of site waters
- pretreatment process/screening operations
- treatment processes (MCD operations).

5.3 Emission control techniques

5.3.1 Overview

Table 2 summarises the applicable dust emission control techniques for each of the potential emission sources identified in Section 5.2. Table 3 summarises applicable gaseous emission control techniques.

No single emission control technique can be expected to be 100% effective under all conditions. Accordingly, a variety of techniques must be employed at any time to mitigate potential impacts to the extent practicable.

Each of the applicable control methods is described in the following sections.

Table 2: Dust control techniques

Dust emission source	Appropriate rates of progress	Minimise open excavation areas	Covers	Partial/ complete enclosure	APCDs	Watering by sprinkler systems	Watering by water cart	Use of surface stabilisation agents	Revegetation of finished surfaces	Revegetation of inactive work areas	Wind barriers	Wheel washes	Paving/ hard stand	Speed limits and plant controls
Excavation/ loading	X	X				X	X				X			
Transportation	X		X			X	X	X			X	X	X	X
Active stockpiling	X					X	X				X			
Inactive stockpiles		X	X			X	X	X		X	X			
Exposed surfaces						X	X	X	X		X			
Treatment processes				X	X	X							X	

Table 3: Gaseous emission control techniques

Gaseous emission source	Appropriate rates of progress	Minimise open excavation areas	Covers	Partial/ complete enclosure	APCDs	Odour suppressant sprays	Odour misting systems	Free product recovery/ containment	Water reuse restrictions
Excavation/loading	X	X				X	X		
Transportation	X					X	X		
Active stockpiling	X					X	X		
Inactive stockpiles			X			X	X		
Exposed surfaces		X	X			X	X		
Water bodies			X			X	X	X	
Reuse of site water	X					X	X		X
Treatment processes				X	X			X	

Note: APCDs – air pollution control devices as applied to operating plant.

5.3.2 Identification of appropriate rates of progress

Dust and odour generation is generally proportional to the rate at which excavation and related haulage/stockpiling processes are undertaken. Furthermore dust generation from such activities is likely to be exacerbated when adverse climatic conditions (such as high winds) prevail.

At all times the progress of excavation, haulage and stockpiling works will be tailored to optimise the performance of air quality mitigation activities with a view to prevailing weather conditions.

5.3.3 Minimisation of open excavation areas

Whenever practically achievable, excavation will be undertaken in a single full depth pass to minimise the plan area of contaminated soil exposed to the atmosphere. In addition, clean-up/ trimming of the base of excavations will be undertaken concurrently with bulk excavation.

5.3.4 Covering of excavation faces

Odour and dust control from such sources will be provided by use of odour suppressants and watering as covering of excavation faces when an excavator is being used is not practical.

Covering of excavation faces after hours will be achieved by one of the following means:

- non-odorous soil cover: typically spread to 150 mm thickness or
- synthetic sheeting: lightweight polyethylene sheeting or tarps.

5.3.5 Covering of stockpiled material

Stockpiles will be maintained at a size that allows for appropriate dust and odour management.

If necessary, stockpiles will be covered with high-density polyethylene (HDPE) sheeting. Sheets will be welded to provide a continuous barrier to the migration of odours and dust. Covers will be securely held down by either weighting or a cover mesh, appropriately secured to the stockpile foot.

Stockpiles covers will be inspected on a daily basis. Repairs to torn or degraded sheeting will be undertaken immediately upon identification.

Covers to odorous material stockpiles will comprise:

- synthetic sheeting – lightweight polyethylene sheeting on tarps or
- hydromulching – use of straw mulch acts as a biofilter and is effective at controlling odorous emissions and
- non-odorous soils – a thin lift of soil (~ 150 mm thick) is effective at mitigating odours.

Hydromulching and non-odorous soil covers are more practical than sheeting for large stockpiles or active stockpiles and will be used preferentially.

5.3.6 Odour suppressants

Odour suppressants are chemicals that either chemically react with or mask volatile odorous compounds.

Odour suppressants may be applied either direct to the surface of an odorous material, or via misting systems. They are often used in conjunction with watering for dust control.

A variety of odour suppressants are available. Some are proprietary chemicals (such as ‘Biosolve’), whilst others use natural oils and fragrances (such as those based on citrus extracts). The effectiveness of such agents is site and chemical specific. Accordingly, trialling is required to obtain optimal performance. In any event, only non-toxic suppressants will be used.

Odour suppressants may be applied by water sprays (either hand held sprays or from water carts) directly to excavation surfaces and at stockpiles where odorous materials are being handled.

5.3.7 Controls on the movement of vehicles

The following controls will be placed on the movement of vehicles from work areas (RM030521-51).

- All surfaces carrying vehicular traffic shall be kept free of contaminated materials.
- All trucks transporting solid materials offsite shall be securely and completely covered immediately after loading the material, to prevent wind blown emissions and spillage. Such covering shall be maintained until immediately before unloading the trucks.
- All truck tail gates shall be securely fixed prior to loading and immediately after unloading solid materials.
- Trucks or equipment shall only move within designated transportation corridors. No trucks or equipment carrying contaminated materials shall be allowed to move across remediated or clean areas except via designated transportation corridors.
- Vehicles transporting materials onsite shall be operated in a manner so as to prevent any loss of materials during loading, transport and unloading activities.
- A site speed limit of 10 km/hr will be observed for all plant travelling onsite haul roads.

Vehicles leaving the site must be clean so as to prevent soiling of onsite and offsite roadways by dirt or tyre marks.

5.3.8 Equipment cleaning

Consent condition 521/51 requires that vehicles leaving the site shall be free of sediment to prevent tracking. A wheel wash, shaker facility or other method suitable of removing dust, mud and other detritus from the wheels and underbodies of vehicles leaving the site shall be established close to the two main exit points. All vehicles leaving the site or travelling between FCC east and west shall have the wheels washed before leaving the site.

Note for convenience of movements across Tahi Street other alternatives may be used to keep this crossing free of material such as large mats or frequent cleaning of the crossing.

5.3.9 Dust suppression by watering

Use of water to wet down an area or an operation is an effective dust control technique. However, this control is only temporary if water is not periodically or continuously applied, or if not supplemented by chemical stabilisation agents. Water may be applied by the following methods:

- water cart – by spray bar and canon
- sprinkler system – both fixed and mobile systems.

These application methods, and the proposed use of chemical stabilisation agents are discussed in the following sections.

5.3.10 Water carts

Water carts will be used to spray water onto haul roads, at excavation faces and stockpiles. Water carts will be equipped with a pump and sprays capable of spraying water at a rate in excess of 3 L/sec. Water carts will also be fitted with water canon capable of directing water at localised operations such as excavator and dozer operations.

5.3.11 Sprinkler systems

As required, a number of mobile irrigators will be moved around the site to address particular operations. Such equipment will typically be able to irrigate a 50 m radius at a flow rate of up to 10 L/sec. Timing systems will be in place to enable after hours watering if necessary.

In addition sprinklers may be used on boundary fences to assist in dust suppression

5.3.12 Revegetation

The establishment of vegetative cover is also an effective method to stabilise surfaces. Revegetation decreases erosion by wind and water and contributes to the development of a naturally fertile and stable surface environment. Also, the technique improves aesthetics.

Two types of vegetation application may be utilised:

- spraygrassing – inactive stockpiles (or part thereof) or inactive exposed areas
- seeding – completed areas.

Spraygrass will be used as a temporary dust control measure to stockpiles and other areas of the site not yet completed.

5.3.13 Boundary wind barriers and screening

As described in the Noise Management and Screening Plan (WP10: Appendix 10) four-metre high barriers will be constructed along various site boundaries.

Whilst primarily designed to mitigate noise impacts, the boundary barriers will also act as wind barriers. Wind barriers reduce the amount of wind blown dust by reducing wind speed on the soil surface, by reducing the drying effects of wind (thereby enhancing the effectiveness of water-based dust suppression techniques) and by acting as a barrier to course particle transport.

5.4 Monitoring programme

5.4.1 Air quality criteria

Site works will be managed to ensure that the following criteria are met (RM030523-19, 37):

- Total suspended particulate (TSP) generated from the site is < 80 $\mu g/m^3$ above background, as a 24-hour average
- dust generated from the site shall not contribute to deposited particulate beyond the boundary of the site at a rate exceeding a 4 g/m^2/month above background
- no visible odour, dust, particulate, smoke, ash or fume that is noxious, dangerous offensive or objectionable shall migrate beyond the site boundary.

TDC will be notified as soon as practical, in the event of a significant increase in discharge of contaminants into the air, which may result in adverse environmental effects (RM030523-38).

5.4.2 Air quality sampling

The following monitoring will be implemented to evaluate air quality on the site:

- three high-volume samplers to determine ambient TSP in accordance with US 40 CFR Part 50 Appendix J (RM030523-25). These samplers are also equipped to sample air for volatile organic vapours. The general locations will be north of the site boundary, south of the site boundary and at a general background location in the site vicinity that best represents ambient conditions, locations to be approved by Tasman District Council (RM030523-24). The physical locations of the samplers is at: (1) open lot adjacent to the house on Aranui Road and Iwa St (2) number 29 Tahi Street and (3) number 10 Coutt Place.
- TSP samples to be collected on a daily basis (RM030523-26).
- dust deposition gauges will be monitored monthly to measure dust concentration at the above sites (RM030523-24)
- Air quality sampling can include personal monitoring pumps to provide a better coverage of more sensitive areas

Samples will be analysed by taking 25% of each sample to evaluate the composite monthly ambient concentration and deposition rates of the following compounds in accordance with ISO/DIS 4222.2 (RM030523-27, RM030523-28):

- lindane
- aldrin
- dieldrin
- DDE, DDD and DDT
- heptachlor
- manganese
- chromium
- nickel.

All unused portions from above will be preserved and presented to the council for archiving (RM030523-29).

PM_{10} and TSP filters shall be collected on at least 10 days of maximum site remediation operations. These will be analysed to determine the percentage of TSP that is PM_{10} material contributed by the project. If it is found to be greater than 30%, then further monitoring shall occur according to a sampling programme approved by TDC (RM030523-26).

In addition, a weather recording station would be established to provide information to site personnel on the prevailing wind direction, and to provide a continuous record of atmospheric conditions.

5.4.3 Residential water tanks

There is a possible risk of contamination of residential water tanks from airborne contaminants released from the site. In consideration the consent holder will:

- prior to works undertake a full round of baseline sampling in residential water tanks (RM030521-19)
- provide an alternative potable water supply for the duration of remediation works (RM030521-21)
- upon completion of the works monitor water quality levels to ensure they do not exceed maximum acceptable levels (MAV) provided in the Drinking Water Standards for New Zealand 2000 (RM030521-22)
- monitoring locations will include properties at 13 Tahi Street, 21 Tahi Street, 23a Tahi Street, 23b Tahi Street and 31 Aranui Road.

Samples collected will be analysed for (RM030521-20):

- aldrin
- dieldrin
- lindane
- DDT, DDD, DDE
- chlordane and heptachlor
- selected metals, including mercury, copper, selenium, zinc and chromium.

In the event that contaminant concentrations exceed relevant criteria, and the rainwater is used for human consumption, the consent holder will provide an alternative potable water supply. This will continue until such time that two consecutive monitoring samples collected at least one week apart, confirm the water quality is consistent with the water quality determined during the baseline survey (RM030521-23).

5.4.4 MCD plant operation

The MCD Plant has a air emissions control system to control discharges to air. This includes a BagHouse and Venturi water scrubber to remove particulate, a activated *Carbon Filter* to remove organochlorines and other volatiles, followed by a ID Fan and Exit Tower or stack.

The air emissions system will be frequently maintained to ensure an efficient removal process. The stack will be monitored 3 monthly as per the consent conditions outlined below.

The concentration of particulate emissions from the stack shall be no more than 20 mg/m^3 (corrected to $0^{o}C$, 1 atmosphere pressure and a dry gas basis) (RM030523-21). Monitoring will be carried out in accordance with ISO 9096:1992(E).

To ensure that the materials are not heated to a level where they could form dioxins, the dryer will be monitored so that a temperature of less than $120^{o}C$ is maintained. Exceeding this temperature will cause the dryer to automatically shut down (RM030523-22).

Emission tests from the discharge stack shall be carried out at weekly intervals for the first month of operation, monthly for the next three months and at six monthly intervals thereafter. Sampling for the first month of operations will be taken when the most heavily contaminated samples are being processed and at least 75% of maximum capacity. After the first month, samples will than be taken with the plant operating at normal load (RM030523-23 a, b, c).

Three samples will be analysed for dioxins, furans, PCBs and HCB and particulate fractions of PM_{10} during the first month (RM030523-23e). In addition samples shall be analysed for gaseous and particulate fractions (RM030523-23d). Filter and deposition samples will be analysed by taking 25% of each sample to determine the composite monthly ambient concentrations and deposition (RM030523-28). Sampling encompasses the following compounds:

- lindane
- aldrin
- dieldrin
- DDE, DDD and DDT
- heptachlor
- manganese
- chromium
- nickel.

At the end of the first month and at six-monthly intervals thereafter, a dispersion modelling assessment of the effects of the discharge will be undertaken. This will be reported to the site auditor, the Tasman District Council’s compliance co-ordinator and the peer review panel as soon as practical, once the analysis has been completed (RM030523-23g).

5.5 Total hazard index

A total hazard index will be calculated for the duration of remedial works using the TSP and deposition data for lindane, aldrin, dieldrin, DDE, DDD and DDT (RM030521-10o; RM030522-10o; RM030523-10o, 30; RM030524-10o; RM030525-10o; RM030526-10o;

RM030527-10o). A total hazard index (HI) will be calculated each month for the first three months (further details in attachment 1):

Though sampling/storing of samples will continue, outcomes based on the HI and the frequency of chemical/mass sample analysis will vary as per Table 4.

Table 4: Hazard index sampling regime (RM030523-31, 32, 33, 34, 35)

Scenario	Hazard index	Frequency period/monitoring period	Outcome
1	HI < 0.5	• HI calculated with monthly data • First three months of monitoring	Analysis frequency reduced to three-monthly
2	HI > 0.5	• HI calculated with monthly data • After three months of monitoring	Monthly analysis frequency remains, and investigate means to reduce HI
3	HI < 0.5	• HI calculated with three-monthly data • After 12 months monitoring	Analysis frequency reduced to six-monthly
4	HI < 0.5	For three consecutive months of monitoring	Analysis frequency reduced to three-monthly, then six-monthly as per scenario 3
5	0.5 < HI < 1	Any stage of monitoring	Analysis frequency reduced to monthly, and investigate means to reduce HI
6	HI > 1	Any stage of monitoring	Operations ceases immediately, cause determined and rectified

5.6 Response to monitored exceedances

Where an exceedance of criteria is recorded, either as a result of regular monitoring or monitoring in response to a complaint, immediate action will be taken to identify the source of the emission and determine appropriate mitigation measures (RM030523-23f).

These may include:

- modification or cessation of the activity that is causing the emission
- reduction in the rate of progress of the works, or changes to the pattern of usage to reduce emissions
- implementation of additional control measures as may be appropriate for the specific situation concerned.

5.7 Community liaison and complaint handling

Liaison with the community will be directly with those neighbouring residents and businesses. Liaison will be undertaken on an ongoing basis as the process of remediation continues. The community liaison duties will principally be undertaken by the site manager. It will be determined at what stage of the programme each neighbour is likely to experience significant declines in levels of air quality and each neighbour shall be appraised of that situation and consulted with respect to the measures that are available to control the noise and the best times to undertake noisier activities.

In addition after one-month's operation of the MCD plant and at three-monthly intervals thereafter, MfE shall hold or attend a public meeting with the community to present results of environmental monitoring data. Prior notice to the community will be given by advertising locally.

A complaints handling and resolution procedure will be implemented by MfE, including the following provisions:

- identification of a contact person for complaints, who will have responsibility for investigation of all complaints, and subsequent contact with the complainant
- publication of a phone number which can be used for noise complaints, and which will be attended at all times when there is any activity on the site
- for each complaint received, prompt action to investigate whether any unusual activity may have given rise to the complaint, and if so, action to prevent a recurrence
- contact with the complainant as required to inform them of the progress of investigations
- recording of all complaints, including the nature of the complaint, investigations undertaken to resolve it, and all contact undertaken (RM030521-14; RM030522-7, 8; RM030523-7, 8; RM030524-7, 8; RM030525-7, 8; RM030526-7, 8; RM030527-7, 8)
- details of all complaints provided to TDC within 24 hours.

5.8 Responsibilities

5.8.1 Staff

MfE Site Manager

The MfE site manager has the responsibility for ensuring that the subcontractor's works are undertaken in accordance with the requirements of this procedure, and shall undertake regular site inspections to confirm this.

Subcontractors

The subcontractor site supervisor has the responsibility to communicate and implement this procedure and undertakes all works in a sage and efficient manner, as required by the relevant regulations and legislation. This includes the supervision of the subcontractor's employees and subcontractors.

The subcontractor site supervisor shall maintain a record of all monitoring that is undertaken and ensure the monitoring is implemented as per the relevant consent conditions, regulations and legislation.

5.9 Inspection test and control points

- Inspection and testing will be in accordance with relevant inspection and test plan and associated inspection checklists reports (ICRs).
- All testing shall be undertaken by NATA/IANZ registered laboratory.

5.10 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.
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6 References

1. Resource consent/conditions RM030521-10e, 14,19, 20, 21, 22, 23, 24; 51; RM030522-7, 8, 10e; RM030523-7, 8, 10e, 11, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38; RM030524-7, 8, 10e; RM030525-7, 8, 10e; RM030526-7, 8, 10e; RM030527-7, 8, 10e.
2. US 40 CFR Part 50 Appendix J.
3. Complaint Register.

7 Attachments - Total hazard index information & calculation

OVERVIEW

This attachment was developed by Tonkin & Taylor (March 2005) and outlines a methodology for calculating the Total Hazard Index (THI) for the Mapua contaminated site. The THI is the sum of individual hazard quotients calculated for exposure via inhalation and ingestion pathways for a range of organochlorine and metal contaminants. The methodology set out below makes reference to the excel spreadsheet named “Risk Assessment Calculations Model Worksheet.xls”.

The first worksheet in the spreadsheet is called “Summary”. This worksheet summarises the individual hazard quotients, hazard indices for each exposure pathway and the cumulative THI value, which have been calculated in the subsequent worksheets.

TOXICITY ASSESSMENT

Introduction

Compounds can be classified as either genotoxic (non-threshold) carcinogens, or threshold compounds depending on their toxic effects. There is a different approach to assessing the potential effects of these two types of compounds.

Non-threshold carcinogens

Carcinogenic compounds that operate through a genotoxic mechanism are assumed to have a linear dose-response relationship. These compounds are referred to as non-threshold carcinogens because there is not considered to be any threshold concentration below which adverse health effects do not occur.

Non-threshold carcinogens are assessed using the unit risk factor, which is defined as the upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular concentration of the substance. The unit risk may be converted to a slope factor, expressed in units of 1/(mg/kg-day).Nickel is considered a non-threshold carcinogen via the inhalation exposure pathway.

Threshold compounds

Threshold compounds may be non-carcinogens or carcinogens that operate via a non-genotoxic mechanism. These compounds are considered to have a level below which there are no adverse health effects.

The toxicity factors for threshold compounds are expressed as Tolerable Daily Intake (TDI). The TDI is the daily dosage of a chemical that is considered to be without any appreciable risk of harmful effect even if continued exposure occurs over a lifetime. The Hazard Quotient is the estimated Daily Intake divided by the TDI. The sum of the individual hazard quotients is the Hazard Index.

The organochlorine compounds, chromium and manganese are considered to be threshold compounds. It should be noted that nickel is considered a threshold compound for the ingestion exposure pathway, as explained in the AEE report.

Toxicity factors
The derivation of toxicity factors for each of the compounds considered is set out in the air quality assessment report that accompanied the Assessment of Environmental Effects (AEE) report for the Mapua site (Appendix E of the AEE report) and has not been reproduced here.

Intake factors
The intake factors used in the THI calculations are derived from various exposure factors that characterise the potential duration, frequency and rate of contact of the contaminant at the receptor. These are described in Appendix D of the air quality assessment report that accompanied the AEE report.

The THI calculations are based on the "reasonable maximum exposure" scenario. This approach combines upper bound and average exposure factors so that the result represents the highest rate of exposure that could reasonably be expected to occur. The exposure factors used to calculate the THI are summarised in Table 1 (source: MfE/MoH, 1997. Health and Environmental Guidelines for Selected Timber Treatment Chemicals, Ministry for the Environment and Ministry of Health, June 1997. Wellington)

Table 1 Exposure factors

Factor	Value
Exposure Frequency (EF)	24 hours per day, 350 days per year
Exposure Time (ET)	24 hours per day
Exposure Duration (ED)	1 year for threshold compounds 2 years (project duration) for non-threshold carcinogens
Body Weight (BW)	15kg for a child 70kg for an adult
Averaging Time (AT)	365 x 70 years for non-threshold carcinogens 365 x ED for threshold compounds
Inhalation Rate (IR)	$3.8m^3$/day for a child $20m^3$/day for an adult
Soil Intake (SI)	100 mg/day for a child

The inhalation intake factor is calculated from:

$$\text{Inhalation Intake Factor} = \frac{(IR \times ET \times Abs \times EF \times ED)}{(BW \times AT)}$$

The ingestion intake factor is calculated from:

$$\text{Ingestion Intake Factor} = \frac{(SI \times ET \times Abs \times EF \times ED)}{(BW \times AT)}$$

The factors are as described in Table 1, apart from Abs, the absorption across the lungs, which is conservatively assumed to be 1 (i.e. all inhaled material is absorbed).
There are three intake factors used in the THI calculation:

- Inhalation exposure for a child resident (used for inhalation exposure to threshold compounds) ($0.25m^3$/kg-day)
- Inhalation exposure for an adult resident (used for the carcinogenic compound nickel) ($0.01m^3$/kg-day)
- Ingestion exposure for a child ($6.393m^3$/kg-day)

These calculations are set out in the excel worksheet titled "***Intake Factors***". These factors do not need to be changed by the user.

Inhalation exposure
Direct inhalation of contaminants is the most significant exposure pathway for the discharges to air from the Mapua site. The potential exposure due to inhalation of contaminants is calculated using the following relationship:

Inhalation Intake = Concentration in Air x Inhalation Intake Factor

Inhalation intake and hazard quotients
The chemical concentrations in air have previously been measured as Total Suspended Particulate (TSP). More recent testing has been carried out using PUF filters, which provide a combined measure of particulate and vapour phase concentrations.

The chemical concentrations in air are inputted directly into the worksheet titled "***Inhalation hazard (TSP + vapour)***". The concentrations from analysis of the PUF samples at the monitoring site are inputted directly into the worksheet. The worksheet calculates the daily intake and hazard quotients for all of the compounds based on the worst case exposure scenario of a child exposed for an entire year.

INGESTIONS EXPOSURE
Introduction
Exposure via direct ingestion of soil has also been considered as an exposure pathway. The level of exposure can be estimated using the following equation:

Ingestion Intake of Soil = Concentration in Soil x Soil Ingestion Factor

Deposition rate
The average annual rate of deposition of contaminants onto the soil is calculated from the monthly deposition rate, as measured using deposition gauges. The results from the deposition gauge are inputted into the spreadsheet titled "***Annual deposition rate***".

Chemical concentrations in soil

The concentration of contaminants in soil is an equilibrium between the cumulative deposition of contaminants and the loss of contaminants due to leaching and run-off of soil and volatilisation of contaminants. The conservative assumption has been made that there is no loss due to leaching and run-off of soil. Volatilisation from soil has been considered for the organochlorine compounds, but not for the metals.

The concentration of each contaminant in soil (C_s) is calculated from:

$$C_s = \frac{D_w \text{ x } (1 \text{ x } e^{-ks} \text{ x } T_c) \text{ x } 0.1}{Z \text{ x } BD \text{ x } k_s}$$

Where:

k_s is the soil loss constant (year^{-1})

Tc is the total time of deposition (3 years)

D_w is the deposition rate (mg/m^2/year) (based on the results of deposition monitoring)

Z is the soil mixing zone depth (1cm)

BD = soil bulk density (1.5g/cm^3)

k_s is the sum of k_{slr} (soil loss constant due to leaching and run-off, assumed to be zero for both organochlorines and metals) and k_{sv} (soil loss constant due to volatilisation, assumed to be zero for metals).

The soil loss constant due to volatilisation (k_{sv}) is calculated from:

$$k_{sv} = k_t \text{ x } k_e$$

Where:

k_t is the gas phase mass transfer coefficient

k_e is the equilibrium coefficient

The gas phase mass transfer coefficient (k_t) is calculated from:

$$k_t = 0.482 \text{ x } u^{0.78} \text{ x } Sc_a^{-0.67} \text{ x } De^{-0.11}$$

Where:

u is the annual average wind speed (4.27m/s in the Nelson area)

Sc_a is the diffusion in air

De is the diameter of the effective area (1m)

The diffusion in air (Sc_a) is calculated from:

$$Sc_a = \mu_a/(\rho_a \times D_a)$$

Where:

ρ_a is the density of air (1.19×10^{-3} g/cm^3)

μ_a is the viscosity of air (1.70×10^{-4} g/cm/s)

D_a is the diffusion coefficient (cm^2/s) (variable for each compound)

The equilibrium coefficient (k_e) is calculated from:

$$k_e = \frac{3.1536 \times 10^{10} \times H}{Z \times K_{ds} \times R \times T \times D}$$

Where:

H is the Henry's Law constant (atm m^3/mol) (variable for each compound)

Z is the soil mixing zone depth (1cm for dermal exposure) (conservative assumption)

K_{ds} is the soil/sediment partitioning coefficient (mL/g) (variable for each compound)

R is the ideal gas law constant (0.08206L atm/(mol·K))

T is the average temperature (283K)

BD is the soil bulk density (1.5g/cm^3)

Ingestion hazard quotients

The ingestion hazard quotients are calculated on separate worksheets for the organochlorines and metals because the calculations are slightly different.

The ingestion hazard quotients for organochlorines are calculated in the worksheet titled "***Ingestion hazard (org)***". The annual deposition rate is read automatically from the previous worksheet. The worksheet then calculates the estimated daily intake (taking into account losses from the soil due to volatilisation) and hazard quotients.

The ingestion hazard indices for metals are calculated in the worksheet titled "***Ingestion hazard (metals)***". This is a simpler worksheet compared to the calculation for organochlorines because there are assumed to be no losses due to volatilisation. Again, the worksheet reads the annual metals deposition rates directly from the earlier worksheet and automatically calculates the individual hazard quotients.

Appendix 4:

Work Plan 4 – Erosion and Sedimentation Control

Version	**Date**
1	14 July 2005
2	11 Dec 2006

Contents

Appendix 4: Work Plan 4 – Erosion and Sedimentation Control

1 Purpose and scope

The purpose of this procedure is to describe methods that can be used for the control of erosion and sedimentation on an as needed basis, during the FCC site remediation works at Mapua.[1] Visual monitoring of any sediment movement will be paramount and suitable methods of containment and erosion control will be implemented as required.

This procedure is also to demonstrate how vehicles shall be kept free of sediment before going onto neighbouring roads or other sites.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Sequence of operations

Erosion and sediment control

1. Prior to bulk earthworks commencing, install silt fencing at the base of the site perimeter fence, and key into ground, if required.
2. Construct two semi-permanent sedimentation basins located within the low topographic points of the south west corner of FCC west and FCC east, if required.
3. Install permanent drainage structures or suitable alternatives before the removal of topsoil and commencement of earthworks for formation within the catchment area of each structure, if required.

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[1] Methods described meet and exceed conditions as outlined in RM030521-10c; RM030522-10c; RM030523-10c; RM030524-10c; RM030525-10c; RM030526-10c; RM030527-10c.

4. Construct temporary drainage works to minimise the period of exposure of disturbed areas as needed.

5. Ensure stabilisation of diversion and catch drains to divert uncontaminated runoff from outside the site, clear of the site. Uncontaminated surface water passing through the site will not be allowed to mix with contaminated site water.

6. Ensure the provision of contour and diversion drains across exposed areas before, during and immediately after clearing and the re-establishment and maintenance of these drains during soil removal and earthworks operations.

7. Ensure the provision of sediment filtering or sediment traps, in advance of and in conjunction with earthworks operations, to prevent contaminated water leaving the site, as needed.

8. Ensure the maintenance of the above drainage and sedimentation control works on a regular basis to ensure that no disturbed area is left without adequate means of containment and treatment of contaminated water.

9. Ensure the limitation of areas of erodable material to be exposed at any time to those areas being actively worked.

10. Ensure the minimisation of sediment loss during construction of embankments by means such as temporary or reverse super-elevation during fill placement, constructing berms along the edge of the formation leading to temporary batter flumes and short term sediment traps as needed.

11. Ensure the progressive completion of the earthworks.

12. Ensure the installation of permanent sedimentation control structures.

13. Establish methods for ensuring all vehicles are clean and free of contamination before leaving the site onto neighbouring roads or other sites. This includes movement across Tahi Street. Methods include inspection of vehicles and washing to remove any caked on material.

14. In addition other methods may be employed such as the use of road covers between the East and West sites for vehicle movement.

4.2 Work methods

1. Erosion and sediment control measures include but are not limited to the installation, operation and maintenance of stormwater retention basins, covers over existing stormwater pits, bunding, silt fences and straw bale barriers.
2. Sediment and solid waste will be regularly removed from any stormwater detention basins.
3. Soil excavations on the land shall cease if they create visible turbidity in the estuary area, until arrangements are made to protect the coastal marine environment (RM030521-45).
4. Erosion and sediment control measures will be completed as required.

4.3 Inspection test and control points

1. Inspection of all erosion and sedimentation control works will occur after each rain period and during periods of prolonged rainfall.
2. All sedimentation control structures will be cleaned out whenever the accumulated sediment has reduced the capacity of the structure by 60% or more, or whenever the sediment has built up to a point where it is less than 300mm below the spillway crest.
3. Accumulated sediment will be removed from the sedimentation control structures in such a manner as to not damage the structures, and placed so that it will not be conveyed back into the construction areas or watercourses.

4.4 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

4.5 Completion of works

1. All sediment control basins and spillways constructed will be removed after completion of the works.
2. Any rock mattresses from the spillway will be removed and buried into the basin area or used as scour protection or removed from site.
3. Embankment material will be spread and compacted into the basin area.
4. All access roads will be removed.
5. The disturbed material shall be compacted to at least the relative density of the material existing in the adjacent ground.

4.6 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent/condition RM030521-10c, 45, 51; RM030522-10c; RM030523-10c; RM030524-10c; RM030525-10c; RM030526-10c; RM030527-10c.

Appendix 5:

Work Plan 5 –

Water Management

Version	Date
1	14 July 2005
2	11 Dec 2006

Contents

Tables

Appendix 5: Work Plan 5 – Water Management

1 Purpose and scope

The purpose of this procedure is to describe the water management procedure to be followed on the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Record of Changes

During the period of development of this RAP changes have occurred to the sampling requirements for groundwater. Table 1 documents the timeline for these changes –

Table 1: Record of changes before adoption of full remedial action plan

Date	Event	Change
Dec 2004	Extensive Baseline GW Sampling Plan that included – • EC, pH, alkalinity, Static GW Level, Metals (As, Cd, Cr, Co, Cu, Hg, Mo, Ni, Pb, Sb, Se, Sn, Zn), Cyanide, Organochlorine pesticides, Organophosphorus pesticides, Acidic herbicides, Polycyclic Aromatic Hydrocarbons, Monocyclic Aromatic Hydrocarbons, Total Petroleum Hydrocarbons, Chlorinated volatile hydrocarbons, Chlorinated benzenes, Phenols and Cresols and Polychlorinated biphenyls.	Site Auditor review of these results in a memo dated 3 December 2004, requests to add the following to the GW requirements – • Chlorobenzene, atrazine, simizine, diazinon and carbaryl This meant including the following suites into the monitoring program, although not required by the consent – • Volatile Organic Compounds (VOCs) and • Organonitrogen and Organophosphorous pesticides (ONP / OPP)

Mar 2005	Resource consent requirement for filtered groundwater samples. Analytical lab advice provided in the baseline monitoring report (Tonkin and Taylor ,Mar 2005) recommended that filtering can lead to falsely lower results.	Hill laboratories recommendation of decanted and/or centrifuged samples as opposed to filtering was agreed by all relevant parties, including the Site Auditor, Compliance Officer and Peer review Panel.
May 2005	5 sets of results (Oct 04 to Mar 05) with the more extensive tests including consent requirements of – • Organochlorine pesticides (OCP), Metals suite (ICP-MS), Acidic herbicides, EC, pH, alkalinity and Static GW Level and non consent requirements of – • VOCs and ONP and OPP were assessed for trends.	In a memo from the Site Auditor dated 12 May 2005 it is recommended the following changes occur – Testing for – • VOCs (chlorobenzene), acidic herbicides, ONP and OPP and full metals suite be reduced to annually The memo also recommended that the following be added to the monitoring suite – • TKN, ammonia and Phosphorous
19 May 2005 9 June 2005	Formal request to TDC to change the consent conditions for GW to the following – **Monthly –** • OCPs, EC, pH, alkalinity, and static GW Level **Quarterly –** • TKN, Nitrate, Phosphorous, Copper, and OPPs (carbaryl) **Annually –** • VOCs (chlorobenzene), acidic herbicides, ONP / OPP and Metals. **Offsite Bores -** • Sampled for monthly parameters and all parameters above annually. This change was approved by the Tasman District Council in a letter dated 9 June 2005.	
	Targeted Sampling as required, including – • Additional testing of bores BH 3,4,5 and 9 for VOCs, Metals, ONP and OPP during the excavation of the landfill to look for any possible disturbance of other contaminants, • Additional monthly nutrient testing of residential bores when higher levels were detected, • Testing of inside roof water supply for 36 Tahi when it was learnt house not on reticulated supply, • Testing of other residential bores to determine any possible plume	

5 Procedural text

5.1 Objectives

The objectives of this Water Management Plan are to:

- meet and exceed resource consent conditions (RM030521-10d; RM030522-10d; RM030523-10d; RM030524-10d; RM030525-10d; RM030526-10d; RM030527-10d)
- define the water management measures to be implemented during the works
- define the water quality standards that are proposed for reuse and/or disposal of water
- ensure no uncontrolled discharges of water from the site occur into the receiving environment

- undertake the water management programme in the most cost effective and efficient manner possible
- comply with all regulatory requirements
- define the responsibilities of personnel within MfE in regard to the implementation of the plan.

5.2 Management approach

Water shall be managed using an approach involving a hierarchy of methods. The methods in order of highest preference are:

1. prevent surface water and groundwater from mixing with contaminated materials or contaminated water. Any sediment discharged to groundwater is to meet the soil acceptance criteria (SAC) (RM030525-19)
2. direct surface water via bunds etc to sedimentation basins for reuse onsite or discharge into the bay
3. remove water from areas where it is mildly impacted and reuse for dust suppression or increasing soil moisture content
4. remove water from the MCD process pad and treat appropriately depending on concentration

5.3 Types of water

Water will be classified into one of 5 types as detailed in Table 2.

Table 2: Water types

Water type	Description
Stormwater	Rainfall on remediated/clean areas of the site that is not contaminated, and is suitable for reuse onsite or for discharge to the bay.
Groundwater	Water beneath the surface that is collected in wells or drainage galleries, or that may flow into deeper excavations on the site.
Grey water	Defined as that water that is either treated or untreated, and has an acceptable quality to be reused for dust suppression and soil remoisturisation.
Black water	Water from the ablution facilities.
Contaminated water and washwater from the MCD pad	Defined as that water which requires treatment to either grey or stormwater quality prior to reuse or disposal.

5.4 Management methods

The Water Management Plan of MfE shall, as far as practicable, limit discharge to receiving land and waters and minimise/contain the migration of contaminated surface and ground water (RM030524-19; RM030524-30, 33; RM030525-28; RM030526-19, 24; RM30527-24, 25). In order to achieve the objectives a range of infrastructure, plant and equipment will be utilised and may include:

- construction of retention basins, which must be lined if they contain contaminated water
- surface and groundwater control measures
- mobile pipelines and pumping equipment to transfer water across the site
- design, construction, commissioning and operation of a washwater treatment plant associated with the MCD facility.

5.5 Site surface water controls

5.5.1 Controlling surface runoff from within the site

During remediation, the site shall be managed to minimise discharge of stormwater (RM030524-38). Clean runoff will be segregated from potentially contaminated runoff. Active earthwork areas (or disturbed areas) will be hydraulically isolated from the balance of the site, where practical.

Earth bunds will separate all runoff sources from the eastern part of the site from contact with disturbed contaminated materials and contaminated runoff.

In addition, potentially contaminated runoff will be controlled by a range of measures which may include temporary bunds, diversion drains, ditches and silt fences.

Surface water derived from within a disturbed area will be directed into a temporary contaminated water storage basin located down gradient of the works. The location of these basins will depend on the progress of works within areas requiring remediation.

4.5.2 Controls on the existing stormwater system

Works will be undertaken to seal off all existing stormwater connections in a work area prior to the commencement of any earthworks in that area. Such work will typically involve the placement of a concrete plug or seal within pipes and/or pits. This will ensure that no impacted stormwater exits the site and likewise no stormwater generated off site migrates into the site.

5.6 Site ground water controls

5.6.1 Ground water monitoring

All analyses required, will be carried out by an IANZ (International Accreditation New Zealand) registered laboratory (RM030525-31). Groundwater monitoring shall be undertaken prior to commencement of the remedial works and on a monthly basis during the remediation works at boreholes BH1, BH2, BH3, BH4, BH5 and B9 (RM030524-23, 24; RM030525-11, 23, 24).

In addition monitoring shall be conducted at three-monthly intervals at selected down-gradient private bores, including 13 Tahi Street, 17 Tahi Street, 26 Tahi Street and 36 Tahi Street (RM030524-27, RM030525-25).

Any monitoring wells that are destroyed during remedial works shall be reinstated in a similar location and to an equivalent standard in consultation with TDC (RM030524-26, RM030525-24).

5.6.2 Works affecting groundwater levels and quality

Monitoring of groundwater levels and quality shall take place in areas where remedial activities potentially alter the flow and quality (e.g. dewatering, installation of a slurry wall, soakage discharges, stormwater or dewatering flows) (RM030527-11, 26). Monitoring results will be compared with equivalent data prior to the works. Remedial activities must be undertaken or modified in a manner that minimises the spread of contaminated groundwater (RM030524-31, RM030525-29).

If dewatering is undertaken, MfE if permitted by the owners, will survey adjacent private wells in the area before, during and after de-watering process. The survey will record groundwater level and usage rates, and if the wells become unusable MfE shall provide the affected owners with an alternate supply (RM030527-19).

Records of any groundwater dewatering, shall be provided to TDC on a weekly basis during dewatering including location, rate and duration of pumping (RM030527-20)

5.6.3 Monitoring analytes and thresholds of groundwater

The suite of analytes to be tested in groundwater monitoring shall be determined in consultation with the Council Compliance Co-ordinator. The programme shall include: (RM030524-11, 25, RM030525-23):

Monthly

- Organochlorine pesticides suite (including DDX, aldrin, dieldrin and lindane)
- Electrical conductivity
- pH
- Total alkalinity
- Static groundwater level

Quarterly

- Total Kjeldahl Nitrogen
- Nitrate
- Phosphorous
- Copper
- Carbaryl (Organophosphorus Pesticide)

Annually

- Chlorobenzene (VOCs)
- Acidic Herbicides suite
- Organonitrogen and Organophosphorus Pesticides suite
- ICP-MS metals suite

Table 3 groundwater analyte threshold trigger levels. When these trigger levels are exceeded, as a result of site work the consent holder must institute corrective action (RM030524-28, RM030525-26). These values are subject to review by TDC based on initial baseline sampling results.

Table 3: Groundwater contaminant thresholds at which corrective action is required

Contaminant	Drinking water MAV DWSNZ, 2000 (mg/L)	ANZECC 99% LOP freshwater aquatic ecosystem trigger values (mg/L)	Threshold concentration in groundwater (mg/L)
DDT (2,4- and 4,4 isomers)	0.002	4×10^{-7}	0.00004
DDD (2, 4- and 4,4 isomers)	0.002	6×10^{-6}	0.0006
DDE (2, 4- and 4,4 isomers)	0.002	5×10^{-7}	0.00005
Lindane	0.002	7×10^{-6}	0.0007
Aldrin	0.00003	3×10^{-6}	0.0003
Dieldrin	0.00003	1×10^{-5}	0.0010
Chlordane	0.0002	1×10^{-6}	0.00010
Heptachlor	0.00004	4×10^{-7}	0.00004
Mercury	0.00004	4×10^{-7}	0.00004
Copper	2	0.0013	0.13
Selenium	0.1	0.005	0.50
Zinc	–	0.0024	0.24
Chromium (total)	0.05	0.0044	0.44

Any exceedance will be confirmed through retesting, and further sampling undertaken to isolate the source of contamination. Further action to be approved by TDC, but may include interim measures such as pumping and discharge, until a long-term corrective response is developed in consultation with TDC (RM030524-29, RM030525-27).

5.7 Trade waste licence

A Trade Waste Discharge Agreement will be established, if required, with TDC in order to facilitate the discharge of waters to the sewerage system.

5.8 Water discharge criteria

5.8.1 Discharges to stormwater

Groundwater pumped for de-watering may only be discharged into a surface water system if the pumped water meets the target criteria for stormwater discharges (RM030526-25, see Section 5.8.3).

5.8.2 Stormwater discharges to the bay

Any discharges are to be made via the stormwater. Following determination of discharge rates, stormwater discharges are to meet criteria as approved by TDC assuming a worst-case scenario in terms of receiving waters dilution (RM030524-32, RM030525-30, RM030527-21).

Discharges of stormwater from the site to the bay are anticipated to be infrequent. Where possible water in the stormwater basin will be allowed to evaporate or be reused onsite. However, it is likely that discharge of clean water to the bay would be required as a result of some storm events.

Stormwater will comprise run off from undisturbed areas and validated areas. Accordingly, it is anticipated that any contaminants if present would be limited to those sorbed onto suspended particles. On that basis, it is proposed that prior to discharge the quality of water to be discharged from the stormwater basin be assessed against stormwater criteria (RM030524-35, RM030525-30, RM030526-20, RM030527-22).

Table 4 summarises the proposed criteria. It is noted that some criteria are below the practical quantification limit (PQL) of the analytical method for the specific compound and may be below the background concentration in bay water.

5.8.3 Stormwater monitoring

All analyses required, will be carried out by an IANZ (International Accreditation New Zealand) registered laboratory (RM030525-31). Stormwater monitoring will be undertaken to ensure quality adheres to those criteria in Table 4, or otherwise agreed upon with TDC. Sampling shall be targeted to coincide with the first 10 minutes of discharge from the site during six storm events every year of operation. Samples will be collected from the point of discharge to receiving waters and be analysed for parameters in Table 4, turbidity, conductivity and pH (RM030524-36, RM030526-11, 22, RM030527-22).

If standards in Table 4 are not achievedstormwater management will be upgraded to the satisfaction of TDC, where compliance is achieved as close as reasonably practicable to the standards (RM030524-37, RM030526-23, RM030527-23).

Table 4: Stormwater criteria (RM030526-20)

Parameter	ANZECC (2000) Guideline Receiving Water (µg/L)	Preliminary Stormwater discharge targets (µg/L)	
		Eastern discharge[1]	Western discharge[2]
DDT	0.0004	0.04	0.002
Aldrin	0.003	0.3	0.015
Dieldrin	0.01	1	0.05
Lindane	0.007	0.7	0.035
Arsenic	2.3	230	11.5
Cadmium	0.7	70	3.5
Copper	0.3	30	1.5
Lead	2.2	220	11
Mercury	0.1	10	0.5
Selenium	3	300	15
Zinc	7	700	35

Notes:

1 Assumes 100 times dilution in Mapua Channel.

2 Assumes 5 times dilution in drainage channel.

5.9 Sewer discharge criteria

Sewer discharge criteria are subject to licence from TDC.

5.10 Responsibility for implementation

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

6 References

1. Resource consent/conditions RM030521-10d; RM030522-10d; RM030523-10d; RM030524-10d, 23, 24, 25, 26, 27, 28, 29, 31, 32, 34, 35, 36, 37; RM030525-10d, 11, 19, 23, 24, 25, 26, 27, 29, 30, 31; RM030526-10d, 11, 20, 21, 22, 23, 25 ; RM030527-10d, 11, 20, 21, 22, 23, 26.

7 Attachments

Not applicable to this procedure.

Appendix 6:

Work Plan 6 – General Onshore Excavation Works

Version	Date
1	14 July 2005
2	11 Dec 2006

Contents

Appendix 6: Work Plan 6 – General Onshore Excavation Works

1 Purpose and scope

The purpose of this procedure is to describe the general onshore excavation procedure to be followed on the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Objectives

To meet and exceed conditions as outlined in RM030521-10b; RM030522-10b; RM030523-10b; RM030524-10b; RM030525-10b; RM030526-10b; RM030527-10b.

4.2 Sequence of operations

1. Review pre-excavation classification (Stage 1 works).
2. Advise owners within 100 metres of the site boundaries of their option to undertake structural assessment of their built properties at no cost to owners (RM030521-39).
3. Undertake structural assessment of buildings within 100 metres of site if requested by the owner (RM030521-39).
4. Prior to commencing bulk excavation works, all surface hard stand areas will be excavated and hauled to a designated hardstand stockpile area for crushing. Prior to crushing each slab section will be brushed clean of any visual fines to prevent contamination of the crushed product.
5. Survey works and set out site excavation grid.

6. Ensure environmental controls are in place in accordance with erosion and sedimentation controls work procedure.

7. Excavate on a cell by cell basis based on pre-excavation classification and/or any additional sampling.

8. Soil excavations on the land shall cease if they create visible turbidity in the estuary area, until arrangements are made to protect the coastal marine environment (RM030521-45).

9. Material other than rock or hardstand will be loaded directly from excavators to trucks for haulage to stockpiles and/or screening area.

10. Undertake validation sampling at the base and walls of the excavation to confirm contaminated material has been removed in accordance with the soil acceptance criteria.

11. Screening and stockpiling undertaken in accordance with work procedure.

12. After screening oversize material will be tested and allocated to treatment, relocation or reuse.

13. Treatment of contaminated materials in accordance with the site specific MCD treatment procedure, including noise management.

14. Survey excavation prior to backfilling operations and forward survey plan and volumetric calculations to Engineer.

15. Mix treated soil and screened oversize and backfill in accordance with NZS4431:1991 Code of Practice for Landfill for Residential Development (RM03521-48).

16. Validate and dispose of any stockpiled general refuse or other material as per Work Plan 13.

4.3 Types of equipment

1. Excavators 20T–40T.
2. Front end loaders.
3. Trucks (tip trucks and/or articulated dump trucks).
4. Water trucks.
5. Mobile screening equipment.
6. Others.

The requirements of the specification shall be met by using the above list of equipment in various sizes and forms together with any other plant or equipment that may be considered necessary.

All equipment will be controlled by qualified operators.

4.4 Work methods

1. Conventional methods of bulk earthmoving will be employed where possible, with the excavation undertaken on a cell or cell group basis corresponding to the pre-excavation classification.

2. Depending upon initial classification, material will be taken to the relevant area within the site boundaries to be screened, stockpiled or reused as backfill.

3. The following screening plant may be used as required

    - Conventional 'grizzly' screens will be used for removal of coarse (> 150 mm) materials including debris and other solid wastes.
    - Inclined vibrating screens capable of segregating a variety of sizes down to <10 mm.
    - Rotating trommels capable of segregating a variety of sizes.

4. Post screening oversize material will be tested and allocated to treatment, relocation or reuse.

5. Soil excavation adjacent to the marine environment will cease if it creates visible turbidity in the estuary area.

6. Any disruption to pedestrian access along the coastal boundaries of the site shall be minimised and access shall be reinstated on completion of the works. Where possible, temporary access shall be provided at times and locations where public safety is not at risk (RM030521-47).

7. Operations will be undertaken in accordance with the "Remediation of FCC Site Mapua – Archaeological Protocols and Procedures". If koiwi, taonga or other cultural/ archaeological material is discovered in any area, the site manager shall ensure that the Iwi Monitoring Protocol is initiated with the nominated archaeologist and iwi monitor immediately contacted and excavation work ceases in the immediate area until material is recovered or the matter is resolved (RM030521-15, RM030522-15, RM030523-15, RM030524-15, RM030525-15, RM030526-15, RM030527-15).

4.5 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

4.6 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent/conditions RM030521-10b, 15, 39, 45, 47, 48; RM030522-10b, 15; RM030523-10b, 15; RM030524-10b, 15; RM030525-10b, 15; RM030526-10b, 15 and RM030527-10b, 15.
2. NZS4431:1991 Code of Practice for Landfill for Residential Development.
3. WP09 Backfill and Compaction and WP10 Noise Management.

6 Attachments

6.1 Archaeological Protocol and Procedures

INTRODUCTION

The Tasman District Council and the Ministry for the Environment have committed funds to clean-up contamination of the former Fruitgrowers' Chemical Company's site at Port Mapua. The site will be remediated by excavating contaminated material and treating it on-site using a mechano-chemical destruction (MCD) process. Material may be excavated to a depth of approximately 2.5m, depending on the extent of contamination. The site will be remediated to a very high standard, to levels that will allow a mix of residential, recreational, and commercial activity. Those estuarine sediments adjacent to the site that currently exceed internationally accepted criteria for marine life will be excavated from the estuary.

The FCC site is in an archaeologically sensitive area, and a number of sites have been recorded in the vicinity of Grossi Point, showing evidence of gardening, food processing and manufacturing of stone tools. Some burial sites (human remains) have also been uncovered at Grossi Point.

The Tasman District Council and the Ministry for the Environment recognise the potential significance of the FCC site and accordingly commissioned Amanda Young to undertake an archaeological assessment. This shows that some archaeological material exists on-site. This material has been recorded as NZ Archaeological Association site number N27/178. A further archaeological site, N27/88, had been previously recorded on the neighbouring property (13 Tahi Street), part of which is also subject to the clean-up. An authority pursuant to Section 14 of the *Historic Places Act* 1993 to modify or damage part of these sites for the purposes of the remediation has been obtained from the NZ Historic Places Trust (Authority 2004/08).

As part of the archaeological assessment, a 'sensitivity map' has been prepared identifying those areas of the site where it is likely that archaeological material may be present, and those areas where it is unlikely. A copy of the map is attached to this protocol. This sensitivity map is only an initial indication of potential and is imprecise and very preliminary. All parties acknowledge it as such, and that the map will be refined as work on the site proceeds.

Parties to this protocol recognise the fact that the remediation involves a highly contaminated site and that delays are to be minimised. Health and safety issues are paramount and accordingly only trained personnel are permitted access to the site.

This document sets out procedures for the following situations:

- Monitoring of excavation works
- Procedures to be followed in the event any archaeological evidence may be discovered
- Participation of the archaeologist when archaeological material is encountered

PARTIES TO THIS PROTOCOL

This document represents an understanding between Tasman District Council, the Ministry for the Environment and the project archaeologist.

A separate Cultural Heritage protocol has been agreed on with various Iwi parties.

MONITORING OF EXCAVATION WORKS

It is acknowledged by the parties to this protocol that the FCC Site contains materials that contain extremely high levels of contaminants. Routine access to the site is necessarily restricted to approved staff and contractors who are appropriately trained in health and safety aspects.

It is also acknowledged that archaeological material is present on the site, and may be disturbed during site works. There are two stages at which this material may be discovered – excavation, and screening.

Prior to work beginning on the site all relevant on-site contractors shall be briefed of the potential for archaeological material to be discovered. In particular Civil Works contractors involved in disturbing soil will be aware of the correct procedures and protocols should material be discovered. A good relationship between the Civil Works contractors, Iwi monitors and Archaeologist is essential.

It is agreed between the parties that where site excavation works are to be undertaken in an area of the FCC Site shaded on the accompanying map as being “Likely” or “Possible” to contain material of archaeological interest, the Archaeologist shall be present on-site during excavation activities, unless the excavations in a particular area indicate that finds are unlikely, in which case the parties may agree with the Site Manager not to be present for excavation of that area. It is noted that an Iwi Monitor will also be present during these excavations.

It is also agreed that, to the extent reasonably practicable (taking into account operational requirements), site excavation works will commence in an area shaded on the accompanying map as being “Likely” or “Possible” to contain material of archaeological interest. This will allow the opportunity for site workers to become familiar with the material of interest and to be aware of procedural requirements.

DISCOVERY OF MATERIAL

Should material be discovered, the Site Manager will immediately cease excavation of the face and/or processing of that material.

For those areas where the Archaeologist will already be on-site, the Archaeologist shall undertake any site investigation and reporting as required by the conditions of the Authority. The investigation is to be completed within 48 hours of being contacted by the Site Manager, or within such other longer period as agreed between the Site Manager, the Archaeologist and Iwi. The Archaeologist will be responsible for notifying the Historic Places Trust, and (if any human remains are discovered) the Police, District Coroner and a registered physician as appropriate. The Iwi Monitor will be responsible for notifying Iwi.

For those areas where the Archaeologist is not automatically on-site, the Site Manager shall immediately contact the Archaeologist. In such a case the Archaeologist will follow the same procedure as noted above.

Where a find is made, a 10m radius from the site will be kept free from work until such time as the site investigations noted above have been completed.

Any archaeological material discovered shall be handled only in accordance with the agreed Health and Safety Plan for the remediation works.

A protocol will be agreed with Iwi for procedures to be followed in the event of discovery of koiwi and taonga, in relation to recovery, cleaning, and any subsequent reburial and site blessing. The Ministry of Culture and Heritage will be notified of the discovery of any taonga as required under the Antiquities Act 1975.

ACCESS TO THE SITE

Access to the site will only be permitted with the express prior permission of the Site Manager, and on completion of the appropriate Health and Safety training. However, subject to the above requirements, the Site Manager will allow the Archaeologist access to the site to carry out the duties noted in this protocol.

NOTIFICATION OF COMMENCEMENT OF WORKS

The Site Manager will give the Archaeologist and Historic Places Trust as much notice as possible and in any case no less than two working days advance notice of the commencement of earthworks, including the re-commencement after any period longer than three weeks during which no earthworks have occurred.

DISPUTE RESOLUTION

If the Archaeologist and/or Iwi Monitor perceive any breach of agreed protocol they shall notify the Site Manager immediately. Dispute resolution will be achieved through discussion between the Site Manager, Archaeologist and Iwi Monitor. Excavations in the immediate area will cease or resume elsewhere until discussion has been undertaken. Details of all disputes will be sent to TDC Compliance Co-ordinator or representative within 24 hours, including details of disagreement and proposed outcomes. If necessary TDC representatives will assist in dispute resolution to minimise any disruption to the remediation.

Appendix 7:

Work Plan 7 – Detailed Excavation in Adjacent Properties

Version	**Date**
1	14 July 2005
2	11 Dec 2006

Contents

Appendix 7: Work Plan 7 – Detailed Excavation in Adjacent Properties

1 Purpose and scope

The purpose of this procedure is to describe the detailed excavation procedure to be followed on adjacent properties to the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Objectives

To meet and exceed relevant resource conditions (RM030521-10k; RM030522-10k; RM030523-10k; RM030524-10k; RM030525-10k; RM030526-10k; RM030527-10k).

4.2 Sequence of operations

1. Review pre-excavation classification (Stage 1 works).
2. Structural assessment of buildings if requested by owners as per General Excavation WP (RM030521-39).
3. Prior to commencing bulk excavation works, consultation will occur with owner and occupiers concerning sequence/timing of works,
4. Land Access agreement will be signed by both parties before work begins
5. Existing vegetation/fencing to be retained if possible. (RM030521-41)
6. Undertake survey works and set pegs at 7.5 metre intervals (i.e. Residential grid), or at each cross section, whichever is the lesser.

7. Ensure environmental controls are in place.

8. Ensure work area is appropriately barricaded to prevent public access.

9. Material other than rock or hardstand will be loaded directly from excavators to trucks for haulage to stockpiles.

10. Undertake validation in accordance with RAP and confirm SAC has been attained.

11. Survey excavation to determine volumetric calculations.

12. Backfilling with imported fill of like materials to similar compaction as previously..

13. Where existing fencing and vegetation is removed as required, they shall be reinstated at completion of works in consultation with landowners (RM030521-42).

4.3 Types of equipment

1. Small excavators or backhoe.
2. Tip trucks.
3. Water trucks and/or adequate reticulation from alternative water supply.
4. Mobile screening equipment.
5. Roller
6. Others.

The requirements of the specification shall be met by using the above list of equipment in various sizes and forms together with any other plant or equipment that may be considered necessary.

All equipment will be controlled by qualified operators, and during these sensitive works, an MfE representative will supervise the works.

4.4 Work methods

1. Conventional methods of bulk earthmoving will be employed where possible, with the excavation undertaken on a grid-by-grid basis corresponding to the pre-excavation classification. All care will be taken not to damage any of the private property.

2. Depending upon initial classification, material will be taken to the relevant area to be either screened or reused.

3. The following screening plant may be used as requied:

    - Conventional 'grizzly' screens will be used for removal of coarse (> 150 mm) materials including debris and other solid wastes.
    - Inclined vibrating screens capable of segregating a variety of sizes down to 10 mm.
    - Rotating trommels capable of segregating a variety of sizes.

    After screening oversize material will be tested and allocated to treatment, relocation or reuse.

4. Soil excavation on the land shall cease if it creates visible turbidity in the estuary area, until arrangements are made to protect the coastal marine environment.

5. Any disruption to walking access by the public along the coastal edges and estuary shall be minimised and access shall be reinstated on completion of the works. Where possible, temporary access shall be provided at times and locations where public safety is not an issue (RM030521-47).

6. Operations will be undertaken in accordance with the "Remediation of FCC Site Mapua – Archaeological Protocol and Procedures" (WP 6: Appendix 6). If koiwi, taonga or other cultural/ archaeological material is discovered in any area, the site manager shall ensure that the iwi monitoring protocol is initiated with the nominated archaeologist and iwi monitor immediately contacted and excavation work ceased in the immediate area until material is recovered or matter resolved (RM030521-15, RM030522-15, RM030523-15, RM030524-15, RM030525-15, RM030526-15, RM030527-15).

7. Backfilling of excavations shall be in accordance with NZS 4431: 1991 Code of Practice for Landfill for Residential Development (RM03521-48). Backfill with imported fill on existing residential properties will proceed immediately following removal of contaminated material. Fencing and/or vegetation will be restored in consultation with residents.

4.5 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

4.6 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent RM030521-10k, 15, 39, 41, 42, 47, 48; RM030522-10k, 15; RM030523-10k, 15; RM030524-10k, 15; RM030525-10k, 15; RM030526-10k, 15 and RM030527-10k, 15.

2. Remedial Action Plan.

3. NZS 4431: 1991 Code of Practice for Landfill for Residential Development.
4. WP6 General onsite Excavation (Archaeological Protocols- Attachment)

Appendix 8:

Work Plan 8 –

Marine Excavation Works

Version	Date
1	14 July 2005
2	11 Dec 2006

Contents

Appendix 8: Work Plan 8 – Marine Excavation Works

1 Purpose and scope

The purpose of this procedure is to describe the marine sediment excavation procedure to be followed on the FCC site remediation works at Mapua.[1]

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Sequence of operations

1. Submission/approval of Marine Excavation Work Procedure to TDC (RM030522-33).

2. Ensure a baseline macro-invertebrate and sediment quality sampling/monitoring programme is undertaken within and distant from the area of sediment excavation prior to commencing the sediment excavation. The sampling is to be arranged by Tasman District Council (TDC) in consultation with the consent holder to ensure work is carried out at prescribed times. The programme will extend throughout the remedial works at the following intervals (unless otherwise directed by TDC): 12 month, 24 month and 36 month (RM030522-19).

[1] Methods describe meet and exceed conditions as outlined in RM030521-10j; RM030522-10j; RM030523-10j; RM030524-10j; RM030525-10j; RM030526-10j; RM030527-10j.

3. Shoreline profile surveys shall be carried out at no greater than 20 metres centres along the coastal boundary of the project site before work commences. The profiles shall extend to at least 0.5 metres below MLWS or 200 metres from the shoreline, whichever is reached first. The profiles shall be re-surveyed after completion of the main work to confirm that the original seabed profile has been reinstated. Subsequently, surveys shall be carried out on the East side at 2, 4, 12, 24, 36 months and West side at 6, 12, 24, 36 months. If required, remedial measures to re-instate the seabed profile shall be undertaken to the satisfaction of the Council's Compliance Co-Ordinator. (RM030522-24).

4. Develop consultation database to identify all interested and affected parties. Preliminary consultation and advertising, as per consent conditions (RM030522-23) will take place, which will include:
   - Consultation with Maritime New Zealand and Hydrographer of Royal NZ Navy prior
   - Consultation with Mapua Boat Club Inc at least one month prior
   - Advertisement of excavation works commencing in Nelson Mail at least one week prior
   - Consultation with TDC with regard to the imported gravel selection to be used (RM030522-32b).

5. Ensure services have been located and marked, tide times have been noted and that designated works have sufficient time for completion.

6. If required prepare/fabricate complete silt curtain sediment control device which will be readily installed if emergency works are required below water level.

7. Ensure a stockpile of approved backfill material is available and accessible to the excavator in order to ensure backfill is undertaken during the excavation period.

8. Construct any gravel access road below the existing estuary seabed (RM030522-32a).

9. Excavate and stockpile material via long-reach excavator using ‘slot’ procedure (detailed below).

10. Load and transport excavated material directly to stockpile for testing/treatment.

11. Take validation samples from excavated area.

12. Through ongoing monitoring/survey, determine any remedial measures or treatment to be undertaken in accordance with RM030522-20.

13. A Revegetation Management Plan will be prepared and approved prior to undertaking any restoration. The plan will detail how the replanting of maritime vegetation shall be achieved following completion of the works (RM030522-30, RM030522-31).

14. Excavation of marine sediments will not be carried out during rain or underwater and will take place as late in the remediation process as practical (RM030522-21, RM030522-22).

4.2 Types of equipment

1. Long reach excavators.
2. Trucks.
3. Others.

The requirements of the specification shall be met by using the above list of equipment in various sizes and forms together with any other plant or equipment which may be considered necessary.

All equipment will be controlled by a qualified operator.

4.3 Work methods

1. Conventional methods of bulk earthmoving will be employed where possible. A long reach excavator will be used to initially excavate marine sediments from the tidal zone at low tide. The programme used to excavate the material will be based upon the rate at which the excavation can take place to ensure that the works are completed (i.e. excavation, sampling and backfilling) before the tide comes back in. During excavation visual assessment of turbidity will take place continuously100 m upstream and downstream from the excavation face. The best practical option to minimise turbidity should be put in place if turbidity levels increase conspicuously (RM030522-20).

2. Any gravel road or path laid by MfE subcontractors in the coastal marine area will be placed below the existing estuary seabed level to ensure no road remains following completion of works (RM030522-32a).

3. Marine sediments will be transferred to FCC east site, where they will be stockpiled and allowed to drain. Based on the earlier sediment characterisation works, it is anticipated that post-drainage, the sediments will be placed within FCC east. Use will be based on the marine sediments meeting the SAC for the intended land use and will be placed in accordance with the “BackFill and Compaction Work Procedure”.

4. Where imported gravels are required for works within the tidal zone, these shall be similar to the existing gravels, or removed or capped with existing gravels on completion of the works to the satisfaction of the Tasman District Council compliance co-ordinator (RM030522-32). Gravel from a known origin will be sampled at a rate of one composite (three subsamples) per 1000 m^3 plus quality control sampling. For material of unknown or suspect origin, samples will be taken at a rate of one composite per 400 m^3 plus quality control samples. Visual assessments of imported material will also be made to ensure material is free from gross contamination.

5. All excavated areas will be covered prior to the next tidal cycle with a layer of gravels so as to prevent the migration of fines on the excavated surface. Works will would then recommence on the next low tide cycle and be carried out in the same manner.

6. For removal of the impacted sediment to the south of the landfill, a gravel access road will be constructed to the limit of the works. The excavator will then, working on low tide, excavate the sediments and retreat toward the FCC landfill, recovering the gravels as areas are completed (RM030522-32). A floating silt curtain may be installed if the need arises.

7. Revegetation and plant restorations will be limited to indigenous species with genetic stock from the Tasman Bay area, in accordance with the Revegetation Management Plan (RM030521-50).

8. Operations will be undertaken in accordance with the "Remediation of FCC Site Mapua-Archaeological Protocol and Procedures" (WP6: Appendix 6). If koiwi, taonga or other cultural/ archaeological material is discovered in any area, the site manager shall ensure that the iwi monitoring protocol is initiated with the nominated archaeologist, that the iwi monitor is contacted immediately and that excavation work ceases in the immediate area until the material is recovered or the matter is resolved (RM030521-15, RM030522-15, RM030523-15, RM030524-15, RM030525-15, RM030526-15, RM030527-15).

4.4 Surveillance and verification

1. Surveillance of this procedure shall be carried out by the MfE Site Manager.
2. Upon completion of marine remedial works, validation sampling report shall be provided to TDC and the site auditor (RM030522-11, 34).
3. In the event that validation samples do not meet the required criteria, the area shall be re-excavated to the depth at which the remediation levels are met. Should this prove to be impracticable to meet these limits suitable alternatives and/or monitoring will be discussed and agreed with both the Compliance Officer and Site Auditor.

4.5 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent/conditions RM030521-10j, 15, 50; RM030522-10j, 11, 15, 19, 20, 21, 22, 24, 30, 31, 32a, 32b, 33, 34; RM030523-10j, 15; RM030524-10j, 15; RM030525-10j, 15; RM030526-10j, 15 and RM030527-10j, 15.
2. Revegetation Management Plan.
3. Contract Specification.
4. Work Plan 6 – General Onsite Excavation (Archaeological Protocols attachment)

6 Attachments

Not Applicable

Appendix 9:

Work Plan 9 –

Backfill and Compaction

Version	Date
1	14 July 2005
2	11 Dec 2006

Contents

Tables

Appendix 9: Work Plan 9 – Backfill and Compaction

1 Purpose and scope

The purpose of this procedure is to describe the Backfill Placement and Compaction procedure to be followed on the FCC site remediation works at Mapua. Methods described meet and exceed conditions as outlined in RM030521-10g; RM030522-10g; RM030523-10g; RM030524-10g; RM030525-10g; RM030526-10g; RM030527-10g.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

Soils recovered from sorting and treatment operations will be used to the greatest extent possible in reinstating the site. Based on the current material balances there will be no need to import material except for reinstating residential properties. However, some material may be 'borrowed' to achieve a site mass balance and meet the SAC.

4.1 Requirements of backfill material

Only suitable material will be used for backfill. Material deemed as suitable for residential/commercial land are required to:

- Meet soil acceptance criteria (SAC) as specified in Validation Sampling and Analysis Plan (Appendix 13)
- be free of material greater than 150 mm in size
- contain not more than 2% vegetative matter
- be capable of being brought to a moisture content suitable for compaction under weather conditions onsite
- possess all other physical properties suitable for placement at an adequate state of compaction.

No treated material will be backfilled below the water table. All treated material and commercial grade material, including any oversize will be placed above the water table..
For recreational/open space land use, material suitable for backfill is required to:

- meet soil acceptance criteria as specified in Validation Sampling and Analysis Plan (Appendix 13), the key indicators of which are shown in Table 1 below
- be free of material greater than 500 mm in size.

Table 1: Soil/sediment acceptance criteria

Land use	Depth (m)	DDX (total DDT, DDD, DDE) (mg/kg)	Aldrin + dieldrin + 10% lindane (mg/kg)
Residential	All	5	3
Commercial	0 – 0.5 >0.5	5 200	3 60
Recreational/open	0 – 0.5 >0.5	5 200	3 60
Marine sediment	All	0.01	0.01

4.2 Sequence of operations

1. Place fill in no more than 300 mm lifts to a maximum of 600mm and compact using mechanical means to 95% standard compaction at optimal moisture content ± 3%.
2. Test compaction of fill using random sampling locations as per Table 8.1 of NZS 4431 (1991) Code of Practice for Landfill for Residential Development. Thereafter compact levels to 1.5 metres between testing.
3. Trim finished backfill levels to within the tolerances specified (±50 mm).
4. Final regrading will be undertaken in consideration of long-term objectives for land use, thereby minimising any future reworking. Regrading at coastal edges will be as approved by TDC (RM030521-46).

4.3 Types of equipment

Equipment to be used will include if required, bulldozers, scrapers, excavators, front end loaders, trucks, graders, tractors, water carts or sprays and vibrating rollers. (Mechanical/pneumatic breaking equipment will be used if required.)

4.4 Work methods

1. Conventional methods of bulk earthmoving will be employed where possible using bulldozers and scrapers and/or excavators, loaders and trucks.
2. Should any excavated material be available, which is of a quality that meets the requirements for residential fill, it shall be transported to stockpile in order to reduce the quantity of imported material required.

3. Backfill areas will be left clean and free of protruding objects.
4. Buffer zones will be in place to ensure protection of aquatic ecosystems, as per Table 2. Material will be placed beyond buffer zones to avoid contamination of the marine environment.

Table 2: Buffer distance schedule for placement of contaminated soil below 0.5 m

Distance from shoreline/buffer distance (m)	Maximum concentration of DDX (total DDT, DDD, DDE) (mg/kg)	Maximum concentration of aldrin + dieldrin + 10% lindane (mg/kg)
3	40	12
10	120	40
15	200	60

5. When rain is expected to cause a delay in operations, fill deposited will be spread, graded and rolled to form a surface sufficiently dense to shed the rain to drains. Those areas that have not been fully compacted before significant rain, will after return of acceptably dry conditions, be ripped to their full depth, bladed to shape and processed as newly deposited fill.
6. Compaction standards will be as per Table 3. Track compaction is proposed to aid revegetation of the recreational areas but will be limited to the top layer.

Table 3: Compaction standards

Land use	Compaction
Recreational	Roller/track compaction
Recreational/commercial	95% standard maximum dry density

7. Compaction will be checked by standard maximum dry density tests and field density test for materials other than sand or by the dry density index and field density tests for sands in accordance with values in Table 4.
8. Screened oversize material is expected to be mixed with treated fines to achieve a geotechnically stable material and meet the Soil Acceptance Criteria. This will occur within excavations with both treated material and fines deposited into the excavation then mixed with operating equipment.
9. Upon completion the site will be graded in accordance with contours detailed on drawing 1939/1/01 and 1939/1/02 unless otherwise discussed with TDC.

Table 4: Frequency of field density tests

Area	Frequency of tests
Residential/commercial areas	Not less than: • one test per 300m^3 distributed reasonably evenly throughout full depth and area; or • one test per layer or 300 mm thickness and/or one per 1000 m^2
Confined operations filling behind structures	One test per two layers per 50 m^2
Service trenches	One test per two layers per 40 linear metre

4.5 Materials tracking

1. Material from excavation and imported material will be tested before using it for fill.
2. Unsuitable material will be determined by MfE representative.
3. Quality records will identify the source, destination and classification for all fill material used onsite.

4.6 Inspection, tests and control points

1. Inspection and testing will be carried out using appropriate checklists.
2. All testing shall be undertaken by an IANZ/NATA registered laboratory.
3. Lots selected shall be homogeneous. Lot numbers shall be maintained for each area tested.
4. Compaction test method shall be used per material type as outlined. Section 2 of AS 3798 (1996).
5. Frequency of testing shall be maintained as per Table 8.1 of AS 3798 (1996).

4.7 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

4.8 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Contract specification.
2. Resource consent/conditions RM030521-10g; RM030522-10g, 46; RM030523-10g; RM030524-10g; RM030525-10g; RM030526-10g; RM030527-10g.
3. NZS 4431 (1991) Code of Practice for Landfill for Residential Development.

6 Attachments

Not applicable.

Appendix 10:

Work Plan 10 –

Noise Management and Screening

Version	**Date**
1	14 July 2005
2	6 March 2007

Contents

Tables

Appendix 10: Work Plan 10 – Noise Management and Screening

1 Purpose and scope

The purpose of this procedure is to describe the procedure for the management of noise and visual impacts at the FCC site remediation project at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Objectives

The objectives of this Noise Management and Screening Plan are to:

- meet and exceed conditions as outlined in resource consent (RM030521-10l; RM030522-10l; RM030523-10l; RM030524-10l; RM030525-10l; RM030526-10l; RM030527-10l)
- address matters raised in Annex E of NZS 6803:1999 Acoustics – Construction Noise (RM030521-27, RM030522-28)
- limit noise and visual impacts resulting from remediation operations conducted on the FCC site
- to define the control measures to be implemented during the works
- to set out procedures for noise monitoring
- to set out procedures for community liaison and noise complaints handling
- to define the responsibilities of MfE personnel/subcontractors in regard to the implementation of the plan.

4.2 Noise criteria

Noise criteria represent the noise level goals for any noise-sensitive receiver from the noise associated with the remediation operation. A “noise-sensitive receiver” includes a residence or commercial premise.

Subject to the below specifications all site works shall be designed and conducted to ensure that noise from those activities does not exceed the noise limits in the following table. Between 0730 and 1800 weekdays sound levels will be measured and assessed in accordance with the provisions of NZS6803:1999 Acoustics – Construction Noise. Noise generating activities shall not occur within the shaded periods shown in Table 1 (RM030521-24, RM030522-25).

Table 1: Noise limits

When measured at dwellings in residential areas							
Time period	Week days (dBA)			Saturdays (dBA)		Sundays and public holidays (dBA)	
	L_{10}	L_{eq}	L_{max}	L_{eq}	L_{max}	L_{eq}	L_{max}
0700–0730	55	–	75	55	75		
0730–1800	–	70	85	55	75		
1800–2000	55	–	75				
2000–0700	40	–	70				
At or within the boundary of any site in commercial areas for all days of the year excluding Sundays and public holidays.							
	L_{10}	L_{eq}	L_{max}				
0730–1800	–	70	–				
1800–0730	55	–	70				

Heavy traffic shall not enter or leave the site between the hours of 1800–0730. (RM030521-25)

In specific circumstances where the noise mitigation measures are impracticable or provide other unacceptable adverse effects, or are not wanted by neighbours then the above noise limits may be exceeded provided that:

- Activities that are likely to exceed the noise limits in Table 1 may only occur between 0730 and 1800 week days;
- noise levels are kept as quiet as reasonably practicable;
- neighbours likely to be exposed to levels that exceed the limits are consulted about the proposed timing and duration of the works;
- to the extent possible, the works are undertaken at times that cause the least inconvenience to neighbours. (RM030521-26)

Subject to the above, noise monitoring shall be undertaken if complaints are received from neighbouring residents to check compliance with the above table.

Between the hours of 1800 and 0700 measured sound levels shall be subject to adjustment for any special audible characteristic. The adjustment described in Appendix A6 of NZS6802:1999 Assessment of Environmental Noise shall be added to the measured levels (RM030521-29, RM030522-29).

4.3 Operations

Operations will be conducted during the following hours, unless noise monitoring indicates otherwise:

- MCD treatment plant – 7.00 am to 8.00 pm Monday to Friday and 7.00 am to 6.00 pm Saturday
- all other operations – 7.00 am to 6.00 pm Monday to Friday, with no noisy activity prior to 7.30 am and no noise generating activities on Saturday after 6pm or Sundays or public holidays.

Specifically the MCD plant shall be operated so as to minimise any special audible characteristics through regular maintenance and restricted operating hours (RM030521-30). This includes insulating and baffling the equipment as required and maintenance to equipment to remove any special audible noises.

Maintenance and/or repairs of plant and equipment may be carried out outside the aforementioned hours provided:

- plant and equipment subject to maintenance and/or repairs, and compounds for overnight onsite parking of vehicles and mobile plant, shall be located as far away as possible from residences
- it can be demonstrated that noise limits at the residential site boundaries are not exceeded and there is no noise generating activity on Sunday, Saturday evening or public holidays
- no heavy machinery shall be operated during this period.

4.4 Acoustic barriers/visual screening to FCC site boundaries

In consultation with neighbours physical noise attenuation barriers shall be offered at each boundary of the site using the following basic principles:

1. Activities and equipment shall be sited as far as possible from affected properties or behind existing vegetation or proposed barriers for screening (RM030521-40).
2. Shade cloths shall be installed to the inside of chain-mesh perimeter fences (to 1.8 metres high) to provide some diffuse visual screening where sound attenuation barriers are not fixed (RM030521-43).
3. Physical barriers will be established at or near the site boundary where practical prior to excavations commencing. Barriers within five metres of the boundary of the FCC west and east sites shall be agreed upon with adjacent property owners (RM030521-28).
4. Where it is impractical to establish the barrier prior to excavations taking place then the minimum amount of work will be undertaken before the site is returned to a condition that allows the physical barrier to be established.
5. The main objective for the barriers is to provide maximum protection to existing dwellings rather than residential land per se.
6. Screening of the commercial area will be directed to the restaurant buildings, shops and outside dining areas.
7. Barriers/screening will be established in consultation with individual neighbours (RM030521-44).

8. The noise of establishing and disestablishing noise barriers should be taken into account as part of the selection process.

9. Any lighting used on the site shall be focused and shaded to minimise nuisance to nearby residences and businesses operating at night (RM03521-53).

There are a number of options for physical barriers and a number of different constraints at the various boundaries. Physical noise barriers can be:

- permanent so that they could be modified at the end of the project to become the site boundary fence – close boarded timber fencing would be an example of this
- semi permanent such that they could be formed for the duration of the project and then removed as part of the reinstatement process – an example being a stabilised earth stockpile that are proposed along the northern perimeter of FCC east and west to provide noise attenuation and visual relief
- temporary such that it could be readily moved around the site as required – such as empty shipping containers stacked to the required height or timber barriers constructed as a skid.

For sound reducing purposes any timber fence will be solid with no air gaps and constructed from not less than 20 mm thick-boarded timber with the joins battened to ensure no air gaps occur due to shrinkage. Where appropriate, alternatives to timber will be used provided the alternative material offers equal or better noise reduction.

Temporary barriers will also be used on the site to acoustically buffer noisy activities such as the screens and crushers.

The western boundary of the west FCC site

The potential to temporarily screen at the edge of the landfill will be investigated if required.

Temporary local screens would be located near to the MCD plant, screening area and next to excavation works as they take place. In consultation with the neighbours to the west of the site temporary screening will be investigated near to these dwellings on privately owned land. This will be provided in the instance that this proves practical and the residents see this as an acceptable and desirable mitigation measure.

4.5 Noise monitoring programme

A noise monitoring programme will be undertaken in accordance with resource consent condition RM030521-31. A sound level meter will be available at the site office at all times.

Measured levels will be compared with the appropriate criteria, on a weekly basis or, if the potential for exceedance is present, on a daily basis.

This initial monitoring programme will take place weekly during the first month of operation, at times when the plant is operating at least at 75% of it's maximum capacity, monthly for the next six months and at six-monthly intervals thereafter while the plant is operating (RM030521-11, 31). Monitoring will also be undertaken following any complaint received regarding noise.

Results of all monitoring will be made available to Council.

4.6 Response to monitored exceedences

Where a sustained (as determined by MfE) exceedence of the criteria is recorded, either as a result of regular monitoring or monitoring in response to a complaint, immediate action will be taken to identify the source of the noise and determine the best practicable noise mitigation measures. In addition details of the exceedence will be supplied to TDC. Mitigation measures may include:

- reduction in the noise emission from individual equipment items
- reduction in the number of equipment items onsite, or changes to the pattern of usage to reduce noise impacts
- other noise control measures as may be appropriate for the specific situation concerned.

Following implementation of one or a number of the above measures, noise monitoring will be repeated. This process will be repeated until compliance with the relevant criteria is achieved.

4.7 Community liaison and complaint handling

Liaison with the community will be directly with those neighbouring residents and businesses. Liaison will be undertaken on an ongoing basis as the process of remediation continues. The community liaison duties will principally be undertaken by the Site manager. It will be determined at what stage of the programme each neighbour is likely to experience high levels of noise and each neighbour shall be appraised of that situation and consulted with respect to the measures that are available to control the noise and the best times to undertake noisier activities.

In addition after one month's operation of the MCD Plant and at three-monthly intervals thereafter, MfE shall hold or attend a public meeting with the community to present results of environmental monitoring data.

A complaints handling and resolution procedure will be implemented by MfE, including the following provisions:

- identification of the Site Manager as a contact person for complaints, who will have responsibility for investigation of all complaints, and subsequent contact with the complainant
- publication of a 0800 phone number (0800 FCC SITE) which can be used for noise complaints, and which will be attended at all times when there is any activity on the site
- for each complaint received, prompt action to investigate whether any unusual, noisy, or non-compliant activity may have given rise to the complaint, and if so, action to prevent a recurrence
- if required, instigation of noise monitoring at the complainant's residence
- contact with the complainant as required to inform them of the progress of investigations
- recording of all complaints, including the nature of the complaint, investigations undertaken to resolve it, and all contact undertaken with the complainant and recorder (RM030521-14; RM030522-7, 8; RM030523-7, 8; RM030524-7, 8; RM030525-7, 8; RM030526-7, 8; RM030527-7, 8)
- details of all complaints provided to TDC within 24 hours.

4.8 Surveillance and verification

Surveillance of this procedure shall be carried out by an MfE representative/subcontractor and appropriate records kept on file.

4.9 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent/conditions RM030521-10l, 14, 24, 26, 27, 28, 29, 30, 31, 40, 43, 44, 53; RM030522-7, 8, 10l, 11, 25, 27, 28, 29; RM030523-7, 8, 10l; RM030524-7, 8, 10l; RM030525-7, 8, 10l; RM030526-7, 8, 10l; RM030527-7, 8, 10l.
2. NZS 6801: 1999 Measurement of Environmental Sound.
3. NZS 6802: 1999 Assessment of Environmental Sound.
4. NZS 6803: 1999 Acoustics – Construction Noise.
5. Complaint Register .

6 Attachments

Not applicable to this procedure.

Appendix 11:

Work Plan 11 – Hazardous and Waste Substances Management

Version	Date
1	14 July 2005
2	6 March 2007

Contents

Tables

Appendix 11: Work Plan 11 – Hazardous and Waste Substances Management

1 Purpose and scope

The purpose of this procedure is to describe the handling of hazardous substances to be followed for the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

The objectives of this Hazardous and Waste Substances Plan are to: meet and exceed conditions as outlined in RM030521-10m, RM030521-37-38; RM030522-10m; RM030523-10m; RM030524-10m; RM030525-10m; RM030526-10m; RM030527-10m.

- Any design, construction and management of hazardous substance storage facilities shall be in accordance with the approved Hazardous Substances Management work procedure (RM030521-37),
- Hazardous materials that cannot be processed onsite, shall be placed in secure containers and disposed to an approved facility. (RM030521-38).

There are three discrete operations occurring at the site that will require the use and storage of chemicals and other potentially hazardous substances at the site:

1. The excavation and handling of contaminated soil and reinstatement of the site,
2. Any highly concentrated chemicals or pure product found during excavation of the site,
3. The treatment of the contaminated soil and any associated chemicals.

4.1 Identification of hazardous substances

4.1.1 FCC east

Activities associated with potentially hazardous substances at FCC east include:

- minimal storage and use of small quantities of oils, greases, hydraulic and brake fluids for maintaining equipment
- storage and use of odour suppressant chemicals.

Maximum quantities of hazardous substances that will be used onsite have been estimated in Table 1.

Table 1: Inventory of hazardous substances associated with FCC east

Substance	Maximum estimated quantity (litres)	Fire/explosion quantity ratio	Human health quantity ratio	Environment quantity ratio
Odour suppressant	400	–	–	0.0933
Grease	20	–	0.0060	0.0018
Oil	60	–	0.0059	0.0059
Detergents/cleansers	6	–	0.0007	0.0002
	Total quantity ratio		**0.00126**	

The human health quantity ratio exceeds thresholds for commercial, residential and open space zoned land. A land use consent will be obtained by MfE, if required, before any storage or handling of hazardous substances.

4.1.2 Refuelling

The quantity of diesel stored on the site may require a dangerous good licence from TDC. This will be determined before work begins.

Diesel estimates have not been made, as it is proposed that the majority of refuelling take place offsite. Where refuelling onsite is necessary it will take place at the decontamination area adjacent to the FCC East main gate. Significant loss of diesel from vehicle fuel tanks is regarded as highly improbable.

4.2 Identification of hazardous substances – FCC west

Activities associated with potentially hazardous substances at FCC west include:

- refuelling of vehicles and equipment with diesel by mobile tanker on an as required basis
- storage and use of diesel in an aboveground tank for operating the drier and generator
- storage and use of reagents used in the MCD plant (urea, diammonium phosphate (DAP), copper sulphate, ferric oxide, and calcium oxide)
- storage and use of small quantities of oil and grease for maintaining equipment.

The MCD plant and associated equipment, including storage sheds, are to be located on FCC west with the amount of associated hazardous substances stored to be no more than necessary. Maximum quantities of hazardous substances that will be used onsite have been estimated in Table 2.

Table 2: Inventory of hazardous substances associated with MCD plant (EDL)

Substance	Maximum estimated quantity	Fire/explosion quantity ratio	Human health quantity ratio	Environment quantity ratio
Diesel	2000 litres	0.0667	0.2222	0.2222
Urea	5 tonnes	–	0.5556	0.0556
MCD Reagents	40 tonnes	–	1.4815	0.4444
Grease	120 litres	–	0.0120	0.0036
Oil	500 litres	–	0.0491	0.0491
Detergents/cleaners	6 litres	–	0.0007	0.0002
	Total quantity ratio		**2.3260**	

The human health quantity ratio exceeds thresholds for commercial, residential and open space zoned land. A land use consent will be obtained by MfE, if required, before any storage or handling of hazardous substances.

The use/storage of any other hazardous substances not mentioned in this procedure will be under approval and legislation outlined in the New Zealand Hazardous Substances and New Organisms Act 1996.

4.3 Work methods

4.3.1 Site design, construction and operation

Risks associated with hazardous substances are low as the quantities of hazardous substances stored onsite at any one point in time is low. Uncontrolled spills of diesel or additives such as urea could present a risk to the aquatic environment or site personnel.

To minimise risk the following control measures will be implemented:

1. Emergency and spill plan developed, which identify spill points, minimise probability of spills, identify spill containment equipment, outline appropriate training of site personnel.
2. The design, construction and management of hazardous substance storage facilities shall be in accordance with the approved hazardous substances work procedure (RM030521-37).
3. MfE subcontractors will comply with any relevant Industry Codes of Practice (e.g. fuel storage).
4. Diesel will be stored in a 10,000 litre above ground storage tank. The tank will be double walled and store no more than 9,000 litres at a time.
5. A spill kit will be maintained at the site of any refuelling, and spills will be controlled to prevent migration offsite.
6. Vehicles will not be refuelled in the coastal area.

7. Urea and other reagents will be stored in covered bins/silos in the MCD plant area and will only be accessed as required.

8. Bins will be located in a bunded area that is isolated from stormwater system. Any materials spilt will be swept up immediately.

9. Oils and greases will be stored on the site for use in mobile and fixed equipment, particularly at the MCD Plant. Flammable (class 3) materials will be stored in a designated bunded storage area or shed

10. All hazardous substances transported to the site will be in accordance with Dangerous Goods Rule 1999 (encompassing NZS 5433: Transportation of Dangerous Goods). Drivers will be approved for the transport of such materials, carry appropriate equipment, and have been trained to deal with any incidents involving hazardous substances.

11. Waste hazardous substances that cannot be treated onsite will be placed in secure containers and disposed of to an approved facility (RM030521-38). A waste transfer manifest will be completed for any waste materials that leave the site (RM030521-56).

4.4 Non-hazardous waste/litter control

MfE will control other wastes generated from site activities (i.e. office waste) and prevent littering of site by collecting waste on a daily basis. Bins for office waste will be disposed of regularly and reuse/recycling encouraged where possible.

4.5 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent/conditions RM030521-10m, 37, 38, 56; RM030522-10m; RM030523-10m; RM030524-10m; RM030525-10m; RM030526-10m; RM030527-10m.
2. The Hazardous Substances and New Organisms Act 1996.
3. Emergency Response Plan
4. Dangerous Goods Rule 1999 encompassing NZS 5433: Transportation of Dangerous Goods.

6 Attachments

Not applicable to this procedure.

Appendix 12:

Work Plan 12 –

Vibration Management

Version	Date
1	14 July 2005
2	6 March 2007

Contents

Tables

Appendix 12: Work Plan 12 – Vibration Management

1 Purpose and scope

The purpose of this procedure is to describe the vibration management procedure to be followed on the FCC site remediation works at Mapua. This includes structural assessment work required.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Aim

This work procedure outlines vibration management procedures to be adopted, so that remedial works may proceed in a safe and efficient manner with minimal impacts on adjacent residents.

4.2 Sequence of operations

1. Undertake any preliminary structural assessments as required of buildings within 100 metres of the site, and take preventative action if necessary. (RM030521-39)
2. Determine five sample locations to undertake vibration monitoring including at least one location north and one location south of the site. Locations to be approved by TDC (RM030521-32).
3. Weekly vibration monitoring during the first month of operation whilst plant is operating at least at 75% of its maximum capacity (RM030521-32).
4. Monthly monitoring for the next six months and six-monthly thereafter (RM030521-32).

4.3 Work method

4.3.1 Structural investigations of surrounding buildings

Prior to commissioning of MCD plant, clearing and excavation, MfE subcontractors shall undertake structural assessments as required of buildings within 100 metres of the site. Assessments will be conducted by a registered engineer experienced in foundation design and structural engineering. The assessment will list weaknesses or potential weaknesses that could be affected by vibrations from the site. Residents are to be notified that assessments are conducted at no cost to the property owner.

MfE will provide necessary bracing or other measures to prevent failure from vibration arising from the MCD plant. Assessments will also be conducted on completion of the remediation and the results provided to TDC (RM030521-39).

4.3.2 Monitoring

All monitoring to be in accordance with ISO 2631 (1989) Standard, Evaluation of Human Exposure to Whole Body Vibration Part 2; and the German DIN4150 Standard – Part 3 (1993) (RM030521-32).

Vibration monitoring will be undertaken if complaints are received from neighbouring residents to verify compliance with thresholds, and residents will be notified of monitoring results (RM030521-36).

4.3.3 Vibration thresholds

Thresholds as defined in ISO 2631 (1989): Peak Vibration Velocity Limits in Residential Buildings are to be adopted and are (RM030521-33):

- continuous vibrations:
  - day (0730–2000) – 0.4 mm/s
  - night (2000–0730) – 0.14 mm/s
- transient/short duration vibrations with several occurrences per day:
  - day (0730–2000) – 5 mm/s
  - night (2000–0730) – 0.5 mm/s.

Thresholds for other types of building are as set out in DIN4150 Standard – Part 3 (1993), as displayed in Table 1 below (RM030521-34).

Table 1: Guideline values of vibration velocity, for evaluating the effects of short-term vibration (DIN 4150)

Type of structure	Vibration velocity (mm/s) Foundation Frequency		
	<10 HZ	10–50 Hz	50–100* HZ
Buildings used for commercial and industrial purposes, and of similar design	20	20–40	40–50
Dwellings and buildings of similar design and/or use	5	5–15	15–20
Structures that, because of their sensitivity to vibration, do not correspond to those listed in lines 1 and 2 and are of great intrinsic value (eg buildings that are under a preservation order)	3	8–10	8–10

* For frequencies above 100 HZ, the lower value specified in this column shall be applied.

4.3.4 Exceedance of thresholds

Any exceedance of thresholds shall be resolved by MfE through suitable screening or modifications of site processes to meet criteria (RM030521-35). Where vibration may affect properties identified as sensitive, bracing or other measures to ensure integrity of buildings/ structures will be employed.

4.4 Community liaison and complaint handling

Liaison with the community will be directly with those neighbouring residents and businesses. Liaison will be undertaken on an ongoing basis as the process of remediation continues. The community liaison duties will principally be undertaken by the site manager. It will be determined at what stage of the programme each neighbour is likely to experience high levels of vibration and each neighbour shall be appraised of that situation and consulted with respect to the measures that are available to control the noise.

In addition after one month's operation of the MCD Plant and at three-monthly intervals thereafter, MfE shall hold or attend a public meeting with the community to present results of environmental monitoring data. A complaints handling and resolution procedure will be implemented by MfE, including the following provisions:

- identification of the Site Manager as a contact person for complaints, who will have responsibility for investigation of all complaints, and subsequent contact with the complainant
- publication of a 0800 phone number (0800 FCC SITE) which can be used for complaints, and which will be attended at all times when there is any activity on the site
- for each complaint received, prompt action to investigate whether any unusual or non compliant activity may have given rise to the complaint, and if so, action to prevent a recurrence
- if required, instigation of vibration monitoring at the complainant's residence (RM030521-36)
- contact with the complainant as required to inform them of the progress of investigations

- recording of all complaints, including the nature of the complaint, investigations undertaken to resolve it, and all contact undertaken with the complainant and recorder (RM030521-14; RM030522-7, 8; RM030523-7, 8; RM030524-7, 8; RM030525-7, 8; RM030526-7, 8; RM030527-7, 8)
- details of all complaints provided to TDC within 24 hours.

4.5 Surveillance and verification

Surveillance of this procedure shall be carried out by a designated MfE representative with appropriate records maintained on file.

4.6 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. Resource consent conditions RM030521-14, 31, 32, 33, 34, 35, 36, 39; RM030522-7, 8; RM030523-7, 8; RM030524-7, 8; RM030525-7, 8; RM030526-7, 8; RM030527-7, 8.
2. ISO 2631 (1989) Standard, Evaluation of human exposure to whole body vibration Part 2.
3. DIN4150 Standard – Part 3 (1993).
4. Complaint Register.

6 Attachments

Not required for this procedure.

Appendix 13:

Work Plan 13 –

Validation Sampling and Analysis

Version	Date
1	4 July 2005
2	30 July 2006
3	30 April 2007

Contents

Tables

Appendix 13: Work Plan 13 – Validation Sampling and Analysis

1 Purpose and scope

This Work Plan describes the procedures to be followed when conducting soil/sediment sampling and analysis as part of the FCC site remediation works at Mapua. As detailed in Table 1, there are several types of validation sampling/analysis covered by this work plan. The primary objectives of validation sampling and analysis are to firstly, facilitate soil/sediment clean up operations on site and to secondly, demonstrate that the site has been remediated to a standard suitable for the proposed land uses as stipulated in Table 2. Information from the validation sampling will be used to generate a site validation report that will be prepared in accordance with the *Guidelines for Reporting on Contaminated Sites in New Zealand*, Ministry for the Environment, 2001.

Table 1: Types of Validation Sampling

Type of Validation	Purpose of Validation
(1) Soil Management	Soil management is carried out on soil material prior, or during excavation, relocation and/or treatment and is designed to assess contaminant levels and to determine treatment/handling requirements. Soil management samples will also be taken to address logistical issues and/or future planning.
(2) Sediment Management (marine sediments)	Assessment of marine sediment contaminant levels is used to determine extent of excavation, treatment/handling requirements and fate of the sediments. Following completion of the works validation sampling is carried out on *in situ* marine sediments, at the base and at the edges of the excavation to demonstrate that the remaining marine sediments meet assigned Soil Acceptance Criteria (SAC) for the marine environment.
(3) Imported Soil Material (e.g. topsoil, gravel)	To confirm that imported materials (materials derived from offsite) are suitable for intended land uses as per relevant SAC.
(4) On-Site Material (e.g. commercial soil, concrete and oversize)	To confirm that materials derived and used on the site (other than treated soil) are suitable for intended land uses as per relevant SAC.
(5) Exported Materials (e.g. greenwaste, rubbish)	To confirm that material exported off the site is free of contamination, relative to contaminant mass, and meets the requirements of the receiving environment, e.g. Eves Valley Landfill.
(6) Assessment of MCD Treated Materials	To demonstrate that soil materials have been remediated to a standard suitable for the proposed end land uses in accordance with relevant SAC. Additionally, this sampling is undertaken as part of the evaluation of destructive efficiency (DE) of the MCD plant.
(7) Remediated Areas	To demonstrate that soil and marine sediment materials have been remediated to a standard suitable for the proposed end land uses in accordance with relevant SAC.

Note: *Relevant SAC for various end land uses are detailed in Tables 4 and 5.

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2 Definitions

Cell – Each area onsite has been divided into a 15m x 15m x 0.5m (or 1m after 2m depth) and has been assigned an alphanumeric name by assigning a letter (A to N) to a given row (based on its' longitudinal position) and a number (1 to 26) to a column (based on its' latitudinal position) as per Map 1 (Appendix 19).
Note for residential end use the cell is divided into four quadrates to give an effective validation size of 7.5m x 7.5m x 0.5m (or 1m after 2m depth).

Excavated soils – Soil excavated from a cell or cells.

In Situ soils – Soil remaining in the ground on the site.

Oversize materials – Excavated material that needs to be treated is screened to remove material larger than 10 mm in size. The material greater than 10mm in size is termed "oversize".

Soil/Sediment Acceptance Criteria (SAC) –maximum permissible concentration levels for a series of selected contaminants identified in soils and marine sediments at the FCC Mapua site as detailed in Tables 3 & 4. These SAC were set by the independent site auditor and are based on site specific risk based acceptance criteria for protection of human health and the environment. The "substances" in Table 4 were developed from previous targeted sampling that was conducted to identify contaminants of concern at the site.

~~2~~3 Flowchart

No flowchart applicable.

~~3~~4 Record of Changes

During the period of development of this RAP changes to the validation protocol have been agreed upon and during the course of the remediation. Table 2 documents the timeline for these changes –

The following changes have been implemented at incremental stages –

Table 2: Incremental changes before adoption of full validation protocol

Date	Event	Change
30 June 2005	Clarification of the final 10 and 50% suite. Following the 10 + 10 extensive analysis requested by the Site Auditor.	Memo from GHD with the following recommendations, which were adopted: 50% Previous - TPH, VOC and selected Metals. Now – TPH, OPP and ONP's 10% Previous – suite of analytes for which Soil Investigation levels (SILs) for Urban Redevelopment Sites in NSW are listed in Contaminated Sites: Guidelines for the NSW Site Auditor Scheme Now – VOC's, PAH (Chlorobenzene), Selected Metals, PCB's.

27 June 2006	SAC change for Nickel and Magnesium.	Section 127 application to TDC approved to change the Soil Acceptance criteria for Nickel and Manganese to reflect the ultramafic Nelson region that has high background levels of these two elements. New category for Topsoil SAC created with previous residential levels. New residential level for Nickel from 60 to 600 mg/kg and Manganese from 500 to 1500 mg/kg.
4 July 2006	Validation of MCD Treated Material	Validation Protocol for MCD treated material developed and agreed by TDC, EDL, MfE and Site Auditor. Includes a rolling average to determine acceptability of treated material, instead of a previously recommended 95% UCL method.
28 Aug 2006	Frequency of Nickel and Nitrogen testing for MCD soil	Reduced from every 3-days to twice per month.
Mar 2007	Oversize adhesion	Previous RAP has requirement for 5% adhesion. This has been increased to up to 10% allowance, on the basis that all treated material is below 200 ppm.
Apr 2007	Quality Assurance Soil Sampling Program	A soil sampling program has been developed in conjunction with the Site Auditor to meet the following objectives – - Investigation of differing types of backfill material on the East site and their OCP and nutrient composition, including commercial and mixed treated fines compositions. - QA/QC Independent checks, blind duplicates, independent laboratory checks and an independent person to take samples concurrently. Outcomes of this program will be included in the final Validation Report submitted to the Site Auditor.

~~4~~5 Procedural text

5.1 Aim

Validation sampling will be undertaken to facilitate site cleanup operations and to demonstrate that the site has been remediated to a standard suitable for the proposed land uses as per Table 3, and to meet or exceed resource consent conditions (RM030521-10p; RM030522-10p; RM030523-527 10p).

In addition, methods employed will be in compliance with contaminated site investigation, soil sampling, analysis and interpretation (Ministry for the Environment, June 2003). Following remediation, soils shall comply with the SAC for land end use preferences shown in Tables 4 and 5 (RM030521-17a; RM030522-17a, 22; RM030523-17a; RM030524-17a, 21; RM030525-17a; RM030525-20; RM030526-17a; RM030527-17a).

Table 3: Proposed end land uses for Mapua FCC site

Site	End land use
East (of Tahi Street)	Commercial / Open space
West (of Tahi Street)	Residential
FCC landfill	Recreational
Marine sediments	Aquatic ecosystem protection
Neighbouring properties	Residential

Table 4: Soil/sediment acceptance criteria (SAC) for the key organochlorine contaminants of concern

Land use	Depth (m)	DDX (total DDT, DDD, DDE) (mg/kg)	Aldrin + dieldrin + 10% lindane (mg/kg)
Residential	All	5[1]	3[1]
Commercial	0–0.5 Below 0.5	5[1] 200[2]	3[1] 60[2]
Recreational/open space	0–0.5 Below 0.5	5[1] 200[2]	3[1] 60[2]
Marine sediment	All	0.01	0.01

1 Based on protection of the offsite environment through rainfall run off. This will also be protective of human health and groundwater.

2 Based on protection of groundwater.

Table 5: Soil/sediment acceptance criteria (SAC) for contaminants at FCC Mapua site

Substance	Residential[1] (mg/kg)	Topsoil[10] (mg/kg)	Open space[1,2] (mg/kg)	Commercial (mg/kg)[1,2]	Marine sediments[7] (mg/kg)
Arsenic	30[3]	30[3]	200	500	20
Boron	3[3] (sol)	3[3] (sol)	6,000	15,000	
Cadmium	3	3	40	100	1.5
Chromium (III)	600[3]	600[3]	24%	60%	
Chromium (VI)	9[3]	9[3]	200	500	80
Copper	300[6]	300[6]	2,000	5,000	65
Cyanide (complexed)	20[9]	20[9]	1,000	2,500	
Cyanide (free)	50[9]	50[9]	500	1250	
Lead	300	300	600	1500	50
Manganese	1500	1500	3,000	7,500	
Methyl Mercury	10	10	20	50	
Mercury (inorganic)	1	1	30	75	0.15
Nickel	600	60	600	3,000	70
Sulphur	600	600	600	600	
Zinc	200	200	14,000	35,000	200
Aldrin + dieldrin +10% lindane	3[4]	3[4]	60[4]	60[4]	0.01[4]
Chlordane	50	50	100	250	0.0005
DDT	5[4]	5[4]	200[4]	200[4]	0.01[4]
Heptachlor	10	10	20	50	
PAHs	20	20	40	100	
Benzo(a)pyrene	0.27[5]	0.27[5]	25[5]	25[5]	0.430
Phenol	40[9]	40[9]	17,000	42,500	
PCBs (total)	10	10	20	50	0.023
Total Petroleum hydrocarbons in sandy silt					
C7-C9	500[5]	500[5]	500[5]	500[5]	
C10-C14	510[5]	510[5]	2,200[5]	2,200[5]	
C15-C36	NA[5,8]	NA[5,8]	NA[5,8]	NA[5,8]	

1. The soil values without notation are from National Environmental Protection Council (NEPC) Assessment of Site Contamination Schedule B(1) "Guidelines on Investigation Levels for Soil and Groundwater" Table 5A Soil Health Investigation Levels or the interim urban Ecological Levels (which ever is lowest, except for nickel and manganese where the higher one is used).
2. The commercial and recreational values apply to soil below 0.5 m depth. Surface soil should comply with the residential values.
3. Health and Environmental Guidelines for selected Timber Treatment chemicals. Ministry of Health, Ministry for the Environment, June 1997.
4. Risk based acceptance criteria for FCC Mapua, Egis 2001.
5. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Ministry for the Environment, August 1999.
6. Ministry for the Environment draft revised copper value, June 2003.
7. The marine sediment guidelines are ISQG-Low from ANZECC 2000.
8. NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
9. Ecotox values, RIVM, Technical Evaluation of the Intervention Values for Soil/Sediment and Groundwater, February 2001.
10. The soil values without notation are from National Environmental Protection Council (NEPC) Assessment of Site Contamination Schedule B(1) "Guidelines on Investigation Levels for Soil and Groundwater" Table 5A Soil Health Investigation Levels or the interim urban Ecological Levels (which ever is lowest except for manganese). Note: The only difference between Residential and Top soil is that nickel is more protective of human health.

5.2 Soil/Sediment sample collection protocols

5.2.1 Responsible parties

Validation sampling of the excavated areas, *in situ* material, excavated materials, oversize materials, marine sediments and imported materials or material removed from site will be undertaken by the MfE Site Manager or designated MfE representative.

Validation sampling of Mechanical Chemical Dehalogenation (MCD) treated materials will be undertaken by an MfE representative.

Sampling will be conducted in compliance with AS 4482.1 – *1997 Guide to the Sampling and Investigation of Potentially Contaminated Soil*. This standard details collection, handling, containment and transportation protocols for samples to prevent cross-contamination and deterioration of samples.

All analyses will be carried out by an International Accreditation New Zealand (IANZ) accredited laboratory as per Resource Consent RM030524- 39.

Note: QA/QC requirements under the standard AS4482.1, including duplicate laboratory comparisons will be met through a dedicated sampling program designed and approved by the Site Auditor.

5.2.2 Dry excavation surfaces

At depths less than three metres, a hand auger will typically be used for sampling both organic and inorganic analytes. When sampling from a hand auger, care must be taken to pare away the outer layer of the sample to minimise the risk of cross-contamination between cell layers. Samples may also be recovered by trowel and from excavator bucket returns from dry excavation surfaces.

5.2.3 Excavation surfaces under water

Where water is ponded over excavation surfaces, then samples will be recovered by split tube, piston sampler or ‘clam-shell’ grab. The particular method used will be that best suited to the material being sampled, with a view to minimising sample disturbance.

5.2.4 Marine sediments

Sediment samples will be collected at low tide using a split-tube, piston sampler or ‘clam-shell’ grab or similar suitable instrument. The particular method used will be that best suited to the material being sampled, with a view to minimising sample disturbance.

~~5~~6 Sampling methodology and analysis

6.1 Site Management

Good day-to-day management of the FCC site clean up involves processing contaminant levels for *in situ soils* and *excavated soils*, during the remediation project.

This preassessment allows good decision making for handling and treatment requirements for the various materials.

Samples will be taken from the top of cells, before determining excavations, from areas where evidence of professional judgement tells us further excavation will be required or when a fast turnaround time for an 'indication' is required. Results of the analysis are used to make site decisions on treatment and/or site handling options and are not used for final validation.

It is envisioned that there will be a significant number of site management samples taken to assist in good decision making and to allow timely access to results.

6.2 Marine Sediment Management

Cleanup of the FCC Mapua site involves removing and replacing the surface marine sediments in the tidal flats in the eastern and southwestern areas of the site. Prior to excavation, contaminant levels within the sediments must be preassessed to determine handling and treatment requirements. Sampling management for marine sediment samples and operations are detailed in Table 6 below.

Table 6: Validation protocol for Marine Sediments

Type	Sample Zone	Analysis / Comments
Assessment of marine sediments	Sampling the marine sediments will be carried out using a 15m grid set out across the tidal flats areas. Sediment sampling will be carried out at low tide.	Organochlorine Pesticides Results used to determine extent of excavation.
Excavated marine sediments	Sampling for stockpiled marine sediments can be either from the stockpile, by dividing a $100m^3$ stockpile into 4 quadrates (based upon north, south, east and west). A representative sample is to be taken from a random location within each quadrate. Alternatively the results from excavations can be used to validate the marine material.	Organochlorine Pesticides Results used to determine reburial options based on SAC.
***In situ* marine sediments**	Sampling the marine sediments will be carried out at low tide, using a 15m grid set out across the tidal flats areas. Samples will be taken along the edge of the excavation and within the excavation to determine compliance with the Soil Acceptance Criteria.	100% of the samples for Organochlorines 50% of the samples are analysed for – Metals and Total Petroleum Hydrocarbons 10% of the samples are analysed for – Volatile Organic Compounds, Organophosphorous pesticides, Organonitrogen pesticides, PAH, PCB, Cyanide, Boron Results used to validate remediation.

Sampling procedure – - All sampling equipment is to be cleaned between samples to prevent cross-contamination. - Samples are to be stored in appropriate containers in an enclosed, cool, secure location for up to two weeks. - All samples are to be analysed by an accredited IANZ laboratory. - Surface 20 cm (or deeper) shall be removed to ensure a representative sample is acquired

Assessment analysis of the marine sediments is used to confirm and/or determine the full extent of the excavation area required. Final validation of in situ sediment will occur following excavation. Results of the assessment work will be used to determine the fate of the excavated marine sediments. Some additional sampling of the imported material after placement may also occur to assist in validation.

6.3 Validation of Imported Materials

Remediation will require the use of some materials to be imported onto the site for use during the site cleanup operations, such as topsoil and marine gravel. Validation will be carried out to confirm that imported materials are suitable for their intended land use as per the Soil Acceptance Criteria. Table 7 below provides the sampling and analysis protocol for imported materials.

Table 7: Validation protocol for Imported Materials

Type	Sample Zone	Analysis / Comments
Imported marine gravel & soil material from a known source	At least 1 composite sample will be taken for each 1000m^3 of imported materials, plus quality control sampling. Additional sampling at the Site Manager's discretion.	Organochlorine Pesticides Results used to confirm suitable for being bought on to the site and for their intended end use.
Imported material of unknown or suspect origin	Sample may be taken from the source initially to determine suitability. Material imported on site will have at least 1 composite sample per 400m^3 of materials, plus quality control sampling Random quality assurance samples are also taken of this material.	Organochlorine Pesticides Additional analysis if suspected to be present e.g. Total Petroleum Hydrocarbons or Metals. If this sampling shows evidence of contamination exceeding the SAC, then the TDC compliance co-ordinator may request additional sampling and characterisation of the material to ensure it meets the criteria.
Sampling procedure – - All sampling equipment is to be cleaned between samples to prevent cross-contamination. - Samples are to be stored in appropriate containers in an enclosed, cool, secure location for up to two weeks. - All samples are to be analysed by an accredited IANZ laboratory. - Surface 20 cm (or deeper) shall be removed to ensure a representative sample is acquired - In addition to quantitative validation, visual assessment of the material will also be undertaken to ensure material is free from gross contamination, is visually acceptable and does not present pungent odour.		

6.4 Validation of Material Derived and Used On-site

Some materials that are derived on-site (e.g. commercial / open space soil, oversize material and crushed concrete) can be reinstated on site if they meet the relevant SAC. Table 8 outlines sampling protocols and analysis used for validating whether or not material derived and used on-site is suitable for its intended end land use.

It is anticipated that there are areas on the site that are classified as meeting the commercial criteria insitu and can remain in place. However some of these areas may need to be excavated to get access to materials below. This would primarily occur when excavating commercial soils to reach residential quality material below.

Table 8: Validation protocol for Material derived and used On-site

Type	Sample Zone	Analysis / Comments
Commercial/ open space soil	At least 1 composite sample will be taken for each 100m^3 of commercial material. Additional sampling at the Site Manager's discretion.	100% of the samples for Organochlorines
Oversize Materials **(>10mm)**	A representative 50kg sample is taken from the oversize pile. A representative sample of the fine material remaining on the oversize is taken.	The percentage of fines remaining on the oversize is monitored and must be less than 5%. Fine material is analysed for Organochlorine Pesticides to determine final land use of the oversize material.
Crushed Concrete Materials	A representative sample is taken from the crushed concrete or more solid concrete is chipped away or a core sample is taken, and then ground down in the lab.	Sampled for Organochlorine Pesticides. Determine reburial options based on SAC.
Sampling Procedure - All sampling equipment is to be cleaned between samples to prevent cross-contamination. - All samples are to be analysed by an accredited IANZ laboratory. - Surface 20 cm (or deeper) shall be removed to ensure a representative sample is acquired		

6.5 Validation of Exported Materials

Material to be exported off site will be minimised, however it is anticipated that there will be material that will need to have contaminated soil removed and then sent to landfill or other suitable alternative. Validation will carried out to confirm that exported materials are suitable for their receiving environment. Table 9 below provides the validation protocol for exported materials.

Table 9: Validation protocol for Exported Material

Type	Sample Zone	Analysis / Comments
Exported material including greenwaste	At least 1 composite sample of attached soil fines or other residues will be taken for each 1000m^3 of exported materials, unless	Organochlorine Pesticides. Results used to confirm suitability for the selected receiving environment.

and rubbish.	additional sampling is required. Results are based on total estimated mass of contaminants versus the total volume of material.	Additional analysis will be undertaken if suspected to be present e.g. Total Petroleum Hydrocarbons or Metals. Visual inspection to ensure a majority of the soil has been removed.
Sampling procedure – -In addition to quantitative validation, visual assessment of the material will also be undertaken to ensure material is free from gross contamination, is visually acceptable and does not present an unacceptable odour. -All sampling equipment is to be cleaned between samples to prevent cross-contamination. Samples are to be stored in appropriate containers in an enclosed, cool, secure location with proper preservation for up to two weeks before analysis. -All samples are to be analysed by an accredited IANZ laboratory.		

6.6 MCD Treated Materials

This validation protocol has been amended following the initiation of Stage 3. The 95% Upper Confidence Limit (UCL) proved to be difficult and unreliable to use when assessing output from a plant such as the MCD plant, as it required a significant amount of samples to be of statistical use. A rolling average provides a fast and reliable determination method and has been adopted. Table 10 below outlines the agreed validation protocol for the treated fines.

Table 10: Validation protocol of MCD Treated Material

The following guidelines have been developed and reviewed by: MFE, the Site Auditor, the TDC representative, and the Site Management team for implementation – effective 4 July 2005
a. A sample will be taken from every day's production (normally 6 days per week), at least one per 25m^3. These samples will be analysed for the basic OCP suite of DDX, Lindane, Aldrin and Dieldrin at the detection limit of 3 mg/kg.
b. Sampling will occur at random times of the production day at the discretion of the Site Manager.
c. All samples will be analysed by an IANZ accredited laboratory.
d. For every 3rd production day, the sample will also be analysed for copper and leachable nitrogen and any other reagent residue which is included in Attachment 1 of the Resource Consent.
e. For every 200 m^3 of treated soil, a sample will be analysed for the 50% validation suite which consists of: manganese, selenium and sulphur (if needed).
f. For every 1000 m^3 of treated soil, a sample will be analysed for the 10% validation suite which consists of: Total Petroleum Hydrocarbons (TPH), Volatile Organic Compounds (VOC) including chlorobenzene, Polycylic Aromatic Hydrocarbons (PAH), and heavy metals.
g. As to validation, the following will be acceptable: (1) The daily results will be tabulated into a rolling average concentration which includes at least six samples (which approximates 100 m^3). If after twelve days (to allow calculation of the rolling average), the DDX and ADL concentrations are below the SAC, then the production for that initial group of six will be accepted. (2) Any daily batch that exceeds 1.5 times the SAC will be rejected and removed for re-processing. Also any batch which would cause the rolling average to exceed the SAC will be rejected and removed for re-processing. (3) Should the results of the other (non OCP) analysis described in (e) & (f) above exceed the SAC, the Site Auditor will be requested to advise on the action to be taken.

Conditions:
i. This protocol will be reviewed at each site management meeting for the next three months. If changes need to be made, such changes will be forwarded for review and comment to the Site Auditor, Principal and TDC as per the Resource Consents and Remedial Action Plan and completed within seven working days.
ii. This sampling procedure will be adopted for the rest of the contract.
iii. The suite of analytes may vary on different areas of the site. If unusual odours or solvents are detected in the excavated soil, then TPH and VOC's will be included into the 50% suite. When excavating the West or the Landfill, it is also expected that the 50% suite will expanded to include: ONP, OPP, TPH and BTEX.
iv. MfE may take additional samples at their cost at any time to ascertain validation status.
v. Sampling will be done at the Pug Mill for the Top and Bottom Mills and the Infeed belt for the Infeed sample.
vi. EDL will continue to maintain records of additives, production volumes, and pebble components for calculating the Destruction Efficiency

6.7 Excavated Areas

All material found to be above the SAC for its intended land use will be excavated and relocated to another area if possible, or treated by MCD.

Excavated areas will be validated as per the following table:

Table 11: Validation Grid Size

End Use	Validation Grid Size
Commercial / Open Space / Recreational / Marine Sediments	15m x 15m x 0.5 or 1m layers
Residential	7.5m x 7.5m x 0.5 or 1m layers

Before any material is backfilled the excavated areas will be validated as per the protocol below. Table 12 outlines the validation protocols for validating each excavation against the relevant Soil Acceptance Criteria, consistent with its intended end land use.

Table 12: Validation Protocol for Remediated Areas

Type	Sample Zone	Analysis / Comments
Excavated Areas - Floors	Each cell floor (west - 7.5m^3 grid and all others 15m^2) is divided into 4 quadrates. Four random samples will be taken from each quadrate to form one composite sample. Therefore a minimum of one composite sample will be generated from each cell floor.	100% of the samples for Organochlorines 50% of the validation samples from the excavated floors are analysed for – Total Petroleum Hydrocarbons, Organophosphorous and Organonitrogen pesticides. 10% of the validation samples from the excavated floors are analysed for – Volatile Organic Compounds, Selected metals, PAH, PCB, Cyanide and Boron. Results used to validate remediation.
Excavated Areas - Walls	Each 0.5m or 1m layer (west - 7.5m^3 grid and all others 15m^2) is divided into 4 quadrates. Four random samples are taken from each wall layer to form one composite sample. Therefore one composite	100% of the samples for Organochlorines 50% of the validation samples from the excavated floors are analysed for – Total Petroleum Hydrocarbons, Organophosphorous and Organonitrogen pesticides. 10% of the validation samples from the excavated floors are analysed for – Volatile Organic Compounds, Selected metals,

	sample is taken from each wall layer within the cell.	PAH, PCB, Cyanide and Boron. Results used to validate remediation.

Sampling Procedure

- All sampling equipment is to be cleaned between samples to prevent cross-contamination.

- Each sample will constitute approximately 100g of fines

- All samples are to be analysed by an accredited IANZ laboratory.

- The surface shall be removed to ensure a representative sample is acquired Floor samples will generally be taken 10 cm (or deeper) below surface level to ensure a representative sample is acquired.

~~6~~7 Determination of Results

The determination of results set out below will be the basis for acceptance of the validation results against the Soil Acceptance Criteria.

It is anticipated that there will be a significant amount of results generated during the course of the remediation. Many additional samples, other than those required by this protocol, will be taken to maintain good decisions making and to support the final result. This data will be managed in an appropriate form and be provided upon completion.

Further work will be undertaken on the most appropriate statistical method for summarising the results. The following is proposed as a minimum requirement to demonstrate compliance with the Soil/Sediment Acceptance Criteria:

7.1 Excavated Areas / Marine Sediments

All excavated material will be validated as a minimum per the following requirements:

100% Suite (Organochlorines)
Results from each excavated cell, including all layers and floors (Section 6.7), or marine sediments (Section 6.2) will be averaged to determine the average concentration for each cell. For marine sediments this will be each strip of excavated material.

The average from each cell must not exceed the relevant Soil/Sediment Acceptance Criteria and no one result can be 1.5 times higher.

50% and 10% Suites (All other analysis)
Results from excavated cells will be grouped into areas of excavation called subgrades, of approximately 4 and 8 cells. These subgrades will have a number of 50% and 10% suites within each group. The results of the 50% and 10% suites will be averaged within each subgrade.

The average of each subgrade must not exceed the relevant Soil/Sediment Acceptance Criteria and no one result can be 1.5 times higher.

Note: In addition the 100% suite will also be analysed per subgrade.

7.2 Commercial Material

Commercial material can be validated in-situ, as material excavated to storage in piles, and/or material that is moved to get at contamination or material located near it.

Results for OCP will be averaged per $100m^3$ of commercial material.

The average must not exceed the relevant Soil/Sediment Acceptance Criteria and no one result can be 1.5 times higher.

7.3 Treated Material

Will be validated as per the rolling average outlined in Section 6.6.

7.4 All Other Materials

Including - Imported Materials (Section 6.3), Oversize Materials and Crushed Concrete (Section 6.4, Exported Materials (Section 6.5).

All results from each individual source will be averaged. The average must not exceed the relevant Soil/Sediment Acceptance Criteria and no one result can be 1.5 times higher.

7.5 Detection Limits

For analysis of any analytes that is below the detection limit, half the detection limit will be used.

8 Destruction Efficiency (DE)

Contract conditions require that the destructive efficiency of the MCD plant be calculated and should remain at or above 90% efficiency. The formula for destructive efficiency (DE) is as follows, where *m=mass*.

$$DRE(\%) = \frac{m(OCP)_{\inf eed} - m(OCP)_{treatedfines} - m(OCP)_{treatedoversize}}{m(OCP)_{\inf eed}} \times 100$$

A spreadsheet has been designed to calculate the destructive efficiency of the plant. This spreadsheet requires the following input parameters:

INFEED FINES

- → Conc DDX = concentration of DDT + DDE + DDD (in fines)
- → Conc ADL = concentration of Aldrin + Dieldrin + 10% Lindane (in fines)
- → Batch Volume = actual volume of 3 day batch
- → Batch Density = density of 3 day batch
- → Mass of Additives = quantity of additives added during processing

TREATED FINES

- → Conc DDX = as above (in treated fines)
- → Conc ADL = as above (in treated fines)

The DE is a calculation that is used to ensure an effective level of total destruction of the OCP's. However there is some discussion ongoing over the relevance of a treatment DE (covering the treatment process) and a site DE (including any contaminants that may have been appropriately disposed of off site e.g. pure product). Both of the above scenarios will be addressed in further documentation and final validation reports.

Appendix 14:

Work Plan 14 – Traffic Control

Version	Date
1	14 July 2005
2	May 2007

Contents

Appendix 14: Work Plan 14 – Traffic Control

1 Purpose and scope

The purpose of this document is to describe the procedures to be followed for traffic controls on the FCC site remediation works at Mapua.

2 Definitions

Not applicable to this procedure.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

4.1 Aim

This work procedure outlines traffic control procedures to be adopted, so that remedial works may proceed in a safe and efficient manner and in accordance with Tasman Resource Management Plan and Consent Conditions (RM030521-10h; RM030522-10h, 46; RM030523-10h; RM030524-10h; RM030525-10h; RM030526-10h; RM030527-10h).

4.2 Sequence of operations

1. Develop a traffic control strategy as part of the remedial action plan (RAP). The traffic control strategy shall include:
   - (a) design drawings for any temporary roadways, access and detours showing pavement, wearing surface and drainage details
   - (b) a signpost layout plan showing:
     - location, size and legend of all temporary signs
     - temporary regulatory signs and temporary speed zones
     - all traffic control devices such as temporary traffic signals, linemarking, pavement reflector, guideposts, guardrail, barrier boards, etc.

2. Local authority/council/traffic department approval will be obtained as applicable.

3. The construction sequence as it relates to traffic management will be generally as follows:
   - establishment of traffic control devices, including signs, barricades, lamps, fencing, flagmen and traffic lights as applicable
   - construction of sidetracks/widenings/crossovers, as applicable and as detailed in the RAP
   - divert traffic on to the sidetracks/widenings/crossovers as applicable so as to allow start of work
   - the overall construction sequence will be as detailed in the construction programme.

4.3 Work method

1. All work will be in accordance with the specification, using approved barricades, signs and lighting installed and controlled by adequately trained and competent employees. The safety and capacity of adjacent road network will not be compromised by the proposed activity.

2. Separate level accesses at a minimum width of 6 m, will be provided into FCC west and FCC east from Tahi Street.

3. Vehicle crossings will:
   - include a formed surface to the road boundary of the site
   - accommodate space requirements as per TRMP
   - extend a minimum distance of 20 m from the edge of the road
   - be between 6 and 9 m wide
   - maintain good visibility
   - kept free of contaminated material
   - *have a gravel/crushed concrete surface placed over them*.

4. Trucks regularly moving between the sites, or servicing the site, will have adequate space to manoeuvre within each site. On occasions larger trucks may require temporary use of the adjoining section of Tahi Street. Given the low traffic volumes and vehicle speeds any traffic disruptions will be minimised.

5. Site will be enclosed by security fencing which will include lockable gates at the access points.

6. Parking for operation related vehicles will:
   - be accommodated within the site boundaries
   - be sufficient in number for all personnel during the normal operation of the activity
   - meet the requirements for space as per Class 1 medium to long-term parking
   - divert/require vehicles to pass though wheel wash before leaving the site.

7. MfE will use its best endeavours to arrange for alternative equivalent parking areas to be provided in the vicinity of any parking areas that are not available as a result of site activities (RM030521-52).

8. Dust and wind blown emissions associated with movement of material for processing across Tahi Street will be minimised by a 10 km/hr speed limit. Loads will be secure with dust minimisation procedures in place.

4.4 Inspection

1 All traffic control arrangements and devices will be inspected daily by the foreman, to ensure that the arrangements the Traffic management plan is being adhered to.

4.5 Responsibilities

Responsibility for implementation of this plan lies with MfE. The project manager has overall responsibility for implementation of the plan. Functional responsibility for monitoring and field activities lies with the site manager.

5 References

1. RM030521-10h, 52; RM030522-10h, 46; RM030523-10h; RM030524-10h; RM030525-10h; RM030526-10h; RM030527-10h
2. AS1742.3

6 Attachments

6.1 Traffic management form

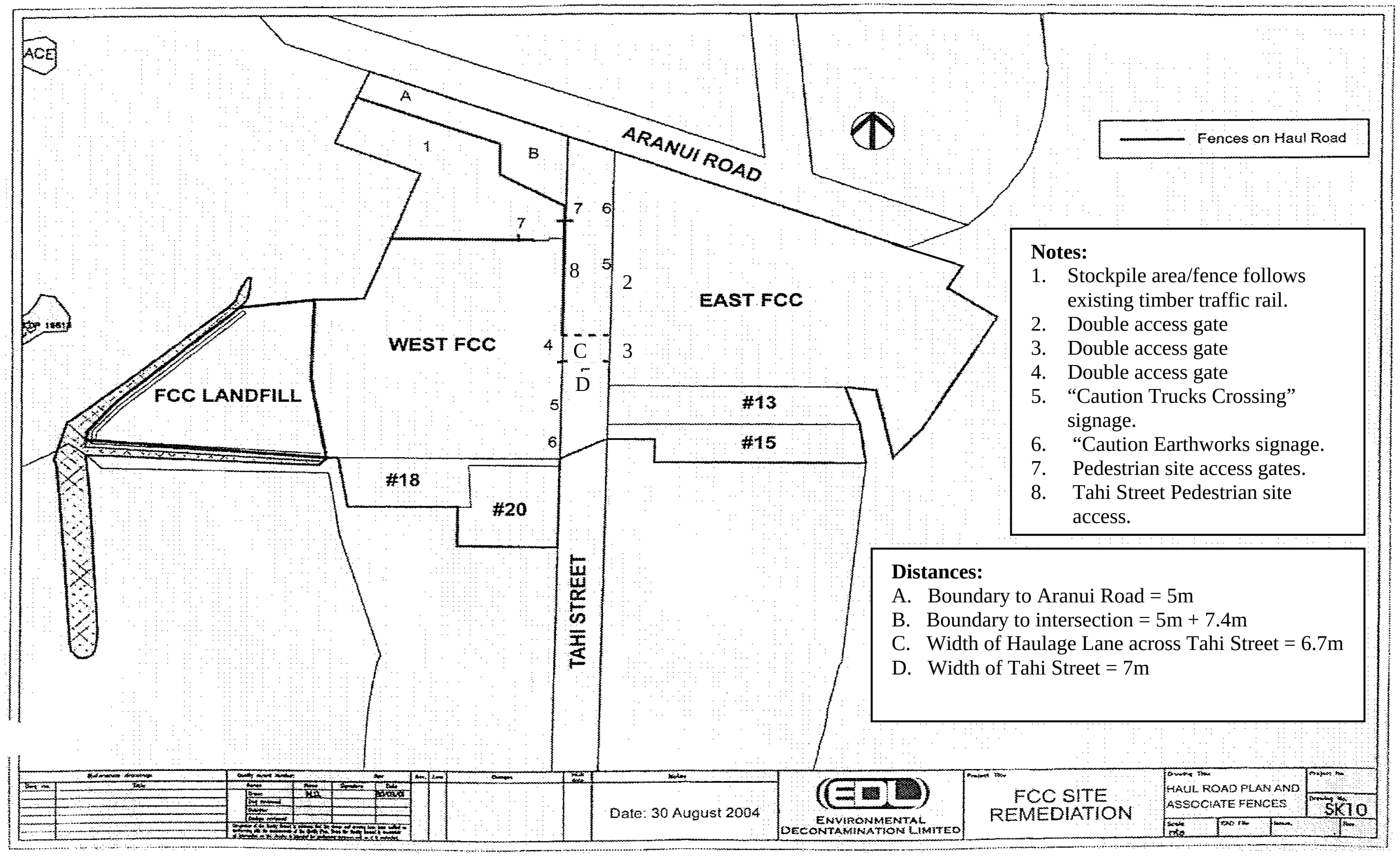
TRAFFIC MANAGEMENT PLAN FORM

<table>
<tr><td rowspan="2">Traffic Management Plan Reference</td><td colspan="4"></td></tr>
<tr><td colspan="4">For Office Use Only</td></tr>
<tr><td>Organisation</td><td colspan="2">Applicant
MFE</td><td colspan="2">Road Controlling Authority
TDC</td></tr>
<tr><td>Contract Name/ Number</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Location</td><td rowspan="2">Road Name(s)
Tahi Street, Mapua</td><td rowspan="2">Road Level (1,2,3,)

1</td><td rowspan="2">Speed Limit
50</td><td>From RP
0</td></tr>
<tr><td>To RP
200</td></tr>
<tr><td>Description of Activity</td><td colspan="4">Work vehicles crossing Tahi Street when moving between sites separated by Tahi Street.</td></tr>
<tr><td>Work Programme</td><td colspan="4">August 04 to Feb 06</td></tr>
<tr><td>Proposed/Restricted Work Hours</td><td colspan="4">No works to take place on public holidays</td></tr>
<tr><td>Traffic Details (Main Route)</td><td colspan="2">AADT
Low Volume</td><td colspan="2">Peak Hour Flow</td></tr>
<tr><td rowspan="3">Proposed Traffic Management Method</td><td colspan="3">Installation of Trucks Crossing Signs (TW2.7A) in both directions
Letter drop to residents of Tahi Street advising of hazard
Signs will also be placed at the entrances to both sites reminding operators of the machinery to look for pedestrians and to give way to traffic</td><td>Active</td></tr>
<tr><td colspan="3">Not Applicable</td><td>Unattended</td></tr>
<tr><td colspan="3">Not Applicable</td><td>Night</td></tr>
<tr><td>Proposed Speed Restrictions</td><td colspan="4">Not Applicable</td></tr>
<tr><td>Positive Traffic Management Measures</td><td colspan="4">All signs are to be mounted on wooden posts permanently for the duration of the works</td></tr>
<tr><td>Contingency Plans</td><td colspan="4">TMP to be reviewed annually</td></tr>
<tr><td>Public Notification</td><td colspan="4">Letter Drop</td></tr>
<tr><td>Personal Safety</td><td colspan="4">All operators of machinery to be shown a copy of the approved TMP</td></tr>
<tr><td>On-site Monitoring</td><td colspan="4">Site to be monitored daily by Contractor</td></tr>
<tr><td>Other information</td><td colspan="4"></td></tr>
<tr><td>Layout Diagrams</td><td colspan="4">See Attached</td></tr>
</table>

<table>
<tr><td rowspan="2">Traffic Controllers
(Include a Copy of
Training Certificate or Warrant)</td><td>________________________________ Signature
Name (STMS)</td><td>Phone (24 hours)</td></tr>
<tr><td></td><td>Phone</td></tr>
<tr><td>Prepared By</td><td>Name</td><td>Date</td></tr>
<tr><td>Accepted/
Requires Amendment</td><td>RCA Representative</td><td>Date</td></tr>
</table>

6.2 Mapua traffic management plan



Appendix 15:

Work Plan 15 –

Site Access and Works Control

Version	Date
1	14 July 2005

Contents

Appendix 15: Work Plan 15 – Site Access and Works Control

1 Purpose and scope

The purpose of this document is to describe the procedure to be followed by workplace managers for site access and works control at FCC Mapua site.

The scope of this procedure shall include all persons entering the FCC Mapua site including, direct MfE employees, subcontractors, service providers, suppliers and visitors entering and/or carrying out works at the site.

2 Definitions

Subcontractor	Person/s contracted by MfE to conduct work on the company’s behalf. Also includes contractors appointed by approved subcontractors.
Service provider	Person/s appointed by MfE or subcontractors to conduct work at the site i.e. repairs to vehicles and equipment.
Supplier	Person/s required to deliver supplies ordered by MfE, subcontractors or contractors.
Visitor	Person/s who arrive on site to visit workplace personnel and who will not be carrying out any work.

3 Flowchart

Not applicable to this procedure.

4 Procedural text

All access and works carried out at the FCC Mapua site by all person/s must be controlled. These controls will vary depending on the access and work required, and failure to do so could expose workplace personnel to unnecessary risks.

4.1 Access and works control of employees and subcontractors

MfE employees and approved subcontractors shall only the FCC Mapua site after they have completed the following:

- Where necessary a pre-placement medical examination carried out as part of health monitoring plan (Appendix ?)
- an onsite induction presented by an appropriate MfE representative and recorded in the workplace induction training register.
- received training in the applicable procedures required to carry out their work activities
- when specified, log on/log off the visitors' log, every time they enter/leave the site. The log will be kept at a specified point and be identified during the induction.
- Subcontractors may also be subject to contract approval and other requirements at the discretion of the MfE management prior to commencing activities on site.

4.2 Access and works control of service providers

Service providers required to access and work at the FCC Mapua site shall be required to report to the designated access point as sign posted at the entry or when specified, the appropriate supervisor or nominee and complete the following:

- Complete the Visitors' Log when entering the workplace.
- Ensure intended work is approved by the MfE site manager prior to commencement of the work.
- Only undertake approved works.
- Service providers not inducted at the workplace shall be accompanied by an appropriate inducted site representative.
- Prior to leaving the site the service provider shall complete the Visitors' Log and where necessary provide a verbal or written update to the MfE site manager.

Access and works by service providers should only be of a short duration (i.e. 24 hours or less), and for longer work durations, they should meet the applicable requirements of subcontractors. Refer requirements of 4.1.

Service providers who are required to access and work on site alone and/or on a regular basis shall be fully inducted.

4.4 Access by suppliers

Suppliers required to access the site shall be required to report to the designated access point as sign posted at the entry, or when specified, the appropriate supervisor or nominee and complete the following:

- When the supplies are delivered to the designated access point then the supplier shall exit the workplace immediately after delivery.
- When supplies are to be delivered to areas other than the designated access point the supplier will complete the Visitors' Log when entering the workplace.
- Site delivery vehicles shall only be allowed to operate in approved corridors of the site and if not inducted shall be accompanied by an inducted site person either company or subcontractor.

Suppliers who are required to access the FCC site alone or on a regular basis shall be inducted to a level appropriate for their access.

4.5 Access by visitors

Visitors required to access the FCC site shall be required to report to the designated access point as sign posted at the entry to the workplace and complete the following:

- At the designated access point, the visitor will complete the Visitors' Log when entering and leaving the workplace.
- Whilst onsite, visitors who have not been inducted shall be accompanied by an inducted site person either company or subcontractor.

In the interests of safety, visitors who are required to access the FCC site alone or on a regular basis shall be fully inducted.

5 References

Not applicable to this procedure.

6 Attachments

Not applicable to this procedure.

Appendix 16:

Work Plan 16 –

Health and Safety Management

Version	Date
1	14 July 2005

Contents

Appendix 16: Work Plan 16 – Health and Safety Management

1 Introduction

The following document sets out a detailed regime for health and safety management across the whole of the Fruitgrowers Chemical Company remediation project site at Mapua.

Risks at this site cover a broad range of health-related issues associated with potential exposure to the contaminants present on the site, and which are the focus of the remediation project. Other significant risks are inherent in the use and storage of hazardous substances at the site, and in the typical physical risks likely to be encountered at a substantial remediation site where earthmoving machinery and large items of equipment are continuously present and operating.

This health and safety management plan has five key attachments which provide more detailed procedural steps with respect to:

- site safety rules
- noise control policy
- first aid planning
- health monitoring record
- contaminant information.

2 Health and safety policy statement for the FCC site remediation project

The Ministry for the Environment (MfE), as project manager, is committed to ensuring the health and safety of contractor employees, subcontractors and visitors at the FCC remediation project site at Mapua. The MfE is also committed to continuous improvement and will pursue best practice in occupational health and safety and shall comply with the requirements of all relevant legislation.

3 Health and safety procedures

Effective procedures have been introduced and will be maintained to ensure that all site hazards are identified and appropriate measures are introduced to control these hazards.

- These procedures will be reviewed and monitored to take account of changing conditions and circumstances at the FCC site.
- Appropriate records will be kept of the hazard management programme.
- Employees have the opportunity to participate in the development of health and safety practices at the site.

- All relevant documentation relating to occupational health and safety issues is made available to employees.
- Hazard identification and risk assessment procedures are in place, are monitored, and are regularly updated.
- All employees are trained, supervised and provided with information to undertake their duties safely.
- All personal protective equipment needed to maintain health and safety is provided to employees, and it is ensured that employees are adequately trained in the proper use, maintenance and storage of personal protective equipment.
- Visitors will also be provided with appropriate personal protective equipment and training as necessary.
- All accidents and incidents are reported to the health and safety officer representative onsite.
- This policy will be regularly monitored and revised.

3.1 Management responsibilities

- The MfE site representative has overall responsibility for the effective management of health and safety at the FCC remediation project site.
- Management will support the safe and early return to work of injured employees.
- Management shall consult with employees on all health and safety matters that affect them.
- All plant and work systems used are suitable for their intended purpose and meet safety requirements.
- Adequate training, information, instruction and supervision shall be provided.
- Contractors and visitors shall be made aware of safety procedures.
- Management shall respond promptly to any health and safety issues brought to their attention.
- All accidents and near misses are properly recorded, reported and investigated.
- All management and designated health and safety personnel responsibilities are clearly delineated.

3.2 Employees responsibilities

- All employees are responsible for carrying out work in a way that does not adversely affect their own health and safety and that of other workers at the site.
- All employees shall learn and understand the health and safety rules and will comply with them.
- Employees must be certain that they completely understand instructions before starting work, avoid taking shortcuts and always use safe work practices.

- Employees shall correctly use any information, training, personal protective equipment and safety devices provided.
- If in doubt about the safety of a task, employees must stop and get instructions from the site representative, supervisors or the foreman before continuing.
- Employees shall make sure they understand exactly what their responsibilities are in emergencies.
- Employees must know how and where health and safety advice can be obtained.
- Employees must report all accidents and unsafe conditions to the MfE site representative, supervisors or the health and safety representative.

4 Applicable legal requirements

The site representative shall be responsible for ensuring access to up-to-date health and safety and related legislation. The principal health and safety legislation and codes of practice shall be readily available onsite, as set out in the following tables.

4.1 Legislation relevant to health and safety at the FCC site

Acts and regulations	Availability format	Reference source
Health and Safety in Employment Act 1992	Hard copy	www.legislation.govt.nz
Land Transport Rule: Dangerous Goods 1999	Electronic	www.legislation.govt.nz
Building Act 1991	Electronic	www.legislation.govt.nz
Health and Safety in Employment Regulations 1995	Electronic, and hard copy of Amendment	www.legislation.govt.nz
Hazardous Substances and New Organisms Act 1996	Electronic	www.hsno.govt.nz www.legislation.govt.nz
Dangerous Goods Act 1989	Electronic	www.legislation.govt.nz
Fire Service Act 1991	Electronic	www.legislation.govt.nz
Electricity Act 1992	Electronic	www.legislation.govt.nz
Accident Compensation and Rehabilitation Act 1995	Electronic	www.legislation.govt.nz
Factories and Commercial Premises (First Aid) Regulations 1985	Electronic	www.legislation.govt.nz
Asbestos Regulations 1983	Hard copy	www.legislation.govt.nz
Fire Safety and Evacuation of Buildings Regulations 1992	Hard copy	www.legisltion.govt.nz
Electricity Regulations 1993	Hard copy	www.legislation.govt.nz

4.2 Codes of practice and guidelines relevant to health and safety at the FCC site

Codes of practice and guidelines	Availability format	Reference source
Electrical Practices for Construction Work	Hard copy	www.osh.dol.govt.nz
Overhead Projection	Hard copy	
Safety Line Systems	Hard copy	
Guidelines for the Provision of Facilities and general safety in the Construction Industry	Hard copy	www.osh.dol.govt.nz
Excavation Work	Hard copy	
Management of Noise in the Workplace	Electronic	www.osh.dol.govt.nz
Code of Practice for Safety With Underground Services	Electronic	www.osh.dol.govt.nz
Code of Practice for Demolition	Hard copy	www.osh.dol.govt.nz
Code of Practice for Excavation and Shafts for Foundations	Electronic	www.osh.dol.govt.nz

5 Health and safety requirements placed on subcontractors and suppliers

All subcontractors working at the FCC remediation project site are required to develop and implement their own workplace health and safety plan. These individual plans must be submitted and approved by the MfE site representative prior to commencement of any work on the site.

6 Inspection and auditing requirements

a Inspection schedule

Offices: monthly
Operational areas: fortnightly
Trucks inspected in terms of normal maintenance procedures.

Site hazards inspection:
Frequency: weekly
Responsibility: foreman

Plant safety checklist and defects report:
Frequency: daily
Responsibility: leading hand or foreman

Plant inspection report:
Frequency: monthly
Responsibility: foreman/mechanic/operator

b Audit schedule

Audits are to be undertaken by the MfE site representative at intervals not exceeding six months.

c Site safety rules

All employees and site visitors must be familiar with the site safety rules before entering the FCC remediation site. Attachment A to this health and safety management plan contains the site safety rules for the site. The information in the site safety rules will be communicated to all new employees during the workplace induction programme.

6.1 Medical examinations

All employees who are expected to work onsite for a period in excess of one month over the duration of the contract must complete a medical examination.

Medical examinations are not required for truck drivers who are only transporting materials to and from the site.

The medical examination comprises a full blood test, urine test, physical examination and chest x-ray. An occupational physician will conduct the medical examination.

"Fitness for duty" reports prepared by the occupational physician will be forwarded to the MfE site representative prior to commencing work on the site.

6.2 Health monitoring

The appropriate form of a health monitoring record is given in Attachment D.

6.3 Site induction procedures

The workplace safety induction will be undertaken for all new employees and subcontractors and shall cover as a minimum the following matters:

(i) plan of the site, showing:
- first aid facilities
- fire extinguisher locations
- work zones
- amenities locations

(ii) site history

(iii) expected site contaminants

(iv) hazard reporting procedure

(v) accident and incident reporting

(vi) emergency evacuation procedure

(vii) first aid and emergency medical

(viii) serious injury evacuation

(ix) health and safety meetings and tool box meetings

(x) specific work procedures

(xi) personal protective equipment

(xii) hazardous substances procedure

(xiii) plant safety requirements

(xiv) drugs and alcohol procedure

(xv) site safety rules.

The induction programme will be presented by the MfE site representative at any time when conditions either vary or changes to operations may have occurred. All employees and visitors must be familiar with the site safety rules before entering the site.

6.4 First aid

A first aid kit will be located in the site office and a qualified first aider will be available at all times and will be responsible for minor emergency treatments, and the replenishment of the first aid kits.

An injury treatment book will be maintained and the first aider must record all treatments, no matter how apparently insignificant.

A first aid plan for the site has been developed and is presented as Attachment C.

6.5 Noise policy

The noise policy which applies at the FCC remediation site is set out in Attachment B to this plan.

7 Site-specific health and safety requirements

7.1 Hazard assessment for site contaminants

7.1.1 Contaminants likely to be encountered

Following the completion of the detailed site characterisation report there is now a greater understanding of the nature and extent of contamination on the FCC site.

The potential or confirmed contaminants are listed in the MSDS register held onsite. This includes a summary of workplace exposure standards for the various contaminants, the physical and chemical properties of the substances, acute and chronic health effects associated with these contaminants, and first aid procedures to be followed subsequent to exposure to these contaminants.

Contaminants likely to be found onsite

Group	Substance	Media[1]	General toxicity information
Inorganics	Asbestos	S	Proven human carcinogen
Heavy metals	Chromium (Cr)	S/L	Proven human carcinogen (Cr(VI))
	Arsenic (As)	S/L	Proven human carcinogen
	Lead (Pb)	S/L	Reproductive and central nervous system hazard
	Cadmium (Cd)	S/L	Suspected human carcinogen, kidney toxin
	Mercury (Hg)	S/L	Toxic to nervous system and many other organs
Organochlorine pesticides (OCPs)	DDT	S/L	Central nervous system hazard, headaches, nausea
	DDD	S/L	Central nervous system hazard, headaches, nausea
	DDE	S/L	Central nervous system hazard, headaches, nausea
	Aldrin	S/L	Central nervous system hazard, headaches, nausea
	Dieldrin	S/L	Central nervous system hazard, headaches, nausea
	Lindane	S/L	Central nervous system hazard, headaches, nausea
	Phenoxy acid herbicides (2,4 D 2,4,5 T)	S/L	Central nervous system hazard, headaches, nausea
Organophosphorous pesticides (OPPs)	Mevinphos	S/L	Central nervous system depression, headaches, nausea
	Dichlorovos	S/L	Central nervous system depression, headaches, nausea
	Hexamethyl-phosphoramide	S/L	Central nervous system depression, headaches, nausea
	Various others	S/L	Central nervous system depression, headaches, nausea

Note: 1. S = solid (soil or solid waste); L = liquid (groundwater, surface water).

The information in the above table does not provide a complete review of all contaminants that may be encountered on the site. Rather, the information is presented to reinforce the potentially hazardous nature of the most significant probable site contaminants. Unknown contaminants may exist onsite and will be handled using unknown contamination protocols.

7.1.2 Other hazardous substances stored or used onsite

In addition to the contaminants that may be encountered as a result of site remediation and landfilling operations, a range of other hazardous substances are stored and used onsite. A hazardous substances register for these substances is maintained onsite, together with a material safety data sheet for each substance. Hazardous stack discharges from the MCD plant generated from reagents must also be considered. (e.g. ammonia).

7.1.3 Exposure pathways

The primary potential receptors with respect to contaminants present at the site are workers involved in the remediation project. In particular, workers carrying out the following activities are considered to have the greatest potential for exposure to site contaminants:

- plant operations (plant soils input, processing, and treated soils output)

- site operations (excavation, screening, movement of soils and backfilling, etc)
- dewatering operations
- labourers undertaking excavation by hand
- termination and removal of above and below ground services.

Potential exposure pathways for site workers are:

- inhalation of contaminated dusts and vapours
- ingestion (swallowing) of contaminated soil, dusts, sediments and water
- skin contact with contaminated soil, dusts, surface water and groundwater.

7.1.4 Material safety data sheets (MSDSs)

Material safety data sheets shall be maintained at the site for all relevant hazardous substances. The site representative shall ensure that these MSDSs are held on a central file, together with an up-to-date listing of the MSDSs held on the file. The file will be located adjacent to the first aid kit.

7.2 Physical hazards onsite

Physical hazards also require consideration with respect to work performed at the site. These include sharp metal or ragged metal edges, broken concrete, holes, sumps or depressions in the land, and heavy objects.

7.2.1 Work areas

The site is divided into a number of specific work areas. These areas are delineated onsite by the use of barricade mesh. The following work zones have been determined as applicable to this site and may be found in annex to this plan.

Remediation and earthworks areas

Those areas where remediation and associated earthworks will be undertaken represent the majority of the site. Generally most of these areas are suspected to contain contaminants and, as such, workers will require personal protective equipment and to undergo decontamination on leaving such an area. The level of PPE will be based on the likelihood of contaminant exposure and the results of air monitoring.

Exclusion zones

These are areas of the site that may require the adoption of additional health and safety measures, work practices and personnel protective equipment including chemical protective suits, respirator protection and hand and foot protection. These zones primarily correspond to areas where:

- structures and underground services are to be retained
- a structure is in the process of being demolished

- there is a potential for exposure to contaminated dusts, asbestos, or toxic vapours in the particular zone.

These areas will be classified as exclusion zones when they are worked.

Due to the staged nature of the remediation operations a limited number of areas will be worked at any one time. On completion of the remediation of an area that area will be validated and fenced off as a clean, rehabilitated section of the site.

Contamination reduction zone

The designated haul roads and the personal decontamination facility will function as the contamination reduction zone. All necessary decontamination procedures must be carried out within this zone. All personnel entering and exiting an exclusion zone shall do so through the decontamination facility. Plant decontamination facilities, such as wheel wash operations, will also be located within the contamination reduction zone.

Support zone

All areas outside the exclusion zone and the contamination reduction zone shall be regarded as support zones. Potentially contaminated clothing and equipment shall not be permitted in these zones. A support zone shall only be entered from the exclusion zone via the contamination reduction zone.

7.3 Personal protective equipment

The following table summarises the levels of personal protective equipment (PPE) that may be required for this project. PPE selection will be dictated by the results of the occupational health monitoring programme. PPE will be immediately accessible to all personnel at all times.

Selection of personal protective equipment

Level of protection	Equipment	Areas required
Base level	Steel-toed boots Hard hats Safety vests Hearing protection (if required)	Exclusion zones and contamination reduction zones (subject to results of air monitoring programme)
D	Coveralls with long sleeves, or Tyvek overalls, or Kleengauard coveralls Steel-toed boots Hard hats Hearing protection Safety glasses or goggles Face shield (optional) Gloves of leather or nitrile rubber	As above
C	Level D equipment, plus Half facepiece air purifying respirator, Type AB2, Class P2 cartridges, meeting AS1716 requirements	As above

B	Level D equipment, plus Full facepiece positive pressure-demand, self-contained breathing apparatus (SCBA), meeting AS1716 requirements or Full facepiece positive pressure-demand airline respirator, with a 5–10-minute escape bottle, meeting AS1716 requirements	As above

The selection of the appropriate PPE level will be based on the nature of the chemical contaminants, their hazards and the activity being undertaken. The level of PPE required may be upgraded if air monitoring results exceed relevant action levels. A requirement to stop work may eventuate should air quality monitoring results exceed relevant action levels.

Some areas of highly contaminated waste will be identified, excavated and segregated within the exclusion zone. All personnel involved with the treatment of contaminated waste stockpiles are required to wear Level C protection if there is the possibility that they will come into contact with dust baring contaminants.

Training will be carried out in the requirements of PPE during site induction and toolbox talks. Male personnel working in Level C or B environments are required to be cleanly shaven for the purposes of ensuring the proper fit of respiratory protective equipment. All personnel are required to perform positive and negative pressure fit tests prior to entering a contaminated area requiring the wearing of respiratory protection.

7.4 Personal decontamination

Decontamination of personnel will be carried out to minimise the transport of contaminants out of the exclusion zone and offsite. All personnel exiting the exclusion zone will be decontaminated prior to movement to other areas.

The following decontamination procedure is proposed within the contamination reduction zone:

- wash boots by hosing or scrubbing
- proceed to decontamination unit
- remove boots and place in designated area (Levels B and C only)
- enter decontamination unit
- remove respirator, place bins for decontamination and washing (Levels B and C only)
- remove coveralls, place in bin (Levels B and C only), or place on wall hooks (base level and Level D only)
- wash hands and face and shower if necessary
- proceed to change room and thence to lunch room or office as appropriate.

Attachment A: Site Safety Rules

Objective

Work on this site shall be carried out in accordance with the following safety rules which govern the various areas of activity at the site.

Access to site

1. A site entry logbook will be provided to document all personnel movements on and off the site.
2. All persons working onsite shall be inducted prior to commencing work and have their induction training documented.
3. All visitors to site must report to the site office for an abridged site induction prior to entry to the site. All visitors must be signed in and out in the site entry logbook.

Environmental protection

The land (including the roads), waters and air surrounding the site, and the site haulage roads constitute the environment to be protected for the duration of this project.

Although the MfE site representative and supervisors hold the relevant documentation highlighting individual responsibilities in regard to minimising environmental impacts, a summary of these is now outlined below.

- Control of surface water run-off by protecting and maintaining all stormwater drains with hay bales and silt fence/geotextiles, and by bunding around soil stockpiles as required.
- Protection of surface waters during refuelling operations.
- Preventing air pollution by applying dust suppression during excavation, backfilling and general site activities.
- Preventing release of air and liquid contaminants during excavation activities by following set procedures and all air monitoring and disposal requirements.
- Minimising odour emissions by following mitigation procedures and monitoring requirements.
- Minimising noise and vibration during all site activities by maintaining equipment in good condition.
- Restricting the transport of materials and personnel to designated routes.
- Decontaminating vehicles prior to their leaving the site.
- Managing (including inspection) the transfer of contaminated materials leaving the site.
- Minimisation and recycling of waste materials as appropriate.

Reporting requirements

1. Report all accidents and incidents to the site foreman immediately.
2. Report all injuries and work-related illnesses to the first aider and record injuries in the first aid register.
3. Report all hazards and unsafe situations to the site foreman immediately.

Work safety procedures

1, All work to be carried out onsite shall be identified and planned by the site representative and/or work supervisor(s) in co-ordination with site contractors prior to commencing work.
2. Work shall be planned with safety in mind and conducted in a safe manner using best industry practice.
3. Where safe work procedures have e already developed for onsite work they must be followed.
4. Where subcontractors are coming onto the site for short-term works (less than 24 hours) a 'work permit' shall be completed prior to commencement of the works.

Personal protective equipment

1. Safety helmets, boots and visibility vests must be worn at all times on the site.
2. Appropriate PPE must be worn as directed by the site foreman or MfE site representative in order to minimise the chance of personal injury or health risk.
3. All personnel shall wear approved PPE as specified in the health and safety management plan and shall undergo the appropriate decontamination procedures when leaving the exclusion zone.
4. Facial hair that interferes with proper fit of respirators or other respirator protection will not be permitted. Persons must have properly fitted respirators to work in areas requiring respiratory protection.

Use of equipment onsite

1. All electrical equipment and tools must be maintained in good repair and have a current testing tag.
2. All lifting gear must have a visible safe working load (SWL) tag and a current inspection certificate.
3. All mobile plant and equipment must have a plant certification form completed prior to being used in site work.
4. All equipment and tools must be presented to the site foreman before being used on the site.

Certificates of competency

1. All persons working onsite shall present to the site foreman current certification of their competency relevant to the activities they are carrying out.
2. **No person** shall operate plant or carry out the duties of a crane driver, dogman, crane chaser, scaffolder or rigger unless they hold a **current permit** or certificate of competency relevant to that activity.

General safety

1. No drugs or alcohol permitted onsite.
2. No smoking permitted in areas highlighted as non-smoking, particularly exclusion zones and/or areas where the risk of fire or explosion exists from hydrocarbons.
3. No glass bottles allowed onsite.
4. Keep work areas free from excess materials and building waste.
5. Maintain stockpiles in a safe and tidy condition.
6. Dispose of food scraps and rubbish in the containers provided.
7. Do not commence excavation or demolition unless all services have been identified, and isolated or decommissioned where applicable.
8. No entry to areas delineated by barricade fencing, especially exclusion zones, unless authorised to do so and wearing correct protective clothing and equipment.
9. No unauthorised entry to contractor’s work area.

Hygiene

1. No smoking, eating, drinking or any other activity involving hand to mouth contact prior to personal decontamination is permitted.
2. The wearing of contact lenses whilst undertaking site activities is not permitted unless safety glasses are also worn.
3. All food and drink is to be stored and consumed in the site lunch room facility or site office in the support zone.

Behaviour onsite

1. No horse play or practical jokes will be tolerated.
2. No unauthorised removal of hazardous material or construction debris from the site will be permitted.

Attachment B: Noise Control Policy

Noise control policy at the FCC remediation site, Mapua

Objective

To minimise the impact of construction-generated noise and ensure compliance with relevant regulatory criteria and resource consents.

Target

1. Construction noise does not exceed the resource consent noise limits.
2. Intermittent exceedances are prevented from recurring by the successful implementation of control measures.

Background

The current scope of work at the FCC remediation site involves excavation works for removal of contaminated soil; screening and assessment of contaminated materials for treatment, reuse or disposal; and site reinstatement works. Machinery used onsite has the potential to generate noise levels above the accepted safe level for not wearing hearing protection in accordance with NZS6801.1999 and NZS6802.1991.

Noise mitigation programme

- Heavy vehicle traffic shall not enter or leave the site between the hours of 1800 and 0730.
- Approved silencing devices shall be provided and maintained with respect to all power-operated plant used in the open areas of the site.
- Encapsulation of engine chambers.
- Maintenance and repairs may be carried out outside working hours provided that this work is done as far away as possible for occupied premises, no heavy machinery is involved, and noise generated is inaudible at noise-sensitive premises.
- Ensure plant items are correctly maintained to manufacturers' specifications.
- MCD plant working hours limited to:
  - Monday–Friday: 7.00 am to 8.00 pm
  - Saturday: 7.00 am to 6.00 pm.
- All other works limited to:
  - Monday–Friday: 7.00 am to 6.00 pm
  - Saturday: 7.00 am to 6.00 pm.
- No work to be undertaken on Sundays or public holidays.
- All vehicles to follow approved haul routes offsite and speed limited to local requirements.

Response when noise action level exceeded

If noise action level is exceeded review work practices and noise control procedures including maintenance of equipment, installation of silencers, provision of noise barriers and modification of work hours.

Responsibilities

Provision of information

The site representative is to ensure that all employees are provided with information in relation to:

- what noise is
- health effects due to noise exposure
- noise exposure levels at this workplace
- specific and general noise control measures in place at the workplace
- any programme of action or timetable for future improvements
- defect reporting requirements and procedures
- when and how to use personal hearing protection.

Noise assessment

It is the site representative's responsibility to ensure that, following an initial assessment, noise assessments are undertaken weekly, monthly, then six-monthly, as well as whenever there is:

- installation or removal of machinery
- a change to workload or equipment operating conditions that could result in significant change to noise levels
- modification of working arrangements to alter the length of time employees would spend in noisy areas.

All operational assessments shall be in accordance with guidelines given in NZS6803.1999 Acoustics – Construction Noise.

The general objectives of the assessment are to:

- identify all employees likely to be exposed to noise levels above specified limits
- obtain information on noise sources and work practices
- check effectiveness of measures taken to reduce exposure
- assist in the selection of appropriate personal hearing protection
- identify hearing protection areas.

Employees

Employees should comply with all statutory and established workplace procedures and co-operate, as far as possible, in all activities which have as their objective the protection of hearing at work.

Controls

The site representative shall ensure that all supervisory staff and employees follow all noise controls.

Administrative

Wherever practicable the supervisor will ensure the control measures for noise are adopted.

Identification of hearing protection areas

All relevant areas are signposted as 'hearing protection areas' and all persons entering these areas shall wear personal hearing protection during normal operations.

Where signposting is not practicable the supervisor shall consult with affected personnel to identify the circumstances such as in the vicinity of loading operations where personal hearing protection will be worn. All instructions and personnel consulted will be recorded in appropriate toolbox talks or training attendance records.

Warning notices are displayed on all tools and equipment where personal hearing protection is to be worn.

Supervisory staff shall monitor identified hearing protection areas or circumstances for effective compliance.

Provision of personal hearing protection

The supervisor will provide a reasonable choice of personal hearing protection devices that conform to the relevant New Zealand Standards, with the level of hearing protection provided to exceed an SLC80 rating of 20dB(A).

Training and education

The site representative shall ensure that the following training and education strategies are met.

Induction

Employees and visitors are to be issued with personal hearing protection and provided with information in relation to its correct use. Communication will be made about designated areas and circumstances where and when personal hearing protection must be worn, and the statutory responsibilities of both the employer and employees with respect to this.

Education

All employees are provided with information at intervals not exceeding 12 months in relation to:

- what noise is
- health effects due to noise exposure
- when and how to use personal hearing protection
- statutory responsibilities of employer and employees.

Wherever practicable the education programme will be conducted by a suitably trained provider (normally the equipment supplier).

The supervisor will provide workplace-specific information at intervals not exceeding periods of 12 months in relation to:

- noise exposure levels at the workplace
- specific and general noise control measures in place at the workplace
- any programmes of action or timetable for future improvements
- defect reporting requirements.

Audiometric testing

All employees exposed to noise will be monitored through regular audiometry examinations and levels reviewed to monitor any changes. The site representative shall ensure that testing is conducted at the following intervals by a qualified provider in accordance with New Zealand Standards, as per the following schedule:

- pre-employment
- 12 months after initial examination
- then every two years.

Design goals for new plant

Wherever practical, noise levels of replacement noise-generating equipment will be assessed to ensure that the need for noise reduction is taken into account when deciding on its purchase.

During maintenance and modification of noise-generating equipment engineering treatment will, when practicable, be included to reduce noise levels within the plant. This treatment may include, but is not limited to:

- reduction in metal-to-metal impacts
- replacement of equipment with items having lower noise levels
- replacement of worn parts and/or improvements in lubrication
- installation of noise dampening surfaces, equipment or barriers
- reductions in the speed of equipment.

Records

The site representative shall ensure all records are maintained in accordance with documentation procedures and shall include the following items:

- operators' daily report sheets
- workplace inspection checklist
- maintenance history log
- personal audiometric testing results
- personal protective equipment register
- site noise monitoring results.

Attachment C: First Aid Plan

Workplace	FCC remediation site, Mapua
Address	Tahi Street, Mapua
Type of work performed	1. Demolition of buildings, pavements, ground slabs and below-ground structures. 2. Excavation works for removal of contaminated soil. 3. Treatment for highly contaminated soil. 4. Materials reuse and/or disposal, as required. 5. Control of groundwater and surface water generated during the site works. 6. Office administration. 7. Reinstatement of services and structures.
Types of injuries or illnesses likely to be sustained	Sprains and strains (e.g. pushing/pulling/lifting/carrying) Sprains and strains (e.g. repetitive movements) Sprains and dislocations (e.g. falls from heights or from vehicles) Bruises, etc (e.g. from slips/trips on uneven surfaces) Bruises and cuts (e.g. hit by striking or falling objects) Burns or skin irritation (e.g. contact with hot surfaces or corrosive substances) Foreign bodies (e.g. dusts, objects in the eyes) Sunburn and heat stress (e.g. effects of hot weather) Respiratory problems (e.g. inhalation of dust, fumes and gases) Poisoning (e.g. ingestion, inhalation, or contact with contaminated substances)
Number of persons generally onsite	Administration – 5 Supervisors – 3 Operators – 7 Security
Size and layout of workplace	The site covers an area of approximately 5.06 hectares.
Location of medical centre	Mapua, Ruby Bay and Moutere District Health Centre, 62 Aranui Road, Mapua Ph (03) 540 2211
Location of hospital	Nelson Public Hospital, Waimea Road, Nelson Ph (03) 546 1800
Numbers of first aiders, areas and shifts	Supervisors x 2 Operators (to be confirmed)
Training requirements	Completion of Senior First Aid Certificate
Response procedures	First aiders identified in emergency procedures charts displayed around the workplace.
First aid kit management	**Health, safety and environment officer:** To ensure kits supplied meet the requirements of the Health and Safety in Employment Act 1991 and the Factories and Commercial Premises (First Aid) Regulations 1985. **Supervisors:** To monitor contents of workplace first aid kits during workplace inspections, **Operators and drivers:** To inspect contents of first aid kits in accordance with the operators' daily report sheet.

First aid kit locations	Site office Site-based vehicles
First aid kit contents	Kits to be supplied in accordance with Type B kit requirements of the Factories and Commercial Premises (First Aid) Regulations 1985.
First aid record-keeping location	Site office
First aid reporting	All injuries and/or illnesses, regardless of severity, to be reported to applicable supervisor immediately.
Contact numbers	Emergency services – 111 Richmond Police Station – (03) 543 9500 Motueka Police Station – (03) 528 1220 Fire Brigade – (03) 540 2501 Nelson Public Hospital – (03) 546 1800
Communication of plan	Plan to be communicated in workplace induction, toolbox talks, emergency response programme and by signage.
First aid plan review	Site representative to review this plan as part of the six-monthly management review of the site activities.

Attachment D: Health Monitoring Record

Hazard to be monitored	Location	Employees exposed	Test type	Frequency	Responsible person
Hepatitis A	Remediation area	All	Antibodies test	Three years	Supervisor
Hepatitis B	Remediation area	All	Antibodies test	Three years	Supervisor
Tetanus	Remediation area	All	Injection	Five years	Supervisor
Noise	Remediation area	All	Audiogram	Two years	Supervisor
Pesticides exposure (DDX)	Remediation area	All	Blood test	Prior to starting work	Supervisor

Comments and special notes

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Attachment E: Contaminant Information

Contaminant information for the FCC remediation site

The following information is provided for the principal contaminants known or expected to be present at the FCC remediation project site at Mapua.

Note: There may be other contaminants at the site whose identity is currently unknown. All soils should therefore be considered as containing potentially toxic contaminants until remediated and/or until analysis shows them to be uncontaminated or at least not significantly contaminated.

Chlorophenols

Chlorophenols include the following compounds:

- 3-chlorophenol
- 3-chloro-1-hydroxybenzene
- 3-hydroxychlorobenzene.

Chlorophenols are typically colourless crystalline compounds with characteristic odours.

Health effects

Chlorophenols irritate the eyes, the skin and the respiratory tract. They are toxic by skin absorption, inhalation or ingestion.

Occupational exposure limits

No occupational exposure limits have been set for chlorophenols.

First aid measures

Contact with the skin:	Remove contaminated clothing and launder before reuse. Rinse, then wash skin with soap and water. Get medical attention.
Contact with the eyes:	First rinse with plenty of water for several minutes, holding eyelids open. Remove contact lenses if worn. Get medical attention.
If inhaled:	Remove to fresh air. Move affected person away from source of exposure to chlorophenols. Provide artificial respiration if required. Get medical attention.
If swallowed:	Rinse mouth with water. Do not induce vomiting. Get medical attention.

Organochlorine pesticides (DDT/DDD/DDE)

DDT was extensively used in the past for the control of various insects in the agricultural sector in New Zealand, in particular the grass grub. DDE is a decomposition product of DDT and has no known uses. DDT and DDE are white crystalline solids. The odour thresholds are not available.

Health effects

Acute oral exposure to high doses of DDT in humans results in adverse effects on the central nervous system, including headaches, nausea and convulsions.

Tests involving acute exposure of animals have shown DDT to have moderate acute toxicity from oral exposure.

In terms of chronic (long term) toxicity, animal studies have shown that oral exposure to DDT causes reproductive effects, such as reduced fertility, adverse effects on sperm production, and decreased testicular and ovarian weights. Developmental effects, such as embryotoxicity and foetotoxicity, have also been observed in oral animal studies.

Animal studies have shown an increased incidence of liver tumours in mice and hamsters, and thyroid tumours in female rats, following oral exposure to DDE.

Occupational exposure limits

No occupational exposure limits have been set for DDE or DDD. A workplace exposure standard has, however, been set for DDT of 1mg/m^3.

First aid measures

Contact with the skin:	**Immediately** remove contaminated clothing and launder before reuse. **Immediately** rinse, then wash skin with soap and water. Get medical attention, even if no symptoms develop.
Contact with the eyes:	First rinse with plenty of water for several minutes, holding eyelids open. Remove contact lenses if worn. Get medical attention, even if no symptoms develop.
If inhaled:	**Immediately** remove to fresh air. Move affected person away from source of exposure to chlorophenols. Provide artificial respiration if required. Get medical attention even if no symptoms develop.
If swallowed:	**Do not induce vomiting.** Rinse mouth with water and, only provided that the victim is conscious, give 1–2 glasses of water to drink. If the victim is unconscious or convulsing **do not give anything by mouth**. Get **immediate** medical attention.

Appendix 17:

Work Plan 17 –

Occupational Health Monitoring

Version	Date
1	14 July 2005

Contents

Appendix 17: Work Plan 17 – Occupational Health Monitoring Plan

Occupational health monitoring policy for organochlorine pesticides at Mapua clean-up site

1 Background

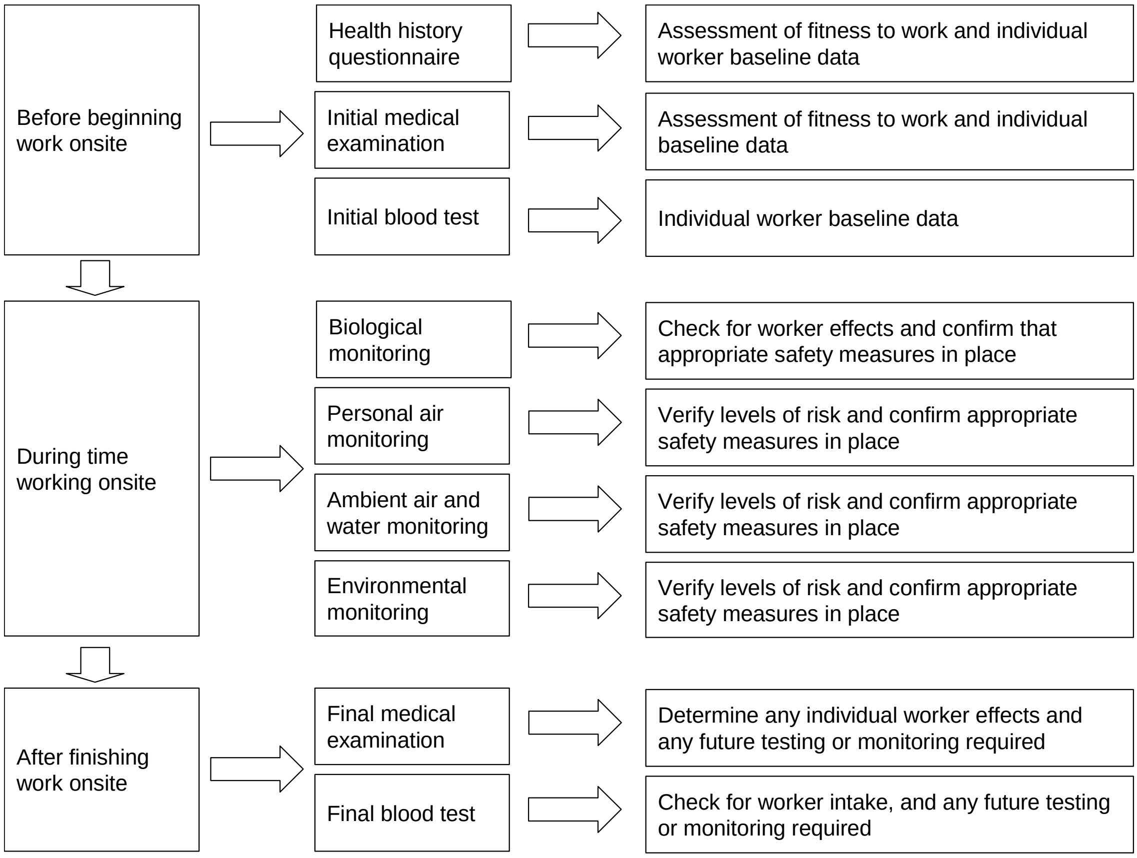
The Fruitgrowers Chemical Company (FCC) site at Mapua, now owned by Tasman District Council, contains 50,000 m^3 of soil and debris that is contaminated with organochlorine pesticides (OCPs) including DDX (= DDT, DDD and DDE), dieldrin and aldrin. There are hot spots up to 5000 ppm DDX and 200 ppm dieldrin, and the nature of the soil is a mix of clay, silt and gravel.

A clean-up programme, led by the Ministry for the Environment, is now underway using a mechano-chemical de-halogenation plant. During this process there is potential for workers to be exposed to OCPs through inhaling contaminated dust. Health and safety measures, including a site specific health and safety plan, are in place to address the probable risks to worker health from OCPs.

2 Objective

There is now a need to implement a programme of monitoring that provides information on the adequacy of the measures in the health and safety plan, with respect to OCPs. The results of monitoring conducted under this plan will feedback into the health and safety plan and adjustments to policy and procedure will be made where required.

3 Overview



4 Worker health monitoring

4.1 Initial worker health history questionnaire

Prior to beginning work onsite all workers will be asked to fill out a health history and lifestyle questionnaire. This questionnaire will include questions on:

- allergies
- medication
- work history and work-related injury
- previous significant exposures to toxins, focusing on contaminants found onsite
- family histories.

This questionnaire will help determine whether it is safe for individuals to work onsite and whether any observed health effects are due to workers exposure to OCPs at Mapua or due to previous exposure(s).

4.2 Worker medical examinations

Prior to beginning work onsite, all workers will be examined by an occupational physician to assess their current (baseline) state of health and fitness to work. The medical examination will include:

- complete physical and assessment of limbs and joints
- respiratory function including a statement as to the ability to wear a respirator and a "fit test" of the form and type of respiratory protection to be used onsite. This will be repeated every six months
- establishment of baseline levels of the biological indices in Section 4.3
- EKG under normal and stress conditions
- eyesight, colour blindness exam and hearing.

These examinations will help determine whether it is safe for individuals to work onsite and whether any observed health effects are due to workers exposure to OCPs at Mapua.

Once workers have finished working onsite, an exit medical exam will be conducted. At this time the occupational physician will decide whether follow-up questionnaires and future medical testing are required.

4.3 Biological monitoring

Biological monitoring will be undertaken to check for any effects on workers from OCPs. This will involve full blood counts, testing for levels of OCP in blood, renal (kidney) and hepatic (liver) function.

4.3.1 Testing frequency

Workers will be tested before starting and after finishing work onsite (during medical examinations), and every three months in between.

4.3.2 Testing methodology

Blood tests will test for all OCPs that are likely to be present onsite.

The occupational physician will liaise with the site supervisor and testing laboratory to arrange for tests to be taken at appropriate times in the work cycle and to ensure samples are stored and transported correctly.

4.4.4 Interpretation and actions

Trends in test results will be analysed and any changes will be assessed for significance by the occupational physician. If measured levels or tends in test results are of concern, then the site supervisor in consultation with the occupational physician will determine appropriate actions. These actions may include halting work onsite, increasing the amount or grade of personal protective equipment or conducting further tests.

5 Personal air monitoring

One of the greatest risks of exposure onsite is from inhalation of dust contaminated with OCPs. To provide a check on the levels of risk originally assessed for the site and on whether the safety measures are adequate, personal air monitoring will be conducted.

5.1 Testing frequency

Personal air monitoring will be conducted once every three months.

5.2 Testing methodology

Staff working in selected locations including excavations and processing plant will wear personal monitoring equipment attached to their protective equipment that will measure airborne OCP exposure. Monitoring equipment will also be placed in staff smoko rooms and inside work vehicles. Personal air monitoring will be conducted in accordance with the appropriate analytical method from the National Institute of Occupational Safety and Health (NIOSH) *Manual of Analytical Methods* (NMAM) or a suitable alternative.

5.3 Interpretation and action

The occupational physician will consider whether the levels of OCP detected from the personal air monitoring are cause for concern. If the occupational physician decides that measured levels of workplace exposure are of concern, then the site supervisor in consultation with the occupational physician will determine appropriate actions. These actions may include halting work onsite, increasing the amount or grade of personal protective equipment and conducting further blood tests.

After conducting the first round of personal air monitoring the occupational physician and the site supervisor will review the adequacy of personal protective equipment.

6 Environmental monitoring

6.1 Testing frequency

When high concentrations of OCP occur onsite, they will occur in excavations. To check that the risks to workers from these areas have been correctly assessed and are being adequately managed, real-time monitoring will be conducted, at the discretion of the site supervisor.

6.2 Testing methodology

This monitoring will be carried out, by the site supervisor using drager tubes to check for volatile organic vapours. Full methodology yet to be confirmed.

6.3 Interpretation and action

If volatile organic vapours are detected in an excavation, the site supervisor will assess whether worker safety measures are adequate and take action as necessary.

7 Ambient air and groundwater monitoring

Resource consent conditions at the site require monitoring of ambient air and groundwater for OCPs and other contaminants. The results of this monitoring will be analysed by the site manger for evidence of OCPs not presently thought to be onsite and for abnormally high concentrations of OCPs. The site manager will determine whether the results of this monitoring warrant changes to health and safety procedures.

8 Reporting

When medical examinations, health questionnaires, blood tests, or personal air monitoring results are cause for concern, the occupational physician will notify the site supervisor immediately.

The site supervisor will make results of personal air monitoring available to the occupational physician within one working day of receiving them. If these results are cause for concern, the occupational physician will notify the site supervisor immediately.

On completion of the final medical examination the occupation physician will forward a “certificate of exposure to hazard” and a copy of all test results to the individual’s general practitioner.

9 Responsibilities

Action	Responsible
Worker health monitoring	
Conducting initial and final medical examinations and health questionnaire	Occupational physician
Informing site supervisor of special worker requirements based on initial medical and health questionnaire	Occupational physician
Implementing appropriate safety measures onsite	Site supervisor
Collection, storage and transport of samples	Occupational physician in consultation with nominated laboratory and site supervisor
Conducting analyses on samples	Nominated laboratory
Interpreting results from testing	Occupational physician
Informing the site supervisor immediately of any concerning test results or trends in test results	Occupational physician
Determining and implementing appropriate safety response	Site supervisor in consultation with occupational physician
Storage of individual worker medicals and test results for duration of work onsite	Occupational physician
Forwarding copies of medical examinations, biological monitoring and certificates of exposure to workers' general practitioners	Occupational physician
Personal air monitoring	
Forwarding results of personal air monitoring to occupational physician	Site supervisor
Interpreting results from personal air monitoring	Occupational physician
Reporting concerning test results to site supervisor immediately	Occupational physician
Determining and implementing appropriate safety response	Site supervisor in consultation with occupational physician
Environmental monitoring	
Discretionary real-time monitoring of "hot spot" excavations	Site supervisor
Determining appropriate safety response on detection of volatile organic vapours	Site supervisor
Ambient air and ground water monitoring	
Reviewing monitoring results for high levels of OCPs and new OCPs	Site supervisor
Determining appropriate safety response	Site supervisor

Appendix 18:

Work Plan 18 –

Communications Strategy Plan

Version	**Date**
1	14 July 2005
2	18 February 2006

Contents

Appendix 18: Work Plan 18 – Communications Strategy Plan

Public consultation strategy

Overview

For the remediation project to be successfully completed, the ongoing consultation and public liaison process must continue to be effective and efficient. There is a highdegree of support from the community, due to a desire to have a long-standing environmental and community problem dealt with. As the work is taking place over an extended timeframe, it is important that engagement with the community continues to be carried out sympathetically and proactively. This will help ensure the project continues to receive public support.

The ongoing consultation and public liaison process described below, takes into consideration the following factors:

- the consultation work undertaken to date
- the location of the site in the heart of a community
- the importance of the Waimea Inlet as a holiday and tourist destination, as well as an increasingly residential/lifestyle community
- the need to keep the general public informed of ongoing plans for remediation of the site.

Consultation objectives, scope and duration

A key goal of the consultation and public liaison process for this project is to disseminate clear and factual information to minimise the potential for uninformed and irrational objections to the project. Specific objectives include the following:

- make the overall community aware of the project and update them on ongoing progress
- advise the community of the range of opportunities to comment on the project and be involved in the clean-up process
- provide opportunities for comment
- respond to comments and requests for information
- feed information on issues and concerns back to the investigations and remediation team.

In this way concerns can be identified and clearly explained. .

The scope of information covered in the ongoing consultation needs to include:

- how site work is progressing

- the timetable and timeframes
- effects
- how effects are being managed and mitigated
- how any potential risks to the community are being managed and mitigated
- realistic projections of the outcome and end use of the area.

It is essential to the overall success of the project that the consultation does not cease until completion of the project, at the very earliest. The community has access to factual information as the remediation takes place and has a means of airing any concerns.

Consultation phases

The consultation process has already gone through a number of phases during the initial Stage 1 and 2 works, and now as we progress through Stage3 – the final clean-up.

Phase 1 – Consultation strategy

A consultation strategy was initially developed, that identified the various groups that would have a specific interest in the works.

Phase 2 – Formation of community interest groups

Contact was made with those groups to detail the overall objectives of the project and the opportunities for the community's involvement in the process. From these initial meetings, four individual community groups were established, each representing their geographical area in relation to the site. The four groups represent the residents on the three boundaries of the site, namely Tahi Street, Aranui Road and Coutts Place. The fourth group represents the commercial precinct at the north eastern boundary of the site.

The Mapua Task Force was established by Council. The group comprises project staff, Councillors and community residents. This task force provides a link between the community and the principal (the Ministry for the Environment) so that community concerns can be addressed.

The peer review panel (PRP) was also appointed by TDC, with members having expertise in environmental disciplines relevant to the site. The PRP's role is to review, comment and make recommendations on management plans, proof of performance and monitoring reports.

Phase 3 – Investigation and consenting

This phase focused on informing parties of the results of the investigation work carried out, the details of the proposed remediation works, and confirming working procedures and means of mitigation proposed for effects. This phase was iterative with the remediation team and the environmental effects assessment, to ensure issues raised through consultation were addressed in the AEE.

Phase 4 – Remediation

This phase involves ongoing reviews by the PRP, and consultation with the general community through the remediation stage to keep them informed of progress and provide an avenue for them to communicate any concerns. This is largely done through direct liaison with neighbours and meetings with specific interest groups. We arrange regular attendance at the monthly local Residents Ratepayers meeting and other groups as requested.

Consultation methods and tools

The following methods are used to ensure effective and efficient consultation throughout the remediation stage of the works (Stage 3).

0800 number

An 0800 number (0800 FCC SITE) is maintained to answer queries on the project and to receive comments, complaints and compliments.

Media releases

Media releases on the project are prepared and distributed by the principal and/or the Minister for the Environment, at relevant times during the project programme. Any contact with the media is via the principal and/or the Minister for the Environment.

Individual and group consultation

Individual consultation programmes will be maintained for key interest groups that have been established during Stage 1 of the works. Key parties will include the Tasman District Council (as regulator responsible to grant consents), the Department of Conservation and local resident groups. For activities in the coastal marine area, the Maritime Safety Authority, Mapua Boat Club and Hydrographer of the Royal NZ Navy will also need to be advised/consulted

Neighbourhood newsletters

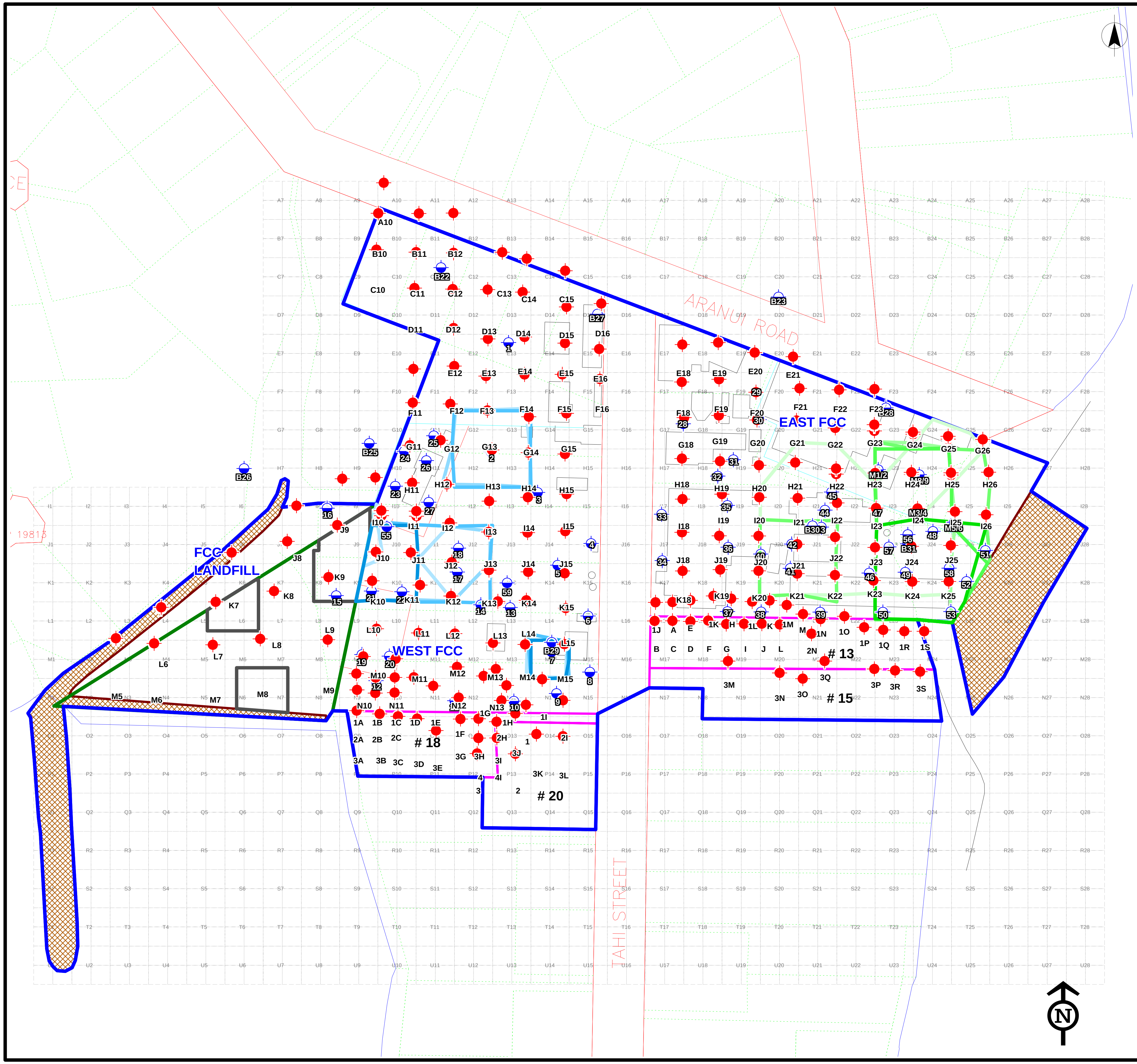
Newsletters are prepared at specific stages for dissemination of information to the community. The newsletters provide specific information on progress with the project, the consent process, and remediation works as appropriate. Feedback to date has been overwhelmingly positive – the community really appreciate being kept up to date.

Web page

Material on the principal's web page outlines the goals and objectives of the work programmes, timelines, updates, background, progress reports and other key information.

Information board

A notice board informing the public about the site works has been erected adjacent to the site office, and is kept up to date.



Mapua Site Layout - All Layers

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

All Layers Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

2001 Sample Locations for All Layers

- All Samples

1996 Woodward-Clyde Sample Locations for All Layer

- All Samples

Areas with DDX > 200 Or ADL > 60

	Landfill Site	West Site	East Site
Layer 1			
Layer 2			
Layer 3			
Layer 4			
Layer 5			

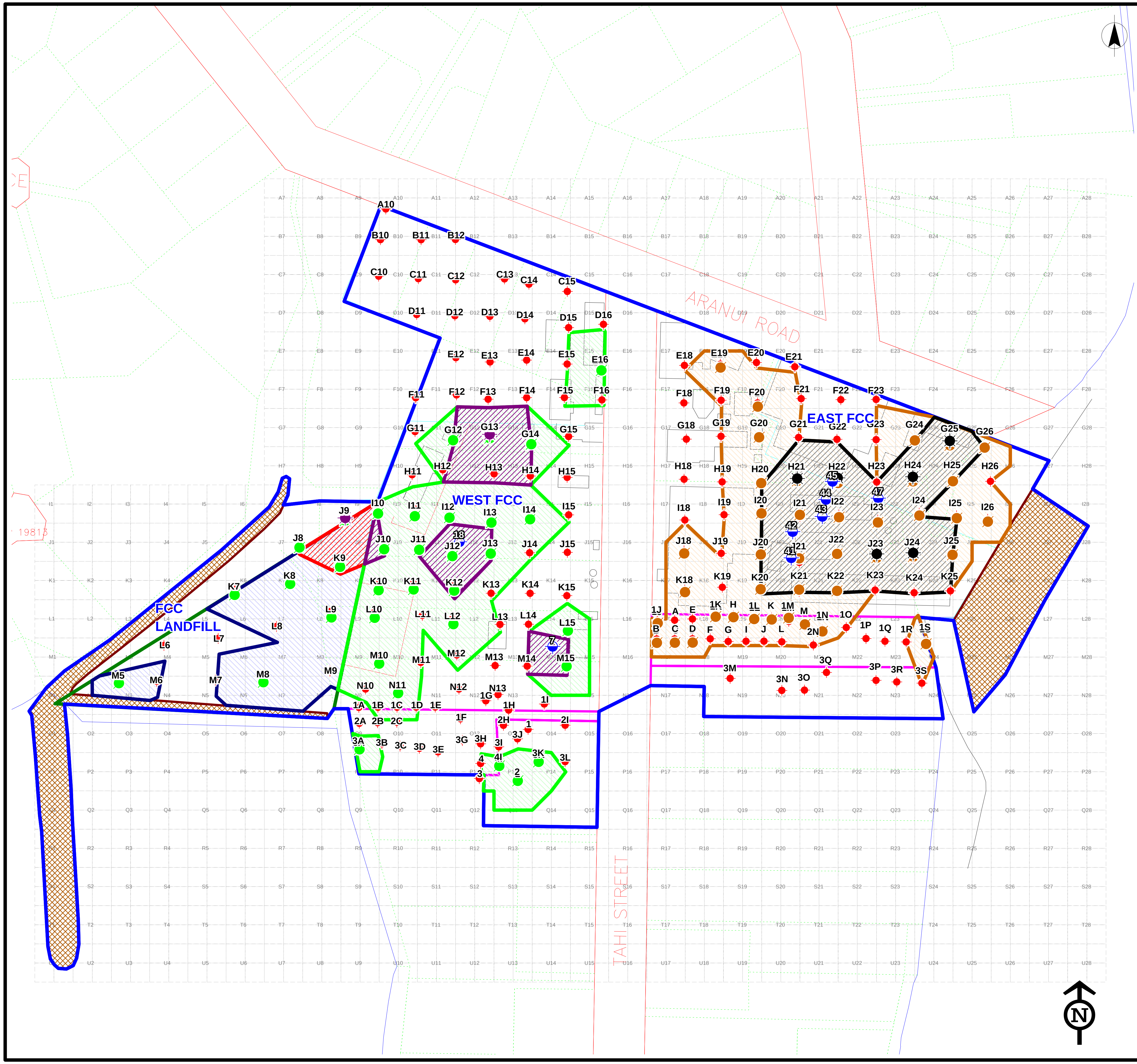
TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
All Layers -
Removal Areas (DDX > 200)
Including Woodward-Clyde 1996 Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	2
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\DDX_WC_96_Up.WOR



Mapua Site Layout - Layer 1

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 1 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

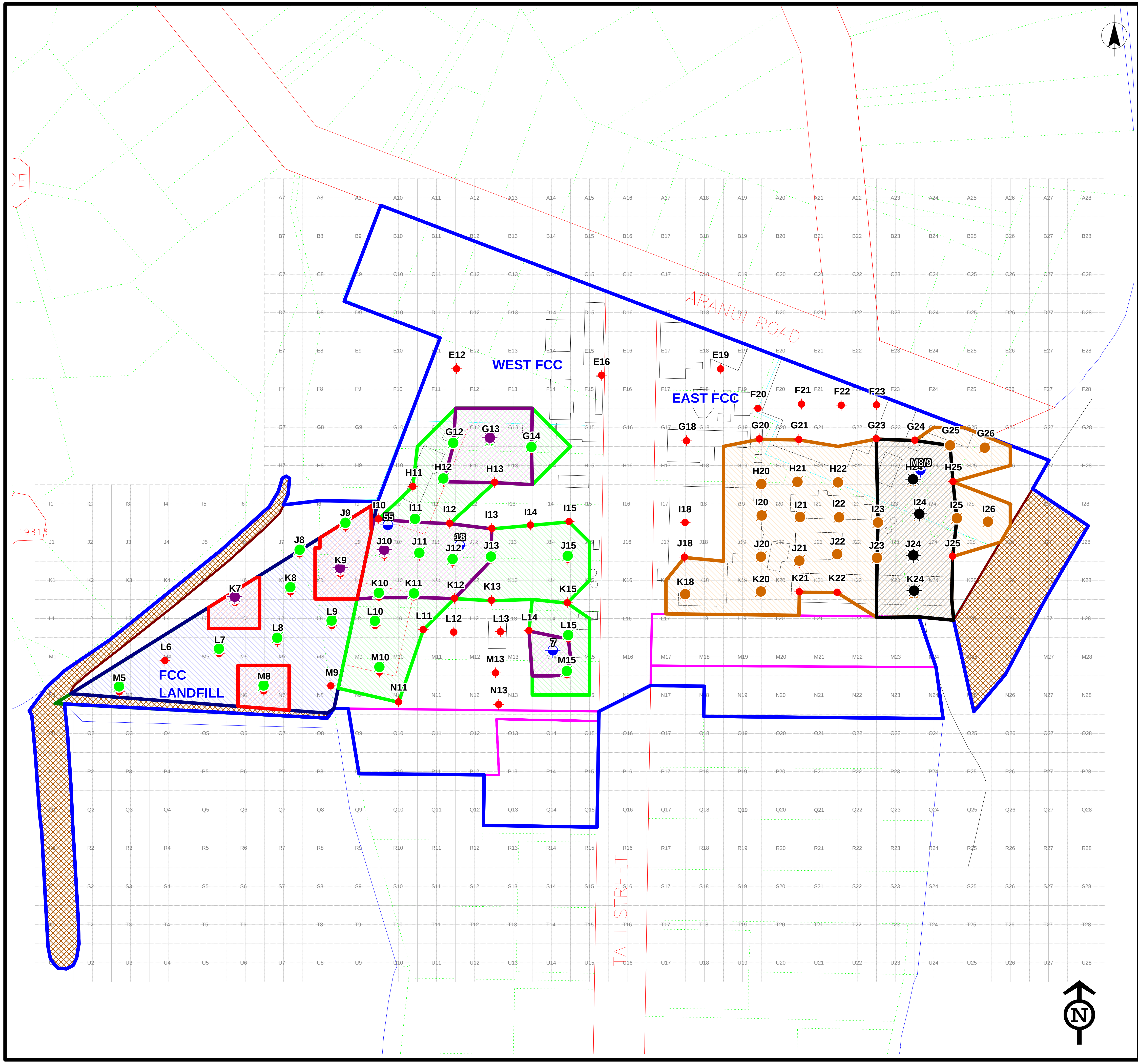
Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 1 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	3
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\DDX_WC_96_Up.wor



Mapua Site Layout - Layer 2

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 2 Map Legend

Cadastral Property boundaries
The Site
Neighbouring Properties
Landfill Area
Marine Sediments
Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

DDX < 5 Or A+D+(L/10) < 3

East Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

West Site

DDX > 5 Or A+D+(L/10) > 3
DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

East Site
West Site
Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

East Site
West Site
Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

DDX > 200 Or A+D+(L/10) > 60

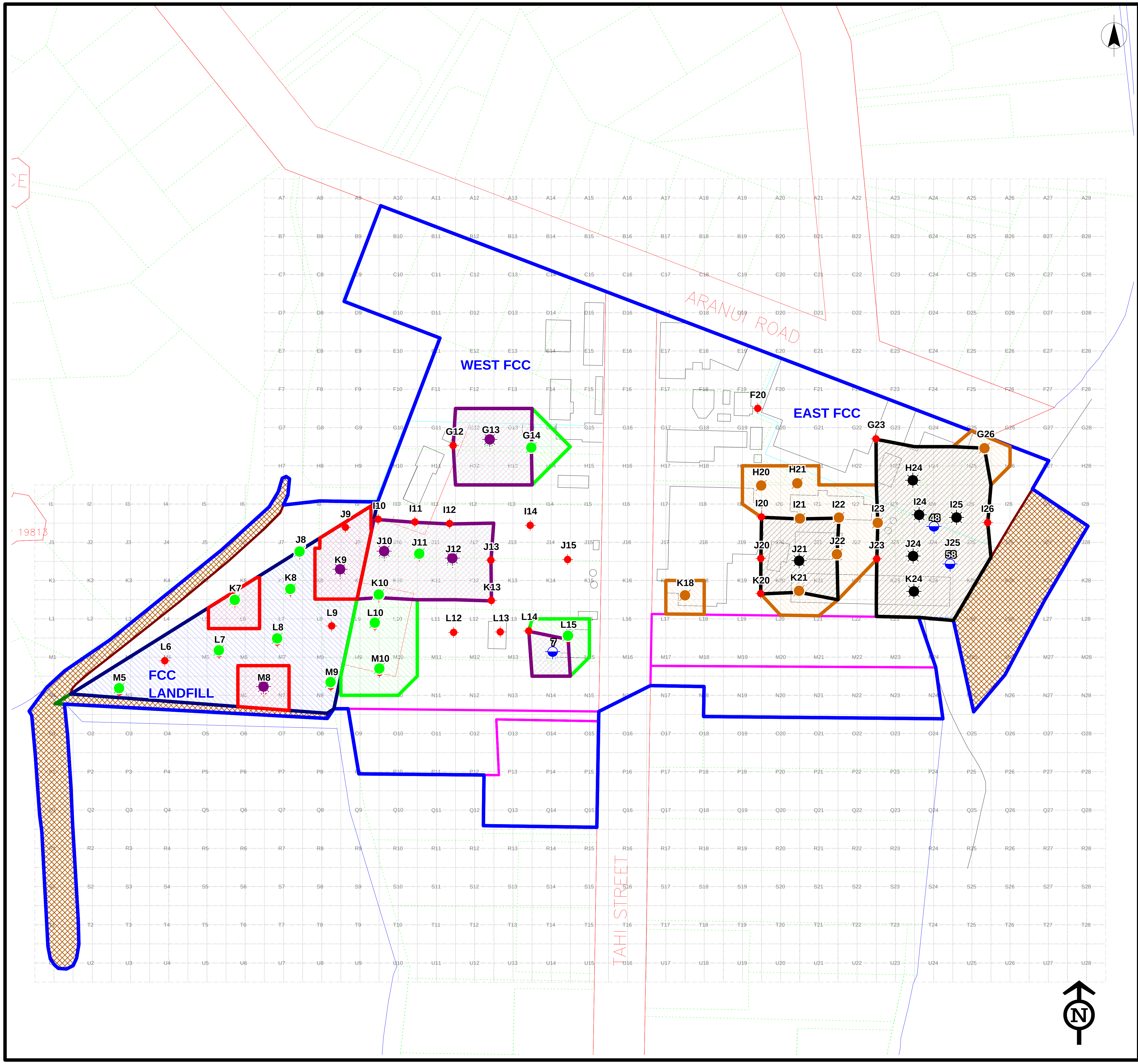
Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 2 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	4
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\March_2002_20m2.wor



Mapua Site Layout - Layer 3

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 3 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 3 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn SR	Chk'd PL
Approved	P Russell
Scale 1:1,500	REVISION 4
Date March 2002	

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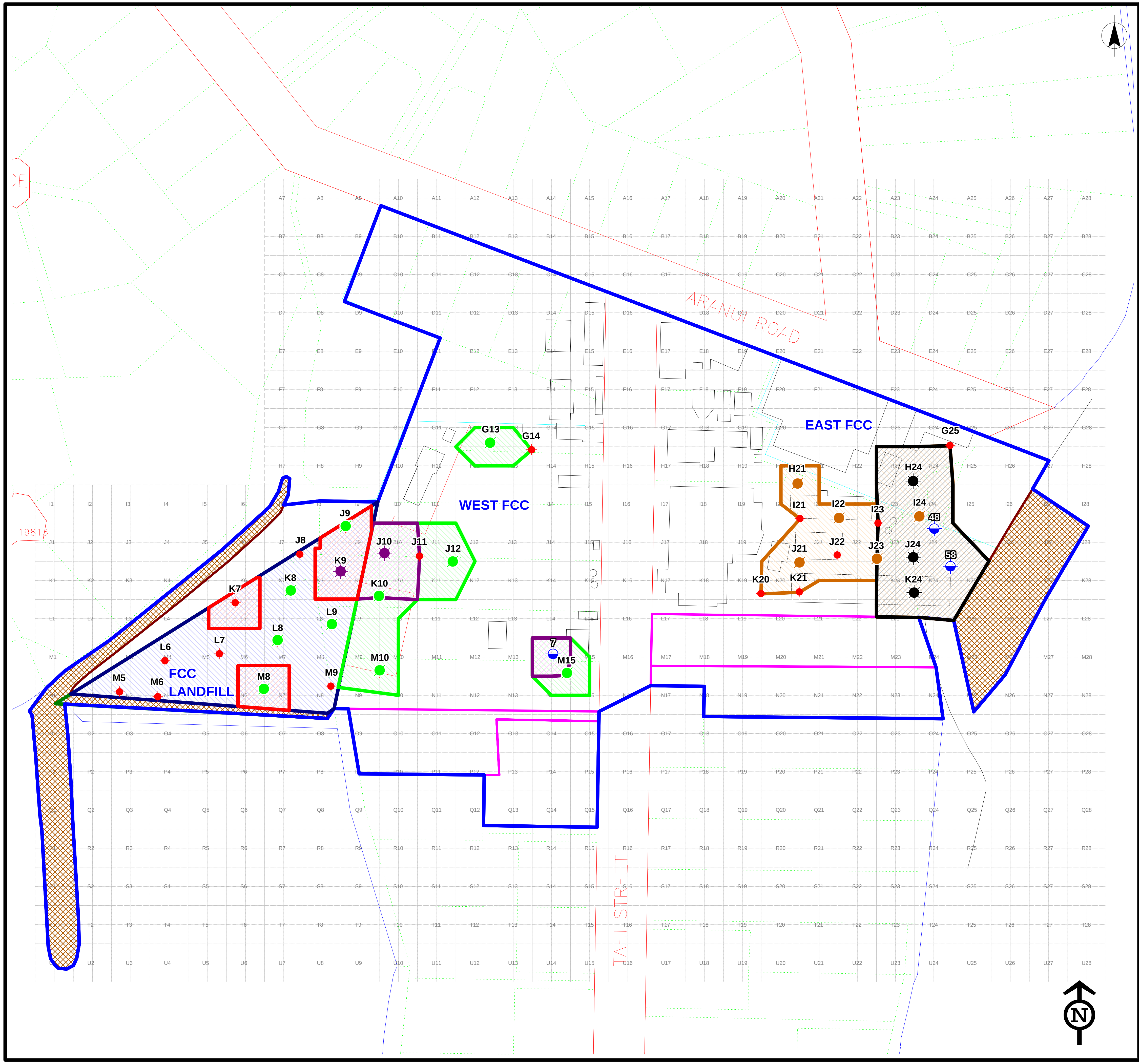


Mapua Site Layout - Layer 4

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 4 Map Legend

- Cadastral Property boundaries
- The Site
- Neighbouring Properties
- Landfill Area
- Marine Sediments
- Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

- DDX < 5 Or A+D+(L/10) < 3

East Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

West Site

- DDX > 5 Or A+D+(L/10) > 3
- DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

- East Site
- West Site
- Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

- East Site
- West Site
- Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

- DDX > 200 Or A+D+(L/10) > 60

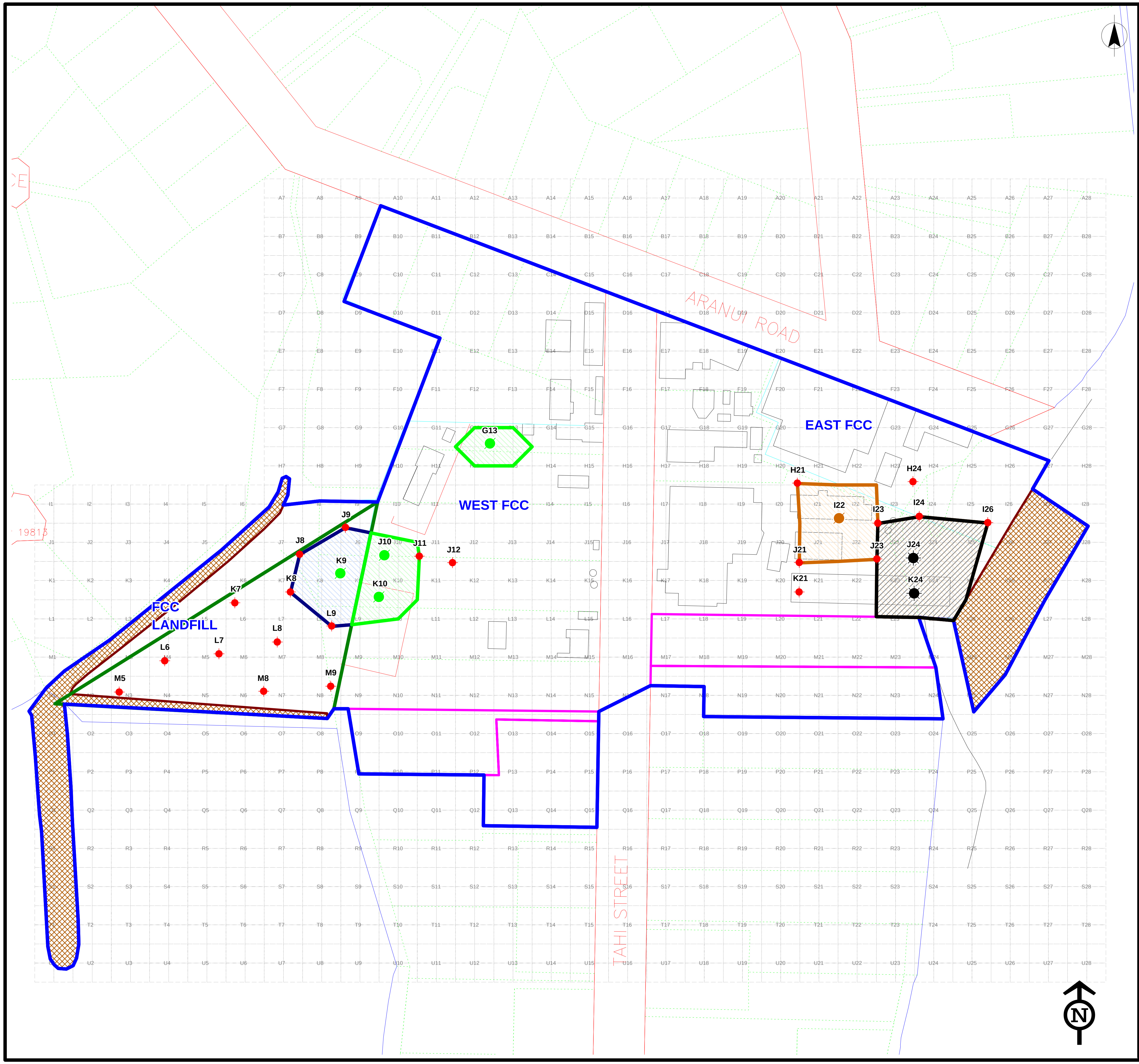
TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 4 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	4
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\Mapua_2002_20m2.wor



Mapua Site Layout - Layer 5

NOTE:

This Site Plan has been prepared using the DCDB as the base map. Locations of site buildings and previous soil sample points have been digitised from other drawings. The Contractor is required to prepare a site map to New Zealand Map Grid Coordinates

with sufficient site survey to verify the DCDB cadastral boundaries, establish the site boundaries and surface features, set-up a soil sampling grid and establish sufficient site control benchmarks.

Layer 5 Map Legend

Cadastral Property boundaries
The Site
Neighbouring Properties
Landfill Area
Marine Sediments
Sampling Grid (7.5m x 7.5m)

Sampling Locations for Layer

DDX < 5 Or A+D+(L/10) < 3

East Site

DDX > 5 Or A+D+(L/10) > 3

DDX > 200 Or A+D+(L/10) > 60

West Site

DDX > 5 Or A+D+(L/10) > 3

DDX > 200 Or A+D+(L/10) > 60

Removal Area for Layers (DDX > 200 Or A+D+(L/10) > 60)

East Site
West Site
Landfill Site

Removal Areas for Layer (DDX > 5 Or A+D+(L/10) > 3)

East Site
West Site
Landfill Site

1996 Woodward-Clyde Sample Locations for Layer

DDX > 200 Or A+D+(L/10) > 60

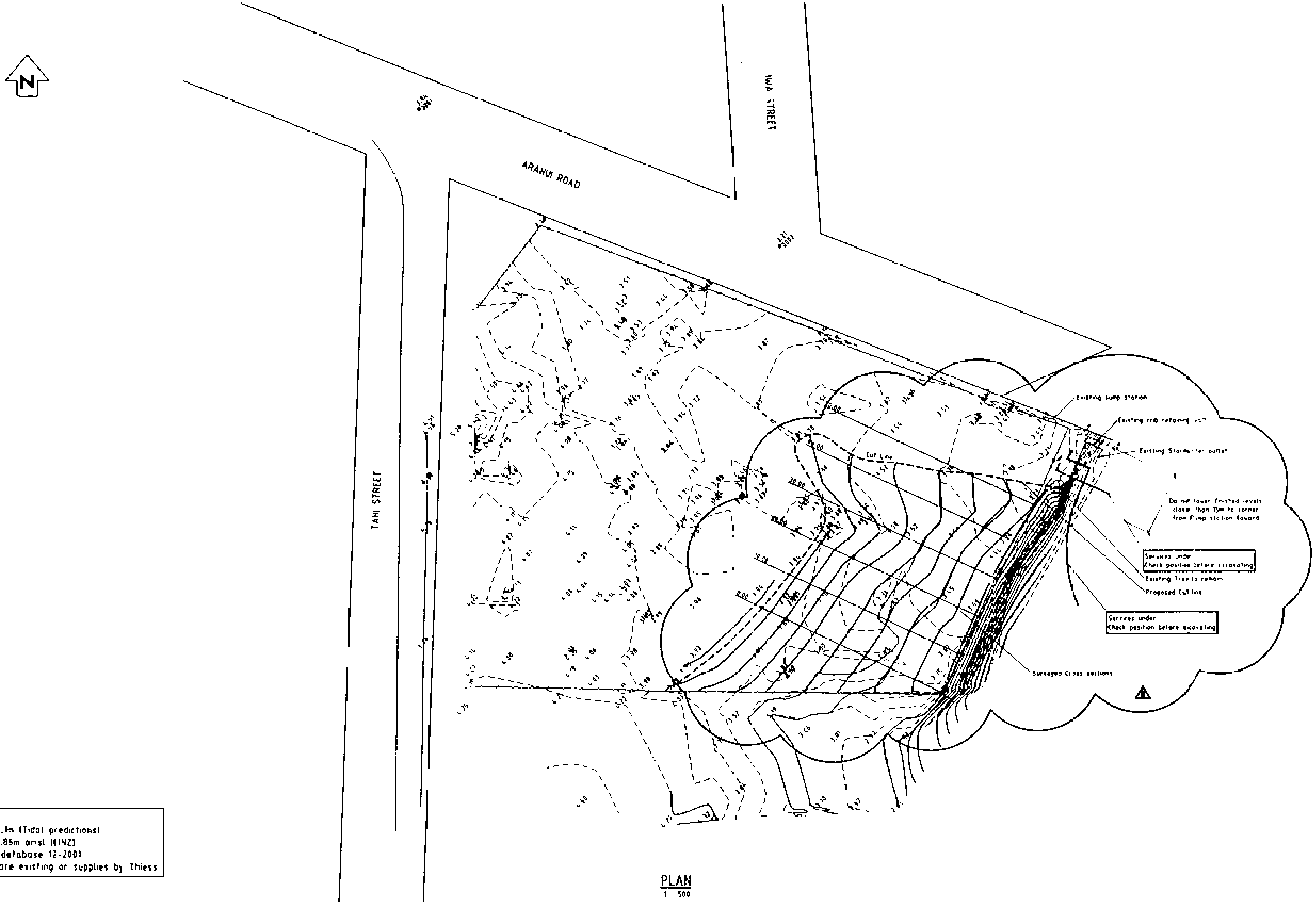
TDC Tasman District Council

Contract 514:
Remediation of the FCC Site
LAYER 5 -
Contaminated Area Plan
Including 1996 Woodward-Clyde Data

MWH

Drawn	SR	Chk'd	PL
Approved	P Russell		
Scale	1:1,500	REVISION	3
Date	March 2002		

MI REF. \801 001724\Mapinfo\WS\DDX_WC_96_Up.wor



NOTE
M.H.W.S. = 4.1m (Tidal predictions)
(Mapua) + 1.86m amsl (K1NZ)
Source LINZ database 12-2001
Spot levels are existing or supplied by Thiess

PLAN
1 : 500

PRELIMINARY
FOR APPROVAL

JOB NO : 401726-01		
CAD REF : Final contours		
XREFS :		
	Name	Date
FIELDBOOK		
SURVEYED	HAH	12-01
DESIGNED	PFP	12-01
DRAWN	JWE	12-01
CHECKED	PFP	01-02
APPROVED		

MWH
MONTGOMERY WATSON HARZA

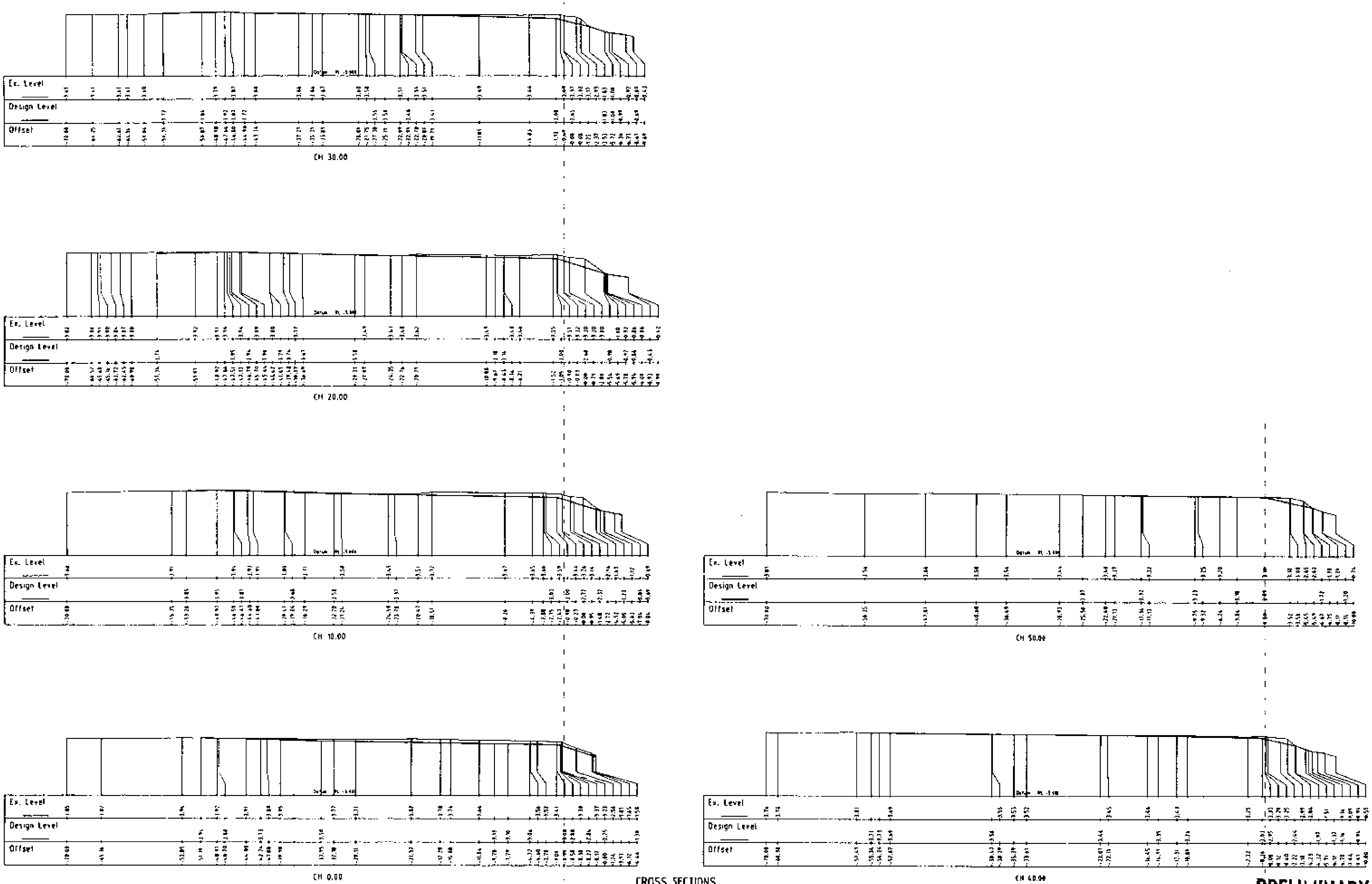
TDC Tasman District Council

MAPUA FCC SITE

PROPOSED SITE ALTERATIONS
AND BULK GROUND LEVELS

Date 23 JAN 2002
SCALES 1:500

1939/1	01	B



CROSS SECTIONS
1 : 250

PRELIMINARY
FOR APPROVAL
23 JAN 2012

JOB NO
CAD REF Final contours
XREFS

FIELDBOOK	Name	Date
SURVEYED	MAM	12-01
DESIGNED	PFR	12-01
DRAWN	JMF	12-01
CHECKED	PFR	01-02
APPROVED		

MWH
MONTGOMERY WATSON HARZA

TDC Tasman District Council

MAPUA FCC

PROPOSED CROSS SECTION

SCALES 1:250

1939/1 | 02 | B

Appendix : 19

Pre-excavation Contamination Maps

(Predicted Contamination)

Version	**Date**
1	14 July 2005

Appendix : 20

Bibliography

Version	Date
1	14 July 2005

Mapua Bibliography

Formatted: Indent: Left: 0 cm, First line: 0 cm

Technical Reports	**Author**	**Date/Issue**
EDL Management Plan	EDL	20 September 2004 (Issue No.4)
MCD Process Description	EDL	20 March 2003 (Issue No.2)
Thiess Remedial Action Plan	Thiess Services Pty Ltd	RAP9
Thiess Management Plan	Thiess Services Pty Ltd	TS-OPS-LR4042-MP001/A3

Appendix B EMS QA / QC Document

PROPOSED QA / QC SOIL VALIDATION SAMPLING OF THE FCC SITE - APRIL 2007

OBJECTIVE 1: To confirm that the reinstatement of the soil (commercial and treated fines) on FCC East meets the Soil Acceptance Criteria for the stated land use. To undertake quality assurance and duplicate lab testing sampling, (to be undertaken by GHD staff). To determine that the level of contaminants remaining in the treated soil and the leachability of these contaminants is fully understood for the different types of fill on the site.

OBJECTIVE 2: To continue a selected number of bores to groundwater level and install groundwater monitoring bores. These will be sampled as part of the GW / Marine Sediment assessment study to be undertaken by CH2M Hill.

Proposal: Take a series of soil samples of the backfilled material on the FCC East site at various depths. Sampling would be accomplished by the Site Team and GHD working in tandem for each sampling location. Different analysis would be undertaken to determine existing contaminants and potential leachability of these contaminants. Samples taken by GHD would be sent to a laboratory other than Hills Laboratory to achieve the duplicate lab analysis requirement.

Locations: 12 of the larger sub grades over the east site have been selected to represent the different types of fill material backfilled on the site. A hole will be drilled within the cell selected within each subgrade as shown on the attached map for the east site. 1 to 3 sampling depths have been selected based on the layers of fill within each sub grade as shown in Table 1 below.

Table 1: Sampling and Analytical Program

SG	Backfill	Average Depth of floors in SG	Depth of Sample	Analysis	Install GW Bore[1]
FCC East -					
2	Commercial Commercial Oversize	3.4	1.2 2.2 2.8	Full Full Leachable OCPs	Yes
3	Seds-Com-OS TF – OS - Seds	2.3	0.5 1.25	Full & Target Full & Target	Yes
4	Commercial TF – Comm - OS	3.0	0.75 1.5	Full Full & Target	
6	TF	1.68	1.5	Target (pH 2 & 5)	
7	Commercial TF – Comm - OS	3.2	0.7 1.7	Full Full & Target	
8	TF – Comm – OS TF – Comm – OS TF – Comm – OS TF – Comm – OS	3.0	0.5 1.0 2.0 2.4	pH only Full & Target (pH 2 & 5) Full & Target Target	Yes
9	Commercial	2.5	1.25	Full	
12	TF – Comm - OS	3.5	1.2	Full & Target	
14	TF – OS – Seds	2.1	0.5 1.1	pH only Full & Target	Yes
16	TF – Comm – OS TF – Comm – OS OS - Concrete	2.2	0.5 1.25 2.2	pH only Full & Target (pH 2 & 5) Leachable OCPs	Yes

17	TF – Comm – OS TF – Comm - OS	3.1	1.5 2.2	Full & Target Full & Target	
20	TF TF TF TF – Com - OS	2.5	0.5 0.75 1.25 1.75	pH only Target (pH 2 & 5) Target Full & Target	Yes
FCC West -					
21	No soil analysis / GW Bores only				Yes
M10					Yes

TF = Treated Fines
OS = Oversize
Seds = Foreshore / Marine sediments
Comm = Commercial

Note 1: Groundwater bores will be monitored as part of the CH2M Hill GW and marine assessment sampling program. The above plan incorporates the installation of the bores only. Soil samples will be taken as the bore is drilled.

Soil Analysis: Table 2 below shows the recommended soil sampling analysis and total number of samples.

Table 2:

	Analysis	**Number of Samples**
Target	pH, nitrate, ammonia, TKN, iron, copper, OCPs, Leachability (nitrate, ammonia, TKN, iron, copper and OCPs) [Note some samples pH 2 and 5]	16
Full	OCPs, TPH, OPP, ONP, VOC's, selected metals, PAHs and chlorobenzene.	17
Leachable OCPs	Leachable OCPs	2
pH only	pH only	4

Type of fill: Table 3 shows the distribution of the analysis for each type of fill:

Table 3:

Type of Fill	**Sub Grades**	**Types of Analysis**
Treated Fines (TF)	6, 20	Target - 4
Seds – Comm - OS	3	Full – 1 Target - 1
TF – OS - Seds	3, 14	Full – 2 Target - 2
TF – Comm - OS	4, 7, 8, 12, 16, 17	Full – 9 Target - 9 Leach OCPs -
Commercial	2, 4, 7, 9	Full – 5
OS - Concrete	16	Leach OCPs - 1

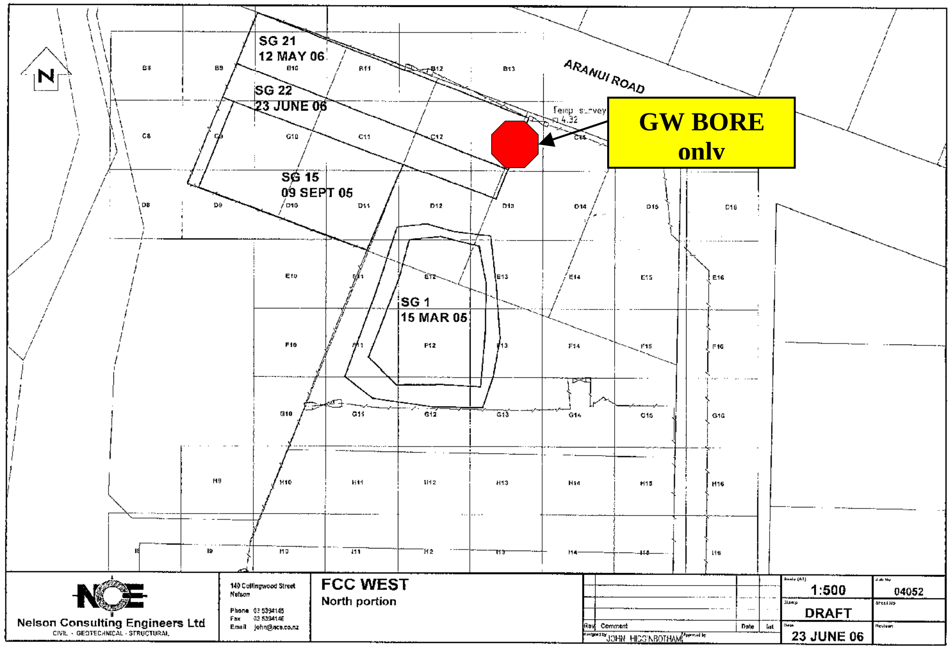
<u>Timeline –</u>

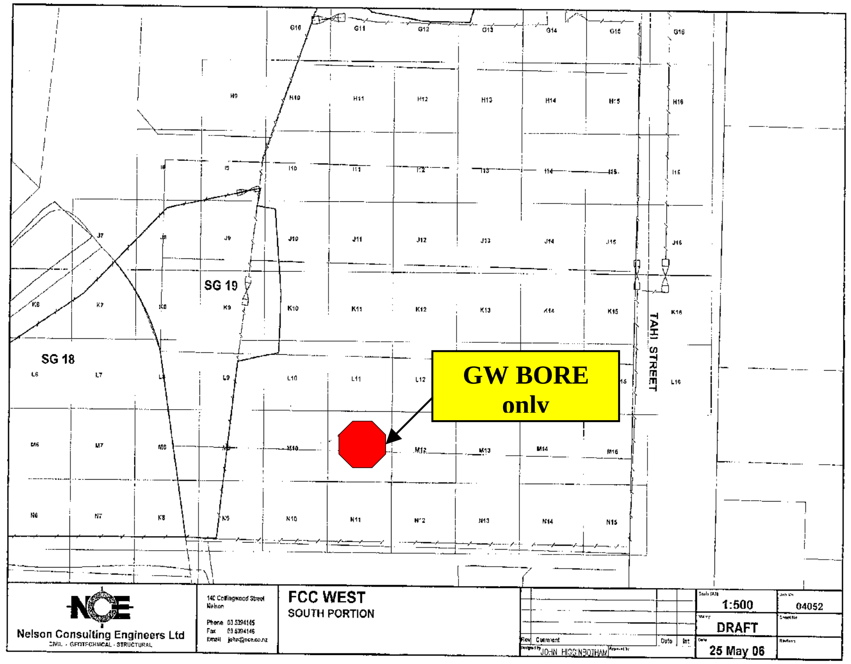
Date	Activity	Persons Required
20 April 2007	CH2M Hill GW Sampling Plan provided and approved. Correlated with this soil sampling plan.	Kim, Peter Nadebaum, CH2M Hill.
23-27 April 2007	1. MWH and EMS to locate and mark each SG and proposed sample point. 2. GW and Soil sampling plan resources confirmed and contracts developed, drillers confirmed etc. 3. Organize sampling supplies, equipment and lab. 4. Obtain previous bore logs from CW Drilling.	EMS and MWH Kim EMS, Steven (GHD), CH2M Kim
30 April 2007	GW Holes Drilled, CH2M Hill to over see installation and provide design.	Drilling Company, John, CH2M Hill
1 May 2007	Soil Samples taken / sent to lab. Marine sediment sampling occurs	Drilling Company and/or Multi Dig, Steven (GHD), John CH2M Hill
2 May 2007	Groundwater sampling of new bores.	CH2M Hill

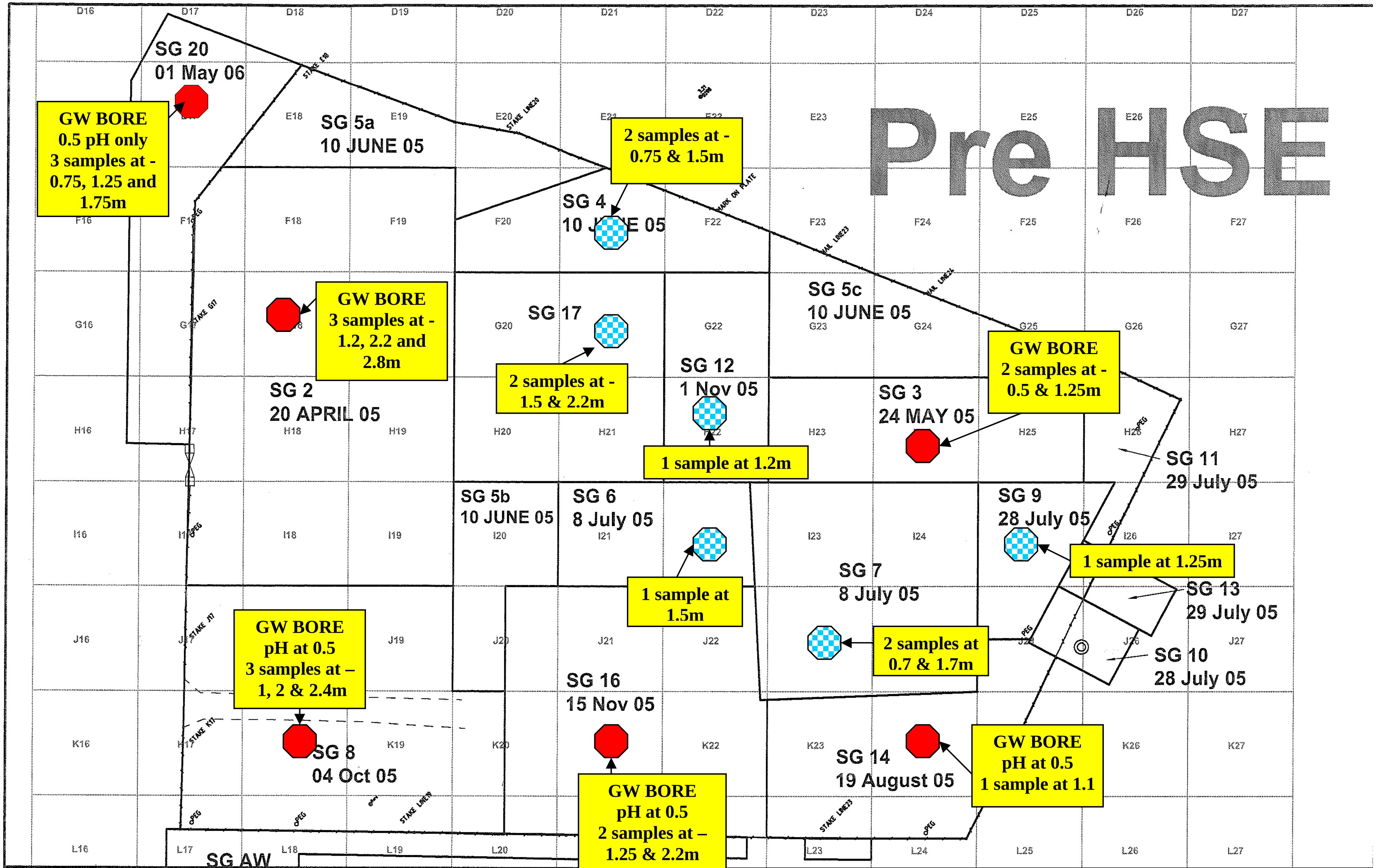
MAPS OF PROPOSED SOIL AND GROUNDWATER SAMPLING LOCATIONS –

Groundwater Bore

Soil Sampling







PRE HSE
MAPUA FCC SITE REMEADIATION
EAST SITE SUBGRADE INSPECTION SITE PLAN
BASE SURVEY DATA PROVIDED BY MWH

Rev	Comment	Date	Int
Designed by	Approved by		

Scale (A3) 1:500	Job No 05052
Stamp DRAFT	Sheet No
Date 01 MAY 06	Revison

Appendix C Data Spreadsheets

Table 62. Summary statistics for the mined residential material

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	448	0.0	3.8	0.32					
Dieldrin	448	0.0	2.5	0.31					
Lindane	448	0.0	4.0	0.30					
A+D +10%L	**448**	**0.0**	**4.1**	**0.65**	***3***	***7.5***	**446**	**2**	0
2,4'-DDD	448	0.0	2.0	0.30					
2,4'-DDE	448	0.0	1.3	0.28					
2,4'-DDT	448	0.0	3.7	0.38					
4,4'-DDD	448	0.0	3.5	0.38					
4,4'-DDE	447	0.0	2.4	0.33					
4,4'-DDT	447	0.0	15.6	0.97					
DDX	**448**	**0.1**	**22.8**	**2.71**	***5***	***12.5***	**405**	**36**	**7**
Dry Matter	55	75.7	100.0	85.3					
Total Hydrocarbons C7-C9	**52**	**2.5**	**5.0**	**4.08**	***500***	***1250***	**52**	0	0
Total Hydrocarbons C10-C14	**52**	**4.5**	**15.0**	**10.1**	***510***	***1275***	**52**	0	0
Total Hydrocarbons C15-C36	52	10.0	70.0	23.3					
Total Hydrocarbons	54	0.3	70.0	34.7					
Boron - Hot Water Soluble	**7**	**0.3**	**0.3**	**0.25**	***3***	***7.5***	**7**	0	0
Cyanide-Total	**7**	**0.1**	**0.1**	**0.05**	***70***	***175***	**7**	0	0
Cyanide, Soluble ('Free')	**7**	**0.2**	**0.2**	**0.20**	***50***	***125***	**7**	0	0
Cyanide, complexed	0	0.0	0.0	-					
Iron	10	6,690	38,500	18,085					
Manganese-Total Recoverable	**14**	**91.0**	**725.0**	**226.5**	***500***	***1,250***	**13**	**1**	0
Arsenic-Total Recoverable	**15**	**1.0**	**17.0**	**5.34**	***30***	***75***	**15**	0	0
Cadmium-Total Recoverable	**15**	**0.1**	**0.1**	**0.05**	***3***	***7.5***	**15**	0	0
Chromium-Total Recoverable	15	19.0	79.0	36.8					
Chromium VI	**11**	**0.2**	**0.2**	**0.20**	***9***	***22.5***	**11**	0	0
Chromium III	**11**	**20.0**	**79.0**	**40.1**	***600***	***1500***	**11**	0	0
Chromium III %	3	1.0	1.0	1.00					
Copper-Total Recoverable	**15**	**3.0**	**26.0**	**9.41**	***300***	***750***	**15**	0	0
Mercury-Total Recoverable	**15**	**0.1**	**0.1**	**0.05**	***11***	***27.5***	**15**	0	0
Nickel-Total Recoverable	**15**	**19.0**	**109.0**	**56.0**	***60***	***150***	**11**	**4**	0
Lead-Total Recoverable	**15**	**2.6**	**7.4**	**4.15**	***300***	***750***	**15**	0	0
Selenium-Total Recoverable	14	10.0	10.0	10.0					
Zinc-Total Recoverable	**15**	**16.0**	**65.0**	**31.0**	***200***	***500***	**15**	0	0
Benzo(a) pyrene	**4**	**0.0**	**0.0**	**0.03**	***0***	***0.675***	**4**	0	0
PAH Screen-total	**4**	**0.3**	**0.5**	**0.41**	***20***	***50***	**4**	0	0
PCBs	**6**	**0.0**	**0.2**	**0.16**	***10***	***25***	**6**	0	0
Alpha-BHC	109	0.0	0.5	0.37					
Beta-BHC	109	0.0	0.5	0.37					
Delta-BHC	109	0.0	0.5	0.37					
Cis-Chlordane	109	0.0	0.5	0.37					
Trans-Chlordane	109	0.0	0.5	0.37					
Chlordane	**109**	**0.0**	**2.5**	**1.85**	***50***	***125***	**109**	0	0
Endosulphan I	109	0.0	0.5	0.37					
Endosulphan II	109	0.0	0.5	0.37					
Endosulphan sulphate	109	0.0	0.5	0.37					
Endrin	109	0.0	0.5	0.37					
Endrin aldehyde	109	0.0	0.5	0.37					
Heptachlor	**109**	**0.0**	**0.5**	**0.37**	***10***	***25***	**109**	0	0
Heptachlor epoxide	109	0.0	0.5	0.37					
Hexa chloro benzene	109	0.0	0.5	0.37					
Methoxy chlor	109	0.0	0.5	0.37					

[1] *Residential SAC.* [2] *Residential limit for individual samples is 2.5 x SAC*

[3] *Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).*

Table 63. Summary statistics for Marine East site mined residential material

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC[1]*	*2.5 x SAC[2]*	Pass[3]	Marginal[3]	Fail[3]
Aldrin	146	0.0	0.5	0.04					
Dieldrin	146	0.0	3.5	0.02					
Lindane	146	0.0	0.0	0.00					
A+D +10%L	**146**	**0.0**	**3.9**	**0.06**	***3***	***7.5***	**145**	**1**	0
2,4'-DDD	146	0.0	13.7	0.21					
2,4'-DDE	146	0.0	0.2	0.01					
2,4'-DDT	146	0.0	7.2	0.16					
4,4'-DDD	146	0.0	53.0	1.41					
4,4'-DDE	146	0.0	0.9	0.15					
4,4'-DDT	146	0.0	56.4	3.58					
DDX	**146**	**0.0**	**125.5**	**4.09**	***5***	***12.5***	**139**	**4**	**3**
Dry Matter	32	7.0	81.5	77.7					
Total Hydrocarbons C7-C9	**31**	**4.0**	**5.0**	**4.42**	***500***	***1,250***	**31**	0	0
Total Hydrocarbons C10-C14	**31**	**10.0**	**10.0**	**10.0**	***510***	***1275***	**31**	0	0
Total Hydrocarbons C15-C36	31	20.0	25.0	20.4					
Total Hydrocarbons	31	30.0	40.0	32.8					
Boron - Hot Water Soluble	**6**	**0.9**	**4.0**	**3.34**	***3***	***7.5***	**3**	**3**	0
Cyanide-Total	**6**	**0.1**	**0.1**	**0.05**	***70***	***175***	**6**	0	0
Cyanide, Soluble ('Free')	**6**	**0.2**	**0.9**	**0.48**	***50***	***125***	**6**	0	0
Cyanide, complexed	0	0.0	0.0	-					
Iron	0	0	0	-					
Manganese-Total Recoverable	**6**	**127.0**	**297.0**	**230.9**	***500***	***1,250***	**6**	0	0
Arsenic-Total Recoverable	**6**	**1.0**	**0.1**	**4.25**	***30***	***75***	**6**	0	0
Cadmium-Total Recoverable	**6**	**0.1**	**0.1**	**0.08**	***3***	***7.5***	**6**	0	0
Chromium-Total Recoverable	6	23.0	41.0	36.0					
Chromium VI	**6**	**0.2**	**0.2**	**0.20**	***9***	***22.5***	**6**	0	0
Chromium III	**6**	**23.0**	**41.0**	**36.0**	***600***	***1500***	**6**	0	0
Chromium III %	0	0.0	0.0	-					
Copper-Total Recoverable	**6**	**4.0**	**11.0**	**9.11**	***300***	***750***	**6**	0	0
Mercury-Total Recoverable	**6**	**0.1**	**0.1**	**0.09**	***11***	***27.5***	**6**	0	0
Nickel-Total Recoverable	**6**	**31.0**	**80.0**	**70.5**	***60***	***150***	**3**	**3**	0
Lead-Total Recoverable	**6**	**3.6**	**9.7**	**7.54**	***300***	***750***	**6**	0	0
Selenium-Total Recoverable	6	10.0	15.0	13.2					
Zinc-Total Recoverable	**6**	**24.0**	**48.0**	**41.1**	***200***	***500***	**6**	0	0
Benzo(a) pyrene	**6**	**0.0**	**0.0**	**0.02**	***0***	***0.675***	**6**	0	0
PAH Screen-total	**6**	**0.3**	**0.4**	**0.32**	***20***	***50***	**6**	0	0
PCBs	**6**	**0.0**	**0.2**	**0.11**	***10***	***25***	**6**	0	0
Alpha-BHC	146	0.0	0.0	0.00					
Beta-BHC	146	0.0	0.0	0.00					
Delta-BHC	146	0.0	0.0	0.00					
Cis-Chlordane	146	0.0	0.0	0.00					
Trans-Chlordane	146	0.0	0.0	0.00					
Chlordane	**146**	**0.0**	**0.2**	**0.00**	***50***	***125***	**146**	0	0
Endosulphan I	146	0.0	0.0	0.00					
Endosulphan II	146	0.0	0.0	0.00					
Endosulphan sulphate	146	0.0	0.0	0.00					
Endrin	146	0.0	0.1	0.00					
Endrin aldehyde	146	0.0	0.0	0.00					
Heptachlor	**146**	**0.0**	**0.0**	**0.00**	***10***	***25***	**146**	0	0
Heptachlor epoxide	146	0.0	0.0	0.00					
Hexa chloro benzene	146	0.0	0.0	0.00					
Methoxy chlor	146	0.0	0.0	0.00					

[1] Residential SAC. [2] Residential limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

▪ Table 64. Summary statistics for Marine West site mined residential material

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	194	0.0	0.0	0.00					
Dieldrin	194	0.0	0.3	0.01					
Lindane	194	0.0	0.1	0.00					
A+D +10%L	**194**	**0.0**	**0.3**	**0.01**	***3***	***7.5***	**194**	0	0
2,4'-DDD	194	0.0	4.6	0.34					
2,4'-DDE	194	0.0	0.1	0.01					
2,4'-DDT	194	0.0	20.1	0.30					
4,4'-DDD	194	0.0	9.5	1.17					
4,4'-DDE	194	0.0	3.3	0.38					
4,4'-DDT	194	0.0	58.9	1.91					
DDX	**194**	**0.0**	**82.2**	**4.62**	***5***	***12.5***	**175**	**8**	**11**
Dry Matter	104	25.6	83.1	74.6					
Total Hydrocarbons C7-C9	**82**	**4.0**	**10.0**	**4.71**	***500***	***1250***	**82**	0	0
Total Hydrocarbons C10-C14	**82**	**10.0**	**15.0**	**10.3**	***510***	***1275***	**82**	0	0
Total Hydrocarbons C15-C36	82	15.0	35.0	21.4					
Total Hydrocarbons	89	30.0	190.0	40.4					
Boron - Hot Water Soluble	**25**	**0.3**	**10.8**	**4.19**	***3***	***7.5***	**21**	**3**	**1**
Cyanide-Total	**25**	**0.1**	**0.2**	**0.06**	***70***	***175***	**25**	0	0
Cyanide, Soluble ('Free')	**25**	**0.2**	**0.2**	**0.20**	***50***	***125***	**25**	0	0
Cyanide, complexed	0	0.0	0.0	-					
Iron	25	9,280	33,900	18,248					
Manganese-Total Recoverable	**25**	**38.0**	**520.0**	**191.2**	***500***	***1,250***	**24**	**1**	0
Arsenic-Total Recoverable	**25**	**1.0**	**0.1**	**5.47**	***30***	***75***	**25**	0	0
Cadmium-Total Recoverable	**25**	**0.1**	**0.1**	**0.05**	***3***	***7.5***	**25**	0	0
Chromium-Total Recoverable	25	6.0	56.0	25.8					
Chromium VI	**25**	**0.2**	**1.0**	**0.56**	***9***	***22.5***	**25**	0	0
Chromium III	**25**	**6.0**	**56.0**	**25.8**	***600***	***1500***	**25**	0	0
Chromium III %	0	0.0	0.0	-					
Copper-Total Recoverable	**25**	**3.0**	**22.0**	**9.52**	***300***	***750***	**25**	0	0
Mercury-Total Recoverable	**25**	**0.1**	**0.6**	**0.11**	***11***	***27.5***	**25**	0	0
Nickel-Total Recoverable	**25**	**9.0**	**71.0**	**24.8**	***60***	***150***	**24**	**1**	0
Lead-Total Recoverable	**25**	**4.1**	**31.8**	**13.27**	***300***	***750***	**25**	0	0
Selenium-Total Recoverable	25	10.0	10.0	10.0					
Zinc-Total Recoverable	**25**	**11.0**	**132.0**	**49.1**	***200***	***500***	**25**	0	0
Benzo(a) pyrene	**24**	**0.0**	**0.1**	**0.02**	***0***	***0.675***	**24**	0	0
PAH Screen-total	**24**	**0.3**	**1.3**	**0.42**	***20***	***50***	**24**	0	0
PCBs	**25**	**0.0**	**0.0**	**0.02**	***10***	***25***	**25**	0	0
Alpha-BHC	180	0.0	0.0	0.00					
Beta-BHC	180	0.0	0.0	0.00					
Delta-BHC	180	0.0	0.0	0.00					
Cis-Chlordane	180	0.0	0.0	0.00					
Trans-Chlordane	180	0.0	0.0	0.00					
Chlordane	**180**	**0.0**	**0.1**	**0.00**	***50***	***125***	**180**	0	0
Endosulphan I	176	0.0	0.0	0.00					
Endosulphan II	176	0.0	0.0	0.00					
Endosulphan sulphate	176	0.0	0.0	0.00					
Endrin	176	0.0	0.0	0.00					
Endrin aldehyde	176	0.0	0.0	0.00					
Heptachlor	**176**	**0.0**	**0.0**	**0.00**	***10***	***25***	**176**	0	0
Heptachlor epoxide	176	0.0	0.0	0.00					
Hexa chloro benzene	176	0.0	0.0	0.00					
Methoxy chlor	176	0.0	0.0	0.00					

[1] Residential SAC. [2] Residential limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

- ### Table 65. Summary statistics for failed Marine Gravel used as residential material

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC[1]*	*2.5 x SAC[2]*	Pass[3]	Marginal[3]	Fail[3]
Aldrin	13	0.0	0.0	0.00					
Dieldrin	13	0.0	0.0	0.13					
Lindane	13	0.0	0.1	0.07					
A+D +10%L	**13**	**0.0**	**0.1**	**0.13**	***3***	***7.5***	**13**	0	0
2,4'-DDD	13	0.0	0.1	2.11					
2,4'-DDE	13	0.0	0.0	0.00					
2,4'-DDT	13	0.0	0.2	14.81					
4,4'-DDD	13	0.0	0.2	0.08					
4,4'-DDE	13	0.0	0.1	0.09					
4,4'-DDT	13	0.0	1.6	34.48					
DDX	**13**	**0.0**	**2.1**	**29.36**	***5***	***12.5***	**13**	0	0
Dry Matter	6	90.8	98.9	97.2					
Total Hydrocarbons C7-C9	**4**	**3.5**	**3.5**	**3.50**	***500***	***1250***	**4**	0	0
Total Hydrocarbons C10-C14	**4**	**5.0**	**5.0**	**5.0**	***510***	***1275***	**4**	0	0
Total Hydrocarbons C15-C36	4	15.0	15.0	15.0					
Total Hydrocarbons	4	25.0	30.0	29.7					
Boron - Hot Water Soluble	**1**	**0.3**	**0.3**	**-**	***3***	***7.5***	**1**	0	0
Cyanide-Total	**1**	**0.1**	**0.1**	**-**	***70***	***175***	**1**	0	0
Cyanide, Soluble ('Free')	**1**	**0.2**	**0.2**	**-**	***50***	***125***	**1**	0	0
Cyanide, complexed	0	0.0	0.0	-					
Iron	3	32,800	38,500	38,078					
Manganese-Total Recoverable	**3**	**578.0**	**725.0**	**715.1**	***500***	***1250***	0	**3**	0
Arsenic-Total Recoverable	**3**	**3.0**	**0.1**	**4.21**	***30***	***75***	**3**	0	0
Cadmium-Total Recoverable	**3**	**0.1**	**0.1**	**0.05**	***3***	***7.5***	**3**	0	0
Chromium-Total Recoverable	3	56.0	79.0	76.3					
Chromium VI	**3**	**0.2**	**0.2**	**0.20**	***9***	***22.5***	**3**	0	0
Chromium III	**3**	**56.0**	**79.0**	**76.3**	***600***	***1500***	**3**	0	0
Chromium III %	0	0.0	0.0	-					
Copper-Total Recoverable	**3**	**24.0**	**26.0**	**25.95**	***300***	***750***	**3**	0	0
Mercury-Total Recoverable	**3**	**0.1**	**0.1**	**0.05**	***11***	***27.5***	**3**	0	0
Nickel-Total Recoverable	**3**	**80.0**	**109.0**	**109.1**	***60***	***150***	0	**3**	0
Lead-Total Recoverable	**3**	**6.8**	**7.6**	**7.66**	***300***	***750***	**3**	0	0
Selenium-Total Recoverable	3	10.0	10.0	10.0					
Zinc-Total Recoverable	**3**	**56.0**	**65.0**	**65.3**	***200***	***500***	**3**	0	0
Benzo(a) pyrene	**1**	**0.0**	**0.0**	**-**	***0***	***0.675***	**1**	0	0
PAH Screen-total	**1**	**0.2**	**0.2**	**-**	***20***	***50***	**1**	0	0
PCBs	**1**	**0.0**	**0.0**	**-**	***10***	***25***	**1**	0	0
Alpha-BHC	13	0.0	0.0	0.00					
Beta-BHC	13	0.0	0.0	0.00					
Delta-BHC	13	0.0	0.0	0.00					
Cis-Chlordane	13	0.0	0.0	0.00					
Trans-Chlordane	13	0.0	0.0	0.00					
Chlordane	**13**	**0.0**	**0.0**	**0.00**	***50***	***125***	**13**	0	0
Endosulphan I	13	0.0	0.0	0.00					
Endosulphan II	13	0.0	0.0	0.00					
Endosulphan sulphate	13	0.0	0.0	0.00					
Endrin	13	0.0	0.0	0.00					
Endrin aldehyde	13	0.0	0.0	0.00					
Heptachlor	**13**	**0.0**	**0.0**	**0.00**	***10***	***25***	**13**	0	0
Heptachlor epoxide	13	0.0	0.0	0.00					
Hexa chloro benzene	13	0.0	0.0	0.00					
Methoxy chlor	13	0.0	0.0	0.00					

[1] Residential SAC. [2] Residential limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

- **Table 66. Summary statistics for Commercial Grade Reburial Material**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	1694	0.0	54.3	0.91					
Dieldrin	1,694	0.0	54.7	3.91					
Lindane	1,694	0.0	791.0	1.76					
A+D+10%L	**1,698**	**0.0**	**98.2**	**5.40**	***60***	***150***	**1692**	**6**	0
2,4'-DDD	1,692	0.0	43.0	3.57					
2,4'-DDE	1,691	0.0	44.0	0.74					
2,4'-DDT	1,694	0.0	171.0	8.43					
4,4'-DDD	1,693	0.0	286.0	10.86					
4,4'-DDE	1,692	0.0	165.0	4.65					
4,4'-DDT	1,693	0.0	554.0	75.29					
DDX	**1,698**	**0.1**	**764.5**	**79.29**	***200***	***500***	**1641**	**53**	**4**
Dry Matter	25	59.2	94.8	85.1					
Total Hydrocarbons C7-C9	**20**	**3.5**	**164.1**	**10.30**	***500***	***1,250***	**20**	0	0
Total Hydrocarbons C10-C14	**19**	**5.0**	**20.0**	**8.8**	***2,200***	***5,500***	**19**	0	0
Total Hydrocarbons C15-C36	19	15.0	90.0	32.5					
Total Hydrocarbons	19	25.0	110.0	38.2					
Boron - Hot Water Soluble	**6**	**0.3**	**1.2**	**0.64**	***15,000***	***37,500***	**6**	0	0
Cyanide-Total	**7**	**0.1**	**6.4**	**6.40**	***3,750***	***9,375***	**7**	0	0
Cyanide, Soluble ('Free')	**7**	**0.2**	**0.3**	**0.22**	***1,250***	***3,125***	**7**	0	0
Iron	9	3.7	17,800	13,153					
Manganese-Total Recoverable	10	4	232	155					
Arsenic-Total Recoverable	**11**	**0.1**	**6.0**	**3.4**	***7,500***	***18,750***	**11**	0	0
Cadmium-Total Recoverable	**10**	**0.1**	**17.0**	**16.42**	***500***	***1,250***	**10**	0	0
Chromium-Total Recoverable	**9**	**16.0**	**40.0**	**29.77**	***100***	***250***	**9**	0	0
Chromium VI	8	0.2	1.0	0.4					
Chromium III	**9**	**16.0**	**40.0**	**31.55**	***500***	***1,250***	**9**	0	0
Copper-Total Recoverable	**9**	**4.0**	**247.0**	**159.3**	***5,000***	***12,500***	**9**	0	0
Mercury-Total Recoverable	**10**	**0.1**	**48.0**	**48.00**	***125***	***313***	**10**	0	0
Nickel-Total Recoverable	**10**	**0.1**	**66.0**	**39.74**	***3,000***	***7,500***	**10**	0	0
Lead-Total Recoverable	**10**	**3.1**	**38.0**	**19.56**	***1,500***	***3,750***	**10**	0	0
Selenium-Total Recoverable	8	10.0	15.3	11.6					
Zinc-Total Recoverable	**10**	**10.0**	**116.0**	**53.50**	***35,000***	***87,500***	**10**	0	0
Benzo(a) pyrene	**4**	**0.0**	**0.0**	**0.0**	***25***	***63***	**4**	0	0
PAH Screen-total	**5**	**0.2**	**18.0**	**9**	***100***	***250***	**5**	0	0
PCBs	**6**	**0.2**	**0.2**	**0.15**	***50***	***125***	**6**	0	0
Alpha-BHC	73	0.0	0.5	0.44					
Beta-BHC	73	0.0	0.5	0.44					
Delta-BHC	73	0.0	0.5	0.44					
Cis-Chlordane	73	0.0	0.5	0.44					
Trans-Chlordane	73	0.0	0.5	0.44					
Chlordane	**73**	**0.0**	**2.5**	**2.20**	***250***	***625***	**73**	0	0
Endosulphan I	73	0.0	0.5	0.44					
Endosulphan II	73	0.0	0.5	0.44					
Endosulphan sulphate	73	0.0	0.5	0.44					
Endrin	73	0.0	0.5	0.44					
Endrin aldehyde	80	0.0	41.2	4.18					
Heptachlor	**73**	**0.0**	**0.5**	**0.44**	***50***	***125***	**73**	0	0
Heptachlor epoxide	73	0.0	0.5	0.44					
Hexachlorobenzene	73	0.0	0.5	0.44					
Methoxychlor	73	0.0	0.5	0.44					

[1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

Table 67. Summary statistics for Pre-July 2005 Treated Fines validation

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	118	0.3	55.0	4.49					
Dieldrin	118	0.8	66.6	11.64					
Lindane	118	0.1	6.0	0.87					
A+D+10%L	**118**	**1.2**	**84.1**	**15.77**	***60***	***150***	**114**	**4**	0
2,4'-DDD	118	0.4	30.4	6.44					
2,4'-DDE	118	0.3	39.0	11.99					
2,4'-DDT	118	0.2	160.0	16.65					
4,4'-DDD	118	0.5	117.0	14.68					
4,4'-DDE	118	3.4	153.0	43.09					
4,4'-DDT	118	0.5	534.0	139.43					
DDX	**118**	**7.2**	**891.0**	**143.33**	***200***	***500***	**104**	**12**	**2**
Dry Matter	18	97.3	100.0	99.4					
Total N (leachable)	**19**	**145.0**	**601.0**	**431.15**					
Total Kjeld N	**19**	**144.0**	**587.0**	**426.2**					
Nitrate + Nitrite	19	1.3	13.6	5.5					
In estuary	17	0.1	0.3	0.2					
Ammonia	**0**	**0.0**	**0.0**	**-**					
Total Hydrocarbons C7-C9	**28**	**2.0**	**3.5**	**2.76**	***500***	***1250***	**28**	0	0
Total Hydrocarbons C10-C14	**28**	**4.0**	**5.0**	**4.55**	***2,200***	***5500***	**28**	0	0
Total Hydrocarbons C15-C36	28	50.0	300.0	147.13					
Total Hydrocarbons	27	50	300	150					
ONP & OPP tested?	**0**	**0.0**	**0.0**	**-**					
Species detected	**0**	**0.0**	**0.0**	**-**					
VOCs tested?	**0**	**0.0**	**0.0**	**-**					
Species detected	0	0.0	0.0	-					
Boron - Hot Water Soluble	**6**	**1.2**	**4.7**	**3.34**	***15,000***	***37500***	**6**	0	0
Cyanide-Total	**6**	**0.1**	**0.4**	**0.3**	***3,750***	***9375***	**6**	0	0
Cyanide, Soluble ('Free')	6	0.2	0.2	0.20	*1,250*	*3125*	6	0	0
0.00	**0**	**0.0**	**0.0**	**-**					
Iron	**0**	**0.0**	**0.0**	**-**					
Manganese-Total Recoverable	**6**	**243.0**	**317.0**	**287.8**	***7,500***	***18750***	**6**	0	0
Arsenic-Total Recoverable	**21**	**4.0**	**12.0**	**7.99**	***500***	***1250***	**21**	0	0
Cadmium-Total Recoverable	20	0.2	0.9	0.4	*100*	*250*	20	0	0
Chromium-Total Recoverable	**21**	**28.0**	**50.0**	**39.1**					
Chromium VI	**6**	**0.2**	**0.2**	**0.20**	***500***	***1250***	**6**	0	0
Chromium III	**6**	**28.0**	**50.0**	**42.76**	***60***	***150***	**6**	0	0
0.00	**0**	**0.0**	**0.0**	**-**					
Copper-Total Recoverable	23	260.0	4,970.0	1,606.77	*5,000*	*12500*	23	0	0
Mercury-Total Recoverable	21	0.1	1.3	0.64	*125*	*312.5*	21	0	0
Nickel-Total Recoverable	21	29.0	50.0	41.75	*3,000*	*7500*	21	0	0
Lead-Total Recoverable	21	10.1	254.0	72.06	*1,500*	*3750*	21	0	0
Selenium-Total Recoverable	6	10.0	10.0	10.00					
Zinc-Total Recoverable	**21**	**43.0**	**124.0**	**84.33**	***35,000***	***87500***	**21**	0	0
Benzo(a) pyrene	9	0.0	0.2	0.09	*25*	*62.5*	9	0	0
PAH Screen-total	9	0.7	2.2	1.44	*100*	*250*	9	0	0
PCBs	9	0.2	0.2	0.15	*50*	*125*	9	0	0
Alpha-BHC	64	0.5	0.5	0.50					
Beta-BHC	64	0.5	0.5	0.50					
Delta-BHC	**64**	**0.5**	**0.5**	**0.50**					
Cis-Chlordane	64	0.5	0.5	0.50					

[1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

Table 68. Summary statistics for Post-July 2005 Treated Fines validation

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	469	0.3	16.8	2.26					
Dieldrin	469	0.3	59.9	8.66					
Lindane	469	0.3	51.1	4.72					
A+D+10%L	**477**	**0.9**	**75.0**	**9.67**	***60***	***150***	**476**	**1**	0
Rolling ADL	**472**	**2.8**	**53.9**	**9.44**	***60***	***150***	**472**	0	0
2,4'-DDD	467	0.3	53.6	9.84					
2,4'-DDE	467	0.3	51.4	11.85					
2,4'-DDT	467	0.3	24.5	5.40					
4,4'-DDD	467	3.3	98.8	17.72					
4,4'-DDE	467	0.3	115.0	37.41					
4,4'-DDT	467	0.3	140.0	33.18					
DDX	**477**	**12.2**	**299.4**	**113.99**	***200***	***500***	**438**	**39**	0
Rolling DDX	**472**	**32.4**	**207.9**	**111.60**	***200***	***500***	**471**	**1**	0
Dry Matter	41	79.3	96.3	89.0					
Total N (leachable)	**99**	**4.5**	**975.0**	**424.65**					
Total Kjeld N	**99**	**1.1**	**967.0**	**419.1**					
Nitrate + Nitrite	99	0.0	36.5	6.0					
Ammonia	92	0.4	820.0	331.3					
Total Hydrocarbons C7-C9	**42**	**3.5**	**5.0**	**4.32**	***500***	***1250***	**42**	0	0
Total Hydrocarbons C10-C14	**42**	**5.0**	**10.0**	**9.94**	***2,200***	***5500***	**42**	0	0
Total Hydrocarbons C15-C36	43	15.0	450.0	165.88					
Total Hydrocarbons	42	30.0	450.0	164.38					
Boron - Hot Water Soluble	14	1	4	3	***15,000***	***37500***	**14**	0	0
Cyanide-Total	**15**	**0.1**	**3.1**	**0.7**	***3,750***	***9375***	**15**	0	0
Cyanide, Soluble ('Free')	**14**	**0.2**	**0.7**	**0.20**	***1,250***	***3125***	**14**	0	0
Iron	79	11,800	34,400	20,848					
Manganese-Total Recoverable	**130**	**175.0**	**573.0**	**294.80**	***7,500***	***18750***	**130**	0	0
Arsenic-Total Recoverable	**136**	**3.0**	**26.0**	**8.7**	***500***	***1250***	**136**	0	0
Cadmium-Total Recoverable	**136**	**0.1**	**3.8**	**0.51**	***100***	***250***	**136**	0	0
Chromium-Total Recoverable	136	18.0	79.0	38.96					
Chromium VI	**13**	**0.2**	**1.0**	**0.20**	***500***	***1250***	**13**	0	0
Chromium III	**14**	**29.0**	**54.0**	**39.0**	***60***	***150***	**14**	0	0
Copper-Total Recoverable	**136**	**40.0**	**5,250.0**	**1,923.6**	***5,000***	***12500***	**134**	**2**	0
Mercury-Total Recoverable	**135**	**0.1**	**2.4**	**0.4**	***125***	***312.5***	**135**	0	0
Nickel-Total Recoverable	**136**	**15.0**	**62.0**	**38.37**	***3,000***	***7500***	**136**	0	0
Lead-Total Recoverable	**136**	**18.4**	**147.0**	**47.84**	***1,500***	***3750***	**136**	0	0
Selenium-Total Recoverable	130	9.5	10.0	10.00					
Zinc-Total Recoverable	**136**	**32.0**	**331.0**	**82.00**	***35,000***	***87500***	**136**	0	0
Benzo(a) pyrene	**14**	**0.0**	**0.1**	**0.04**	***25***	***62.5***	**14**	0	0
PAH Screen-total	**14**	**0.2**	**1.0**	**0.82**	***100***	***250***	**14**	0	0
PCBs	**6**	**0.2**	**0.3**	**0.25**	***50***	***125***	**6**	0	0
Alpha-BHC	9	0.5	0.5	0.50					
Beta-BHC	9	0.5	0.5	0.50					
Delta-BHC	9	0.5	0.5	0.50					
Cis-Chlordane	9	0.5	0.5	0.50					
Trans-Chlordane	9	0.5	0.5	0.50					
Chlordane	**9**	**2.5**	**2.5**	**2.50**	***250***	***625***	**9**	0	0
Endosulphan I	9	0.5	0.5	0.50					
Endosulphan II	9	0.5	0.5	0.50					
Endosulphan sulphate	9	0.5	0.5	0.50					
Endrin	9	0.5	0.5	0.50					
Endrin aldehyde	9	0.5	0.5	0.50					
Heptachlor	**9**	**0.5**	**0.5**	**0.50**	***50***	***125***	**9**	0	0
Heptachlor epoxide	9	0.5	0.5	0.50					
Hexachlorobenzene	9	0.5	0.5	0.50					
Methoxychlor	9	0.5	0.5	0.50					

[1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

▪ Table 69. Summary statistics for 5-10 mm Treated Fine Component validation

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	9	0.25	1.40	0.61					
Dieldrin	9	0.25	13.40	4.01					
Lindane	9	0.02	8.00	3.00					
A+D+10%L	**9**	**0.53**	**13.68**	**4.58**	***60***	***150***	**9**	0	0
2,4'-DDD	9	0.25	2.70	1.54					
2,4'-DDE	9	0.20	9.40	3.59					
2,4'-DDT	9	0.70	6.00	3.34					
4,4'-DDD	9	0.25	4.00	2.11					
4,4'-DDE	9	0.95	42.90	14.79					
4,4'-DDT	9	3.30	21.40	11.30					
DDX	**9**	**7.40**	**61.20**	**33.56**	***200***	***500***	**9**	0	0
Alpha-BHC	1	0.002	0.002	-[4]					
Beta-BHC	1	0.008	0.008	-					
Delta-BHC	1	0.002	0.002	-					
Cis-Chlordane	1	0.017	0.017	-					
Trans-Chlordane	1	0.007	0.007	-					
Chlordane	**1**	**0.060**	**0.060**	**-**	***250***	***625***	**1**	0	0
Endosulphan I	1	0.011	0.011	-					
Endosulphan II	1	0.002	0.002	-					
Endosulphan sulphate	1	0.002	0.002	-					
Endrin	1	0.009	0.009	-					
Endrin aldehyde	1	0.002	0.002	-					
Heptachlor	**1**	**0.002**	**0.002**	**-**	***50***	***125***	**1**	0	0
Heptachlor epoxide	1	0.002	0.002	-					
Hexachlorobenzene	1	0.002	0.002	-					
Methoxychlor	1	0.002	0.002	-					

[1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

[4] Not enough samples to produce a valid 95% UCL.

Table 70. Weights of high toxicity drum loads exported to Germany

Date	Drum #	Weight of Material (kg)
Jun-05	908 / 21	133.0
Jun-05	916 / 22	130.8
Jun-05	918 / 23	40.1
	Sub-Total	***303.9***
Apr-06	1	130.9
Apr-06	2	129.0
Apr-06	3	132.1
Apr-06	4	134.0
Apr-06	5	134.3
Apr-06	6	135.1
Apr-06	7	131.5
Apr-06	8	128.1
Apr-06	9	133.5
Apr-06	10	129.5
	Sub-Total	***1,317.8***
Jun-07	328	132.3
Jun-07	329	132.4
Jun-07	330	132.4
Jun-07	331	132.4
Jun-07	332	132.2
Jun-07	333	132.0
Jun-07	334	132.3
Jun-07	335	132.5
Jun-07	336	115.3
Jun-07	337	131.4
Jun-07	338	101.8
	Sub-Total	***1,407.2***
	TOTAL	***3,028.9***

Table 71. Summary of material exported to Eves Valley Landfill.

Date	Items Taken	Weight (kg)	Est. % Fines	Sample #	DDX (mg/kg)	ADL (mg/kg)	*DDX + ADL (mg/kg)*	Comments
Max					**29.7**	**26.4**	***40.7***	
Average					**4.8**	**0.9**	***5.7***	
07-Nov-05	Greenwaste	4,130	1%	none	0.5	0.05	0.55	Totally greenwaste, little / no fines
08-Nov-05	Greenwaste	`	1%	none	0.5	0.05	0.55	Totally greenwaste, little / no fines
08-Nov-05	Greenwaste, trees	8,250	1%	none	0.5	0.05	0.55	Totally greenwaste, little / no fines
14-Nov-05	Greenwaste	3,540	1%	none	0.5	0.05	0.55	Totally greenwaste, little / no fines
28-Nov-05	Plastic, stones, glass	5,360	3%	unable	3	0.51	3.51	Some plastic, glass, few fines
29-Nov-05	Greenwaste	4,070	1%	none	0.5	0.05	0.55	Totally greenwaste, little / no fines
29-Nov-05	fencing	3,190	2%	unable	2	0.34	2.34	Fencing landfill
30-Nov-05	fencing	3,570	2%	unable	2	0.34	2.34	Fencing landfill
01-Dec-05	Solid Waste	5,200	5%	unable	5	0.85	5.85	very clean, little soil, no sample
01-Dec-05	Plastic	5,900	3%	unable	3	0.51	3.51	Mostly plastic, wood, rocks
01-Dec-05	Solid Waste	6,550	5%	unable	5	0.85	5.85	Concrete, plastic, wood
07-Dec-05	Solid Waste	5,160	5%	unable	5	0.85	5.85	Concrete, plastic, bags
07-Dec-05	Solid Waste	6,890	5%	unable	5	0.85	5.85	very clean, little soil, no sample
07-Dec-05	Solid Waste	8,070	5%	unable	5	0.85	5.85	plastic, stones, timber
07-Dec-05	Solid Waste	6,900	5%	unable	5	0.85	5.85	Plastic, timber, concrete
08-Dec-05	Plastic, stones, glass	6,470	4%	unable	4	0.68	4.68	lots of plastic, stones; no sample
08-Dec-05	Solid Waste	7,670	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
08-Dec-05	Plastic, Solid Waste	7,100	4%	unable	4	0.68	4.68	plastic, timber, stones, bottles
09-Dec-05	Solid Waste	7,110	5%	unable	5	0.85	5.85	Plastic, sacking, concrete
12-Dec-07	Solid Waste	7,190	5%	unable	5	0.85	5.85	Concrete, timber, metal
13-Dec-05	Solid Waste	6,100	5%	unable	5	0.85	5.85	Plastic, timber, metal, concrete
13-Dec-05	Solid Waste	5,190	5%	unable	5	0.85	5.85	Plastic. Stones, timber
13-Dec-05	Solid Waste	5,360	5%	unable	5	0.85	5.85	concrete, metal, plastic
13-Dec-05	Plastic, Waste	3,930	4%	unable	4	0.68	4.68	lots of plastic, stones; no sample
13-Dec-05	Plastic, nylon, Waste	4,570	4%	unable	4	0.68	4.68	plastic, nylon, timber, stones
13-Dec-05	Waste	6,110	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
19-Dec-05	concrete, rocks	10,280	5%	3416, 3417	2.45	0.3	2.75	few fines, managed to sample !!!
12-Jan-06	Solid Waste	5,540	5%	3445	19.35	0.3	19.65	Plastic, sacking, stones, metal
12-Jan-06	Solid Waste	4,800	5%	3446	4.65	0.5	5.15	Concrete, stone
12-Jan-06	Solid Waste, plastic	7,100	5%	3447	4.75	0.7	5.45	plastic, stones, timber
13-Jan-06	Solid Waste	5,220	5%	3448	4.95	2.2	7.15	Plastic, sacking, bottles
13-Jan-06	Solid Waste	5,330	5%	unable	5	0.85	5.85	Timber, concrete, metal
13-Jan-06	Solid Waste	7,020	5%	3449	4.75	1.05	5.8	Stones, nylon, concrete
13-Jan-06	Solid Waste	4,430	5%	unable	5	0.85	5.85	Timber, plastic, bottles
13-Jan-06	Solid Waste	7,840	5%	3450	6.4	14.2	20.6	Plastic, concrete, timber
13-Jan-06	Solid Waste	6,300	5%	unable	5	0.85	5.85	Sacking, concrete, stones
18-Jan-06	Solid Waste	4,480	5%	unable	5	0.85	5.85	Nylon, concrete, sacking, plastic
18-Jan-06	Solid Waste	2,740	3%	unable	3	0.51	3.51	Plastic, nylon, sacking
18-Jan-06	Solid Waste	3,730	3%	unable	3	0.51	3.51	Glass, nylon, sacking, plastic
18-Jan-06	Solid Waste	4,440	5%	unable	5	0.85	5.85	Plastic, sacking, nylon, metal
01-Feb-06	Solid Waste	6,750	5%	unable	5	0.85	5.85	concrete, metal, plastic
01-Feb-06	Solid Waste	6,890	5%	unable	5	0.85	5.85	concrete, metal, plastic
01-Feb-06	Solid Waste	3,730	4%	unable	4	0.68	4.68	Bottles, plastic, metal, stones
07-Feb-06	Solid Waste	3,470	4%	unable	4	0.68	4.68	lots of plastic, stones; no sample
13-Feb-06	Solid Waste	7,720	5%	unable	5	0.85	5.85	Concrete, plastic, wood
13 Eb 06	Solid Waste	7,920	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
13-Feb-06	Solid Waste	8,310	5%	unable	5	0.85	5.85	Concrete, plastic, wood
14-Feb-06	Solid Waste	3,790	4%	unable	4	0.68	4.68	Timber, plastic, bottles
14-Feb-06	Solid Waste	4,230	5%	unable	5	0.85	5.85	Timber, concrete, metal
14-Feb-06	Solid Waste	4,920	5%	unable	5	0.85	5.85	Concrete, plastic, wood
15-Feb-06	Solid Waste	5,060	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
15-Feb-06	Solid Waste	5,120	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
15-Feb-06	Solid Waste	5,870	5%	unable	5	0.85	5.85	Concrete, plastic, wood
16-Feb-06	Solid Waste	4,330	5%	unable	5	0.85	5.85	Timber, concrete, metal
16-Feb-06	Solid Waste	4,760	5%	unable	5	0.85	5.85	Timber, plastic, bottles
16-Feb-06	Solid Waste	6,430	5%	unable	5	0.85	5.85	Concrete, plastic, wood
16-Feb-06	Solid Waste	7,830	5%	unable	5	0.85	5.85	concrete, metal, plastic
16-Feb-06	Solid Waste	8,470	5%	unable	5	0.85	5.85	very clean, little soil, no sample
16-Feb-06	Solid Waste	4,260	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
17-Feb-06	Solid Waste	4,720	5%	unable	5	0.85	5.85	Timber, plastic, bottles
17-Feb-06	Solid Waste	5,880	5%	unable	5	0.85	5.85	Concrete, plastic, wood
17-Feb-06	Solid Waste	4,870	5%	unable	5	0.85	5.85	Timber, concrete, metal
17-Feb-06	Solid Waste	6,770	5%	unable	5	0.85	5.85	concrete, metal, plastic
17-Feb-06	Solid Waste	6,810	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
17-Feb-06	Solid Waste	8,400	5%	unable	5	0.85	5.85	Oversize, plastic
17-Feb-06	Solid Waste	9,500	5%	unable	5	0.85	5.85	Concrete, stone
17-Feb-06	Solid Waste	8,580	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
17-Feb-06	Solid Waste	7,870	5%	unable	5	0.85	5.85	Concrete, stone
18-Feb-06	Solid Waste	9,180	5%	unable	5	0.85	5.85	very clean, little soil, no sample
18-Feb-06	Solid Waste	8,210	5%	unable	5	0.85	5.85	concrete, metal, plastic
20-Feb-06	Solid Waste	6,400	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
20-Feb-06	Solid Waste	6,750	5%	unable	5	0.85	5.85	Concrete, stone
20-Feb-06	Solid Waste	5,590	5%	unable	5	0.85	5.85	Timber, plastic, bottles

20-Feb-06	Solid Waste	10,510	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
20-Feb-06	Solid Waste	8,930	5%	3810	3.9	0.3	4.2	Concrete, plastic, wood
20-Feb-06	Solid Waste	9,800	5%	unable	5	0.85	5.85	Plastic, concrete, timber
20-Feb-06	Solid Waste	8,650	5%	3811	5.1	0.35	5.45	Metal, concrete, plastic; no sample
21-Feb-06	Solid Waste	9,060	5%	unable	5	0.85	5.85	Concrete, plastic, wood
21-Feb-06	Solid Waste	5,700	5%	3916	5.25	0.3	5.55	Metal, concrete, plastic; no sample
21-Feb-06	Solid Waste	7,030	5%	unable	5	0.85	5.85	Plastic, difficult to take sample
21-Feb-06	Solid Waste	7,050	5%	3917	8.9	1	9.9	Metal, concrete, plastic; no sample
21-Feb-06	Solid Waste	7,060	5%	unable	5	0.85	5.85	Concrete, plastic, wood
21-Feb-06	Solid Waste	6,200	5%	unable	5	0.85	5.85	Concrete, timber, metal
28-Feb-06	Solid Waste	6,850	5%	unable	5	0.85	5.85	Plastic, concrete, timber
28-Feb-06	Solid Waste	5,870	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
01-Mar-06	Solid Waste	5,910	5%	unable	5	0.85	5.85	concrete, metal, plastic
01-Mar-06	Solid Waste	6,700	5%	unable	5	0.85	5.85	Plastic, difficult to take sample
01-Mar-06	Solid Waste	9,550	5%	unable	5	0.85	5.85	Concrete, plastic, wood
01-Mar-06	Solid Waste	6,760	5%	unable	5	0.85	5.85	Plastic, difficult to take sample
01-Mar-06	Solid Waste	7,270	5%	unable	5	0.85	5.85	Concrete, timber, metal
02-Mar-06	Solid Waste	3,480	5%	3985	4.85	0.85	5.7	Plastic, concrete, timber
02-Mar-06	Solid Waste	3,430	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
02-Mar-06	Solid Waste	3,920	5%	unable	5	0.85	5.85	Plastic, concrete, timber
02-Mar-06	Solid Waste	3,230	5%	unable	5	0.85	5.85	Concrete, plastic, steel, wood
08-Mar-06	Solid Waste	3,090	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
08-Mar-06	Solid Waste	4,450	5%	4070	28.8	0.85	29.65	Plastic. Stones, timber, concrete
08-Mar-06	Solid Waste	6,670	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
08-Mar-06	Solid Waste	7,430	5%	unable	5	0.85	5.85	Concrete, timber, metal
10-Mar-06	Solid Waste	5,890	5%	unable	5	0.85	5.85	Plastic, concrete, timber
10-Mar-06	Solid Waste	7,320	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
10-Mar-06	Solid Waste	7,470	5%	unable	5	0.85	5.85	plastic, stones, timber
14-Mar-06	Solid Waste	7,860	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
14-Mar-06	Solid Waste	6,260	5%	unable	5	0.85	5.85	Plastic, difficult to take sample
14-Mar-06	Solid Waste	5,960	5%	unable	5	0.85	5.85	Concrete, plastic, steel, wood
15-Mar-06	Solid Waste	4,410	5%	unable	5	0.85	5.85	Concrete, plastic, wood
15-Mar-06	Solid Waste	7,210	5%	unable	5	0.85	5.85	Plastic. Stones, timber
15-Mar-06	Solid Waste	3,800	4%	unable	4	0.68	4.68	Plastic, concrete, timber
15-Mar-06	Solid Waste	5,120	5%	unable	5	0.85	5.85	Concrete, timber, metal
15-Mar-06	Solid Waste	6,750	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
15-Mar-06	Solid Waste	6,210	5%	unable	5	0.85	5.85	plastic, stones, timber
15-Mar-06	Solid Waste	6,550	5%	unable	5	0.85	5.85	Concrete, plastic, steel, wood
15-Mar-06	Solid Waste	1,940	3%	unable	3	0.51	3.51	Plastic, wood, stones
16-Mar-06	Solid Waste	6,550	5%	4195	29.7	1.55	31.25	Plastic, wood, scrap metal
20-Mar-06	Solid Waste	4,690	5%	unable	5	0.85	5.85	Concrete, timber, metal
20-Mar-06	Solid Waste	3,390	4%	4194	14.28	26.4	40.68	Plastic, concrete, timber
20-Mar-06	Solid Waste	3,390	4%	unable	4	0.68	4.68	plastic, stones, timber
21-Mar-06	Solid Waste	6,870	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
22-Mar-06	Solid Waste	5,770	5%	unable	5	0.85	5.85	Plastic. Stones, timber
22-Mar-06	Solid Waste	5,720	5%	4221	14	0.45	14.45	Metal, concrete, plastic
23-Mar-06	Solid Waste	5,840	5%	unable	5	0.85	5.85	Concrete, plastic, wood
23-Mar-06	Solid Waste	6,910	5%	4222	13.35	0.7	14.05	concrete, metal, plastic
23-Mar-06	Solid Waste	7,620	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
23-Mar-06	Solid Waste	7,040	5%	unable	5	0.85	5.85	Concrete, timber, metal
24-Mar-06	Solid Waste	6,260	5%	unable	5	0.85	5.85	Plastic, concrete, timber
31-Mar-06	Solid Waste	5,110	5%	4371	0.6	0.05	0.65	Plastic. Stones, timber
04-Apr-06	Solid Waste	6,730	5%	unable	5	0.85	5.85	Plastic, concrete, timber
04-Apr-06	Solid Waste	7,790	5%	unable	5	0.85	5.85	Concrete, plastic, wood
04-Apr-06	Solid Waste	7,470	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
04-Apr-06	Solid Waste	7,170	5%	unable	5	0.85	5.85	Concrete, plastic, steel, wood
04-Apr-06	Solid Waste	8,430	5%	unable	5	0.85	5.85	concrete, metal, plastic
04-Apr-06	Solid Waste	5,250	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
04-Apr-06	Solid Waste	5,280	5%	unable	5	0.85	5.85	Plastic, concrete, timber
04-Apr-06	Solid Waste	6,550	5%	unable	5	0.85	5.85	Concrete, plastic, wood
04-Apr-06	Solid Waste	4,900	5%	unable	5	0.85	5.85	Concrete, plastic, steel, wood
04-Apr-06	Solid Waste	7,350	5%	unable	5	0.85	5.85	Sacking, concrete, stones
05-Apr-06	Solid Waste	6,710	5%	4271	0.65	0.05	0.7	Plastic, sacking, stones, metal
05-Apr-06	Solid Waste	6,270	5%	4272	1.65	0.15	1.8	Bottles, plastic, metal, stones
05-Apr-06	Solid Waste	4,360	5%	4366	0.8	0.05	0.85	Mostly plastic, wood, rocks
10-Apr-06	Solid Waste	4,570	5%	unable	5	0.85	5.85	Sacking, concrete, stones
10-Apr-06	Solid Waste	7,340	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
11-Apr-06	Solid Waste	7,800	5%	4368	0.8	0.05	0.85	concrete, metal, plastic
11-Apr-06	Solid Waste	5,920	5%	4367	0.85	0.1	0.95	Plastic, sacking, stones, metal
11-Apr-06	Solid Waste	5,990	5%	unable	5	0.85	5.85	concrete, metal, plastic
11-Apr-06	Solid Waste	8,340	5%	unable	5	0.85	5.85	Sacking, concrete, stones
11-Apr-06	Solid Waste	9,350	5%	unable	5	0.85	5.85	plastic, stones, timber
12-Apr-06	Solid Waste	6,160	5%	unable	5	0.85	5.85	Timber, concrete, metal
12-Apr-06	Solid Waste	4,740	5%	unable	5	0.85	5.85	Plastic, sacking, stones, metal
12-Apr-06	Solid Waste	4,680	5%	unable	5	0.85	5.85	Mostly plastic, wood, rocks
12-Apr-06	Solid Waste	12,570	5%	unable	5	0.85	5.85	plastic, stones, timber
18-Apr-06	Solid Waste	6,190	5%	4369	5	0.85	5.85	Metal, concrete, plastic; no sample
18-Apr-06	Solid Waste	4,620	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
19-Apr-06	Solid Waste	8,400	5%	unable	5	0.85	5.85	concrete, metal, plastic
19-Apr-06	Solid Waste	9,370	5%	4370	0.35	0.05	0.4	Plastic, sacking, stones, metal

19-Apr-06	Solid Waste	7,060	5%	unable	5	0.85	5.85	Timber, concrete, metal
26-Apr-06	Solid Waste	8,020	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
26-Apr-06	Solid Waste	9,320	5%	unable	5	0.85	5.85	very clean, little soil, no sample
27-Apr-06	Solid Waste	4,060	5%	unable	5	0.85	5.85	concrete, metal, plastic
27-Apr-06	Solid Waste	4,500	5%	4588	1.5	0.1	1.6	Mostly plastic, wood, rocks
27-Apr-06	Solid Waste	8,010	5%	unable	5	0.85	5.85	plastic, stones, timber
27-Apr-06	Solid Waste	7,240	5%	4589	0.45	0.05	0.5	Metal, concrete, plastic; no sample
11-May-06	Solid Waste	5,450	5%	unable	5	0.85	5.85	Mostly plastic, wood, rocks
11-May-06	Solid Waste	1,830	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
28-Sep-06	Solid Waste & fencing	3,200	5%	unable	5	0.85	5.85	Sacking, concrete, plastic, fencing
08-Jan-07	Solid Waste	9,600	5%	unable	5	0.85	5.85	Plastic, timber, concrete
08-Jan-07	Solid Waste	9,910	5%	unable	5	0.85	5.85	Plastic, timber, misc debries
11-Jan-07	Solid Waste	6,790	5%	6097	0.15	0.05	0.2	Plastic,sticks, metal
11-Jan-07	Solid Waste	9,350	5%	unable	5	0.85	5.85	Metal scrap, plastic
11-Jan-07	Solid Waste	12,160	5%	unable	5	0.85	5.85	Plastic, timber, stumps, stones
12-Jan-07	Solid Waste	9,250	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
12-Jan-07	Solid Waste	7,830	5%	unable	5	0.85	5.85	very clean, little soil, no sample
12-Jan-07	Solid Waste	9,820	5%	unable	5	0.85	5.85	concrete, metal, plastic
12-Jan-07	Solid Waste	9,370	5%	unable	5	0.85	5.85	Plastic, sacking, stones, metal
12-Jan-07	Solid Waste	10,020	5%	unable	5	0.85	5.85	Sacking, concrete, stones
15-Jan-07	fencing West	2,240	3%	unable	3	0.51	3.51	Fencing material
15-Jan-07	Solid Waste	7,950	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
15-Jan-07	Solid Waste	9,060	5%	unable	5	0.85	5.85	concrete, metal, plastic
15-Jan-07	Solid Waste	7,730	5%	unable	5	0.85	5.85	Plastic, sacking, stones, metal
15-Jan-07	Solid Waste	7,890	5%	unable	5	0.85	5.85	plastic, stones, timber
15-Jan-07	Solid Waste	7,160	5%	unable	5	0.85	5.85	Mostly plastic, wood, rocks
19-Jan-07	Fencing west	2,340	5%	unable	5	0.85	5.85	Fencing material
19-Jan-07	fencing east	2,390	5%	unable	5	0.85	5.85	Fencing material
19-Feb-07	Solid Waste	4,210	5%	6098	0.15	0.05	0.2	Metal, concrete, plastic; no sample
23-Feb-07	Greenwaste	3,870	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
02-Mar-07	Greenwaste	4,780	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
05-Mar-07	Solid Waste	9,210	5%	unable	5	0.85	5.85	Sacking, concrete, stones
05-Mar-07	Solid Waste	8,110	5%	unable	5	0.85	5.85	Plastic, wood, stones, metal
05-Mar-07	Solid Waste	7,920	5%	unable	5	0.85	5.85	concrete, metal, plastic
05-Mar-07	Solid Waste	7,530	5%	unable	5	0.85	5.85	Metal, concrete, plastic; no sample
05-Mar-07	Solid Waste	7,100	5%	unable	5	0.85	5.85	concrete, metal, plastic
09-Mar-07	Solid Waste	2,880	3%	6099	0.09	0.03	0.12	Plastic, sacking, stones, metal
19-Mar-07	Solid Waste	8,350	5%	unable	5	0.85	5.85	Bottles, plastic, metal, stones
20-Mar-07	Greenwaste	2,250	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
23-Mar-07	Solid Waste	1,980	3%	unable	3	0.51	3.51	plastic, stones, timber
30-Mar-07	Solid Waste	3,490	4%	unable	4	0.68	4.68	Metal, concrete, plastic; no sample
30-Mar-07	Greenwaste	940	2%	unable	2	0.34	2.34	Totally greenwaste, little / no fines
02-Apr-07	Fencing West paddock	1,120	2%	unable	2	0.34	2.34	Fencing material
20-Apr-07	Solid Waste	6,960	5%	unable	5	0.85	5.85	concrete, metal, plastic
23-Apr-07	Greenwaste & piping	7,010	5%	6428	0.15	0.05	0.2	trees, piping, metal
23-Apr-07	Greenwaste	1,720	2%	6429	0.16	0.08	0.24	Totally greenwaste, little / no fines
23-Apr-07	Solid Waste	4,800	5%	unable	5	0.85	5.85	Totally greenwaste, little / no fines
11-May-07	Solid Waste	5,140	5%	6542	0.15	0.05	0.2	Sacking, concrete, stones
22-May-07	Solid Waste	16,450	5%	unable	5	0.85	5.85	Concrete footings (truck / trailer)
22-May-07	Solid Waste	16,030	5%	unable	5	0.85	5.85	Concrete footings (truck / trailer)
22-May-07	Solid Waste	18,420	5%	unable	5	0.85	5.85	Concrete footings (truck / trailer)
24-May-07	Solid Waste	18,480	5%	unable	5	0.85	5.85	Concrete footings (truck / trailer)
24-May-07	Solid Waste	18,480	5%	unable	5	0.85	5.85	Concrete footings (truck / trailer)
25-May-07	Solid Waste	7,930	5%	6711	2	0.25	2.25	Mostly plastic, wood, rocks
01-Jun-07	Solid Waste	6,550	5%	6712	1.35	0.15	1.5	Fencing, plastic, wood, stones

- **Table 72. Summary statistics for residential and topsoil imported material results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	Pass	Fail
Aldrin	37	0.00	0.50	0.42			
Dieldrin	37	0.00	0.50	0.27			
Lindane	35	0.00	0.50	0.29			
A+D+10%L	**37**	**0.00**	**1.05**	**-**	***3***	**37**	0
2,4'-DDD	37	0.00	0.50	0.39			
2,4'-DDE	37	0.00	0.50	0.89			
2,4'-DDT	37	0.00	0.50	0.50			
4,4'-DDD	37	0.00	0.50	0.57			
4,4'-DDE	37	0.00	0.50	0.31			
4,4'-DDT	37	0.00	1.59	1.01			
DDX	**37**	**0.00**	**3.00**	**-**	***5***	**37**	0
Dry Matter	21	68.20	98.90	90.47			
pH	2	5.70	6.10	6.28			
Total Hydrocarbons C7-C9	**9**	**3.5**	**5.0**	**4.19**	***500***	**9**	0
Total Hydrocarbons C10-C14	**9**	**5.0**	**15.0**	**9.81**	***510***	**9**	0
Total Hydrocarbons C15-C36	9	15.0	30.0	21.38			
Total Hydrocarbons	9	25.0	50.0	38.17			
Boron - Hot Water Soluble	**8**	**0.25**	**2.80**	**2.33**	***3***	**8**	0
Cyanide-Total	**15**	**0.05**	**0.30**	**0.09**	***50***	**15**	0
Cyanide, Soluble ('Free')	15	0.20	0.20	0.20			
Iron	19	10,200	44,800	30,151			
Manganese-Total Recoverable	**24**	**111**	**1,960**	**687.62**	***1,500***	**23**	**1**
Arsenic-Total Recoverable	**23**	**1.0**	**6.0**	**4.45**	***30***	**23**	0
Cadmium-Total Recoverable	**23**	**0.05**	**0.60**	**0.17**	***3***	**23**	0
Chromium-Total Recoverable	24	12.0	129.0	45.98			
Chromium VI	**21**	**0.20**	**2.00**	**0.92**	***9***	**21**	0
Chromium III	**21**	**12.0**	**129.0**	**44.45**	***600***	**21**	0
Copper-Total Recoverable	**23**	**7.0**	**57.0**	**29.59**	***300***	**23**	0
Mercury-Total Recoverable	**23**	**0.05**	**0.40**	**0.10**	***1***	**23**	0
Nickel (Residential Material)	**9**	**14.0**	**109.0**	**62.06**	***600***	**9**	0
Nickel (Topsoil Material)	**14**	**10.0**	**142.0**	**54.08**	***60***	**13**	**1**
Lead-Total Recoverable	**23**	**4.70**	**172.0**	**23.08**	***300***	**23**	0
Selenium-Total Recoverable	**19**	**10**	**10**	**10.00**	***600***	**19**	0
Zinc-Total Recoverable	**23**	**28**	**211**	**78.79**	***200***	**22**	**1**
Benzo(a) pyrene	**8**	**0.01**	**0.03**	**0.02**	***0***	**8**	0
PAH Screen-total	**8**	**0.20**	**0.48**	**0.34**	***20***	**8**	0
PCBs	**8**	**0.02**	**0.15**	**0.13**	***10***	**8**	0
Alpha-BHC	30	0.00	0.50	0.49			
Beta-BHC	30	0.00	0.50	0.49			
Delta-BHC	30	0.00	0.50	0.49			
Cis-Chlordane	30	0.00	0.50	0.49			
Trans-Chlordane	30	0.00	0.50	0.49			
Chlordane	**30**	**0.00**	**2.50**	**3.16**	***50***	**30**	0
Endosulphan I	30	0.00	0.50	0.49			
Endosulphan II	30	0.00	0.50	0.49			
Endosulphan sulphate	30	0.00	0.50	0.49			
Endrin	30	0.00	0.50	0.49			
Endrin aldehyde	30	0.00	0.50	0.49			
Heptachlor	**30**	**0.00**	**0.50**	**0.49**	***10***	**30**	0
Heptachlor epoxide	30	0.00	0.50	0.49			
Hexachlorobenzene	30	0.00	0.50	0.49			
Methoxychlor	30	0.00	0.50	0.49			

[1] *Residential/Topsoil SAC (differs only for Nickel)*

Table 73. Summary statistics for imported marine sediment results (unless stated, all values in mg/kg).

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	Pass	Fail
Aldrin	10	0.00025	0.00025	0.00025			
Dieldrin	10	0.00025	0.0015	0.00084			
Lindane	10	0.00025	0.0008	0.00044			
A+D+10%L	**10**	**0.00053**	**0.00178**	**0.00115**	***0.01***	**10**	0
2,4'-DDD	10	0.00025	0.00025	0.00025			
2,4'-DDE	10	0.00025	0.0009	0.00043			
2,4'-DDT	10	0.00025	0.0009	0.00050			
4,4'-DDD	10	0.00025	0.001	0.00043			
4,4'-DDE	10	0.00025	0.0055	0.00296			
4,4'-DDT	10	0.00025	0.0055	0.00359			
DDX	**10**	**0.0015**	**0.012**	**0.00775**	***0.01***	**9**	**1**
Dry Matter	3	89.6	98	-[3]			
Boron - Hot Water Soluble	1	0.25	0.25	-			
Cyanide-Total	1	0.5	0.5	-			
Cyanide, Soluble ('Free')	1	0.2	0.2	-			
Iron	1	17,200	17,200	-			
Manganese-Total Recoverable	2	266	509	-			
Arsenic-Total Recoverable	**2**	**1**	**4**	-	***20***	**2**	0
Cadmium-Total Recoverable	**2**	**0.05**	**0.05**	-	***1.5***	**2**	0
Chromium-Total Recoverable	3	32	110	-			
Chromium VI	**3**	**0.2**	**0.2**	-	***80***	**3**	0
Chromium III	3	32	110	-			
Copper-Total Recoverable	**2**	**21**	**29**	-	***65***	**2**	0
Mercury-Total Recoverable	**2**	**0.05**	**0.05**	-	***0.15***	**2**	0
Nickel-Total Recoverable	**2**	**48**	**165**	-	***70***	**1**	**1**
Lead-Total Recoverable	**2**	**6.2**	**7.9**	-	***50***	**2**	0
Selenium-Total Recoverable	1	10	10	-			
Zinc-Total Recoverable	**2**	**40**	**69**	-	***200***	**2**	0
Benzo(a) pyrene	**1**	**0.01**	**0.01**	-	***0.43***	**1**	0
Alpha-BHC	10	0.00025	0.00025	0.00025			
Beta-BHC	10	0.00025	0.00025	0.00025			
Delta-BHC	10	0.00025	0.00025	0.00025			
Cis-Chlordane	10	0.00025	0.00025	0.00025			
Trans-Chlordane	10	0.00025	0.00025	0.00025			
Chlordane	**10**	**0.001**	**0.001**	**0.00100**	***0.0005***	0	**10**[2]
Endosulphan I	10	0.00025	0.00025	0.00025			
Endosulphan II	10	0.00025	0.0013	0.00063			
Endosulphan sulphate	10	0.00025	0.0013	0.00050			
Endrin	10	0.00025	0.00025	0.00025			
Endrin aldehyde	10	0.00025	0.00025	0.00025			
Heptachlor	10	0.00025	0.00025	0.00025			
Heptachlor epoxide	10	0.00025	0.00025	0.00025			
Hexachlorobenzene	10	0.00025	0.00025	0.00025			
Methoxychlor	10	0.00025	0.00025	0.00025			
4,4'-DDD	10	0.00025	0.001	0.00043			

[1] *Marine SAC*

[2] *SAC is below detection limit of tests*

[3] *Too few samples for a meaningful 95% UCL Avg.*

- **Table 74. Summary statistics for individual FCC East Site Excavation results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC[1]*	*2.5 x SAC[2]*	Pass[3]	Marginal[3]	Fail[3]
Aldrin	719	0.0	24.0	0.82					
Dieldrin	719	0.0	41.2	0.98					
Lindane	719	0.0	30.6	0.82					
A+D+10%L	**719**	**0.0**	**41.7**	**1.87**	***60***	***150***	**719**	0	0
2,4'-DDD	719	0.0	27.0	1.25					
2,4'-DDE	719	0.0	7.0	0.41					
2,4'-DDT	719	0.0	36.0	1.43					
4,4'-DDD	719	0.0	113.0	2.55					
4,4'-DDE	719	0.0	33.0	1.02					
4,4'-DDT	718	0.0	211.0	7.51					
DDX	**719**	**0.0**	**282.5**	**14.22**	***200***	***500***	**715**	**4**	0
Dry Matter	282	65.6	100.0	88.7					
Total Hydrocarbons C7-C9	**280**	**2.0**	**20.0**	**4.48**	***500***	***1250***	**280**	0	0
Total Hydrocarbons C10-C14	**279**	**4.0**	**1,200.0**	**11.6**	***2,200***	***5500***	**279**	0	0
Total Hydrocarbons C15-C36	279	1.5	1,680.0	34.3					
Total Hydrocarbons	281	0.3	2,900.0	51.0					
Boron - Hot Water Soluble	**50**	**0.3**	**5.6**	**0.35**	***15,000***	***37500***	**50**	0	0
Cyanide-Total	**50**	**0.1**	**0.1**	**0.05**	***3,750***	***9375***	**50**	0	0
Cyanide, Soluble ('Free')	**50**	**0.2**	**0.2**	**0.20**	***1,250***	***3125***	**50**	0	0
Iron	63	1,430	20,100	12,738					
Manganese-Total Recoverable	**72**	**15.0**	**378.0**	**158.4**	***7,500***	***18750***	**72**	0	0
Arsenic-Total Recoverable	**74**	**1.0**	**0.1**	**3.09**	***500***	***1250***	**74**	0	0
Cadmium-Total Recoverable	**74**	**0.1**	**0.1**	**0.05**	***100***	***250***	**74**	0	0
Chromium-Total Recoverable	74	8.0	60.0	27.6					
Chromium VI	**67**	**0.1**	**1.0**	**0.47**	***500***	***1250***	**67**	0	0
Chromium III	67	8.0	60.0	27.3					
Chromium III (%)	**67**	**0.001%**	**0.006%**	**0.003%**	***60%***	***150%***	**67**	0	0
Copper-Total Recoverable	**74**	**3.0**	**94.0**	**11.30**	***5,000***	***12500***	**74**	0	0
Mercury-Total Recoverable	**74**	**0.1**	**0.1**	**0.05**	***125***	***312.5***	**74**	0	0
Nickel-Total Recoverable	**74**	**1.0**	**243.0**	**60.1**	***3,000***	***7500***	**74**	0	0
Lead-Total Recoverable	**74**	**2.3**	**35.7**	**6.83**	***1,500***	***3750***	**74**	0	0
Selenium-Total Recoverable	72	10.0	10.0	10.0					
Zinc-Total Recoverable	**74**	**2.0**	**181.0**	**34.1**	***35,000***	***87500***	**74**	0	0
Benzo(a) pyrene	**49**	**0.0**	**0.1**	**0.03**	***25***	***62.5***	**49**	0	0
PAH Screen-total	**49**	**0.1**	**2.0**	**0.42**	***100***	***250***	**49**	0	0
PCBs	**48**	**0.0**	**0.2**	**0.15**	***50***	***125***	**48**	0	0
Alpha-BHC	499	0.0	0.5	0.44					
Beta-BHC	499	0.0	0.5	0.44					
Delta-BHC	499	0.0	0.5	0.44					
Cis-Chlordane	499	0.0	0.5	0.44					
Trans-Chlordane	499	0.0	0.5	0.44					
Chlordane	**499**	**0.0**	**2.5**	**2.21**	***250***	***625***	**499**	0	0
Endosulphan I	499	0.0	0.5	0.44					
Endosulphan II	499	0.0	1.0	0.45					
Endosulphan sulphate	499	0.0	0.5	0.44					
Endrin	499	0.0	0.5	0.44					
Endrin aldehyde	499	0.0	0.5	0.44					
Heptachlor	**499**	**0.0**	**0.5**	**0.44**	***50***	***125***	**499**	0	0
Heptachlor epoxide	499	0.0	0.5	0.44					
Hexachlorobenzene	499	0.0	0.5	0.44					
Methoxychlor	499	0.0	0.5	0.44					

1 Commercial SAC
2 Commercial limit for individual samples is 2.5 x SAC
3 Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC)

- **Table 75. OCP Validation sample results averaged per FCC East Site excavation cell (all values in mg/kg).**

Cell	Average A+D +10%L	Average DDX
SAC	***60***	***200***
D17	0.98	2.80
D18	0.92	2.64
E16	0.95	2.73
E17	0.99	2.89
E18	0.95	3.32
E19	1.05	6.33
E20	1.05	6.25
E21	1.05	3.25
F16	0.88	2.51
F17	1.01	2.94
F18	1.05	3.50
F19	1.05	5.88
F20	0.98	7.58
F21	1.38	11.50
F22	1.05	4.81
F23	2.44	42.51
G16	0.88	3.32
G17	0.48	1.92
G18	0.02	0.14
G19	0.04	0.34
G20	1.05	3.38
G21	1.05	3.00
G22	1.36	6.81
G23	1.36	25.87
G24	3.63	67.70
G25	2.29	42.24
G26	1.09	7.62
H16	0.96	2.75
H17	0.72	3.74
H18	0.01	1.30
H19	0.02	0.72
H20	3.05	34.46
H21	6.53	36.43
H22	2.90	21.25
H23	1.77	24.67
H24	1.54	10.28
H25	0.95	6.19
H26	0.75	3.99
I16	0.53	1.50
I17	0.48	2.87

Cell	Average A+D +10%L	Average DDX
SAC	***60***	***200***
I18	0.03	0.43
I19	0.02	0.44
I20	2.92	47.67
I21	1.88	19.82
I22	2.69	60.36
I23	1.05	3.00
I24	1.05	3.00
I25	0.81	4.17
I26	0.62	3.47
J16	0.53	1.50
J17	0.89	4.91
J18	1.05	3.80
J19	1.15	6.80
J20	1.69	9.44
J21	0.99	11.17
J22	0.74	3.52
J23	0.79	2.89
J24	1.05	3.75
J25	2.34	40.35
J26	2.86	29.00
K16	0.53	8.25
K17	0.93	5.52
K18	1.68	17.88
K19	1.50	23.70
K20	0.88	12.76
K21	0.79	3.80
K22	0.78	2.91
K23	8.68	4.06
K24	0.93	6.71
K25	1.23	13.47
L16	0.53	2.45
L17	0.88	3.92
L18	0.68	3.22
L19	0.89	10.23
L20	0.72	15.54
L21	0.66	6.58
L22	1.13	3.51
L23	1.17	7.19
L24	0.96	6.43
L25	1.05	6.75

- **Table 76. OCP Validation sample results averaged per FCC East Site excavation subgrade (all values in mg/kg).**

Subgrade	Average A+D +10%L	Average DDX
SAC	***60***	***200***
2	0.42	2.27
3	1.34	12.48
4	1.28	9.53
5a	0.86	3.66
5b	2.22	25.82
5c	2.35	43.21
6	2.17	34.01
7	0.95	3.11
8	1.01	9.85
9	1.67	24.26
10	1.78	33.98
11	0.71	4.03
12	2.03	13.09
13	1.17	6.46
14	2.11	21.51
16	1.05	9.34
17	3.44	18.10
20	0.96	2.95
39	0.55	4.83

Note: 1. SAC values are for Commercial end-use material.

- **Table 77. Summary statistics for individual Landfill site excavation results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	361	0.3	144.0	0.45					
Dieldrin	361	0.3	170.0	0.77					
Lindane	361	0.3	338.0	0.96					
A+D+10%L	**361**	**0.5**	**170.5**	**1.56**	***60***	***150***	**358**	**2**	**1**
2,4'-DDD	361	0.3	18.0	0.98					
2,4'-DDE	361	0.3	21.4						
2,4'-DDT	360	0.3	13.4	0.75					
4,4'-DDD	361	0.3	45.8	2.33					
4,4'-DDE	361	0.3	58.6	0.89					
4,4'-DDT	361	0.3	85.5	3.86					
DDX	**361**	**1.5**	**172.9**	**9.61**	***200***	***500***	**361**	0	0
Dry Matter	103	62.0	98.1	83.6					
Total Hydrocarbons C7-C9	**102**	**3.5**	**10.0**	**4.43**	***500***	***1250***	**102**	0	0
Total Hydrocarbons C10-C14	**102**	**5.0**	**15.0**	**10.0**	***2,200***	***5500***	**102**	0	0
Total Hydrocarbons C15-C36	102	15.0	3,900.0	35.0					
Total Hydrocarbons	102	25.0	3,900.0	48.6					
Boron - Hot Water Soluble	**19**	**0.3**	**3.5**	**1.08**	***15,000***	***37500***	**19**	0	0
Cyanide-Total	**19**	**0.1**	**0.1**	**0.05**	***3,750***	***9375***	**19**	0	0
Cyanide, Soluble ('Free')	**19**	**0.2**	**0.2**	**0.20**	***1,250***	***3125***	**19**	0	0
Iron	16	12,100	32,400	21,805					
Manganese-Total Recoverable	**20**	**108.0**	**779.0**	**392.2**	***7,500***	***18750***	**20**	0	0
Arsenic-Total Recoverable	**19**	**1.0**	**0.1**	**4.35**	***500***	***1250***	**19**	0	0
Cadmium-Total Recoverable	**19**	**0.1**	**0.2**	**0.07**	***100***	***250***	**19**	0	0
Chromium-Total Recoverable	19	12.0	41.0	22.8					
Chromium VI	**19**	**0.2**	**1.0**	**0.79**	***500***	***1250***	**19**	0	0
Chromium III	19	12.0	41.0	22.8					
Chromium III (%)	**19**	**0.001%**	**0.004%**	**0.002%**	***60%***	***150%***	**19**	0	0
Copper-Total Recoverable	**20**	**4.0**	**40.0**	**17.49**	***5,000***	***12500***	**20**	0	0
Mercury-Total Recoverable	**20**	**0.1**	**0.2**	**0.08**	***125***	***312.5***	**20**	0	0
Nickel-Total Recoverable	**20**	**12.0**	**65.0**	**23.6**	***3,000***	***7500***	**20**	0	0
Lead-Total Recoverable	**20**	**4.4**	**31.3**	**19.10**	***1,500***	***3750***	**20**	0	0
Selenium-Total Recoverable	20	10.0	10.0	10.0					
Zinc-Total Recoverable	**20**	**18.0**	**117.0**	**58.9**	***35,000***	***87500***	**20**	0	0
Benzo(a) pyrene	**18**	**0.0**	**0.0**	**0.02**	***25***	***62.5***	**18**	0	0
PAH Screen-total	**18**	**0.2**	**0.6**	**0.35**	***100***	***250***	**18**	0	0
PCBs	**19**	**0.2**	**0.2**	**0.15**	***50***	***125***	**19**	0	0
Alpha-BHC	62	0.5	0.5	0.50					
Beta-BHC	62	0.5	0.5	0.50					
Delta-BHC	62	0.5	0.5	0.50					
Cis-Chlordane	62	0.5	0.5	0.50					
Trans-Chlordane	62	0.5	0.5	0.50					
Chlordane	**62**	**2.5**	**2.5**	**2.50**	***250***	***625***	**62**	0	0
Endosulphan I	62	0.5	0.5	0.50					
Endosulphan II	62	0.5	0.5	0.50					
Endosulphan sulphate	62	0.5	0.5	0.50					
Endrin	62	0.5	0.5	0.50					
Endrin aldehyde	62	0.5	0.5	0.50					
Heptachlor	**62**	**0.5**	**0.5**	**0.50**	***50***	***125***	**62**	0	0
Heptachlor epoxide	62	0.5	0.5	0.50					
Hexachlorobenzene	62	0.5	0.5	0.50					
Methoxychlor	62	0.5	0.5	0.50					

[1] Commercial SAC. [2] Commercial limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

Table 78. OCP Validation sample results averaged per Landfill site excavation cell (all values in mg/kg).

Cell	Average A+D +10%L	Average DDX
SAC	***60***	***200***
I7	1.30	20.23
I8	0.99	11.92
I9	0.53	1.50
J7	0.90	8.29
J8	1.20	18.81
J9	0.57	1.63
K6	0.66	3.21
K7	13.41	19.20
K8	9.24	16.18
K9	0.63	4.45
L4	1.13	4.83
L5	1.24	13.94
L6	2.02	11.70
L7	0.53	3.08
L8	0.53	1.70
L9	0.53	1.72
M3	0.58	1.67
M4	1.98	23.76
M5	9.89	83.28
M6	4.85	82.32
M7	2.65	28.57
M8	4.95	18.97
M9	0.69	2.10
N2	0.76	2.22
N3	2.27	6.98
N4	1.12	2.86
N5	1.02	11.60
N6	12.05	5.74
N7	0.67	3.75
N8	2.31	12.38
N9	0.68	3.37

Note: 1. SAC values are for Commercial end-use material.

Table 79. OCP Validation sample results averaged per Landfill site excavation subgrade (all values in mg/kg).

Subgrade	Average A+D +10%L	Average DDX
SAC	***60***	***200***
18	3.56	14.80
19A	0.84	9.77
19B	0.55	1.66
19C	2.78	10.25
38	0.62	2.40

Note: 1. SAC values are for Commercial end-use material.

- **Table 80. Summary statistics for individual FCC West Site Excavation results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	652	0.0	2.4	0.20					
Dieldrin	652	0.0	136.0	0.42					
Lindane	652	0.0	1.2	0.19					
A+D+10%L	**652**	**0.0**	**137.3**	**0.76**	***3***	***7.5***	**646**	**5**	**1**
2,4'-DDD	652	0.0	2.4	0.24					
2,4'-DDE	652	0.0	1.0	0.20					
2,4'-DDT	652	0.0	9.5	0.45					
4,4'-DDD	652	0.0	2.3	0.29					
4,4'-DDE	652	0.0	17.7	0.50					
4,4'-DDT	652	0.0	43.1	1.12					
DDX	**652**	**0.0**	**66.7**	**2.99**	***5***	***12.5***	**602**	**36**	**14**
Dry Matter	324	64.9	100.0	92.3					
Total Hydrocarbons C7-C9	**286**	**3.5**	**10.0**	**5.67**	***500***	***1250***	**286**	0	0
Total Hydrocarbons C10-C14	**286**	**5.0**	**660.0**	**13.7**	***510***	***1275***	**284**	**2**	0
Total Hydrocarbons C15-C36	286	15.0	5,110.0	34.4					
Total Hydrocarbons	321	25.0	5,680.0	47.9					
Boron - Hot Water Soluble	**53**	**0.3**	**70.0**	**0.85**	***3***	***7.5***	**51**	**1**	**1**
Cyanide-Total	**53**	**0.1**	**0.5**	**0.07**	***70***	***175***	**53**	0	0
Cyanide, Soluble ('Free')	**52**	**0.2**	**0.4**	**0.21**	***50***	***125***	**52**	0	0
Iron	54	7,580	38,200	14,290					
Manganese-Total Recoverable	**54**	**61.0**	**657.0**	**202.2**	***1,500***	***3750***	**54**	0	0
Arsenic-Total Recoverable	**54**	**0.1**	**0.1**	**3.62**	***30***	***75***	**54**	0	0
Cadmium-Total Recoverable	**54**	**0.1**	**22.0**	**0.12**	***3***	***7.5***	**53**	0	**1**
Chromium-Total Recoverable	54	11.0	90.0	28.8					
Chromium VI	**53**	**0.2**	**1.0**	**0.98**	***9***	***22.5***	**53**	0	0
Chromium III	**53**	**11.0**	**90.0**	**28.1**	**600**	***1500***	**53**	0	0
Chromium III (%)	52	0.001%	0.009%	0.003%					
Copper-Total Recoverable	**54**	**3.0**	**2,930.0**	**16.86**	***300***	***750***	**53**	0	**1**
Mercury-Total Recoverable	**53**	**0.1**	**0.9**	**0.07**	***11***	***27.5***	**53**	0	0
Nickel-Total Recoverable	**54**	**7.0**	**148.0**	**44.4**	***600***	***1500***	**54**	0	0
Lead-Total Recoverable	**54**	**2.8**	**104.0**	**10.66**	***300***	***750***	**54**	0	0
Selenium-Total Recoverable	54	10.0	10.0	10.0					
Zinc-Total Recoverable	**54**	**16.0**	**234.0**	**39.3**	***200***	***500***	**53**	**1**	0
Benzo(a) pyrene	**53**	**0.0**	**0.8**	**0.03**	***0***	***0.675***	**52**	0	**1**
PAH Screen-total	**55**	**0.2**	**8.3**	**0.54**	***20***	***50***	**55**	0	0
PCBs	**55**	**0.2**	**0.2**	**0.15**	***10***	***25***	**55**	0	0
Alpha-BHC	264	0.0	0.0	0.00					
Beta-BHC	264	0.0	0.0	0.01					
Delta-BHC	264	0.0	0.0	0.00					
Cis-Chlordane	264	0.0	0.0	0.01					
Trans-Chlordane	264	0.0	0.0	0.00					
Chlordane	**264**	**0.0**	**0.0**	**0.02**	***50***	***125***	**264**	0	0
Endosulphan I	264	0.0	0.0	0.01					
Endosulphan II	264	0.0	0.0	0.01					
Endosulphan sulphate	264	0.0	0.0	0.01					
Endrin	264	0.0	3.8	0.01					
Endrin aldehyde	264	0.0	0.2	0.01					
Heptachlor	**264**	**0.0**	**0.0**	**0.00**	***10***	***25***	**264**	0	0
Heptachlor epoxide	264	0.0	0.0	0.00					
Hexachlorobenzene	264	0.0	0.1	0.01					
Methoxychlor	264	0.0	0.0	0.00					

[1] Residential SAC. [2] Residential limit for individual samples is 2.5 x SAC

[3] Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

- **Table 81. OCP Validation sample results averaged per FCC West Site excavation cell (all values in mg/kg). (Note: SAC values are for Residential end-use material).**

Cell	Average A+D +10%L	Average DDX
SAC	***3***	***5***
A9	0.53	1.50
A10	0.53	2.13
B9	0.53	1.93
B10	0.53	1.79
B11	0.53	1.50
B12	0.53	1.50
C9	0.53	2.56
C10	0.53	2.54
C11	0.53	2.74
C12	0.53	1.50
C13	0.49	2.11
C14	0.72	2.58
C15	0.61	1.73
D9	0.53	1.73
D10	0.53	2.58
D11	0.53	1.71
D12	0.53	2.97
D13	0.62	2.51
D14	0.81	1.71
D15	0.53	1.50
E11	0.51	2.97
E12	0.36	1.05
E13	0.86	2.44
E14	0.63	1.48
E15	1.06	2.25
E16	0.53	2.16
F10	0.34	**6.86**
F11	0.27	1.99
F12	0.25	1.07
F13	0.28	0.85
F14	0.66	1.50
F15	0.53	1.50
F16	0.71	2.15
G10	0.31	1.10
G11	0.26	2.04
G12	0.53	1.69
G13	0.44	1.36
G14	0.51	2.46
G15	0.59	1.79
G16	0.84	1.70
H10	0.39	3.83
H11	0.99	3.61
H12	0.57	1.61
H13	0.32	1.35
H14	0.42	2.19
H15	0.32	1.24
H16	0.38	1.56

Cell	Average A+D +10%L	Average DDX
SAC	***3***	***5***
I10	0.64	3.29
I11	0.44	2.45
I12	0.53	2.00
I13	0.41	1.90
I14	0.26	1.98
I15	0.74	2.53
I16	0.48	**14.42**
J9	0.53	1.50
J10	0.53	2.86
J11	0.42	1.93
J12	0.28	1.18
J13	0.38	1.53
J14	0.31	1.89
J15	0.47	2.96
J16	0.51	**17.36**
K9	0.53	1.50
K10	0.37	2.58
K11	0.11	0.99
K12	0.45	1.92
K13	0.34	2.16
K14	1.41	2.90
K15	0.21	1.05
K16	1.63	**27.55**
L9	0.53	1.98
L10	0.53	1.50
L11	0.53	2.12
L12	0.30	1.27
L13	0.50	1.73
L14	0.40	1.14
L15	0.73	1.15
L16	**36.05**	**6.84**
M9	0.32	2.16
M10	0.48	2.22
M11	0.53	2.51
M12	0.30	3.38
M13	0.44	1.74
M14	0.48	1.48
M15	0.94	1.85
M16	1.38	**10.95**
N9	0.50	2.16
N10	0.39	1.55
N11	0.45	1.76
N12	0.32	1.65
N13	0.19	1.85
N14	0.35	2.09
N15	0.41	2.55
N16	1.07	**30.37**

- **Table 82. OCP Validation sample results averaged per FCC West Site excavation subgrade (all values in mg/kg).**

SG	Average A+D +10%L	Average DDX
SAC	***3***	***5***
1	0.31	2.03
15	0.60	2.57
21	0.53	1.89
22	0.53	1.50
23	0.31	2.19
24	0.45	1.50
25	0.53	1.76
26	0.63	1.21
27	0.36	1.87
28	0.66	1.84
29	0.56	1.95
30	0.59	2.09
31	0.50	2.23
32	0.54	**5.27**
33	0.46	3.00
34	0.50	2.40
35	**5.28**	**13.43**
36	0.39	2.01
37	0.49	2.27
40	0.31	1.64
Fenceline	0.29	1.72

Note: 1. SAC values are for Residential end-use material.

- **Table 83. Summary statistics for the private property excavation results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	*SAC*[1]	*2.5 x SAC*[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	57	0.0	0.3	0.12					
Dieldrin	57	0.0	0.3	0.13					
Lindane	57	0.0	0.3	0.13					
A+D+10%L	**57**	**0.0**	**0.5**	**0.27**	***3***	***7.5***	**57**	0	0
2,4'-DDD	57	0.0	0.3	0.13					
2,4'-DDE	57	0.0	0.3	0.12					
2,4'-DDT	57	0.0	0.7	0.17					
4,4'-DDD	57	0.0	0.7	0.14					
4,4'-DDE	57	0.0	1.0	0.25					
4,4'-DDT	57	0.0	3.2	1.16					
DDX	**57**	**0.0**	**5.5**	**1.26**	***5***	***12.5***	**56**	1	0
Dry Matter	22	82.1	99.8	98.0					
Total Hydrocarbons C7-C9	**21**	**3.0**	**5.0**	**4.99**	***500***	***1250***	**21**	0	0
Total Hydrocarbons C10-C14	**21**	**5.0**	**15.0**	**11.5**	***510***	***1275***	**21**	0	0
Total Hydrocarbons C15-C36	21	15.0	30.0	28.0					
Total Hydrocarbons	22	25.0	50.0	45.7					
Boron - Hot Water Soluble	**4**	**0.3**	**15.0**	**14.15**	***3***	***7.5***	**2**	0	**2**
Cyanide-Total	**4**	**0.1**	**0.1**	**0.05**	***70***	***175***	**4**	0	0
Cyanide, Soluble ('Free')	**3**	**0.2**	**0.2**	**0.20**	***50***	***125***	**3**	0	0
Iron	4	10,600	20,900	19,853					
Manganese-Total Recoverable	**4**	**118.0**	**207.0**	**186.2**	***1,500***	***3750***	**4**	0	0
Arsenic-Total Recoverable	**5**	**1.0**	**0.1**	**4.04**	***30***	***75***	**5**	0	0
Cadmium-Total Recoverable	**5**	**0.1**	**0.1**	**0.05**	***3***	***7.5***	**5**	0	0
Chromium-Total Recoverable	5	18.0	36.0	30.8					
Chromium VI	**4**	**0.2**	**1.0**	**1.11**	***9***	***22.5***	**4**	0	0
Chromium III	**4**	**18.0**	**36.0**	**32.9**	**600**	***1500***	**4**	0	0
Chromium III (%)	4	0.002%	0.004%	0.003%					
Copper-Total Recoverable	**5**	**4.0**	**8.0**	**7.04**	***300***	***750***	**5**	0	0
Mercury-Total Recoverable	**5**	**0.1**	**0.1**	**0.05**	***11***	***27.5***	**5**	0	0
Nickel-Total Recoverable	**5**	**21.0**	**77.0**	**51.8**	***600***	***1500***	**5**	0	0
Lead-Total Recoverable	**5**	**2.7**	**8.2**	**6.63**	***300***	***750***	**5**	0	0
Selenium-Total Recoverable	4	10.0	10.0	10.0					
Zinc-Total Recoverable	**5**	**19.0**	**62.0**	**42.2**	***200***	***500***	**5**	0	0
Benzo(a) pyrene	**4**	**0.0**	**0.0**	**0.02**	***0***	***0.675***	**4**	0	0
PAH Screen-total	**4**	**0.2**	**0.4**	**0.39**	***20***	***50***	**4**	0	0
PCBs	**4**	**0.2**	**0.2**	**0.15**	***10***	***25***	**4**	0	0
Alpha-BHC	32	0.0	0.0	0.01					
Beta-BHC	32	0.0	0.0	0.01					
Delta-BHC	32	0.0	0.0	0.01					
Cis-Chlordane	32	0.0	0.0	0.01					
Trans-Chlordane	32	0.0	0.0	0.01					
Chlordane	**32**	**0.0**	**0.0**	**0.03**	***50***	***125***	**32**	0	0
Endosulphan I	32	0.0	0.0	0.01					
Endosulphan II	32	0.0	0.0	0.01					
Endosulphan sulphate	32	0.0	0.0	0.01					
Endrin	32	0.0	0.0	0.01					
Endrin aldehyde	32	0.0	0.0	0.01					
Heptachlor	**32**	**0.0**	**0.0**	**0.01**	***10***	***25***	**32**	0	0
Heptachlor epoxide	32	0.0	0.0	0.01					
Hexachlorobenzene	32	0.0	0.0	0.01					
Methoxychlor	32	0.0	0.0	0.01					

[1] *Residential SAC.* [2] *Residential limit for individual samples is 2.5 x SAC*

[3] *Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).*

- **Table 84. OCP Validation sample results averaged per private property excavation cell (all values in mg/kg).**

Property	Cell	A+D +10%L	DDX
SAC[1]		***3***	***5***
13 Tahi St	L17	0.01	0.58
	L18	0.04	0.97
	L19	0.18	0.79
	L20	0.17	0.58
	L21	0.30	0.88
	L22	0.32	1.26
	L23	0.02	0.51
	M17	0.53	1.50
	M18	0.27	1.28
	M24	0.02	0.53
18 Tahi St	O9	0.53	3.49
	P9	0.53	1.80

Note: 1. SAC values are for Residential end-use material.

- **Table 85. OCP Validation sample results averaged per private property site excavation subgrade (all values in mg/kg).**

Property	Subgrade	A+D +10%L	DDX
SAC[1]		***3***	***5***
13 Tahi St	AW	0.17	0.80
18 Tahi St	18TS	0.53	2.55

Note: 1. SAC values are for Residential end-use material.

Table 86. Summary statistics for the East Marine Sediments excavation results (unless stated, all values in mg/kg).

Substance	# of Samples	Min	Max	95% UCL Avg	SAC[1]	2.5 x SAC[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	102	0.000	0.4	0.02					
Dieldrin	102	0.000	3.5	0.03					
Lindane	102	0.000	0.0	0.001					
A+D+10%L	**102**	**0.001**	**3.9**	**0.05**	***0.01***	***0.025***	**64**	**17**	**21**
2,4'-DDD	102	0.000	13.7	0.19					
2,4'-DDE	102	0.000	0.2	0.02					
2,4'-DDT	102	0.000	7.2	0.17					
4,4'-DDD	102	0.000	53.0	1.25					
4,4'-DDE	102	0.000	1.2	0.25					
4,4'-DDT	102	0.000	56.4	3.14					
DDX	**102**	**0.002**	**125.5**	**3.45**	***0.01***	***0.025***	**22**	**18**	**62**
Dry Matter	31	68.5	81.5	77.7					
Total Hydrocarbons C7-C9	31	4.0	5.0	4.42					
Total Hydrocarbons C10-C14	31	10.0	10.0	10.0					
Total Hydrocarbons C15-C36	31	20.0	25.0	20.4					
Total Hydrocarbons	31	30.0	40.0	32.8					
Boron - Hot Water Soluble	6	0.9	4.0	3.34					
Cyanide-Total	6	0.1	0.1	0.05					
Cyanide, Soluble ('Free')	6	0.2	0.9	0.48					
Iron	0	0	0	N/A					
Manganese-Total Recoverable	6	127.0	297.0	230.9					
Arsenic-Total Recoverable	**6**	**1.0**	**0.1**	**4.25**	***20***	***50***	**6**	0	0
Cadmium-Total Recoverable	**6**	**0.1**	**0.1**	**0.08**	***1.5***	***3.75***	**6**	0	0
Chromium-Total Recoverable	6	23.0	41.0	36.0					
Chromium VI	**6**	**0.2**	**0.2**	**0.20**	***80***	***200***	**6**	0	0
Chromium III	6	23.0	41.0	36.0					
Copper-Total Recoverable	**6**	**4.0**	**11.0**	**9.11**	***65***	***162.5***	**6**	0	0
Mercury-Total Recoverable	**6**	**0.1**	**0.1**	**0.09**	***0.15***	***0.375***	**6**	0	0
Nickel-Total Recoverable	**6**	**31.0**	**80.0**	**70.5**	***21***	***52.5***	0	**2**	**4**
Lead-Total Recoverable	**6**	**3.6**	**9.7**	**7.54**	***50***	***125***	**6**	0	0
Selenium-Total Recoverable	6	10.0	15.0	13.2					
Zinc-Total Recoverable	**6**	**24.0**	**48.0**	**41.1**	***200***	***500***	**6**	0	0
Benzo(a) pyrene	**6**	**0.015**	**0.0**	**0.02**	***0.43***	***1.075***	**6**	0	0
PAH Screen-total	6	0.3	0.4	0.32					
PCBs	**6**	**0.015**	**0.2**	**0.11**	***0.023***	***0.0575***	**3**	0	**3**
Alpha-BHC	102	0.000	0.005	0.000					
Beta-BHC	102	0.000	0.005	0.001					
Delta-BHC	102	0.000	0.005	0.001					
Cis-Chlordane	102	0.000	0.042	0.001					
Trans-Chlordane	102	0.000	0.025	0.001					
Chlordane	**102**	**0.000**	**0.160**	**0.004**	***0.0005***	***0.00125***	**11**	**76**	**15**
Endosulphan I	102	0.000	0.007	0.001					
Endosulphan II	102	0.000	0.005	0.000					
Endosulphan sulphate	102	0.000	0.005	0.000					
Endrin	102	0.000	0.050	0.001					
Endrin aldehyde	102	0.000	0.005	0.000					
Heptachlor	102	0.000	0.005	0.000					
Heptachlor epoxide	102	0.000	0.005	0.000					
Hexachlorobenzene	102	0.000	0.005	0.000					

1 Marine SAC

2 Marine limit for individual samples is 2.5 x SAC

3 Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

- **Table 87. OCP Validation sample results averaged per East Marine Sediments cell (all values in mg/kg).**

Cell	Average A+D +10%L	Average DDX
SAC	*0.01*	*0.01*
1	0.0091	0.0105
2	0.0022	0.0084
3	0.0016	0.0264
4	0.0016	0.0124
5	0.0075	0.3954
6	0.0041	0.0462
7	0.0077	0.1704
8	0.0038	0.0350
9	0.0125	0.0566
10	0.2628	2.3408
11	0.4345	18.5119
12	0.0153	0.2400
13	0.0118	0.3132
14	0.0049	0.6072
Beach	0.0824	1.6096

Note: The 14 samples, taken 4 months following the excavation and fill, are under the cell label ‘Beach’.

- **Table 88. Summary statistics for the West Marine Sediments excavation results (unless stated, all values in mg/kg).**

Substance	# of Samples	Min	Max	95% UCL Avg	SAC[1]	2.5 x SAC[2]	Pass[3]	Marginal[3]	Fail[3]
Aldrin	149	0.000	0.0	0.00					
Dieldrin	149	0.000	0.4	0.01					
Lindane	149	0.000	0.1	0.002					
A+D+10%L	**149**	**0.000**	**0.5**	**0.01**	***0.01***	***0.025***	**127**	**9**	**13**
2,4'-DDD	149	0.000	4.6	0.32					
2,4'-DDE	149	0.000	1.8	0.00					
2,4'-DDT	149	0.000	10.8	0.24					
4,4'-DDD	149	0.000	9.5	1.04					
4,4'-DDE	149	0.000	7.2	0.32					
4,4'-DDT	149	0.000	58.9	2.13					
DDX	**149**	**0.002**	**82.2**	**4.29**	***0.01***	***0.025***	**55**	**26**	**68**
Dry Matter	97	45.1	83.1	75.5					
Total Hydrocarbons C7-C9	82	4.0	10.0	4.71					
Total Hydrocarbons C10-C14	82	10.0	15.0	10.3					
Total Hydrocarbons C15-C36	82	15.0	35.0	21.4					
Total Hydrocarbons	82	30.0	50.0	34.9					
Boron - Hot Water Soluble	24	0.3	10.8	3.70					
Cyanide-Total	24	0.1	0.2	0.06					
Cyanide, Soluble ('Free')	24	0.2	0.2	0.20					
Iron	28	9,280	33,900	17,887					
Manganese-Total Recoverable	27	38.0	520.0	194.0					
Arsenic-Total Recoverable	**27**	**1.0**	**0.1**	**5.10**	***20***	***50***	**27**	0	0
Cadmium-Total Recoverable	**27**	**0.1**	**0.1**	**0.05**	***1.5***	***3.75***	**27**	0	0
Chromium-Total Recoverable	27	6.0	56.0	25.5					
Chromium VI	**24**	**0.2**	**1.0**	**0.57**	***80***	***200***	**24**	0	0
Chromium III	24	6.0	56.0	26.2					
Copper-Total Recoverable	**27**	**3.0**	**63.0**	**15.44**	***65***	***162.5***	**27**	0	0
Mercury-Total Recoverable	**27**	**0.1**	**0.6**	**0.09**	***0.15***	***0.375***	**25**	**1**	**1**
Nickel-Total Recoverable	**27**	**9.0**	**71.0**	**27.3**	***21***	***52.5***	**15**	**11**	**1**
Lead-Total Recoverable	**27**	**4.1**	**27.2**	**11.67**	***50***	***125***	**27**	0	0
Selenium-Total Recoverable	27	10.0	10.0	10.0					
Zinc-Total Recoverable	**27**	**11.0**	**113.0**	**43.2**	***200***	***500***	**27**	0	0
Benzo(a) pyrene	**24**	**0.015**	**0.1**	**0.02**	***0.43***	***1.075***	**24**	0	0
PAH Screen-total	24	0.3	1.3	0.42					
PCBs	**24**	**0.015**	**0.0**	**0.02**	***0.023***	***0.0575***	**24**	0	0
Alpha-BHC	149	0.000	0.000	0.000					
Beta-BHC	149	0.000	0.000	0.000					
Delta-BHC	149	0.000	0.000	0.000					
Cis-Chlordane	149	0.000	0.018	0.000					
Trans-Chlordane	149	0.000	0.017	0.000					
Chlordane	**149**	**0.000**	**0.083**	**0.001**	***0.0005***	***0.00125***	**4**	**144**	**1**
Endosulphan I	142	0.000	0.003	0.000					
Endosulphan II	145	0.000	0.003	0.000					
Endosulphan sulphate	145	0.000	0.001	0.000					
Endrin	145	0.000	0.067	0.000					
Endrin aldehyde	145	0.000	0.006	0.000					
Heptachlor	145	0.000	0.003	0.000					
Heptachlor epoxide	145	0.000	0.003	0.000					
Hexachlorobenzene	145	0.000	0.001	0.000					
Methoxychlor	145	0.000	0.008	0.000					

1 Marine SAC
2 Marine limit for individual samples is 2.5 x SAC
3 Pass if value < SAC; Marginal if SAC < value < (2.5 x SAC); Fail if value > (2.5 x SAC).

- **Table 89. OCP Validation sample results averaged per West Marine Sediments cell (all values in mg/kg).**

Cell	Average A+D +10%L	Average DDX
SAC	*0.01*	*0.01*
#1	0.003	0.117
#2	0.006	0.322
#3	0.016	0.867
#4	0.005	0.139
#5	0.001	0.034
#6	0.003	0.185
#7	0.094	15.446
#8	0.009	1.316
#9	0.001	0.017
08	0.135	9.054
G7	0.010	0.360
H7	0.002	0.075
I6	0.040	6.999
I7	0.008	10.372
J5	0.010	27.466
J6	0.003	15.720
K4a	0.004	0.447
K4a	0.004	0.447
K4b	0.004	1.573
K5	0.007	4.699
L2	0.002	0.418
L3	0.011	4.905
L4	0.001	0.021
M1	0.002	0.051
M2	0.010	0.979
N1	0.024	2.260
O1	0.005	0.905

Cell	Average A+D +10%L	Average DDX
SAC	*0.01*	*0.01*
O2	0.001	0.004
O3	0.001	0.018
O4	0.002	0.012
O5	0.001	0.005
O6	0.001	0.004
O7	0.001	0.007
O8	0.038	2.516
P1	0.001	0.021
P2	0.002	0.216
P3	0.001	0.012
P4	0.002	0.021
P5	0.001	0.011
P6	0.001	0.007
P7	0.001	0.012
P8	0.004	0.479
PQ	0.001	0.003
Q1	0.010	0.284
Q2	0.003	0.031
Q3	0.001	0.051
Q3	0.001	0.051
Q6	0.001	0.010
Q7	0.001	0.005
Q8	0.011	0.099
Q9	0.004	0.055
R1	0.001	0.017
R2	0.003	0.151
S1	0.006	0.149
8181	0.492	24.250
8182	0.162	4.902
8183	0.093	7.104

Table 90. Summary of All QAQC Data Results by Substance.

Substance	# of Samples	Min	Avg	Max	95% UCL Avg	SAC
OCPS						
Aldrin	49	0.0	1.4	16.2	2.0	
Dieldrin	49	0.0	3.9	22.0	4.7	
Lindane	49	0.0	2.2	14.2	5.8	
A+D +10%L	**49**	**0.3**	**6.9**	**23.5**	**8.1**	***60***
2,4'-DDD	31	0.2	5.8	15.0	6.9	
2,4'-DDE	31	0.1	3.8	13.9	4.9	
2,4'-DDT	31	0.2	5.3	23.1	6.9	
4,4'-DDD	49	0.3	13.2	58.0	15.9	
4,4'-DDE	49	0.1	15.1	60.0	18.0	
4,4'-DDT	49	1.0	31.3	137.0	38.0	
DDX	**49**	**1.3**	**69.0**	**199.1**	**79.5**	***200***
% DDX	18	0.3	0.6	0.9	0.6	
Leachable OCPs						
Aldrin (SPLP g.m-3)	18	0.0001	0.00042	0.0012	0.00052	
Dieldrin (SPLP g.m-3)	18	0.0026	0.00698	0.0142	0.00802	
Lindane (SPLP g.m-3)	18	0.0003	0.00815	0.0483	0.02548	
A+D +10%L (SPLP g.m-3)	18	0.00274	0.00821	0.01581	0.00940	
2,4'-DDD (SPLP g.m-3)	18	0.00005	0.00211	0.0067	0.00262	
2,4'-DDE (SPLP g.m-3)	18	0.00005	0.00093	0.0029	0.00119	
2,4'-DDT (SPLP g.m-3)	18	0.00005	0.00070	0.0029	0.00453	
4,4'-DDD (SPLP g.m-3)	18	0.0009	0.00393	0.0117	0.00474	
4,4'-DDE (SPLP g.m-3)	18	0.0004	0.00307	0.0096	0.00395	
4,4'-DDT (SPLP g.m-3)	18	0.0002	0.00368	0.0113	0.00466	
DDX (SPLP g.m-3)	18	0.0027	0.01437	0.03715	0.01765	
Alpha-BHC (SPLP g.m-3)	18	0.00005	0.00014	0.0003	0.00017	
Beta-BHC (SPLP g.m-3)	18	0.00005	0.00029	0.0009	0.00036	
Delta-BHC (SPLP g.m-3)	18	0.00005	0.00014	0.0003	0.00017	
Cis-Chlordane (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Trans-Chlordane (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Chlordane (SPLP g.m-3)	18	0.00025	0.00025	0.00025	0.00025	
Endosulphan I (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Endosulphan II (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Endosulphan sulphate (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Endrin (SPLP g.m-3)	18	0.00005	0.00008	0.0004	0.00011	
Endrin aldehyde (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Heptachlor (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Heptachlor epoxide (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Hexa chloro benzene (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Methoxy chlor (SPLP g.m-3)	18	0.00005	0.00005	0.00005	0.00005	
Aldrin (TCLP g.m-3)	16	0.0001	0.00066	0.003	0.00088	
Dieldrin (TCLP g.m-3)	16	0.001	0.00761	0.015	0.00897	
Lindane (TCLP g.m-3)	16	0.0005	0.01425	0.11	0.04336	
A+D +10%L (TCLP g.m-3)	16	0.0011	0.00945	0.022	0.01124	
2,4'-DDD (TCLP g.m-3)	6	0.0008	0.00163	0.0023	0.00203	
2,4'-DDE (TCLP g.m-3)	6	0.00005	0.00029	0.0006	0.00042	
2,4'-DDT (TCLP g.m-3)	6	0.00005	0.00005	0.00005	0.00005	
4,4'-DDD (TCLP g.m-3)	16	0.0005	0.00256	0.005	0.00304	
4,4'-DDE (TCLP g.m-3)	16	0.00005	0.00130	0.004	0.00165	

Substance	# of Samples	Min	Avg	Max	95% UCL Avg	SAC
4,4'-DDT (TCLP g.m-3)	16	0.0003	0.00193	0.014	0.00321	
DDX (TCLP g.m-3)	15	0.002	0.00665	0.02	0.00822	
Alpha-BHC (TCLP g.m-3)	16	0.00005	0.00040	0.001	0.00048	
Beta-BHC (TCLP g.m-3)	16	0.0001	0.00051	0.0012	0.00058	
Delta-BHC (TCLP g.m-3)	16	0.00005	0.00037	0.0005	0.00043	
Cis-Chlordane (TCLP g.m-3)	6	0.00005	0.00005	0.00005	0.00005	
Trans-Chlordane (TCLP g.m-3)	6	0.00005	0.00005	0.00005	0.00005	
Chlordane (TCLP g.m-3)	16	0.00025	0.00166	0.0025	0.00203	
Endosulphan I (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Endosulphan II (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Endosulphan sulphate (TCLP g.m-3)	16	0.00005	0.00036	0.001	0.00046	
Endrin (TCLP g.m-3)	16	0.00005	0.00043	0.002	0.00058	
Endrin aldehyde (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Endrin ketone (TCLP g.m-3)	10	0.0005	0.00050	0.0005	0.00050	
Heptachlor (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Heptachlor epoxide (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Hexa chloro benzene (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Methoxy chlor (TCLP g.m-3)	16	0.00005	0.00033	0.0005	0.00041	
Toxophene (TCLP g.m-3)	10	0.0025	0.00475	0.01	0.00632	
Metals						
Iron (mg/Kg)	31	7700	16,561	24000	17,353	
Manganese-Total Recoverable	**27**	**88**	**228.19**	**382**	**248.4**	***7,500***
Arsenic-Total Recoverable	**27**	**1**	**3.25**	**7**	**3.7**	***500***
Cadmium-Total Recoverable	**29**	**0.05**	**0.18**	**0.5**	**0.2**	***100***
Chromium-Total Recoverable	27	11	28.04	40	29.7	
Copper-Total Recoverable (mg/Kg)	**31**	**12**	**343.42**	**1050**	**409.5**	***5,000***
Mercury-Total Recoverable	**27**	**0.05**	**0.16**	**0.4**	**0.2**	***125***
Nickel-Total Recoverable	**27**	**15**	**37.81**	**53**	**39.9**	***3,000***
Lead-Total Recoverable	**27**	**2.5**	**25.68**	**106**	**30.7**	***1,500***
Selenium-Total Recoverable	17	10	10	10	10.0	
Zinc-Total Recoverable	**27**	**20**	**58.63**	**160**	**65.8**	***35,000***
Leachable Metals						
Total Iron (g.m-3) (SPLP)	16	0.2	4.36	11.4	5.68	
Total Copper (g.m-3) (SPLP)	16	0.03	0.32	1.18	0.44	
Total Iron (TCLP g.m-3)	4	0.2	0.2	0.2	0.2	
Total Copper (TCLP g.m-3)	4	1.91	3.08	5.47	4.32	
Iron (TCLP g.m-3)	10	0.025	1.66	4.5	2.16	
Manganese-Total Rec. (TCLP g.m-3)	10	0.025	2.32	3.9	2.84	
Arsenic-Total Rec. (TCLP g.m-3)	10	0.005	0.037	0.14	0.054	
Cadmium-Total Rec. (TCLP g.m-3)	10	0.005	0.006	0.01	0.006	
Chromium-Total Rec. (TCLP g.m-3)	10	0.005	0.005	0.005	0.005	
Copper-Total Rec. (TCLP g.m-3)	10	0.03	1.51	6.7	35.54	
Mercury-Total Rec. (TCLP g.m-3)	10	0.0025	0.0025	0.0025	0.0025	
Nickel-Total Rec. (TCLP g.m-3)	10	0.02	0.13	0.31	0.18	
Lead-Total Rec. (TCLP g.m-3)	10	0.005	0.005	0.005	0.005	
Zinc-Total Rec. (TCLP g.m-3)	10	0.02	0.351	1.1	0.51	
Nitrogen						
Ammonium-N (mg/kg)	16	167	1,244	4830	1,653	
Total Nitrogen (g/100g)	16	0.06	0.24	0.69	0.29	
Nitrate-N (mg/Kg)	26	2	46.20	250	116.26	
Ammonia-N	10	210	1871.00	8300	9072.55	
Kjeldahl-N 'TKN'	10	200	1500.00	4500	2007.49	

Substance	# of Samples	Min	Avg	Max	95% UCL Avg	SAC
Ammoniacal-N (g.m-3) (SPLP)	15	5.75	48.54	213	66.52	
Kjeldahl-N 'TKN' (g.m-3) (SPLP)	15	5.5	46.79	192	63.26	
Nitrate-N + Nitrite-N 'TON' (g.m-3) (SPLP)	16	0.065	1.81	8.83	7.10	
Total-N 'TKN+TON' (SPLP)	16	0.71	45.67	200.83	62.18	
Nitrate-N (g.m-3) (SPLP)	26	0.045	23.70	250	81.70	
Nitrite-N (g.m-3) (SPLP)	16	0.011	0.056	0.162	0.072	
Ammonia-N (TCLP)	10	11	111.30	530	429.77	
Kjeldahl-N 'TKN' (TCLP)	10	9	71.60	320	246.69	
pH Extraction Fluid	6	2.9	2.90	2.9	2.90	
Post extraction fluid pH (TCLP	6	3.7	4.52	5.1	4.79	
Ammoniacal-N (g.m-3) (TCLP Extract)	4	18.1	108.80	275	198.72	
Kjeldahl-N 'TKN' (g.m-3) (TCLP Extract)	4	19	103.00	250	183.10	
Nitrate-N + Nitrite-N 'TON' (g.m-3) (TCLP Extract)	4	0.465	3.32	8.79	6.20	
Total-N 'TKN+TON' (TCLP Extract)	4	20.32	106.32	258.79	188.90	
Nitrate-N (TCLP g.m-3)	14	0.16	2.30	10	8.66	
Nitrite-N (TCLP g.m-3)	4	0.009	0.023	0.054	0.039	
pH and Other						
Extraction Fluid (1=pH4.2, 2=pH5.0, 3=DI)	18	3	3	3	3	
Final pH	28	6	8.18	10.4	8.4	
pH	20	6.8	7.46	9.3	7.7	
% Moisture	39	6	12.4	24	13.2	
Dry Matter (g/100g)	39	79.9	93.4	100	94.7	
Total Hydrocarbons C7-C9	**17**	**3.5**	**3.7**	**4**	**3.8**	***500***
Total Hydrocarbons C10-C14	**17**	**5**	**8.6**	**27**	**10.6**	***2,200***
Total Hydrocarbons C15-C36	17	15	83.2	260	107.3	
Total Hydrocarbons	17	25	87.6	260	112.2	
Benzo(a) pyrene	**17**	**0.01**	**0.081**	**0.81**	**0.134**	***25***
PAH Screen-total	**17**	**0.2**	**0.940**	**7.37**	**1.335**	***100***
Other OCPs						
Alpha-BHC	49	0.005	0.019	0.09	0.022	
Beta-BHC	49	0.005	0.038	0.16	0.044	
Delta-BHC	49	0.005	0.019	0.06	0.022	
Cis-Chlordane	31	0.005	0.012	0.19	0.010	
Trans-Chlordane	31	0.005	0.005	0.005	0.005	
Chlordane	**49**	**0.025**	**0.105**	**0.5**	**0.143**	***250***
Endosulphan I	49	0.005	0.027	0.5	0.030	
Endosulphan II	49	0.005	0.056	0.5	0.101	
Endosulphan sulphate	49	0.005	0.026	0.1	0.038	
Endrin	49	0.005	0.062	0.34	0.136	
Endrin aldehyde	49	0.005	0.054	1	0.1	
Endrin ketone	18	0.025	0.133	0.36	0.164	
Heptachlor	**49**	**0.005**	**0.014**	**0.07**	**0.016**	***50***
Heptachlor epoxide	49	0.005	0.015	0.05	0.018	
Hexa chloro benzene	49	0.005	0.012	0.025	0.014	
Methoxy chlor	49	0.005	0.039	0.25	0.067	
Toxophene	18	0.05	0.217	0.5	0.257	

- **Table 91. Detailed Breakdown of Leachable OCP Inter-lab (Hills and ??) Sample Results and RPDs.**

Sample Source	Final soil type	MfE Aldrin (TCLP g.m-3)	GHD Aldrin (TCLP g.m-3)	MfE Dieldrin (TCLP g.m-3)	GHD Dieldren (TCLP g.m-3)	MfE Lindane (TCLP g.m-3)	GHD Lindane (TCLP g.m-3)	MfE 4,4'-DDD (TCLP g.m-3)	GHD 4,4'-DDD (TCLP g.m-3)	MfE 4,4'-DDE (TCLP g.m-3)	GHD 4,4'-DDE (TCLP g.m-3)	MfE 4,4'-DDT (TCLP g.m-3)	GHD 4,4'-DDT (TCLP g.m-3)	MfE DDX (TCLP g.m-3)	GHD DDX (TCLP g.m-3)	MfE Alpha-BHC (TCLP g.m-3)	GHD Alpha-BHC (TCLP g.m-3)	MfE Beta-BHC (TCLP g.m-3)	GHD Beta-BHC (TCLP g.m-3)	MfE Delta-BHC (TCLP g.m-3)	GHD Delta-BHC (TCLP g.m-3)
SG6 @1.5	TF	0.0004	0.0005	0.0149	0.015	0.0066	0.007	0.0028	0.003	0.0021	0.002	0.0007	0.001	0.0083	0.006	0.0001	0.0005	0.0005	0.0005	0.0001	0.0005
SG16 @1.25	TF - Com - OS	0.0003	0.0005	0.0066	0.005	0.005	0.005	0.0016	0.0005	0.0005	0.0005	0.0008	0.002	0.0042	0.002	0.0001	0.0005	0.0005	0.0005	0.00005	0.0005
SG20 @0.75	TF	0.0004	0.001	0.0058	0.01	0.0492	0.11	0.0033	0.005	0.00005	0.001	0.0003	0.0005	0.00595	0.006	0.0002	0.001	0.0004	0.0005	0.0003	0.0005
General Statistics	**Minimum**	**0.0003**	**0.0005**	**0.0058**	**0.005**	**0.005**	**0.005**	**0.0016**	**0.0005**	**0.00005**	**0.0005**	**0.0003**	**0.0005**	**0.0042**	**0.002**	**0.0001**	**0.0005**	**0.0004**	**0.0005**	**0.00005**	**0.0005**
	Maximum	**0.0004**	**0.001**	**0.0149**	**0.015**	**0.0492**	**0.11**	**0.0033**	**0.005**	**0.0021**	**0.002**	**0.0008**	**0.002**	**0.0083**	**0.006**	**0.0002**	**0.001**	**0.0005**	**0.0005**	**0.0003**	**0.0005**
	Average	**0.0003667**	**0.0006667**	**0.0091**	**0.01**	**0.0202667**	**0.0406667**	**0.0025667**	**0.0028333**	**0.0008833**	**0.0011667**	**0.0006**	**0.0011667**	**0.00615**	**0.0046667**	**0.0001333**	**0.0006667**	**0.0004667**	**0.0005**	**0.00015**	**0.0005**
	Count	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Results of Comparison		**RPDs**	**Avgs.**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**
SG6 @1.5		22%	0.00045	1%	0.01495	6%	0.0068	7%	0.0029	5%	0.00205	35%	0.00085	32%	0.00715	**133%**	0.0003	0%	0.0005	**133%**	0.0003
SG16 @1.25		50%	0.0004	28%	0.0058	0%	0.005	**105%**	0.00105	0%	0.0005	**86%**	0.0014	**71%**	0.0031	**133%**	0.0003	0%	0.0005	**164%**	0.000275
SG20 @0.75		**86%**	0.0007	**53%**	0.0079	**76%**	0.0796	41%	0.00415	**181%**	0.000525	50%	0.0004	1%	0.005975	**133%**	0.0006	22%	0.00045	50%	0.0004
	Lab Detection Limits	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0003	0.15	0.0001	0.05	0.0001	0.05	0.0001	0.05
	Max Detection Limit	0.05		0.05		0.05		0.05		0.05		0.05		0.15		0.05		0.05		0.05	
RPD Statistics	**Minimum**	**22%**		**1%**		**0%**		**7%**		**0%**		**35%**		**1%**		**133%**		**0%**		**50%**	
	Maximum	**86%**		**53%**		**76%**		**105%**		**181%**		**86%**		**71%**		**133%**		**22%**		**164%**	
	Average	**53%**		**27%**		**27%**		**51%**		**62%**		**57%**		**35%**		**133%**		**7%**		**116%**	
Counts																					
12	< 30% RPD	1		2		2		1		2		0		1		0		3		0	
6	30 - 50% RPD	1		0		0		1		0		2		1		0		0		1	
42	**> 50% RPD**	**1**		**1**		**1**		**1**		**1**		**1**		**1**		**3**		**0**		**2**	

Sample Source	Final soil type	MfE Chlordane (TCLP g.m-3)	GHD Chlordane (TCLP g.m-3)	MfE Endosulphan I (TCLP g.m-3)	GHD Endosulphan I (TCLP g.m-3)	MfE Endosulphan II (TCLP g.m-3)	GHD Endosulphan II (TCLP g.m-3)	MfE Endosulphan sulphate (TCLP g.m-3)	GHD Endosulphan sulphate (TCLP g.m-3)	MfE Endrin (TCLP g.m-3)	GHD Endrin (TCLP g.m-3)	MfE Endrin aldehyde (TCLP g.m-3)	GHD Endrin aldehyde (TCLP g.m-3)	MfE Heptachlor epoxide (TCLP g.m-3)	GHD Heptachlor epoxide (TCLP g.m-3)	MfE Heptachlor (TCLP g.m-3)	GHD Heptachlor (TCLP g.m-3)	MfE Hexa chloro benzene (TCLP g.m-3)	GHD Hexa chloro benzene (TCLP g.m-3)	MfE Methoxy chlor (TCLP g.m-3)	GHD Methoxy chlor (TCLP g.m-3)
SG6 @1.5	TF	0.00025	0.0025	0.00005	0.0005	0.00005	0.0005	0.00005	0.001	0.00005	0.002	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005
SG16 @1.25	TF - Com - OS	0.00025	0.0025	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005
SG20 @0.75	TF	0.00025	0.0025	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005	0.00005	0.0005
General Statistics	**Minimum**	**0.00025**	**0.0025**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**
	Maximum	**0.00025**	**0.0025**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.001**	**0.00005**	**0.002**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**
	Average	**0.00025**	**0.0025**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0006667**	**0.00005**	**0.001**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**	**0.00005**	**0.0005**
	Count	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Results of Comparison		**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**
SG6 @1.5		**164%**	0.001375	**164%**	0.000275	**164%**	0.000275	**181%**	0.000525	**190%**	0.001025	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275
SG16 @1.25		**164%**	0.001375	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275
SG20 @0.75		**164%**	0.001375	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275	**164%**	0.000275
	Lab Detection Limits	0.0001	0.1	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05	0.0001	0.05
	Max Detection Limit	0.1		0.05		0.05		0.05		0.05		0.05		0.05		0.05		0.05		0.05	
RPD Statistics	**Minimum**	**164%**		**164%**		**164%**		**164%**		**164%**		**164%**		**164%**		**164%**		**164%**		**164%**	
	Maximum	**164%**		**164%**		**164%**		**181%**		**190%**		**164%**		**164%**		**164%**		**164%**		**164%**	
	Average	**164%**		**164%**		**164%**		**169%**		**172%**		**164%**		**164%**		**164%**		**164%**		**164%**	
Counts																					
12	< 30% RPD	0		0		0		0		0		0		0		0		0		0	
6	30 - 50% RPD	0		0		0		0		0		0		0		0		0		0	
42	**> 50% RPD**	**3**		**3**		**3**		**3**		**3**		**3**		**3**		**3**		**3**		**3**	

Table 92. Detailed Breakdown of Metal and Leachable Metal Inter-lab (Hills and ??) Sample Results and RPDs.

Sample Source	Final soil type	MfE Iron (mg/Kg)	GHD Iron (mg/Kg)	MfE Manganese Tot. Rec. (mg/kg)	GHD Manganese Tot. Rec. (mg/kg)	MfE Arsenic Tot. Rec. (mg/kg)	GHD Arsenic Tot. Rec. (mg/kg)	MfE Cadmium Tot. Rec. (mg/kg)	GHD Cadmium Tot. Rec. (mg/kg)	MfE Chromium Tot. Rec. (mg/kg)	GHD Chromium Tot. Rec. (mg/kg)	MfE Copper Tot. Rec. (mg/kg)	GHD Copper Tot. Rec. (mg/Kg)	MfE Mercury Tot. Rec. (mg/kg)	GHD Mercury Tot. Rec. (mg/kg)	MfE Nickel Tot. Rec. (mg/kg)	GHD Nickel Tot. Rec. (mg/kg)
SG3 @1.25	TF - OS - Sed	17,000	20,000	328	240	4	1	0.1	0.25	31	22	130	110	0.2	0.1	39	33
SG4 @1.5	TF - Com - OS	8,490	7,700	112	88	1	1	0.05	0.25	22	19	15	12	0.05	0.1	33	36
SG6 @1.5	TF	16,400	18,000									852	690				
SG7 @1.7	TF - Com - OS	15,000	11,000	214	120	4	1	0.05	0.25	33	11	83	44	0.1	0.1	36	15
SG8 @1	TF - Com - OS							0.1	0.25								
SG8 @2	TF - Com - OS	16,600	17,000	227	150	4	1	0.1	0.25	32	22	499	470	0.3	0.1	40	31
SG12 @1.2	TF - Com - OS	16,900	16,000	242	130	6	1	0.2	0.25	31	28	549	380	0.2	0.1	42	53
SG14 @1.1	TF - OS - Sed	18,600	24,000	357	250	4	1	0.05	0.25	32	24	272	220	0.1	0.1	38	37
SG16 @1.25	TF - Com - OS	16,100	18,000	289	170	5	1	0.1	0.25	28	24	267	230	0.2	0.1	35	33
SG17 @1.5	TF - Com - OS	16,300	19,000	254	190	5	1	0.1	0.25	33	26	261	230	0.3	0.1	43	35
SG17 @2.2	TF - Com - OS							0.2	0.25								
SG20 @0.75	TF	19,600	22,000									747	820				
General Statistics	**Minimum**	**8,490**	**7,700**	**112**	**88**	**1**	**1**	**0.05**	**0.25**	**22**	**11**	**15**	**12**	**0.05**	**0.1**	**33**	**15**
	Maximum	**19,600**	**24,000**	**357**	**250**	**6**	**1**	**0.2**	**0.25**	**33**	**28**	**852**	**820**	**0.3**	**0.1**	**43**	**53**
	Average	**16,099**	**17,270**	**252.875**	**167.25**	**4.125**	**1**	**0.105**	**0.25**	**30.25**	**22**	**367.5**	**320.6**	**0.18125**	**0.1**	**38.25**	**34.125**
	Count	**10**	**10**	**8**	**8**	**8**	**8**	**10**	**10**	**8**	**8**	**10**	**10**	**8**	**8**	**8**	**8**
Results of Comparison		**RPDs**	**Avgs.**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**
SG3 @1.25		16%	18,500	31%	284	**120%**	2.5	**86%**	0.175	34%	26.5	17%	120	**67%**	0.15	17%	36
SG4 @1.5		10%	8,095	24%	100	0%	1	**133%**	0.15	15%	20.5	22%	13.5	**67%**	0.075	9%	34.5
SG6 @1.5		9%	17,200									21%	771				
SG7 @1.7		31%	13,000	**56%**	167	**120%**	2.5	**133%**	0.15	**100%**	22	**61%**	63.5	0%	0.1	**82%**	25.5
SG8 @1								**86%**	0.175								
SG8 @2		2%	16,800	41%	188.5	**120%**	2.5	**86%**	0.175	37%	27	6%	484.5	**100%**	0.2	25%	35.5
SG12 @1.2		5%	16,450	**60%**	186	**143%**	3.5	22%	0.225	10%	29.5	36%	464.5	**67%**	0.15	23%	47.5
SG14 @1.1		25%	21,300	35%	303.5	**120%**	2.5	**133%**	0.15	29%	28	21%	246	0%	0.1	3%	37.5
SG16 @1.25		11%	17,050	**52%**	229.5	**133%**	3	**86%**	0.175	15%	26	15%	248.5	**67%**	0.15	6%	34
SG17 @1.5		15%	17,650	29%	222	**133%**	3	**86%**	0.175	24%	29.5	13%	245.5	**100%**	0.2	21%	39
SG17 @2.2								22%	0.225								
SG20 @0.75		12%	20,800									9%	783.5				
	Lab Detection Limits	40	5	1	5	2	2	0.1	0.5	2	5	2	5	0.1	0.1	2	5
	Max Detection Limit	40		5		2		0.5		5		5		0.1		5	
RPD Statistics	**Minimum**	**2%**		**24%**		**0%**		**22%**		**10%**		**6%**		**0%**		**3%**	
	Maximum	**31%**		**60%**		**143%**		**133%**		**100%**		**61%**		**100%**		**82%**	
	Average	**14%**		**41%**		**111%**		**87%**		**33%**		**22%**		**58%**		**23%**	
Counts																	
42	< 30% RPD	9		2		1		2		5		8		2		7	
14	30 - 50% RPD	1		3		0		0		2		1		0		0	
36	**> 50% RPD**	**0**		**3**		**7**		**8**		**1**		**1**		**6**		**1**	

Sample Source	Final soil type	MfE Lead Tot. Rec. (mg/kg)	GHD Lead Tot. Rec. (mg/kg)	MfE Zinc Tot. Rec. (mg/kg)	GHD Zinc Tot. Rec. (mg/kg)	MfE Total Iron (TCLP g.m-3)	GHD Total Iron (TCLP g.m-3)	MfE Copper Tot. Rec. (TCLP g.m-3)	GHD Copper Tot. Rec. (TCLP g.m-3)
SG3 @1.25	TF - OS - Sed	37.1	26	65	55				
SG4 @1.5	TF - Com - OS	4.4	2.5	26	24				
SG6 @1.5	TF					0.2	1.7	2.48	3.7
SG7 @1.7	TF - Com - OS	17.9	6.6	45	20				
SG8 @1	TF - Com - OS								
SG8 @2	TF - Com - OS	23.1	17	55	39				
SG12 @1.2	TF - Com - OS	34	17	78	42				
SG14 @1.1	TF - OS - Sed	19.5	17	55	43				
SG16 @1.25	TF - Com - OS	22.9	17	57	40	0.2	1.1	2.45	0.26
SG17 @1.5	TF - Com - OS	30.8	38	82	57				
SG17 @2.2	TF - Com - OS								
SG20 @0.75	TF					0.2	2	1.91	3.1
General Statistics	**Minimum**	**4.4**	**2.5**	**26**	**20**	**0.2**	**1.1**	**1.91**	**0.26**
	Maximum	**37.1**	**38**	**82**	**57**	**0.2**	**2**	**2.48**	**3.7**
	Average	**23.7125**	**17.6375**	**57.875**	**40**	**0.2**	**1.6**	**2.28**	**2.3533333**
	Count	**8**	**8**	**8**	**8**	**3**	**3**	**3**	**3**
Results of Comparison		**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**
SG3 @1.25		35%	31.55	17%	60				
SG4 @1.5		**55%**	3.45	8%	25				
SG6 @1.5						**158%**	0.95	39%	3.09
SG7 @1.7		**92%**	12.25	**77%**	32.5				
SG8 @1									
SG8 @2		30%	20.05	34%	47				
SG12 @1.2		**67%**	25.5	**60%**	60				
SG14 @1.1		14%	18.25	24%	49				
SG16 @1.25		30%	19.95	35%	48.5	**138%**	0.65	**162%**	1.355
SG17 @1.5		21%	34.4	36%	69.5				
SG17 @2.2									
SG20 @0.75						**164%**	1.1	48%	2.505
	Lab Detection Limits	5	5	1	5	0.002	5	N/A	0.1
	Max Detection Limit	5		5		5		0.1	
RPD Statistics	**Minimum**	**14%**		**8%**		**138%**		**39%**	
	Maximum	**92%**		**77%**		**164%**		**162%**	
	Average	**43%**		**36%**		**153%**		**83%**	
Counts									
42	< 30% RPD	3		3		0		0	
14	30 - 50% RPD	2		3		0		2	
36	**> 50% RPD**	**3**		**2**		**3**		**1**	

- **Table 93. Detailed Breakdown of Nitrogen and Other Inter-lab (Hills and ??) Sample Results and RPDs.**

Sample Source	Final soil type	MfE Ammonium-N (mg/kg)	GHD Ammonia-N (mg/kg)	MfE Nitrate-N (mg/Kg)	GHD Nitrate N (mg/kg)	MfE Nitrate-N (TCLP g.m-3)	GHD Nitrate N (TCLP g.m-3)	MfE % Moisture	GHD % Moisture	MfE Dry Matter (g/100g)	GHD Dry Matter (g/100g)	MfE Final pH	GHD Final pH
SG2 @1.2	Comm							11.2	12	88.8	88		
SG2 @2.2	Comm							11.9	9.1	88.1	90.9		
SG3 @0.5	Sed - Comm - OS							6	6.2	94	93.8		
SG3 @1.25	TF - OS - Sed	229	520	12	22			9	9.2	91	90.8	10.4	10
SG4 @0.75	COMM							9.4	10	90.6	90		
SG4 @1.5	TF - Com - OS	189	230	5	8.8			20.1	22	79.9	78	7.2	6
SG6 @1.5	TF	2,580	2,600	12	15	0.448	0.91	10.6	11	89.4	89	8.1	8.1
SG7 @0.7	Comm							9.8	8.2	90.2	91.8		
SG7 @1.7	TF - Com - OS	346	210	3	68			10.7	9.4	89.3	90.6	8.5	7.9
SG8 @1	TF - Com - OS							13.5	12	86.5	88	8.3	
SG8 @2	TF - Com - OS	1,700	2,000	21	9.3			13.7	13	86.3	87	8.4	8.3
SG12 @1.2	TF - Com - OS	1,270	1,800	17	2.5			11.8	10	88.2	90	7.1	7.2
SG14 @1.1	TF - OS - Sed	656	1,700	2	2.5			14.9	24	85.1	76	9.2	8.9
SG16 @1.25	TF - Com - OS	319	250	38	250			12.9	12	87.1	88	7.1	6.8
SG17 @1.5	TF - Com - OS	732	1,100	78	10			15.2	14	84.8	86	7.4	7.7
SG17 @2.2	TF - Com - OS							14.2	13	85.8	87		
SG20 @0.75	TF	4,830	8,300	159	200	8.73	10	18.4	17	81.6	83	8.3	8.6
General Statistics	**Minimum**	**189**	**210**	**2**	**2.5**	**0.448**	**0.91**	**6**	**6.2**	**79.9**	**76**	**7.1**	**6**
	Maximum	**4,830**	**8,300**	**159**	**250**	**8.73**	**10**	**20.1**	**24**	**94**	**93.8**	**10.4**	**10**
	Average	**1,285**	**1,871**	**34.7**	**58.81**	**4.589**	**5.455**	**12.547059**	**12.476471**	**87.452941**	**87.523529**	**8.1818182**	**7.95**
	Count	**10**	**10**	**10**	**10**	**2**	**2**	**17**	**17**	**17**	**17**	**11**	**10**
Results of Comparison		**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**	**RPDs**	**Avgs.**
SG2 @1.2								7%	11.6	1%	88.4		
SG2 @2.2								27%	10.5	3%	89.5		
SG3 @0.5								3%	6.1	0%	93.9		
SG3 @1.25		**78%**	375	**59%**	17			2%	9.1	0%	90.9	4%	10.2
SG4 @0.75								6%	9.7	1%	90.3		
SG4 @1.5		20%	210	**55%**	6.9			9%	21.05	2%	78.95	18%	6.6
SG6 @1.5		1%	2,590	22%	13.5	**68%**	0.679	4%	10.8	0%	89.2	0%	8.1
SG7 @0.7								18%	9	2%	91		
SG7 @1.7		49%	278	**183%**	35.5			13%	10.05	1%	89.95	7%	8.2
SG8 @1								12%	12.75	2%	87.25		8.3
SG8 @2		16%	1,850	**77%**	15.15			5%	13.35	1%	86.65	1%	8.35
SG12 @1.2		35%	1,535	**149%**	9.75			17%	10.9	2%	89.1	1%	7.15
SG14 @1.1		**89%**	1,178	22%	2.25			47%	19.45	11%	80.55	3%	9.05
SG16 @1.25		24%	285	**147%**	144			7%	12.45	1%	87.55	4%	6.95
SG17 @1.5		40%	916	**155%**	44			8%	14.6	1%	85.4	4%	7.55
SG17 @2.2								9%	13.6	1%	86.4		
SG20 @0.75		**53%**	6,565	23%	179.5	14%	9.365	8%	17.7	2%	82.3	4%	8.45
	Lab Detection Limits	5	5	1	5	0.002	5	N/A	0.1	0.1	N/A	0.1	0.1
	Max Detection Limit	5		5		5		0.1		0.1		0.1	
RPD Statistics	**Minimum**	**1%**		**22%**		**14%**		**2%**		**0%**		**0%**	
	Maximum	**89%**		**183%**		**68%**		**47%**		**11%**		**18%**	
	Average	**40%**		**89%**		**41%**		**12%**		**2%**		**5%**	
Counts													
51	< 30% RPD	4		3		1		16		17		10	
4	30 - 50% RPD	3		0		0		1		0		0	
11	**> 50% RPD**	**3**		**7**		**1**		**0**		**0**		**0**	

Appendix D Inter-Group Communications

D.1 Post Reactor Treatment – Blending Instructions

Letter from MfE to EDL, 21 March 2005

Ministry for the
Environment
Manatū Mō Te Taiao

FM/CS/07/01

Grand Annexe
84 Boulcott Street
(Behind Embassy Court)
PO Box 10362
Wellington
New Zealand
Phone (+64 4) 917 7400
Fax (+64 4) 917 7523
http://www.mfe.govt.nz

21 March 2005

Bryan Black
Environmental Decontamination Limited
P.O. Box 58 609
139 Cryers Road
East Tamaki
AUCKLAND

Dear Bryan

Treated Soil Validation

Further to our meeting of Friday 18th March and your subsequent letter dated 20 March.

I wish to reiterate a number of points including:

1. Validation Protocol

MfE would prefer to correct the SAC to the sub 2 mm of the contaminated fines material provided for treatment. This would give not only MfE, but also EDL, much greater certainty over the level of treatment that has occurred. However I accept the current contractual arrangements and concede that the SAC will for now be calculated on the sub 2 mm fraction as it leaves the treatment plant.

However the potential issue of the plant utilising large amounts of inputs and therefore diluting rather that treating the soil remains a concern. MfE will be monitoring this regularly by updating the DRE after each batch of results becomes available and formally calculating the DRE for validation purposes each quarter. MfE will require EDL to meet both its SAC and DRE contractual obligations. Therefore there remains a potentially significant risk for EDL should the quarterly DRE calculation not meet the required levels. MfE consider that this risk could be reduced if the SAC were corrected as above.

2. Grinding of Treated Oversize

This issue is very closely related to the calculation of the DRE. If it is shown that grinding of any treated oversize material reduces the DRE below the required levels, MfE will not accept this material as validated.

3. Information to be provided by contractor

As detailed in the revised validation protocol, EDL are responsible for providing information on a number of parameters including:

- Volume of infeed material treated in each three day batch

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- Mass of "treated oversize" (nominally 5-10mm material) contained in each three day production batch
- Mass of additives (silca sand, DAP and any others) used during each three day production batch

Please ensure that this information is being collected from now on and reported weekly to John Roosen.

Meanwhile MfE have introduced a quarterly reporting protocol that will act as a formal, ongoing, validation step in the project. Therefore can you also provide this information for the period September 04 to February 05 inclusive. If all the information is not available can you provide an estimate for the period and the basis of your estimates.

4. Implications of Lab Turnaround

Your memo suggests that there are likely to be a number of practical difficulties that will arise from lab turn around times when EDL is under non-conformance mode. These are acknowledged but are beyond the control of MfE. The protocol will not be changed and it will be up to EDL to manage this situation on the ground.

5. Compliance of Material Treated to Date

As discussed MfE are prepared to accept the mixing of the treated sub 2 mm fraction treated material in order to meet the requirements of SAC. For this exercise, any mixing must only be carried out under the express direction of John Roosen, and any laboratory testing required to confirm SAC will be at EDL's cost. However I should note that the material must also pass the DRE requirements before MfE will accept it as fully validated.

I should also note that MfE do not expect this arrangement to be necessary in future. It is acknowledged that there have been a number of particular problems that have had to be addressed as part of the project start up. However under the validation protocol any sub 2 mm treated material that does not meet SAC will need to be retreated.

Yours sincerely

pp K Morgan

Nigel Ironside
Manager: Sustainable Industry

Cc John Roosen	Site Office Mapua
Cc Paul Russell	MWH Richmond

Site Instruction 08, 13 April 2005.

SITE INSTRUCTION

Contract: Mapua FCC	Date: 13 April 2005
Client: MFE	Project number: FCC Phase III
Contractor: EDL	Consecutive number: 08

	Key
Contract interpretation or for general information – not involving any variation =	A
Variation for immediate action - price must be submitted within 28 days =	B
- at schedule rates =	C
Proposed variation price requested =	D
Approving Contractor's submitted rate =	E
Other =	F
Description of work:	
In accordance with the letter dated 21 March 2005 from the Project Manager,	
Nigel Ironside, reference is made to Section 5 concerning mixing of the treated sub 2 mm	
fraction. "For this exercise, any mixing must only be carried out under the express direction	
of John Roosen, and any laboratory testing required to confirm SAC will be at EDL's cost	
arrangement to be necessary in future."	
Attached is a statement containing the data relevant to the EDL Piles.	
Also included are DDX and UCL results. Specific directions are provided.	
As soon as a mixing pad is available, please so indicate to the Site Management Office, so	
that we can provide proper mixing proportions	
There should be no additional costs to MfE relative to this site instruction.	

(for Contractor)

Site Manager
(for Ministry for the Environment)

Circulate to:				
MWH – Juliet				

Site Instruction 13, 4 May 2005.

SITE INSTRUCTION

Ministry for the Environment
Manatū Mō Te Taiao

Contract: Mapua FCC	Date 4 May 2005
Client: MFE	Project number: FCC Phase III
Contractor: EDL	Consecutive number: 13

	Key
Contract interpretation or for general information – not involving any variation =	A
Variation for immediate action - price must be submitted within 28 days =	B
- at schedule rates =	C
Proposed variation price requested =	D
Approving Contractor's submitted rate =	E
Other =	F

Description of work:

As a result of a site walk with Brent Pascoe and a review of the validation results received to date:

It was agreed that the following 3 piles could be **returned** to FCC East:
14,15 March
31 Mar 1,2, April
7,8,9 April

It was further agreed that the following 3 piles would be **retreated**:
Pile 4
15,16 Feb
12,14 Feb

Blending was suggested by EDL for the following piles:
Pile 2 29, 30,31 March
Pile 3 11,12,13 April
Pile 5
9,10,11 Feb.
17,18,19 Feb.
22,23,24 Mar
Pile A

Under cl. 26.6 (Part C1 Technical Specification) of your Contract blending of soils for the purpose of reducing contaminant concentrations is not permitted.

A discussion ensued as to the requirements for blending. It was agreed that blending was to undertaken only under J. Roosen's specific instruction. These instructions were being finalized.

(for Contractor)

Site Manager
(for Ministry for the Environment)

Circulate to:				
MWH – Juliet				

Appendix E Destruction Certificates and Eves Valley Landfill Receipts

MEDI-CHEM

Medi-Chem Waste Services Ltd

CERTIFICATE OF ELIMINATION

ISSUED BY:	MEDI-CHEM WASTE SERVICES LTD P O Box 58 832 Greenmount Auckland NEW ZEALAND

Waste Generator:	Ministry for the Environment P O Box 10 362 Wellington
Waste Details:	Waste Solid & Liquid agrichemicals as per attached schedule
Shipment Details: Cerfa Nos	26.9.07(disposal date) DE1350/143573 7 & 8

This certificate confirms that the waste specified above has been eliminated in an environmentally sound manner at the AVG Hamburg Plant Germany, in accordance with the Basel Convention and all statutory permits and regulations in force at the facility.

Issued at MEDI-CHEM WASTE SERVICES LTD (Penrose Branch)

This 26th day of October 2007
Managing Director
Signed Lincoln Falconer

MEDI-CHEM WASTE SERVICES (Penrose Branch)

Shipped Hansa Stockholm

Generator	**Weight**
Env Waikato	2494
Tasman	1689
MFE (Medi-Chem) Total	4183
	2679
	406
	466
	137
Non MFE (Medi-Chem) Total	3688
Container BHCU 305006-1	7871
Bracing & pallet weight	1404
	9275
Env Waikato	3247
ARC	363
Wellington R C	698
Tasman	2357
MFE (Medi-Chem) Total	6665
	299
	80
	269
	239
	431
	83
	239
Non MFE (Medi-Chem) Total	1640
Container 3HCU 305279-0	8305
Bracing,spill pan & pallet weight	1600
	9905

PACKING LIST

UN NUMBER : **As listed**

CLASS : 6.1&3

Ship, Voyage No:	**Hansa Stockholm Vo 200707**	**CONTAINER No :**	**BHCU305279-0 Seal#18910501**
Sailing Date:	**9.8.07**	**Container Nett (Kg):**	**9905 Kg**
Port of Origin:	**Auckland**	**Container Tare (Kg):**	**2185 Kg**
Port of Destination:	**Zeebrugge**	**Container Gross (Kg):**	**12090 Kg**

BIN NO		WEIGHT	CONTENTS	UN Number	Class	GENERATOR
N 04	Bin Nett :	359 Kg	Drum EW7-12 pesticide liquid & solid toxic n.o.s. (88kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Gross :	448 Kg	Drum EW7-5 pesticide liquid & solid toxic n.o.s. & liquid toxic flammable n.o.s. (84kg)	2902 2903 2588	6&3	Env Waikato (MFE)
			Drum EW7-7 pesticide liquid & solid toxic n.o.s. (84kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-22 pesticide liquid & solid toxic n.o.s. (103kg)	2902 2588	6.1	Env Waikato (MFE)
N 05	Bin Nett :	405 Kg	Drum EW7-16 pesticide liquid toxic n.o.s. (117kg)	2902	6.1	Env Waikato (MFE)
	Bin Gross :	494 Kg	Drum EW7-2 pesticide liquid & solid toxic n.o.s. (100kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-3 pesticide liquid toxic n.o.s. (85kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-15 pesticide liquid & solid toxic n.o.s. (103kg)	2902 2588	6.1	Env Waikato (MFE)
N 06	Bin Nett :	389 Kg	Drum EW7-20 pesticide liquid & solid toxic n.o.s. (101kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Gross :	478 Kg	Drum EW7-8 pesticide liquid & solid toxic n.o.s. (113kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-13 pesticide liquid & solid toxic n.o.s. (87kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-4 pesticide liquid toxic n.o.s. (88kg)	2902	6.1	Env Waikato (MFE)
N 12	Bin Nett :	363 Kg	Drum A07-6 pesticide solid & liquid toxic n.o.s. (92kg)	2588 2902	6.1	ARC (MFE)
	Bin Gross :	452 Kg	Drum A07-3 pesticide liquid & solid toxic n.o.s. (74kg)	2902 2588	6.1	ARC (MFE)
			Drum A07-5 pesticide solid toxic n.o.s. (104kg)	2588	6.1	ARC (MFE)
			Drum A07-10 pesticide solid toxic n.o.s. (93kg)	2588	6.1	ARC (MFE)
N 15	Bin Nett :	585 Kg	Drum EW7-23 pesticide liquid toxic n.o.s. (213kg)	2902	6.1	Env Waikato (MFE)
	Bin Gross :	674 Kg	Drum EW7-14 pesticide liquid toxic n.o.s.(220kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-19 pesticide liquid & solid toxic n.o.s. (73kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-21 pesticide liquid toxic n.o.s. (79kg)	2902	6.1	Env Waikato (MFE)
O 08	Bin Nett :	373 Kg	Drum EW7-9 pesticide liquid toxic n.o.s. (100kg)	2902	6.1	Env Waikato (MFE)
	Bin Gross :	462 Kg	Drum EW7-1 pesticide liquid & solid toxic n.o.s & liquid toxic flammable n.o.s. (93kg)	2902 2903 2588	6&3	Env Waikato (MFE)
			Drum EW7-6 pesticide liquid & solid toxic n.o.s. (78kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-10 pesticide solid toxic n.o.s. (102kg)	2588	6.1	Env Waikato (MFE)
O 14	Bin Nett	503 Kg	Drum 341 pesticide liquid & solid toxic n.o.s. (121kg)	2902 2588	6.1	Wellington Reg Ccl (MFE)
	Bin Gross	591 Kg		2902	6.1	
				2902 2588	6.1	
				2902 2588	6.1	
O 15	Bin Nett :	378 Kg	Drum EW7-82 pesticide liquid & solid toxic n.o.s. & liquid toxic flammable n.o.s. (86kg)	2902 2903 2588	6&3	Env Waikato (MFE)
	Bin Gross	467 Kg	Drum EW7-66 pesticide liquid & solid toxic n.o.s. (98kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-65 pesticide liquid & solid toxic n.o.s. (101kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-79 pesticide liquid & solid toxic n.o.s. (93kg)		6.1	Env Waikato (MFE)
O 16	Bin Nett :	319 Kg		2902 2588	6.1	
	Bin Gross :	408 Kg		2902 2588	6.1	
				2588	6.1	
				2588 2902	6.1	
O 17	Bin Nett :	374 Kg	Drum EW7-76 pesticide liquid toxic n.o.s. (107kg)	2902	6.1	Env Waikato (MFE)
	Bin Gross :	463 Kg	Drum EW7-68 pesticide liquid & solid toxic n.o.s. (83kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-75 pesticide liquid & solid toxic n.o.s. (104kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-69 pesticide liquid & solid toxic n.o.s. (80kg)	2902 2588	6.1	Env Waikato (MFE)
O 22	Bin Nett :	577 Kg	Drum 339 pesticide liquid toxic n.o.s. (149kg)	2902	6.1	Wellington Reg Ccl (MFE)
	Bin Gross :	666 Kg	Drum 340 pesticide liquid & solid toxic n.o.s. (127kg)	2902 2588	6.1	Wellington Reg Ccl (MFE)
			Drum 337 pesticide liquid toxic n.o.s. (151kg)	2902	6.1	Wellington Reg Ccl (MFE)
			Drum 338 pesticide liquid toxic n.o.s. (150kg)	2902	6.1	Wellington Reg Ccl (MFE)
O 23	Bin Nett :	508 Kg		2902 2588	6.1	
	Bin Gross :	597 Kg		2902	6.1	
				2902	6.1	
				2902	6.1	
O 24	Bin Nett	589 Kg	Drum 306 pesticide liquid toxic n.o.s. (149kg)	2902	6.1	Tasman Dist Ccl (MFE)
	Bin Gross	678 Kg	Drum 314 pesticide liquid & solid toxic n.o.s. (148kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 301 pesticide liquid toxic n.o.s. (147kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)

			Drum 309 pesticide liquid & solid toxic n.o.s. (145kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
O 25	Bin Nett :	591 Kg	Drum 341 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
	Bin Gross :	680 Kg	Drum 310 pesticide liquid & solid toxic n.o.s. (149kg)	290i2 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 303 pesticide liquid & solid toxic n.o.s. (142kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 305 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
O 26	Bin Nett :	585 Kg	Drum 307 pesticide liquid & solid toxic n.o.s. (135kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
	Bin Gross :	674 Kg	Drum 339 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 340 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 318 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
O 27	Bin Nett :	592 Kg	Drum 326 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
	Bin Gross :	680 Kg	Drum 304 pesticide solid toxic n.o.s. (143kg)	2588	6.1	Tasman Dist Ccl (MFE)
			Drum 324 pesticide liquid & solid toxic n.o.s. (150kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
			Drum 325 pesticide liquid & solid toxic n.o.s. (149kg)	2902 2588	6.1	Tasman Dist Ccl (MFE)
O 28	Bin Nett :	431 Kg		2588	6.1	
	Bin Gross :	520 Kg		2902	6.1	
				2902 2903	6&3	
				2902	6.1	
O 29	Bin Nett :	384 Kg	Drum EW7-87 pesticide liquid & solid toxic n.o.s. (81kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Gross :	473 Kg	Drum EW7-97 pesticide liquid toxic n.o.s. (151kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-93 pesticide liquid & solid toxic n.o.s. & liquid toxic flammable n.o.s. (81kg)	2902 2903 2588	6&3	Env Waikato (MFE)
			Drum EW7-86 pes icide liquid & solid toxic n.o.s. (71kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Nett :					
	Bin Gross :					
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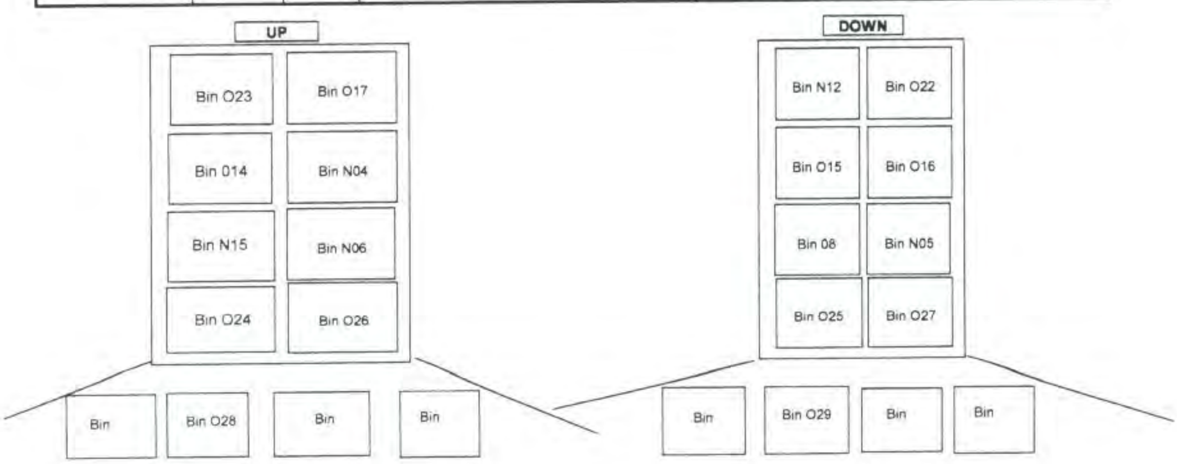

PACKING LIST

UN NUMBER : As listed

CLASS : 6.1&3

Ship, Voyage No:	**Hansa Stockholm Vo200707**	**CONTAINER No :**	**BHCU 305006-1 Seal#18910502**
Sailing Date:	**9.8.07**	**Container Nett (Kg):**	**9275 Kg**
Port of Origin:	**Auckland**	**Container Tare (Kg):**	**2185 Kg**
Port of Destination:	**Zeebrugge**	**Container Gross (Kg):**	**11460 Kg**

BIN NO		WEIGHT	CONTENTS	UN Number	Class	GENERATOR
	Bin Nett :	451 Kg		2902 2588	6.1	
N 28	Bin Gross :	529 Kg		2902 2588	6.1	
				2902 2588	6.1	
				2902	6.1	
	Bin Nett :	448 Kg		2902 2588	6.1	
N 29	Bin Gross :	526 Kg		2902 2588	6.1	
				2902 2588	6.1	
				2902 2588	6.1	
	Bin Nett :	371 Kg		2902 2588	6.1	
N 31	Bin Gross :	449 Kg		2902 2588	6.1	
				2902 2588	6.1	
				2902 2588	6.1	
	Bin Nett :	472 Kg		2902 2588	6.1	
O 01	Bin Gross :	550 Kg		29022588	6.1	
				2902 2588	6.1	
				2902	6.1	
	Bin Nett :	398 Kg	Drum EW7-80 pesticide liquid & solid toxic n.os. (83kg)	2902 2588	6.1	Env Waikato (MFE)
O 03	Bin Gross :	476 Kg	Drum EW7-81 pesticide liquid toxic n.os. (124kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-64 pesticide liquid & solid toxic n.os. & liquid toxic flammable n.o.s (95kg)	2902 2588 2903	6&3	Env Waikato (MFE)
			Drum EW7-61 pesticide liquid & solid toxic n.os. (96kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Nett :	539 Kg	Drum 336 pesticide solid toxic n.o.s. (133kg)	2588	6.1	Tasman D.C. (MFE)
O 04	Bin Gross :	617 Kg	Drum 338 pesticide solid toxic n.o.s. (119kg)	2588	6.1	Tasman D.C. (MFE)
			Drum 337 pesticide solid toxic n.o.s. (150kg)	2588	6.1	Tasman D.C. (MFE)
			Drum 302 pesticide liquid & solid toxic n.o.s. (137kg)	2902 2588	6.1	Tasman D.C. (MFE)
	Bin Nett :	592 Kg	Drum 323 pesticide liquid toxic n.o.s. (149Kg)	2902	6.1	Tasman D.C. (MFE)
O 05	Bin Gross :	670 Kg	Drum 312 pesticide liquid & sorid toxic n.o.s. (149 Kg)	2902 2588	6.1	Tasman D.C. (MFE)
			Drum 321 pesticide solid toxic n.o.s. (149Kg)	2588	6.1	Tasman D.C. (MFE)
			Drum 316 pesticide liquid & solid toxic n.o.s. (145 Kg)	2902 2588	6.1	Tasman D.C. (MFE)
	Bin Nett :	320 Kg		2902 2588	6.1	
O 06	Bin Gross :	398 Kg		2902 2588	6.1	
				2902	6.1	
				2902 2588	6.1	
	Bin Nett :	442 Kg	Drum EW7-83 pesticide liquid & solid toxic n.o.s. (97kg)	2902 2588	6.1	Env Waikato (MFE)
O 07	Bin Gross :	520 Kg	Drum EW7-67 pesticide liquid & solid toxic n.o.s. (94kg)	2902 2588	6.1	Env Waikato (MFE)
				2588	6.1	
			Drum EW7-78 pesticide solid toxic n.o.s. (152kg)	2588	6.1	Env Waikato (MFE)
	Bin Nett :	415 Kg		2902 2588	6.1	
O 09	Bin Gross :	493 Kg		2902 2588	6.1	
				2902	6.1	
			Drum EW7-90 pesticide liquid & solid toxic n.o.s. (101kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Nett :	420 Kg	Drum EW7-88 pesticide liquid & solid toxic n.o.s. (95kg)	2902 2588	6.1	Env Waikato (MFE)
O 10	Bin Gross :	498 Kg	Drum EW7-92 pesticide liquid & solid toxic n.o.s. (93kg)	2902 2588	6.1	Env Waikato (MFE)
				2902 2588	6.1	
			Drum EW7-77 pesticide solid toxic n.o.s.(150Kg)	2588	6.1	Env Waikato (MFE)
	Bin Nett :	364 Kg	Drum EW7-85 pesticide liquid toxic n.o.s. (88kg)	2902	6.1	Env Waikato (MFE)
O 11	Bin Gross :	442 Kg	Drum EW7-89 pesticide liquid & solid toxic n.o.s. (100kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-94 pesticide liquid & solid toxic n.o.s. (91kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-91 pesticide liquid & solid toxic n.o.s. (85kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Nett :	363 Kg	Drum EW7-52 pesticide liquid & solid toxic n.o.s. (103kg)	2902	6.1	Env Waikato (MFE)
O 12	Bin Gross :	441 Kg	Drum EW7-56 pesticide solid toxic n.o.s. (74kg)	2902 2588	6.1	Env Waikato (MFE)
			Drum EW7-50 pesticide liquid toxic n.o.s. (89kg)	2902	6.1	Env Waikato (MFE)

			Drum EW7-55 pesticide liquid toxic n.o.s. (97kg)	2588	6.1	Env Waikato (MFE)
O 13	Bin Nett :	466 Kg	Drum EW7-48 pesticide liquid & solid toxic n.o.s. (85kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Gross :	544 Kg	Drum EW7-57 pesticide liquid toxic n.o.s. (219kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-54 pesticide liquid toxic n.o.s. (83kg)	2902	6.1	Env Waikato (MFE)
			Drum EW7-49 pesticide liquid toxic n.o.s. (79kg)	2902	6.1	Env Waikato (MFE)
O 18	Bin Nett :	346 Kg	Drum EW-72 pesticide liquid & solid toxic n.o.s. (121kg)	2902 2588	6.1	Env Waikato (MFE)
	Bin Gross :	424 Kg		2588	6.1	
				2588	6.1	
				2902	6.1	
O 19	Bin Nett :	466 Kg		2902	6.1	
	Bin Gross :	544 Kg		2902	6.1	
				2902	6.1	
				2588	6.1	
O 20	Bin Nett :	558 Kg	Drum 311 pesticide liquid & solid toxic n.o.s. (141kg)	2588	6.1	Tasman D.C. (MFE)
	Bin Gross :	636 Kg	Drum 322 pesticide solid toxic n.o.s. (148kg)	2588	6.1	Tasman D.C. (MFE)
			Drum 320 pesticide solid toxic n.o.s. (141kg)	2588	6.1	Tasman D.C. (MFE)
			Drum 319 pesticide liquid toxic n.o.s. (128kg)	2902	6.1	Tasman D.C. (MFE)
P 01	Bin Nett :	440 Kg		2902	6.1	
	Bin Gross :	518 Kg		2902 2588	6.1	
				2588	6.1	
				2902	6.1	
	Bin Nett :					
	Bin Gross :					
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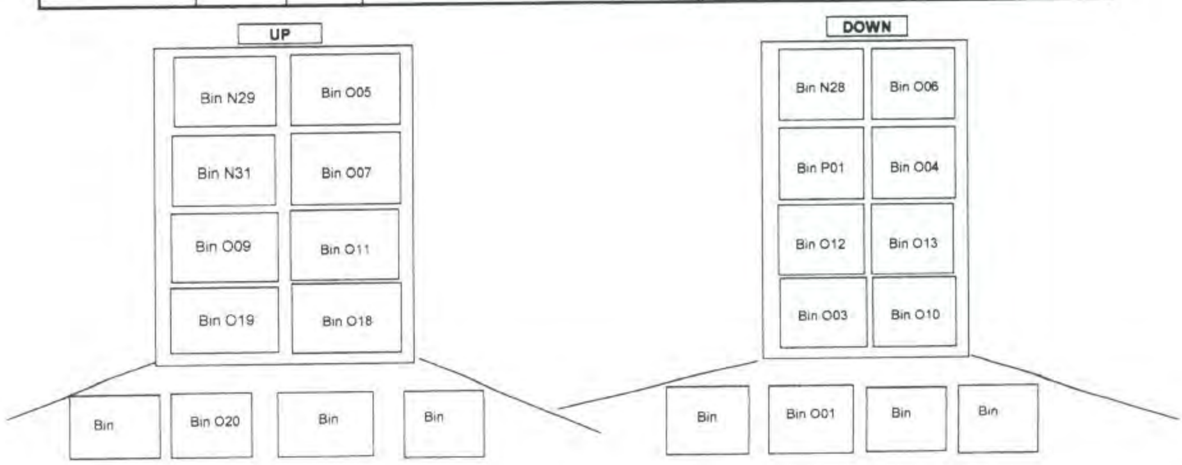

Tasman District Council

RM030521, M003
Writer's Direct Dial: (03) 543-8456
Writer's e-mail: sandy.pomeroy@tdc.govt.nz

7 May 2008

Ministry for the Environment
Attention: Marilyn Bramley
PO Box 10 362
WELLINGTON 6020

Dear Marilyn

MAPUA CLEANUP PROJECT: REFERENCE 07314

Thank you for your letter of 1 May 2008. Attached is a file copy of our letter of 11 December 2007 with the attachment. The attachment includes the invoices calculated at the rates applicable at the time the material was dumped. The invoice sent to MfE was recalculated to the agreed contract rate.

Yours sincerely

Sandy Pomeroy
Accounts Administrator
Encl:

G:\EP Letters\Dbk\2008\MfE - 7 May 2008.doc

FILE

Tasman District Council

11 December 2007

RM030521
Writer's Direct Dial: (03) 543-8430
Writer's e-mail: dennis.bush-king@tdc.govt.nz

Ministry for the Environment
Attention: Fiona Morgan
PO Box 10 362
WELLINGTON 6020

FILE

Dear Fiona

MAPUA CLEANUP PROJECT

Work is proceeding satisfactorily in finishing the final contours of the FCC site. There have been a few issues as may have been expected in relation to the quantity of soil to cover on the FCC East Site, but we have worked through those. We expect Taylors to be finished on the site this side of Christmas, depending on what we finally decide in relation to the sowing of the grass.

The reason for writing however is to advise you of another matter that has emerged. When EDL were decommissioning the plant it appears they took a reasonable amount of material to Eves Valley Landfill. My enquiries indicate they made their own arrangements to transport the material there and incurred the appropriate charges. Our Accounts Department have been trying to recover the charges without perhaps fully appreciating that they were incurred as part of the Mapua Cleanup Project. We have received correspondence from EDL refusing to pay the charge and they have drawn our attention to the contract that EDL had with Ministry for the Environment where it would seem the principal was to meet the associated landfill costs of disposal. A copy of the correspondence is attached.

I note that the landfill charge is at the current rate, but if it is to be considered a charge in relation to the FCC Mapua contract, then the agreed contract rate should apply. I have had our Accounts Department prepare an amended invoice that now represents the outstanding liability.

This is a fair and reasonable charge and one that was unbeknown to me for the reasons explained when we exchanged correspondence. I propose to add the amended amount to the $365,000 (exclusive of GST) sum that we are working to as the final wash-up costs.

Yours sincerely

Dennis Bush-King

Dennis Bush-King
Environment & Planning Manager
Encl:

G:\EP Letters\Dbk\2007\MfE - 11 December 2007.doc

RICHMOND
189 Queen Street
Private Bag 4, Richmond 7050
Tel +64 3 543 8400
Fax +64 3 543 9524

MOTUEKA
7 Hickmott Place
PO Box 123, Motueka 7143
Tel +64 3 528 2022
Fax +64 3 528 9751

TAKAKA
78 Commercial Street
PO Box 74, Takaka 7142
Tel +64 3 525 0020
Fax +64 3 525 9972

MURCHISON
92 Fairfax Street
Murchison 7007
Tel +64 3 523 1013
Fax +64 3 523 1012

www.tasman.gov

Tasman District Council

Ministry For The Environment PO Box 10362 Wellington 6143	

GST Number:	51076806
Invoice Date:	12/12/07
Tax Invoice No:	23982
Customer No:	07314
Order No.	

Tax Invoice

QTY.	DESCRIPTION	RATE	AMOUNT
	SPECIAL WASTE DISPOSAL CHARGES		
	Disposal of Contaminated Material ex Mapua Site at $31.40 +GST per tonne August - Total of 455.35 tonnes = 14297.99+GST		16,085.24 *
	September - Total of 10.28 tonnes = $322.79+GST		363.14 *
	October - Total of 14.7 tonnes = $461.58 +GST		519.28 *

(* Incl GST **$1,885.30**)

Balance Due
16,967.70

Head Office
RICHMOND
189 Queen Street
Private Bag 4, Richmond 7050
Ph (03) 543 8400
Fax (03) 543 9524

Service Centre
MURCHISON
92 Fairfax St
Murchison 7007
Ph (03) 523 1013
Fax (03) 523 1012

Service Centre
MOTUEKA
7 Hickmott Place
PO Box 123, Motueka 7143
Ph (03) 528 2022
Fax (03) 528 9751

Service Centre
GOLDEN BAY
78 Commercial St
PO Box 74, Takaka 7142
Ph (03) 525 0020
Fax (03) 525 9972

email - Info@tdc.govt.nz website - www.tdc.govt.nz

Tasman District Council

Customer Name: Ministry For The Environment

Customer Number: 07314

Tax Invoice: 23982

Invoice Date: 12/12/07

Total Due (Inc GST): 16,967.70

Amount Paid:

071122.004

Environmental Decontamination Ltd

PO Box 58 609, 139 Cryers Rd, East Tamaki,
Auckland, New Zealand
Phone: +64 9 274 9862
Fax: +64 9 274 7393

www.edl.net.nz

Tasman District Council
Private Bag 4,
189 Queen Street
Richmond 7050

RECEIVED
22 NOV 2007
TASMAN DISTRICT COUNCIL

16 November 2007

Attention; Dennis Bush-King

Dear Sir,

I wish to bring to your attention the two attached invoices from your council, They are being returned as it clearly states in our contract under PART C1 OTHER CONTRACT DOCUMENTS on page 42, No 8 REMOVAL OF MCD SLAB (a copy also attached) that it is the Principal that shall meet the landfill costs associated with this disposal. MFE being that Principal is the correct avenue to pursue this payment from.

Thank you for sorting this matter out.

Jenny / Bryce – can we discuss next step. R
Dennis

Yours Faithfully

B. Pascoe

Brent Pascoe
Project Manager

6. PATENTS AND ROYALTIES

6.1 The copyright and property in the Design Documents but not the Licensed Design hereby vests in the Principal who grants to the Contractor an irrevocable licence to use the Design Documents for the work under the Contract and any other purpose. The Contractor shall do everything necessary to perfect such vesting

6.2 'Licensed Design' means those categories of design documentation relating to components that:

(a) the Contractor will incorporate into the Works;

(b) the Contractor or any of its contractors distribute under a trademark or brand name as part of its normal business undertaking; and

(c) form a part of software which is owned by any third party and required for the creation of any models as may be required for the completion of the design of the works in accordance with the Contract.

7. FINAL PAYMENT CLAIM

7.1 With or prior to submission of the final payment claim, under Part B2 of the Contract, the Contractor shall submit to the Principal's representative the following information:

(a) signed copies of Producer Statements required under the Building Act 1991 (where the Act applies to the Works) or statements with similar wording where the Act does not apply, for construction and for construction review;

(b) a full set of the Design Documents marked up to show any 'as-constructed' amendments, a copy of all operating instructions and manuals required for the Works; and

(c) a signed statement by the Contractor that the Works have been completed in accordance with the Contract.

8. REMOVAL OF MCD SLAB

8.1 Unless instructed by the Engineer, the Contractor shall break up and remove the MCD Slab from the Site. The Contractor shall transport and dispose of the slab materials at the Eves Valley landfill or other disposal site approved by the Engineer. The Principal shall meet the landfill costs associated with this disposal and the Contractor shall be responsible for all other costs of demolition, removal, transport and any other associated costs.

9. CONTAMINATED MATERIAL UNDER MCD SLAB

9.1 The Contractor shall, at the direction of the Engineer, either:

(a) Load all contaminated material from under the MCD slab into sealed containers and remove from Site to an approved disposal location; or

TDC Tasman District Council

RECEIVED

Environmental Decontamination Ltd.
PO Box 58609
Greenmount
Manukau
Auckland 2141

GST Number:	51076806
Invoice Date:	13/11/07
Tax Invoice No:	22630
Customer No:	RMAN0030
Order No.	

Tax Invoice

QTY.	DESCRIPTION	RATE	AMOUNT
	SPECIAL WASTE DISPOSAL CHARGES of contaminated material ex Mapua Site at $90 per tonne September 2007 See Attached		925.20 *

(* Incl GST $102.80)

Balance Due

925.20

Head Office
RICHMOND
189 Queen Street
Private Bag 4, Richmond 7050
Ph (03) 543 8400
Fax (03) 543 9524

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MURCHISON
92 Fairfax St
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Fax (03) 523 1012

Service Centre
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Fax (03) 528 9751

Service Centre
GOLDEN BAY
78 Commercial St
PO Box 74, Takaka 7142
Ph (03) 525 0020
Fax (03) 525 9972

email - Info@tdc.govt.nz website - www.tdc.govt.nz

TDC Tasman District Council

Customer Name: Environmental Decontamination Ltd.

Customer Number: RMAN003

Tax Invoice: 22630

Invoice Date: 13/11/07

Total Due (Inc GST): 925.20

Amount Paid:

Tasman District Council

Customer: Environmental Decontamination Ltd -

Month: 9 / 2007

Date	Manifest	Description	Type	Order No	Quantity	Rate	Cost ($)
19/09/2007	70803	Disposal of contaminated material ex Mapua site	Industrial waste		5.39 tonnes	90.00	485.10
27/09/2007	70803	Disposal of contaminated material ex Mapua site	Industrial waste		4.89 tonnes	90.00	440.10
							925.20

TDC Tasman District Council

RECEIVED

Environmental Decontamination Ltd.
PO Box 58609
Greenmount
Manukau
Auckland 2141

GST Number:	51076806
Invoice Date:	13/11/07
Tax Invoice No:	22629
Customer No:	RMAN0030
Order No.	

Tax Invoice

QTY.	DESCRIPTION	RATE	AMOUNT
	SPECIAL WASTE DISPOSAL CHARGES of contaminated concrete ex Mapua Site at $90 per tonne August 2007 See Attached		33,818.40 *

(* Incl GST $3,757.60)

Balance Due
33,818.40

Head Office
RICHMOND
189 Queen Street
Private Bag 4, Richmond 7050
Ph (03) 543 8400
Fax (03) 543 9524

Service Centre
MURCHISON
92 Fairfax St
Murchison 7007
Ph (03) 523 1013
Fax (03) 523 1012

Service Centre
MOTUEKA
7 Hickmott Place
PO Box 123, Motueka 7143
Ph (03) 528 2022
Fax (03) 528 9751

Service Centre
GOLDEN BAY
78 Commercial St
PO Box 74, Takaka 7142
Ph (03) 525 0020
Fax (03) 525 9972

email - info@tdc.govt.nz website - www.tdc.govt.nz

TDC Tasman District Council

Customer Name: **Environmental Decontamination Ltd.**

Customer Number:	RMAN0030
Tax Invoice:	22629
Invoice Date:	13/11/07
Total Due (Inc GST):	**33,818.40**
Amount Paid:	

Tasman District Council

Customer: Environmental Decontamination Ltd -

Month: 8 / 2007

Date	Manifest	Description	Type	Order No	Quantity	Rate	Cost ($)
03/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		7.37 tonnes	90.00	663.30
16/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		8.86 tonnes	90.00	797.40
21/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		3.72 tonnes	90.00	334.80
22/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		31.56 tonnes	90.00	2,840.40
23/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		152.15 tonnes	90.00	13,693.50
24/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		169.85 tonnes	90.00	15,286.50
31/08/2007	70803	Disposal of contaminated concrete ex Mapua site	Contaminated concrete		2.25 tonnes	90.00	202.50
							33,818.40

Ministry for the
Environment
Manatū Mō Te Taiao

AF CS 07 44

1 May 2008

Sandy Pomeroy
Accounts Administrator
Tasman District Council
Private Bag 4
Richmond 7050

RECEIVED
-5 MAY 2008
TASMAN DISTRICT COUNCIL

Dear Sandy

Reference 07314

I attach an email sent to Tasman District Council in January of this year. I have not yet had a response to this email. As advised, I need a copy of the correspondence to determine whether the Ministry is liable to pay the charges or whether TDC should be billing EDL Ltd for the costs.

Could you please supply the letter which was missing from the previous bill and letter.

Thank you

Yours sincerely

M. Bramley

Marilyn Bramley
Ministry for the Environment

Environment House
23 Kate Sheppard Place
PO Box 10362
Wellington, New Zealand
| Phone +64 4 439 7400 | Fax +64 4 439 7700 | www.mfe.govt.nz | www.climatechange.govt.nz |

Marilyn Bramley

From: Marilyn Bramley
Sent: 22 January 2008 15:45
To: 'Dennis.Bush-King@tdc.govt.nz'
Subject: Mapua Cleanup project - landfill charges

Hi Dennis

In you letter of 11 December 2007 to the Ministry about the landfill charges incurred by EDL you noted that a copy of the correspondence between EDL and TDC was attached.

If the correspondence was attached it had vanished by the time it arrived at my desk. Could you please supply a copy? The invoice does not record what was discharged to the landfill in sufficient detail for us to determine whether we are liable to pay the landfill charges or not.

Thanks

Marilyn

TDC Tasman District Council

Tracey Ayre
Level 2

24th April 2008

Ministry for the Environment
PO Box 10362
Wellington 6143
Attention: Accounts Payable

Dear Sir/Madam,

Debtors Reference: 07314

Please note the attached invoice does not appear to have been paid yet. Please forward payment for this immediately.

If you have any queries regarding this letter please do not hesitate to contact me on the numbers below.

Yours sincerely

Sandy Pomeroy
Accounts Administrator

To talk to me directly:
Ph: 03 543 8456 Fax: 03 543 9524

TDC Tasman District Council

Ministry For The Environment
PO Box 10362
Wellington 6143

GST Number:	51076806
Invoice Date:	12/12/07
Tax Invoice No:	23982
Customer No:	07314
Order No.	

Tax Invoice

QTY.	DESCRIPTION	RATE	AMOUNT	
	SPECIAL WASTE DISPOSAL CHARGES			
	Disposal of Contaminated Material ex Mapua Site at $31.40 +GST per tonne August - Total of 455.35 tonnes = 14297.99+GST		16,085.24	*
	September - Total of 10.28 tonnes = $322.79+GST		363.14	*
	October - Total of 14.7 tonnes = $461.58 +GST		519.28	*

(* Incl GST $1,885.30)

COPY

Balance Due

16,967.70

[illegible]

Service Centre
MURCHISON
[illegible]

Service Centre
MOTUEKA
7 Hickmott Place
PO Box 123, Motueka 7143
Ph (03) 528 2022
Fax (03) 528 9751

Service Centre
GOLDEN BAY
78 Commercial St
PO Box 74, Takaka 7142
Ph (03) 525 0020
Fax (03) 525 9972

email - info@tdc.govt.nz website - www.tdc.govt.nz

TDC Tasman District Council

Customer Name: Ministry For The Environment

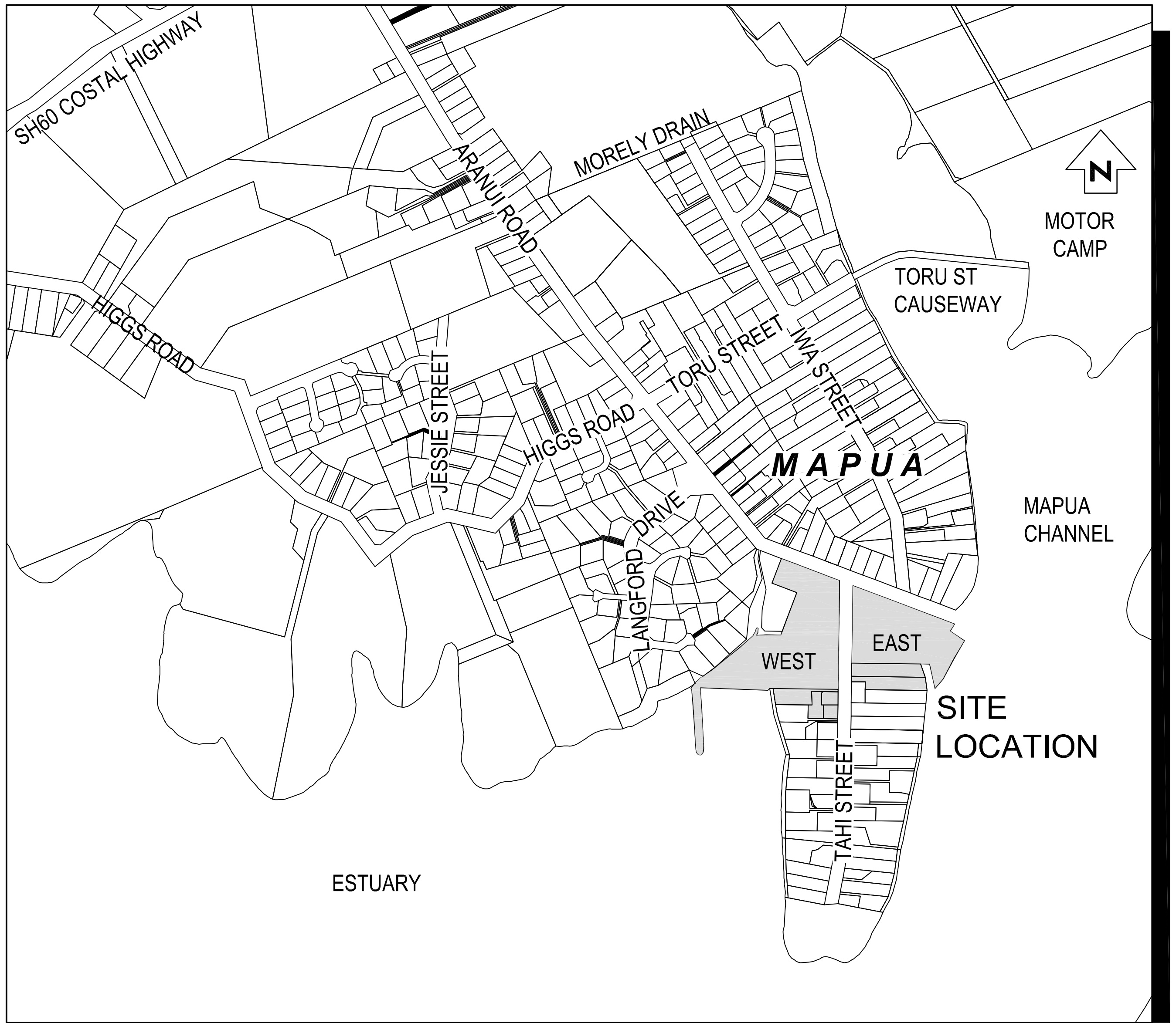
Tax Invoice: 23982
Invoice Date: 12/12/07

Customer Number:	07314
Total Due (Inc GST):	16,967.70
Amount Paid:	

Appendix F ‘As Built Drawings'

12 September 2008 - 11:17am

REMEDIATION OF THE FCC SITE AT MAPUA



LOCALITY PLAN

SCALE 1:2500

Ministry for the Environment
Manatû Mô Te Taiao

MWH

GENERAL DRAWING INDEX

SHEET No.	DESCRIPTION
G1	COVER SHEET, LOCATION PLAN AND GENERAL INDEX
G2	EAST AND WEST SITE DRAWING INDEX
G3	GENERAL ARRANGEMENT
G4	GEOTECHNICAL PLAN - USE ZONING AREAS
G5	TYPICAL DETAILS AND SECTIONS

Status Stamp

AS BUILT

Date Stamp

12 SEPTEMBER 2008

JOB No. Z0172403 SHEET NO. G1

P:\801\001724\03 MFE\Cad\As Built\AB Cover_Index 1-2.dwg

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB Cover_Index 1-2.dwg

REMEDIATION OF THE FCC SITE AT MAPUA

DRAWING INDEX EAST SITE

SHEET No.	DESCRIPTION
E1	EAST SITE LAYOUT PRE-EXCAVATION vs BACKFILL
E2	SG2-SECT A PRE EXCAVATION AND BACKFILL SHEET 1 OF 3
E3	SG2-SECT B & C PRE EXCAVATION AND BACKFILL SHEET 2 OF 3
E4	SG2-SECT D PRE EXCAVATION AND BACKFILL SHEET 3 OF 3
E5	SG3 & 4-PRE EXCAVATION AND BACKFILL
E6	SG5A & 5B- PRE EXCAVATION AND BACKFILL
E7	SG5C & SGAW- PRE EXCAVATION AND BACKFILL
E8	SG6 & SG9- PRE EXCAVATION AND BACKFILL
E9	SG7- PRE EXCAVATION AND BACKFILL
E10	SG8-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
E11	SG8-SECT C PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
E12	SG10,SG11 & SG13-PRE EXCAVATION AND BACKFILL
E13	SG12-PRE EXCAVATION AND BACKFILL
E14	SG14-PRE EXCAVATION AND BACKFILL
E15	SG16-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
E16	SG16-SECT C PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
E17	SG17-PRE EXCAVATION AND BACKFILL
E18	SG20-SECT A & C PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
E19	SG20-SECT B PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
E20	SG39- PRE EXCAVATION AND BACKFILL

DRAWING INDEX WEST SITE

SHEET No.	DESCRIPTION
W1	WEST SITE LAYOUT PRE-EXCAVATION vs BACKFILL
W2	SG1-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W3	SG1-SECT C & D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W4	SG15-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W5	SG15-SECT C PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W6	SG18-SECT A, B & C PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W7	SG18-SECT D & E PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W8	SG19 PRE EXCAVATION AND BACKFILL
W9	SG19B PRE EXCAVATION AND BACKFILL
W10	SG19C PRE EXCAVATION AND BACKFILL
W11	SG21 PRE EXCAVATION AND BACKFILL
W12	SG22 PRE EXCAVATION AND BACKFILL
W13	SG23-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W14	SG23-SECT C PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W15	SG24-SECT A, B & C PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W16	SG24-SECT D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W17	SG25 PRE EXCAVATION AND BACKFILL
W18	SG26-SECT A, B & C PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W19	SG26-SECT D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W20	SG27-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W21	SG27-SECT C & D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W22	SG28-SECT A, B, C & D PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W23	SG28-SECT E & F PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W24	SG29-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W25	SG29-SECT C PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W26	SG30 PRE EXCAVATION AND BACKFILL
W27	SG31-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W28	SG31-SECT C & D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W29	SG32 PRE EXCAVATION AND BACKFILL
W30	SG33 PRE EXCAVATION AND BACKFILL
W31	SG34 PRE EXCAVATION AND BACKFILL
W32	SG35-SECT A TO F PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W33	SG35-SECT G TO J PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W34	SG36 PRE EXCAVATION AND BACKFILL
W35	SG37-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W36	SG37-SECT C & D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W37	SG38-SECT A & B PRE EXCAVATION AND BACKFILL SHEET 1 OF 2
W38	SG38-SECT C & D PRE EXCAVATION AND BACKFILL SHEET 2 OF 2
W39	SG40 PRE EXCAVATION AND BACKFILL
W40	FNCLINE PRE EXCAVATION AND BACKFILL

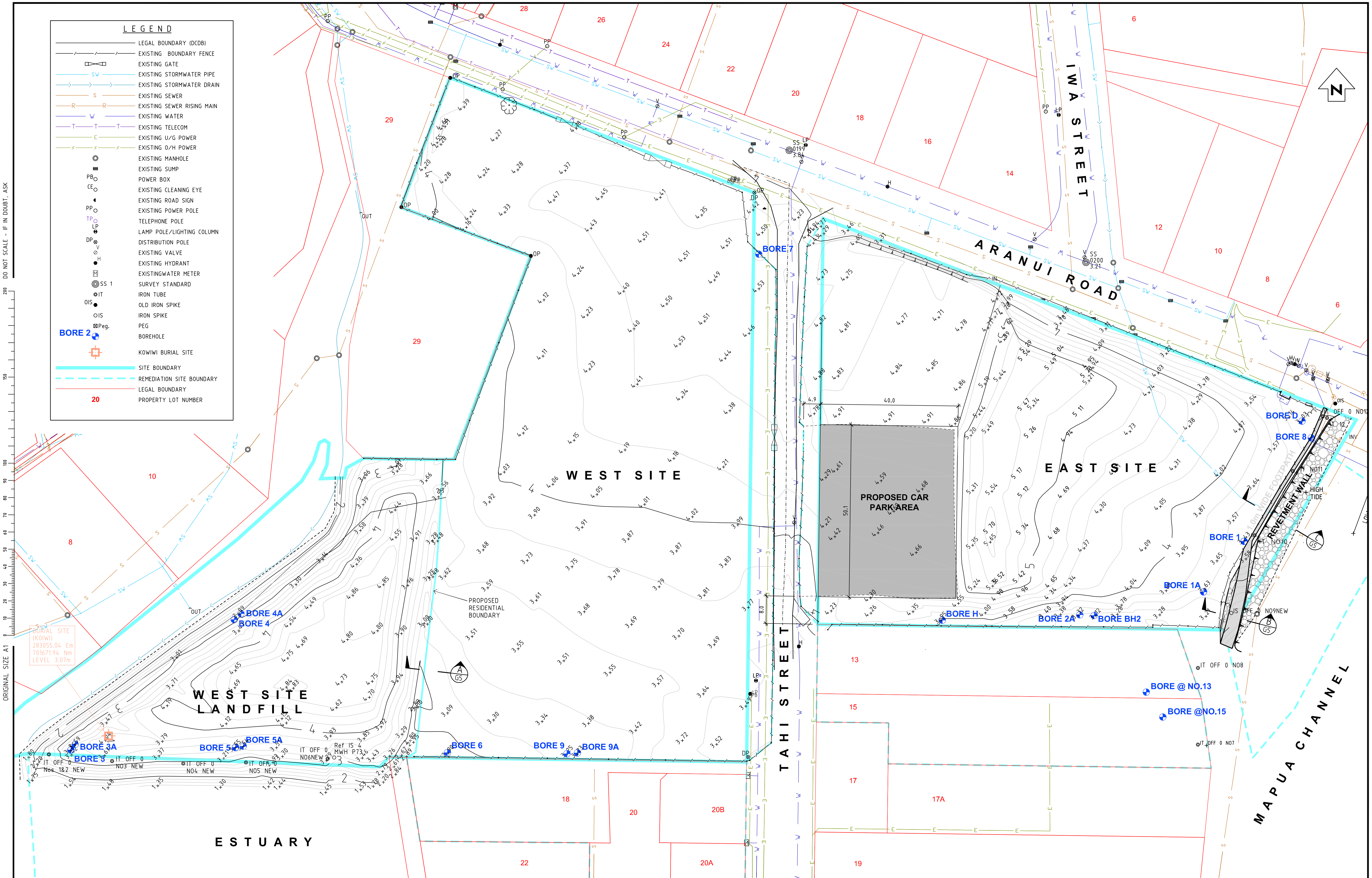
Ministry for the Environment
Manatû Mô Te Taiao

MWH

Status Stamp
AS BUILT

Date Stamp
12 SEPTEMBER 2008

JOB No. Z0172403 SHEET NO. G2



AB	AS BUILT	PFR	09-08	PFR	09-08
REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
		CHECKED		APPROVED	

TAB/DWG : Layout1 / AB General Arrangement 3-4.dwg
SERVER : NELSON
XREFS :

FIELDBOOK	Name	Date
SURVEYED	MAH	11-07
DESIGNED	PFR	02-06
DRAWN	SJF	09-08
CHECKED	PFR	09-08
APPROVED		09-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

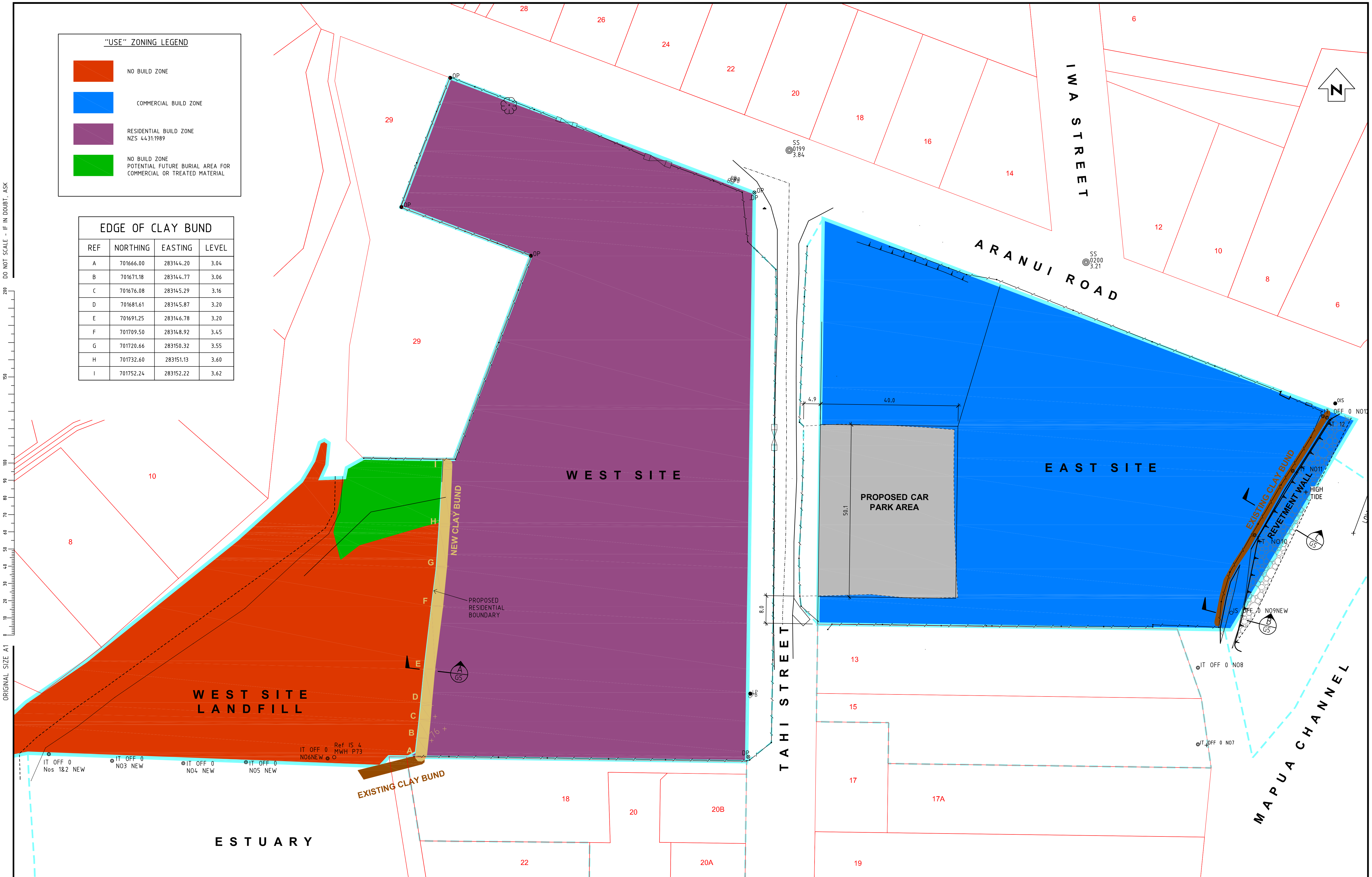
MAPUA F.C.C. SITE

GENERAL ARRANGEMENT

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) 1 : 500 (A3) 1 : 1000

Job No.	Sheet No.	Rev.
801/001724	G3	AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB General Arrangement 3-4.dwg



EDGE OF CLAY BUND

REF	NORTHING	EASTING	LEVEL
A	701666.00	283144.20	3.04
B	701671.18	283144.77	3.06
C	701676.08	283145.29	3.16
D	701681.61	283145.87	3.20
E	701691.25	283146.78	3.20
F	701709.50	283148.92	3.45
G	701720.66	283150.32	3.55
H	701732.60	283151.13	3.60
I	701752.24	283152.22	3.62

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	PFR	09-08	PFR	09-08

TAB/DWG : Layout2 / AB General Arrangement 3-4.dwg
SERVER : NELSON
XREFS :

FIELDBOOK	Name	Date
SURVEYED	MAH	11-07
DESIGNED	PFR	02-06
DRAWN	SJF	09-08
CHECKED	PFR	09-08
APPROVED	P.F. Russell	09-08

MWH

Ministry for the Environment
Manatû Mô Te Taiao

MAPUA F.C.C. SITE

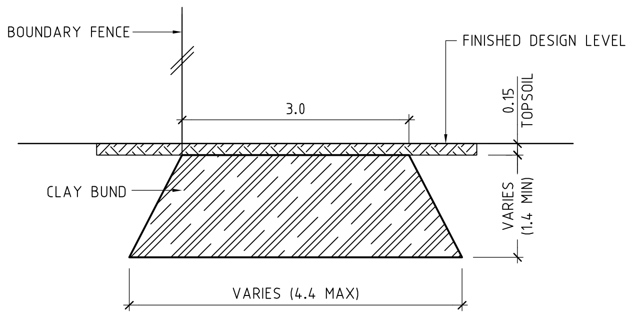
GEOTECHNICAL PLAN
"USE" ZONING AREAS

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) 1 : 500 (A3) 1 : 1000

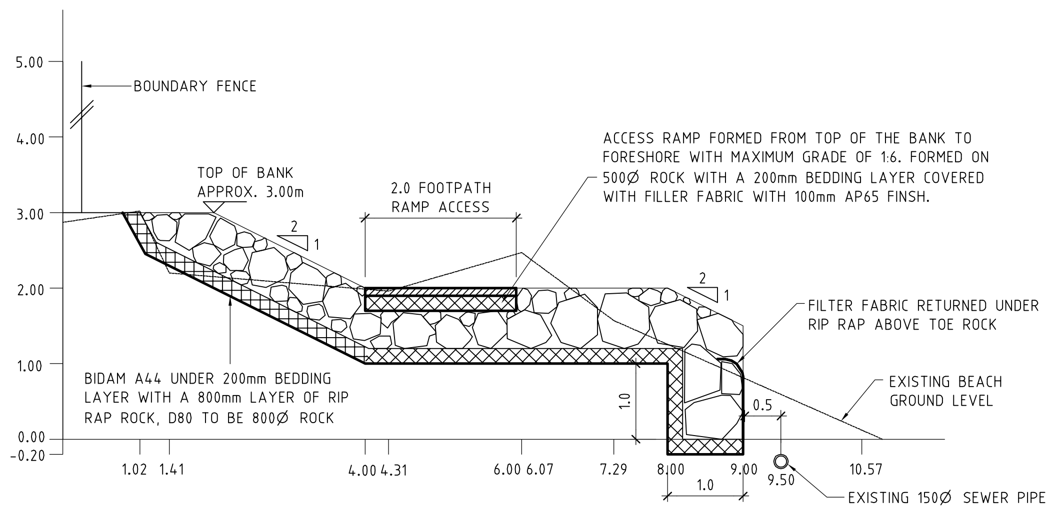
Job No.	Sheet No.	Rev.
801/001724	G4	AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB General Arrangement 3-4.dwg

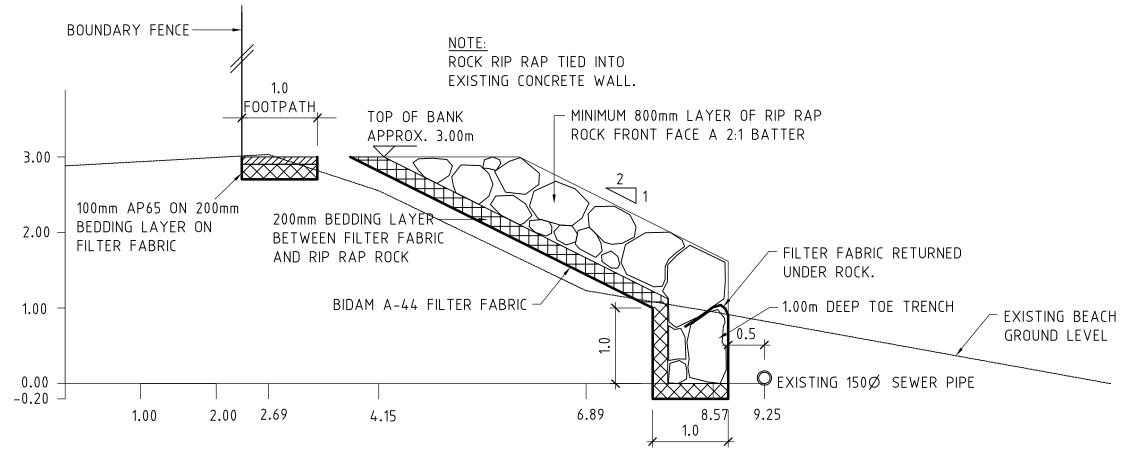
DO NOT SCALE - IF IN DOUBT, ASK



SECTION A G3
1 : 50



SECTION B G3
1 : 50



SECTION C G3
1 : 50

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	PFR	09-08	PFR	09-08

TAB/DWG : Layout1 / AB General Details 5.dwg
SERVER : NELSON
XREFS :

FIELDBOOK	Name	Date
SURVEYED	MAH	11-07
DESIGNED	PFR	02-06
DRAWN	SJF	09-08
CHECKED	PFR	09-08
APPROVED	P.F. Russell	09-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

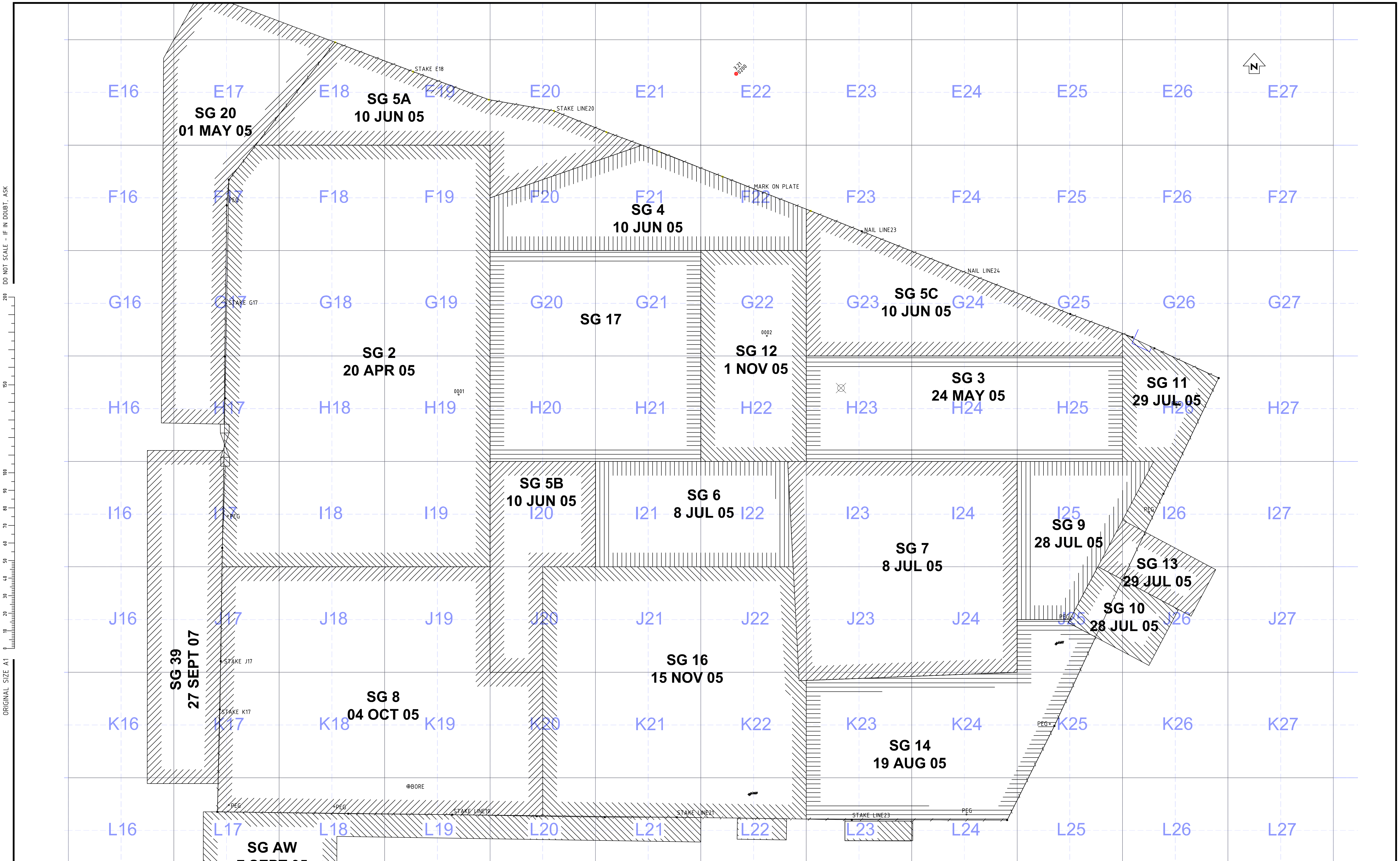
MAPUA F.C.C. SITE

SECTIONS AND DETAILS

Status Stamp	AS BUILT
Date Stamp	12 SEPTEMBER 2008
SCALES (A1) 1 : 500 (A3) 1 : 1000	

Job No.	Sheet No.	Rev.
801/001724	G5	AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB General Details 5.dwg



PLAN INDICATING EXCAVATED/BACKFILL AREAS ON EAST SITE

1:250

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08				

Job No: 1724-03
TAB/DWG : E1 - SITE LAYOUT / AB_EAST_01 Cover.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	VL	09-04
CHECKED	JCW	09-04
APPROVED	P. F. Russell	09-04

MWH

Ministry for the **Environment** Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

EAST SITE LAYOUT
PRE EXCAVATION vs BACKFILL

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

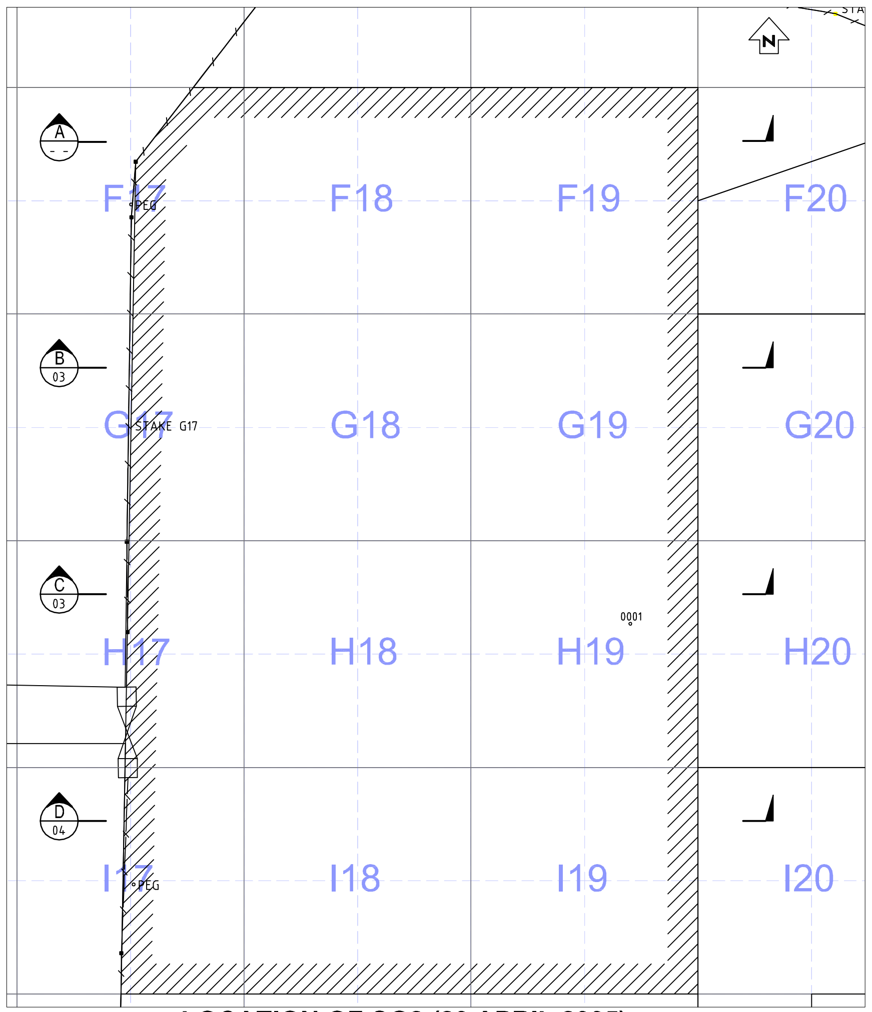
TDC Plan No.	Sheet No.	Rev.
6487s1	E1	AB1

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_01 Cover.dwg

ORIGINAL SIZE A1 — DO NOT SCALE - IF IN DOUBT, ASK

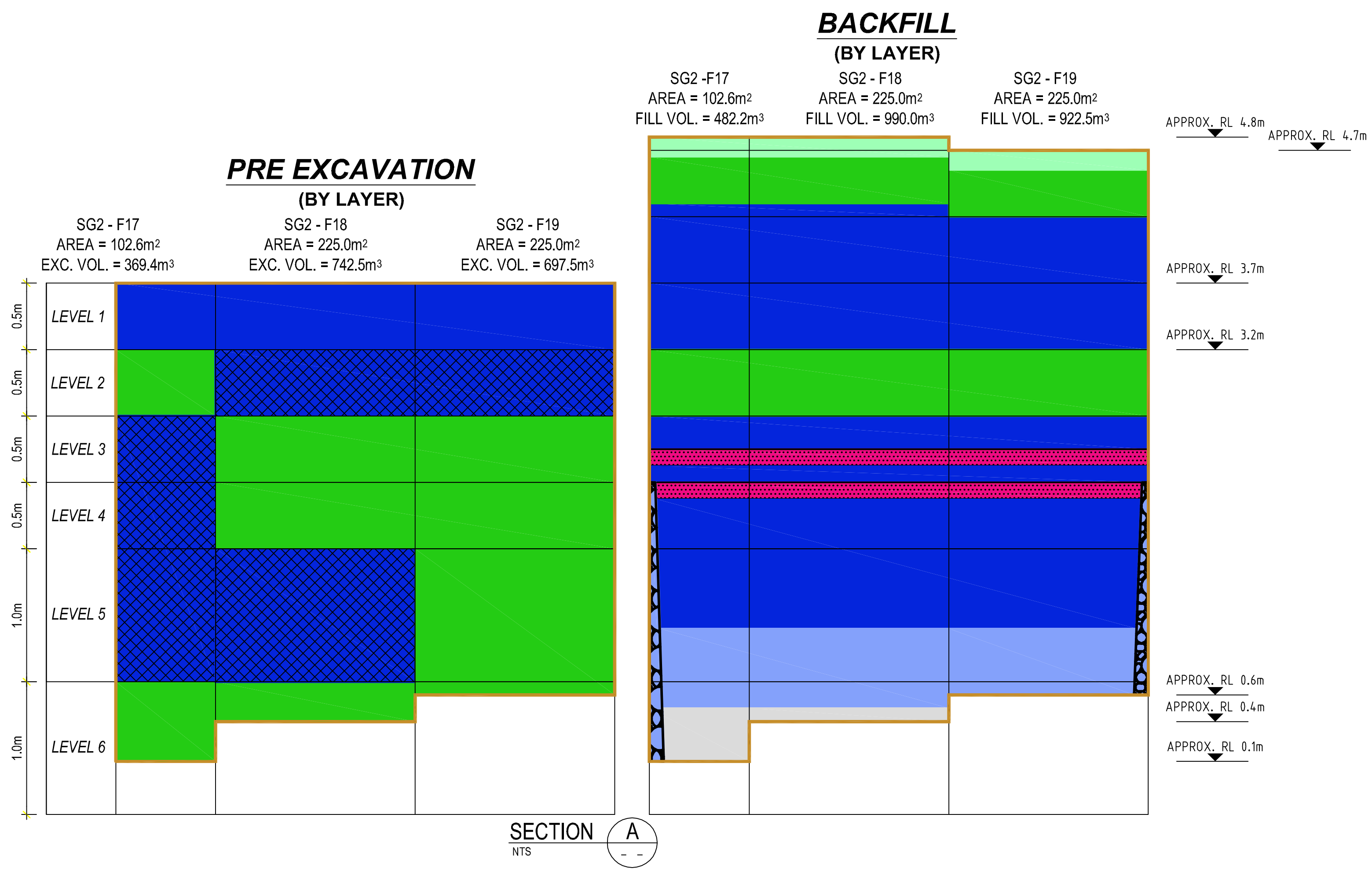
12 September 2008 - 10:33am

P:\801\001724\03 MFE\Cad\As Built\AB_EAST_01 Cover.dwg

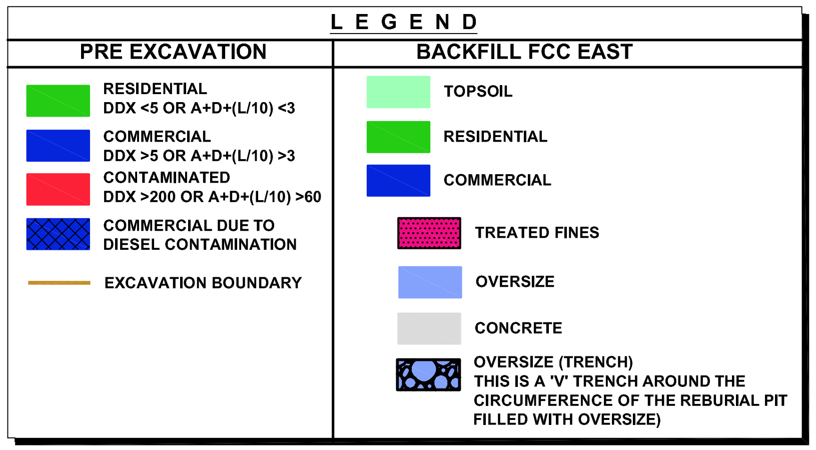


LOCATION OF SG2 (20 APRIL 2005)

1:250



SCHEMATIC SECTION OF SG2



DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:32am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08				
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03

TAB/DWG : E2 - SG2 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)

XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG2 - PRE EXCAVATION AND BACKFILL
SECTION A OF SECTIONS A-D

Status Stamp: **AS BUILT**

Date Stamp: **12 SEPTEMBER 2008**

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s2	E2	AB1

P:\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

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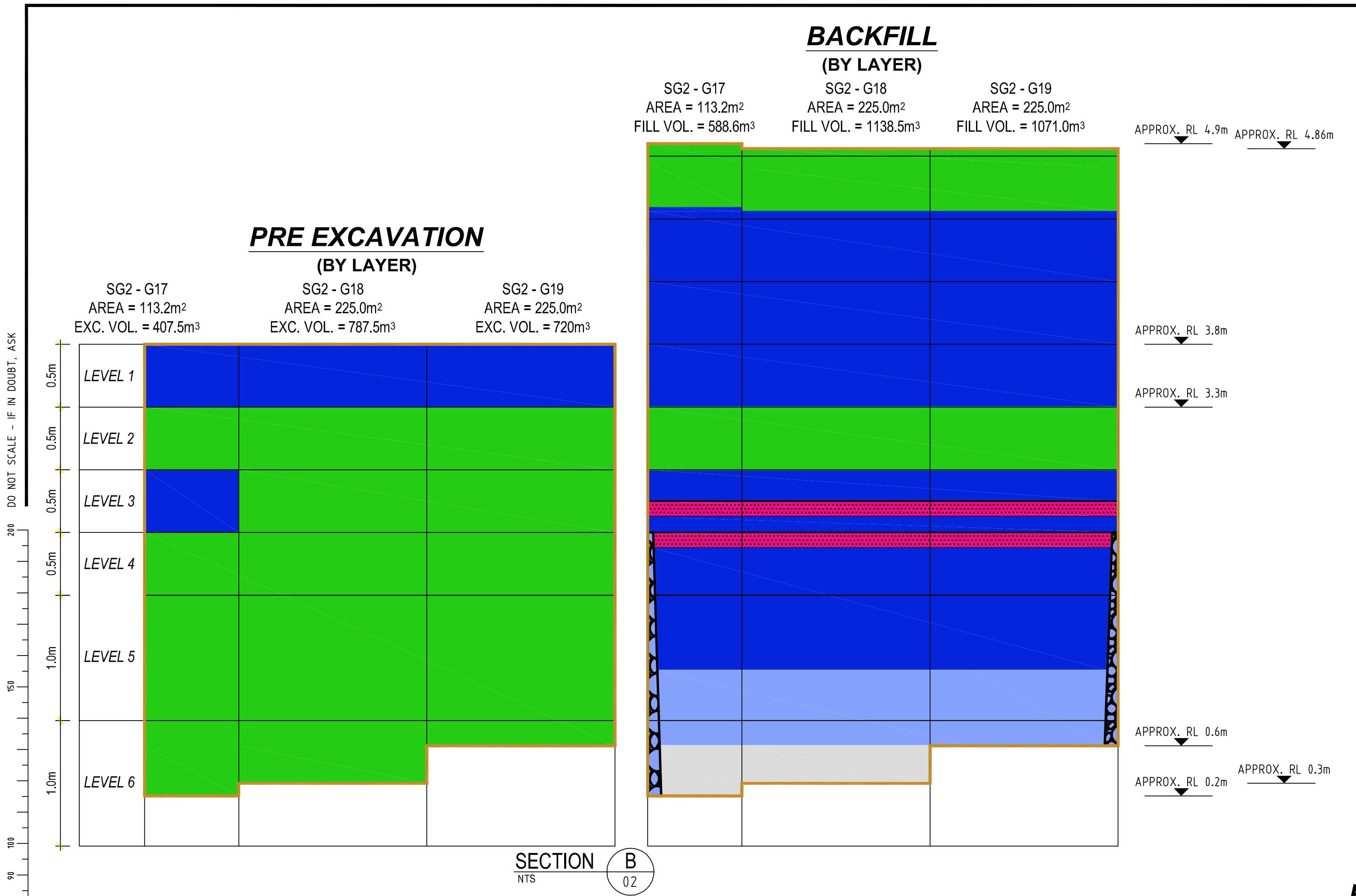
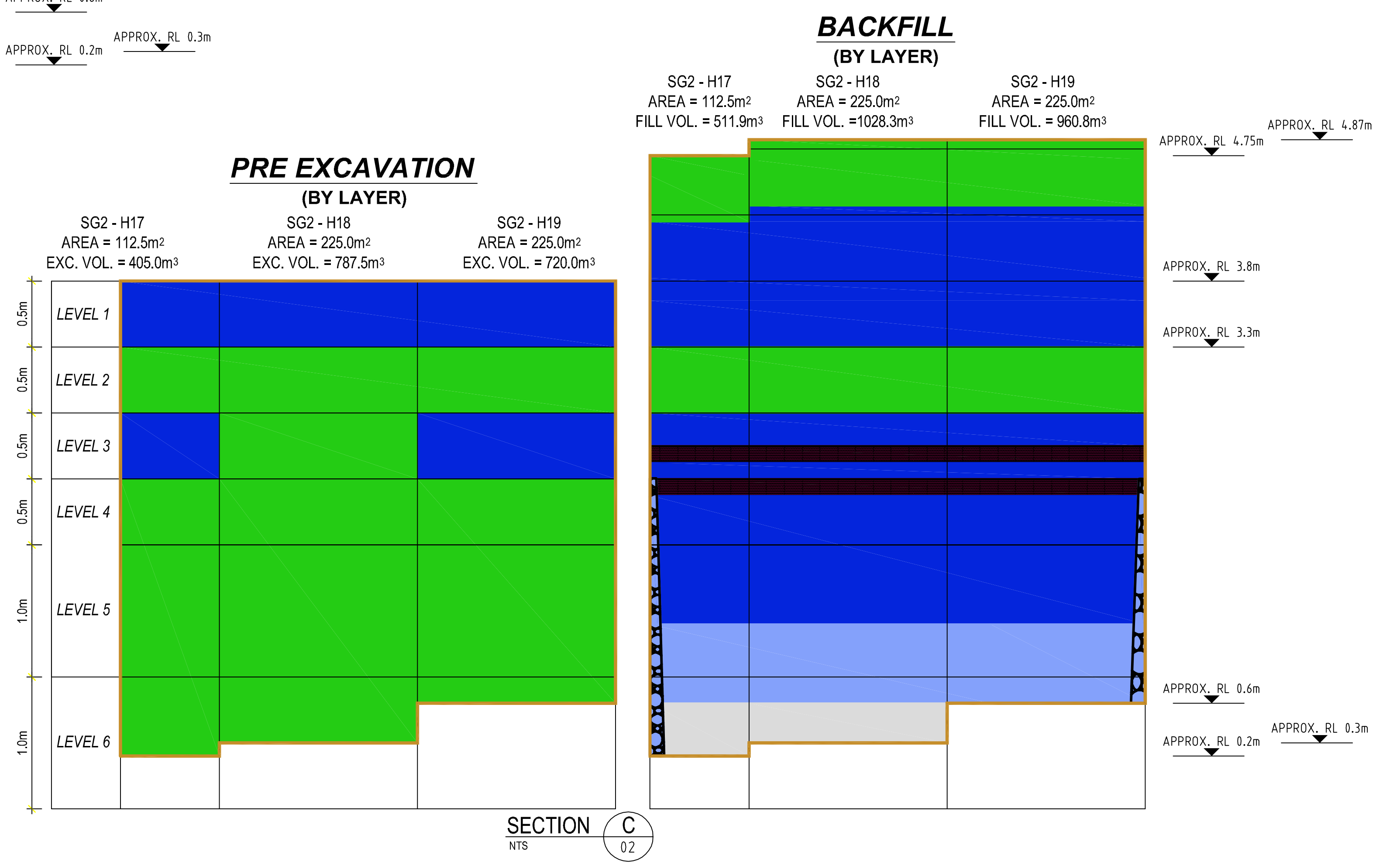


SCHEMATIC SECTION OF SG2

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
COMMERCIAL DUE TO DIESEL CONTAMINATION	TREATED FINES
EXCAVATION BOUNDARY	OVERSIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)



SCHEMATIC SECTION OF SG2

ORIGINAL SIZE A1
DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 10:32am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORKS 20-03-08				
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E3 - SG2 (2) / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG2 - PRE EXCAVATION AND BACKFILL
SECTIONS B&C OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s3	E3	AB1

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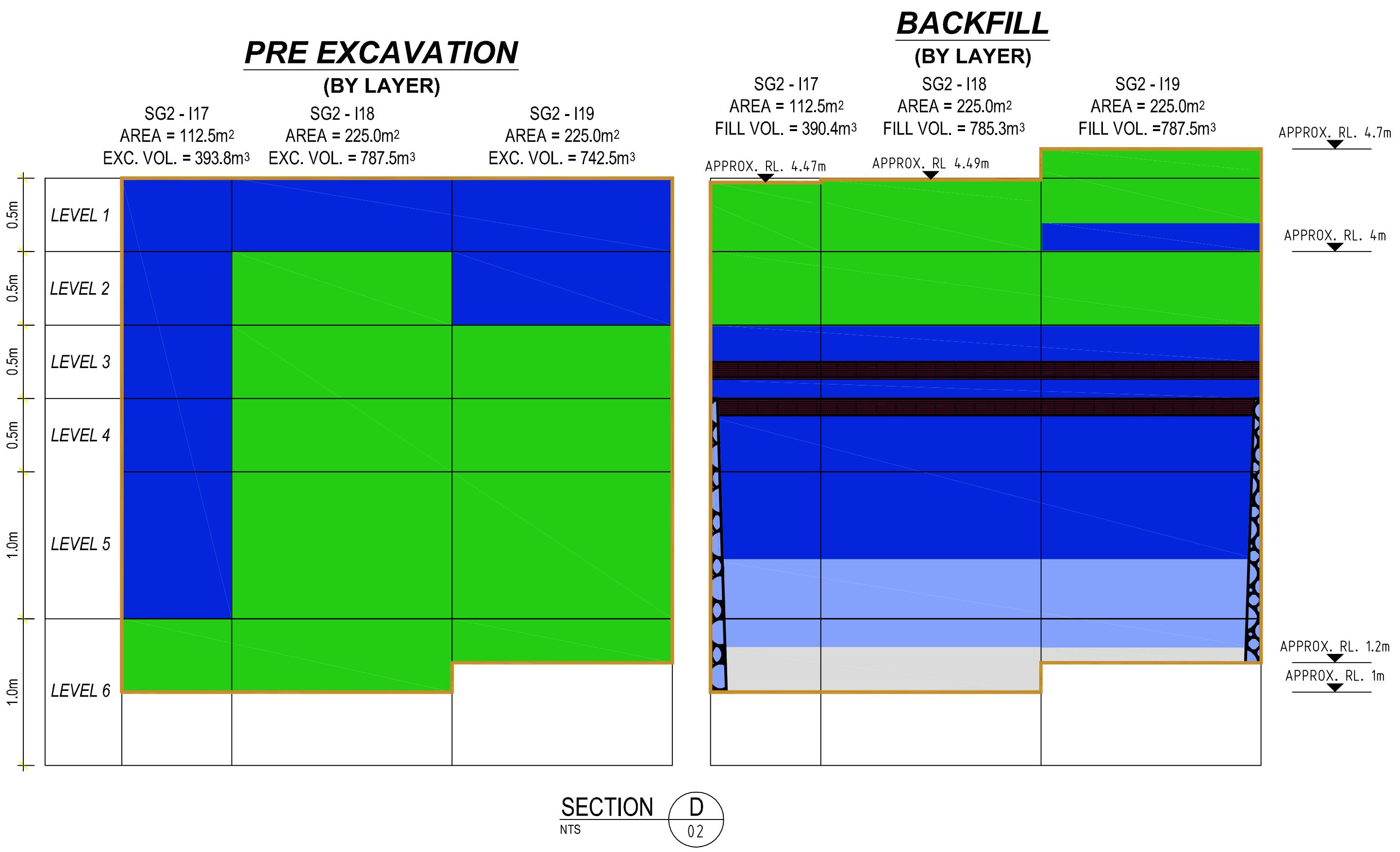


SCHEMATIC SECTION OF SG2

L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
COMMERCIAL DUE TO DIESEL CONTAMINATION	TREATED FINES
EXCAVATION BOUNDARY	OVERSIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:31am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORKS 20-03-08				
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E4 - SG2 (3) / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the **Environment** Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

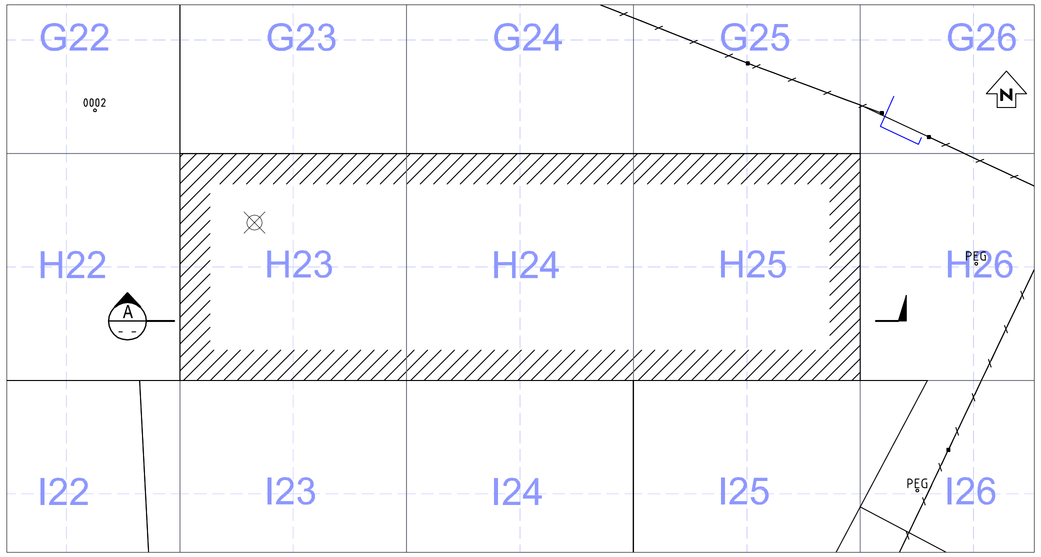
SG2 - PRE EXCAVATION AND BACKFILL
SECTION D OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

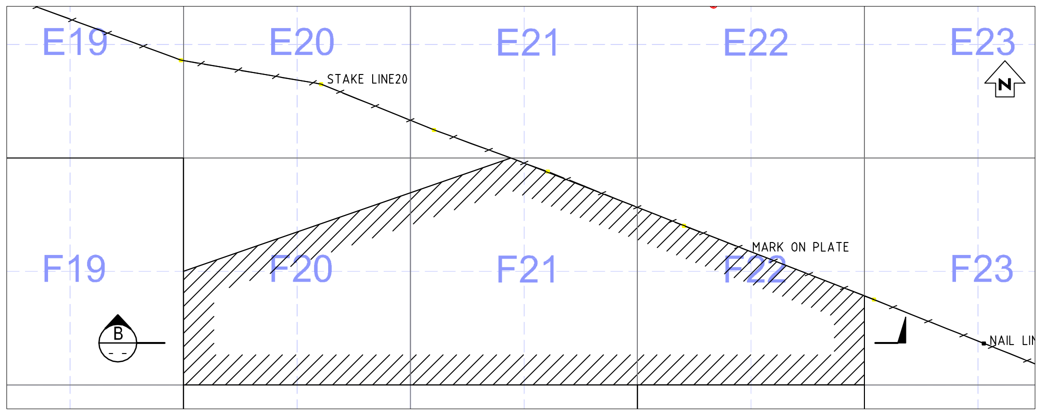
TDC Plan No.	Sheet No.	Rev.
6487s4	E4	AB1

P:\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

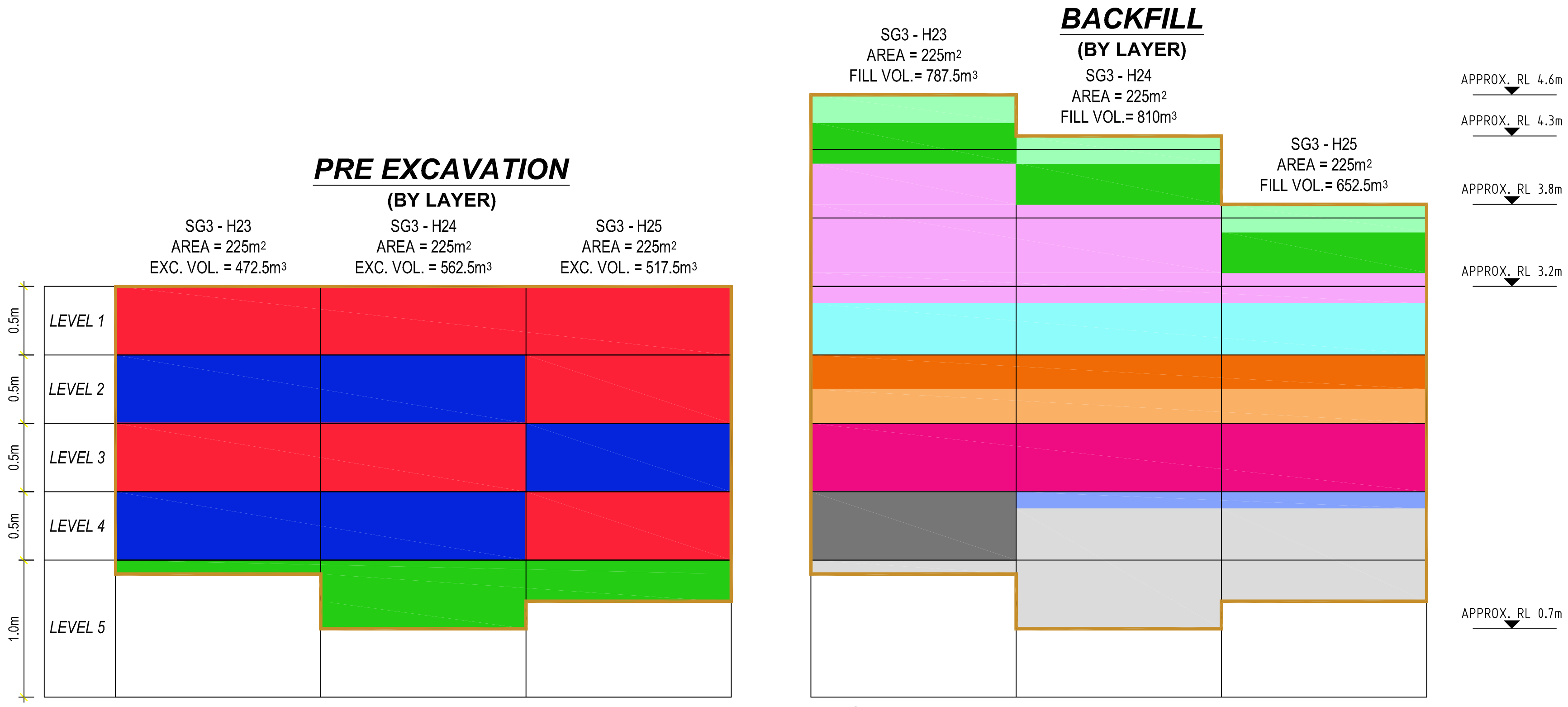
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg



LOCATION OF SG3 (29 MAY 2005)
1:250

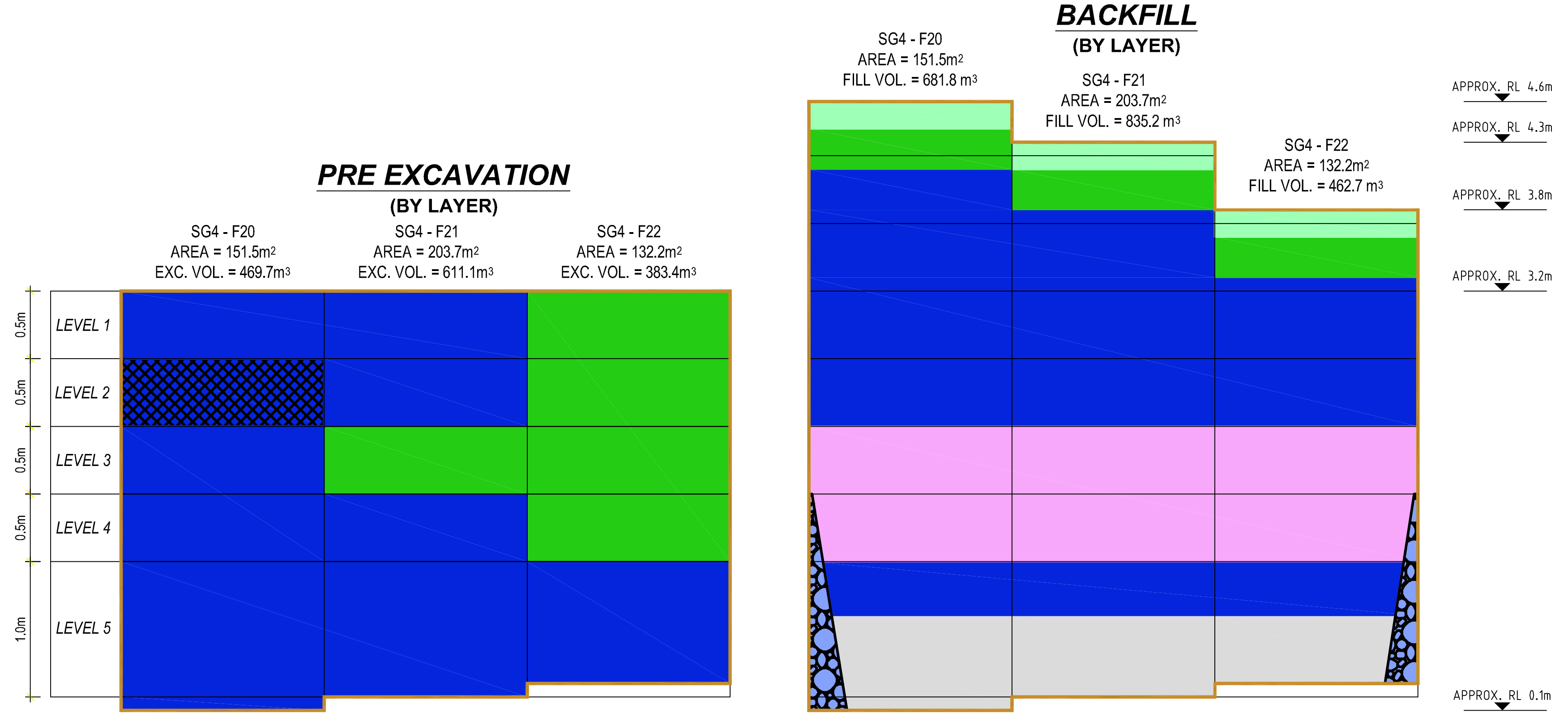


LOCATION OF SG4 (10 JUN 2005)
1:250



SECTION A
NTS

SCHEMATIC SECTION OF SG3



SECTION B
NTS

SCHEMATIC SECTION OF SG4

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	MARINE SEDIMENTS
COMMERCIAL DUE TO DIESEL CONTAMINATION	COMMERCIAL
EXCAVATION BOUNDARY	MARINE SEDIMENTS + COMMERCIAL + OVERSIZE
	SAND
	TREATED FINES + MARINE SEDIMENTS + OVER SIZE
	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE
	CONCRETE
	OVERSIZE + CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PKB	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E5 - SG3&4 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

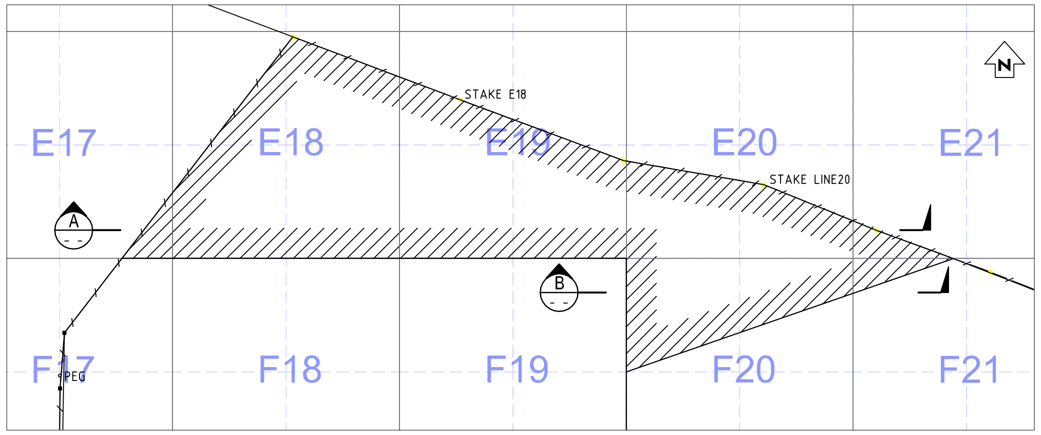
SG3 & SG4
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

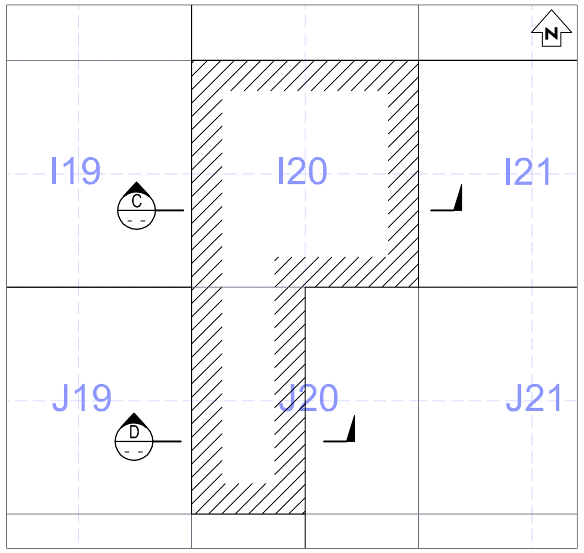
TDC Plan No.	Sheet No.	Rev.
6487s5	E5	AB1

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

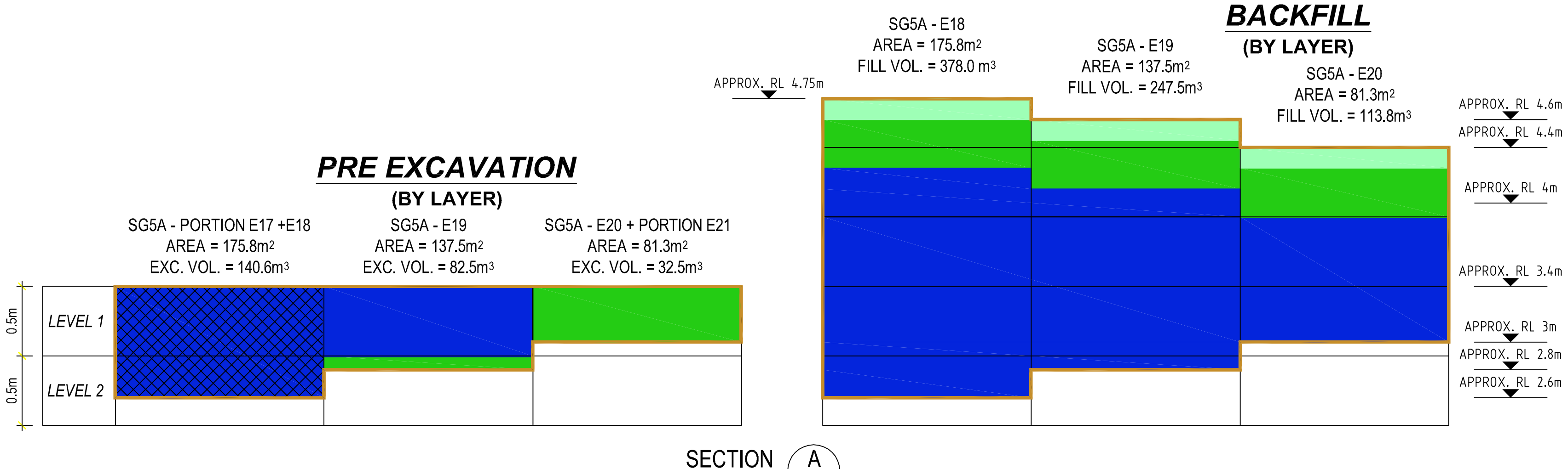
DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 10:31am



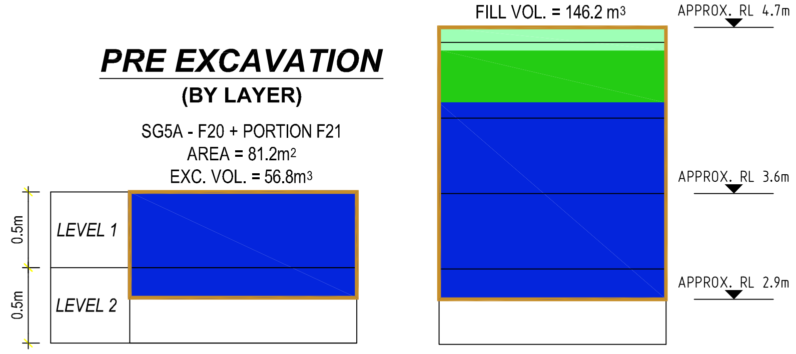
LOCATION OF SG5A (10 JUN 2005)
1:250



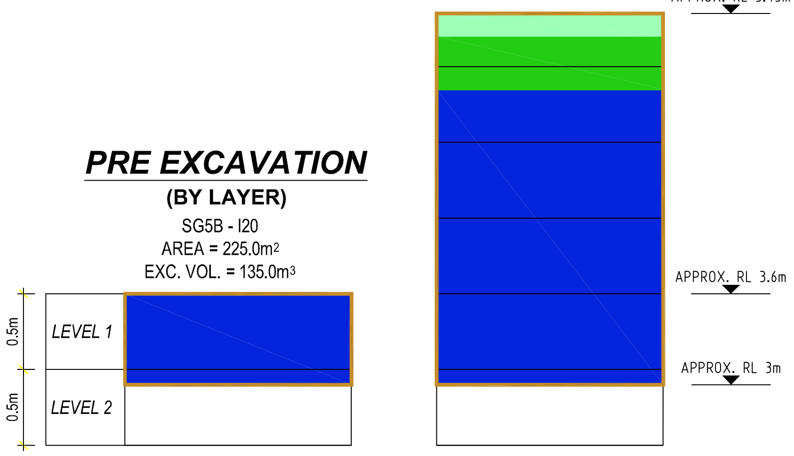
LOCATION OF SG5B (10 JUN 2005)
1:250



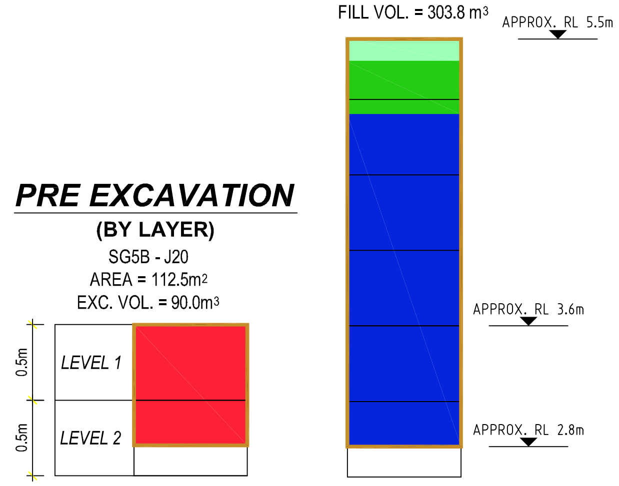
SCHEMATIC SECTION OF SG5A



SCHEMATIC SECTION OF SG5A



SCHEMATIC SECTION OF SG5B



SCHEMATIC SECTION OF SG5B

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
COMMERCIAL DUE TO DIESEL CONTAMINATION	
EXCAVATION BOUNDARY	

NOTE:
THE FLOOR OFF J20 WAS VALIDATED AS COMMERCIAL

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 10:30am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E6 - SG5 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG5A & SG5B
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s6
Sheet No. E6
Rev. AB1

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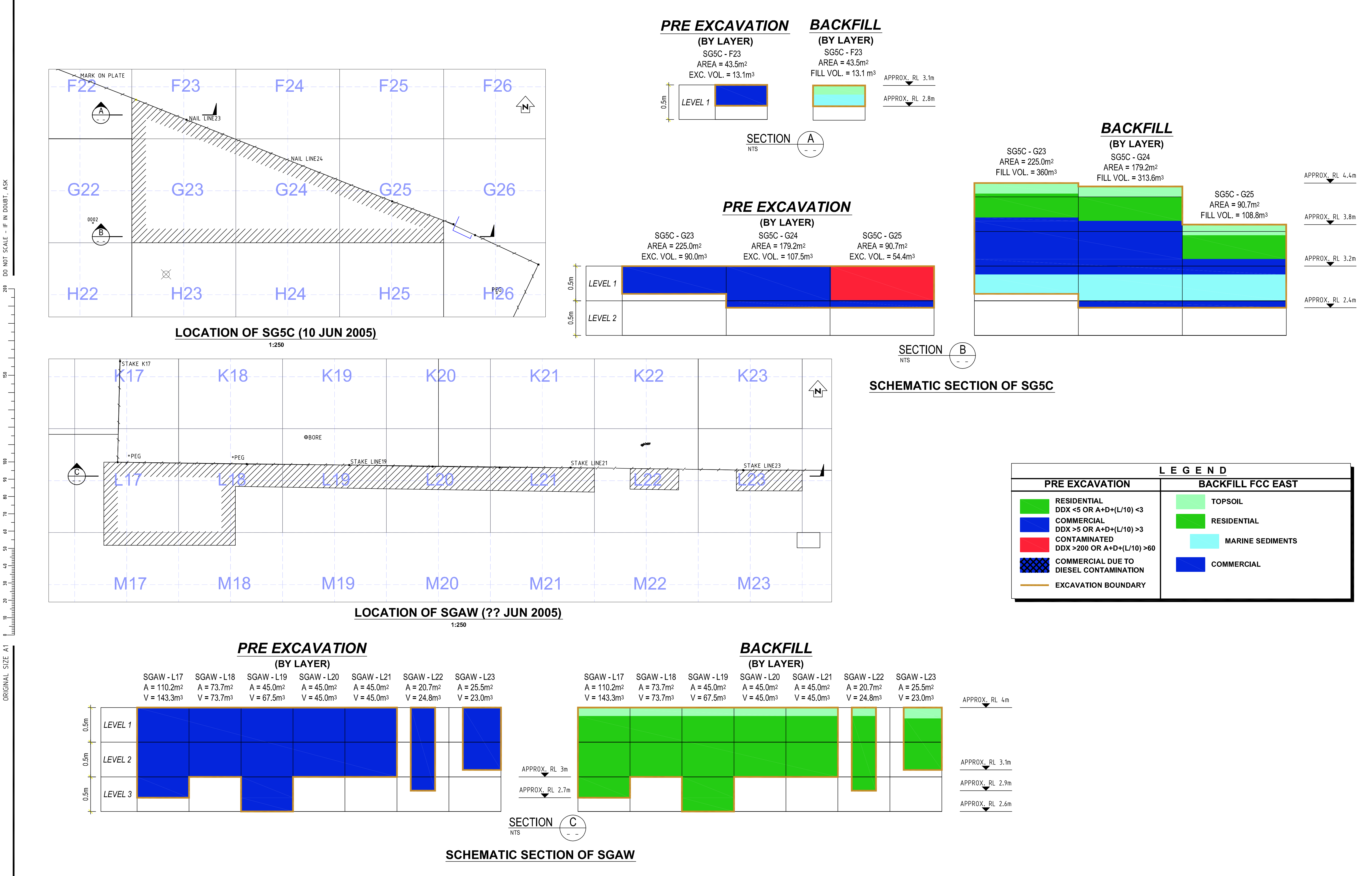
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg



REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E7 - SG5C / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

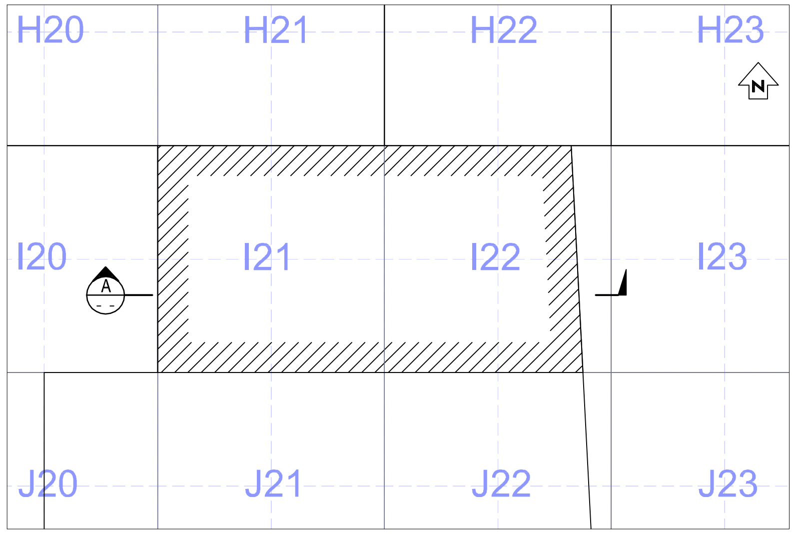
Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

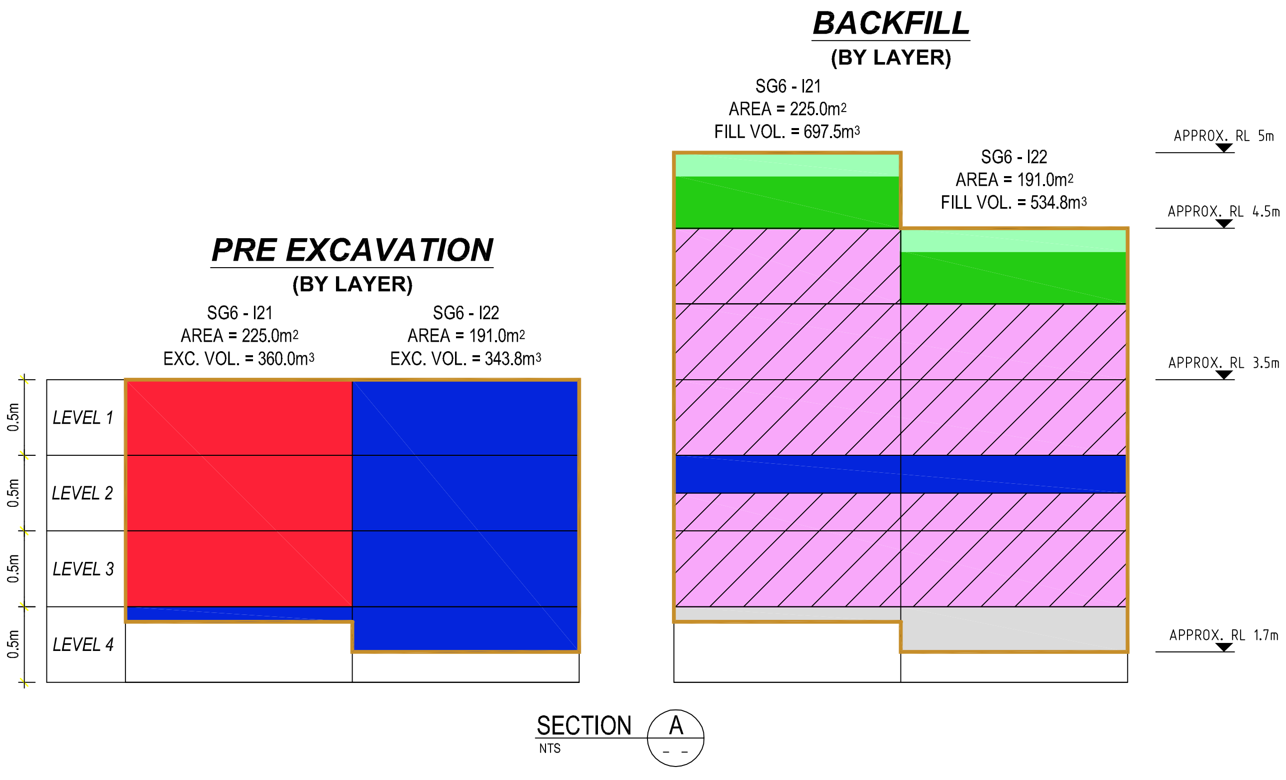
SG5C & SGAW
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s7
Sheet No. E7
Rev. AB1

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

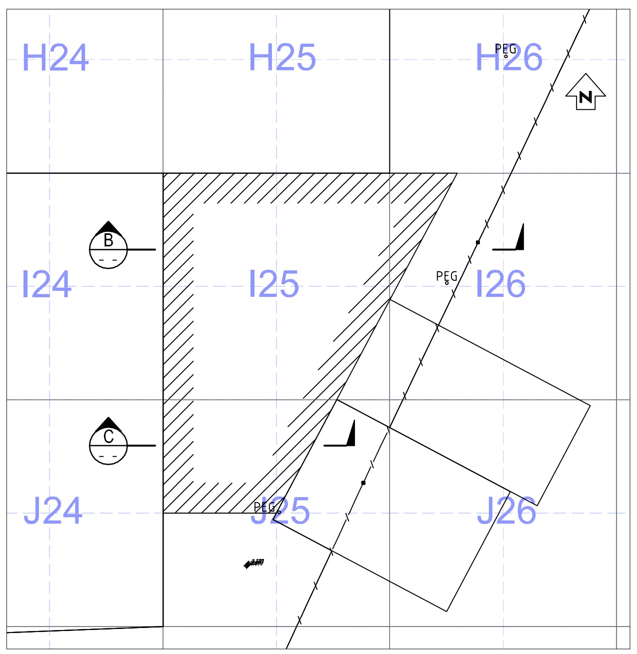


LOCATION OF SG6 (08 JUL 2005)
1:250

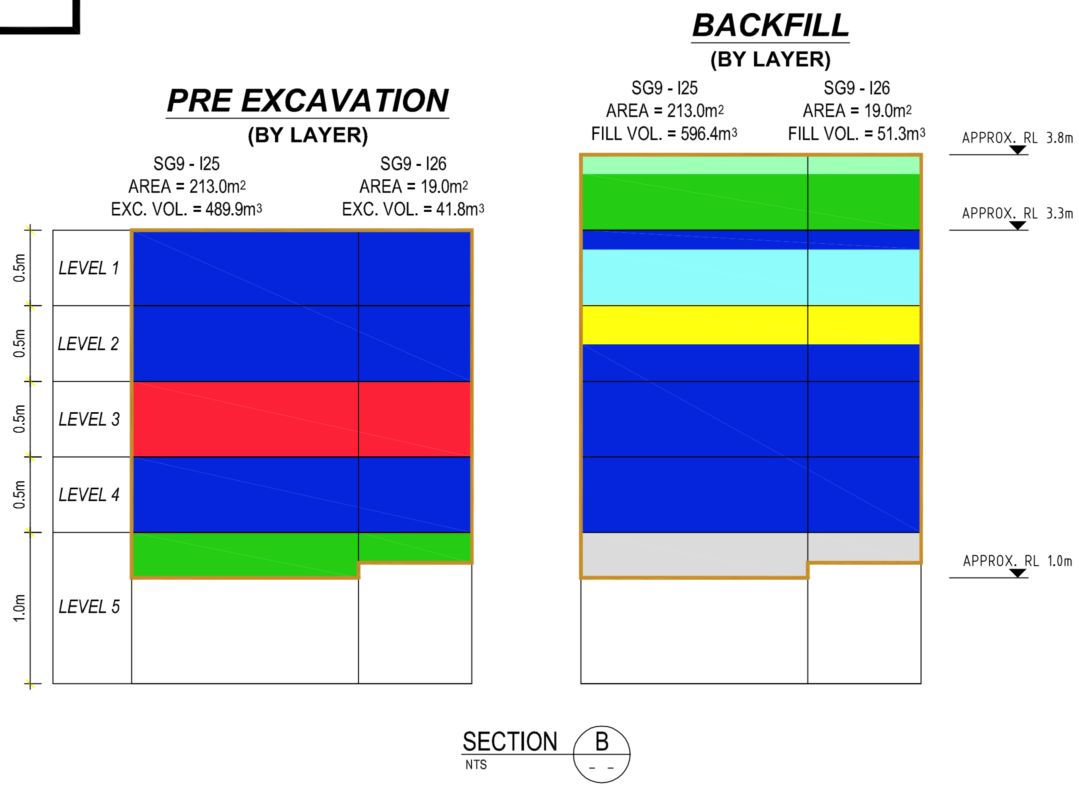


SCHEMATIC SECTION OF SG6

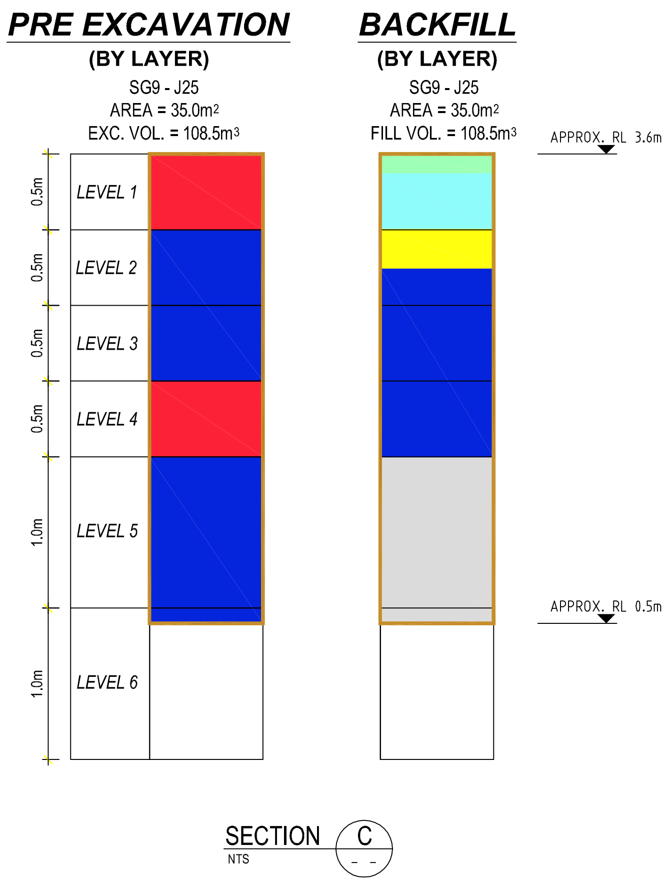
L E G E N D			
PRE EXCAVATION		BACKFILL FCC EAST	
	RESIDENTIAL DDX <5 OR A+D+(L/10) <3		TOPSOIL
	COMMERCIAL DDX >5 OR A+D+(L/10) >3		RESIDENTIAL
	CONTAMINATED DDX >200 OR A+D+(L/10) >60		MARINE SEDIMENTS
	EXCAVATION BOUNDARY		COMMERCIAL
			TREATED FINES
			CONCRETE
			CLAY



LOCATION OF SG9 (28 JUL 2005)
1:250



SCHEMATIC SECTION OF SG9



SCHEMATIC SECTION OF SG9

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E8 - SG6&9 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE
SG6 & SG9
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s8	E8	AB1

12 September 2008 - 10:29am
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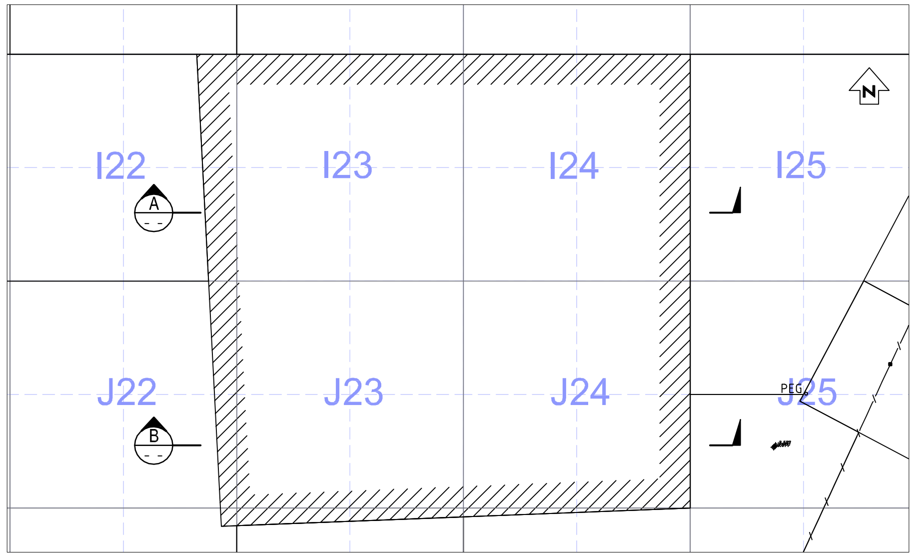
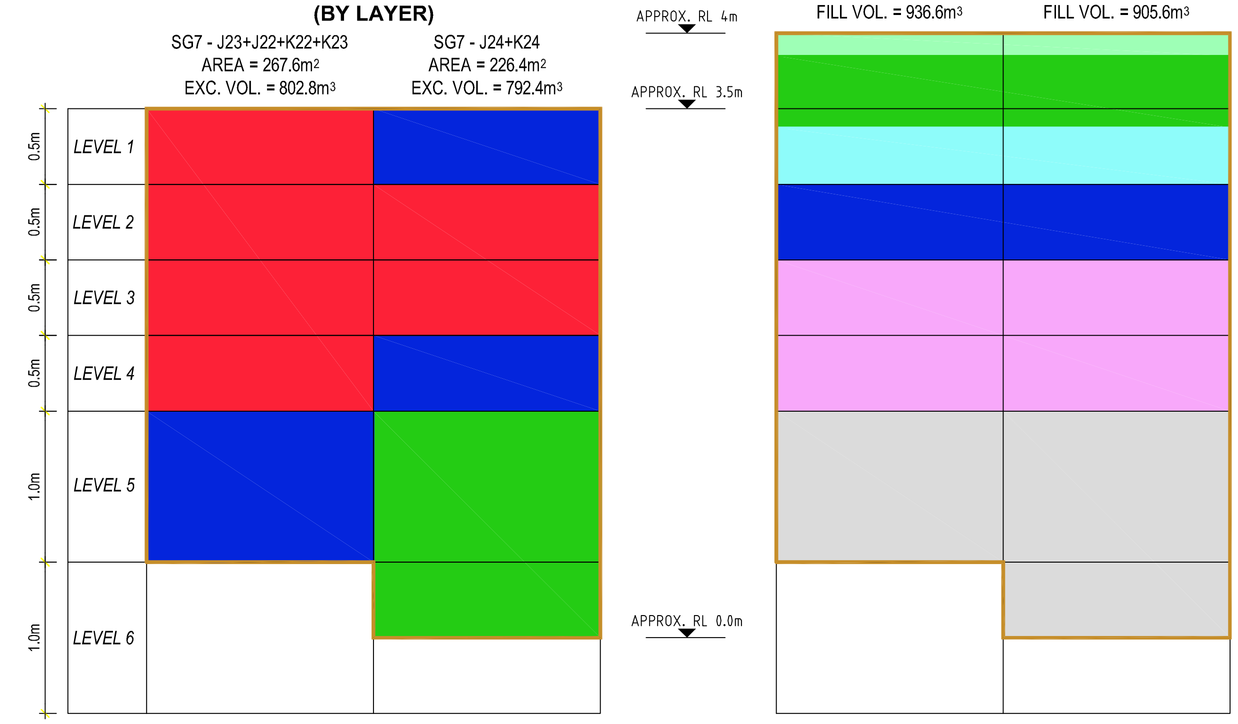
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

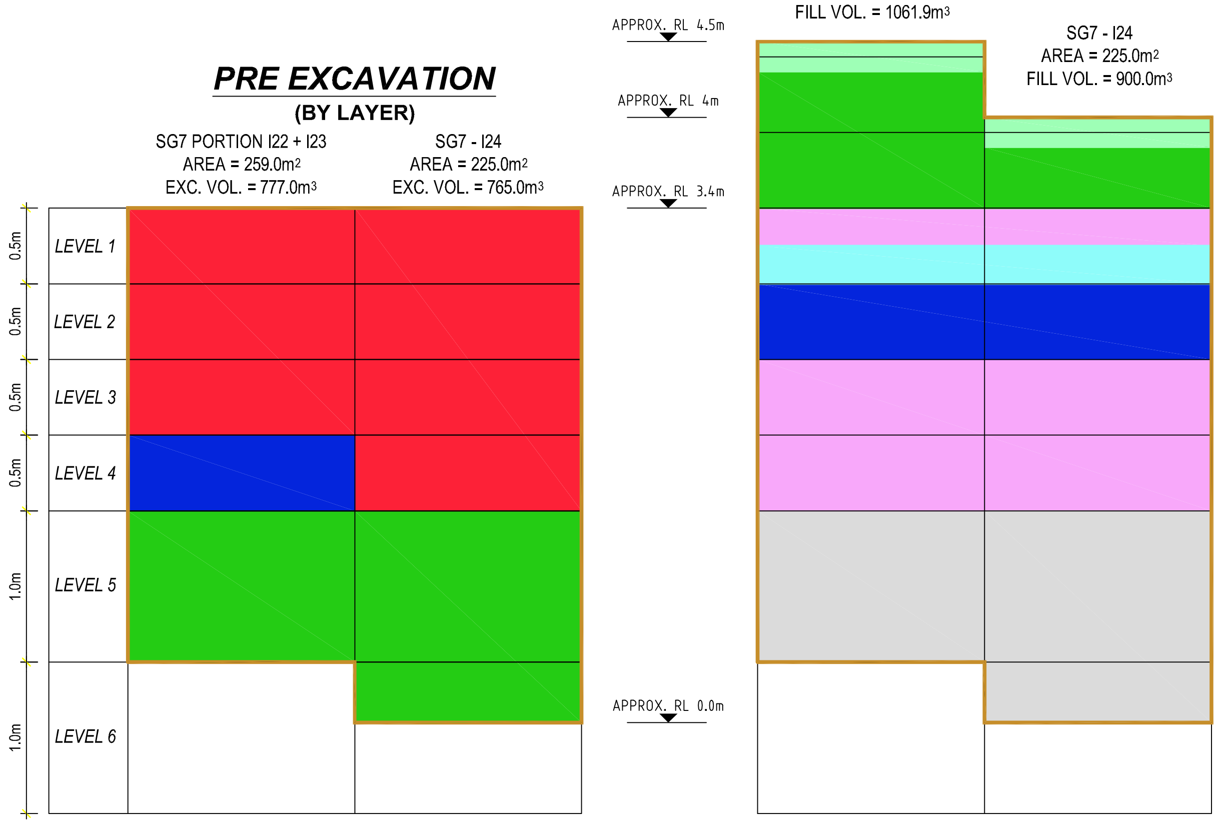


LOCATION OF SG7 (08 JUL 2005)
1:250



SECTION B
NTS

SCHEMATIC SECTION OF SG7



SECTION A
NTS

SCHEMATIC SECTION OF SG7

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	MARINE SEDIMENTS
EXCAVATION BOUNDARY	COMMERCIAL
	TREATED FINES + COMMERCIAL + OVER SIZE
	CONCRETE

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:28am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E9 - SG7 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	[signature]	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE
SG 7
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s9	E9	AB1

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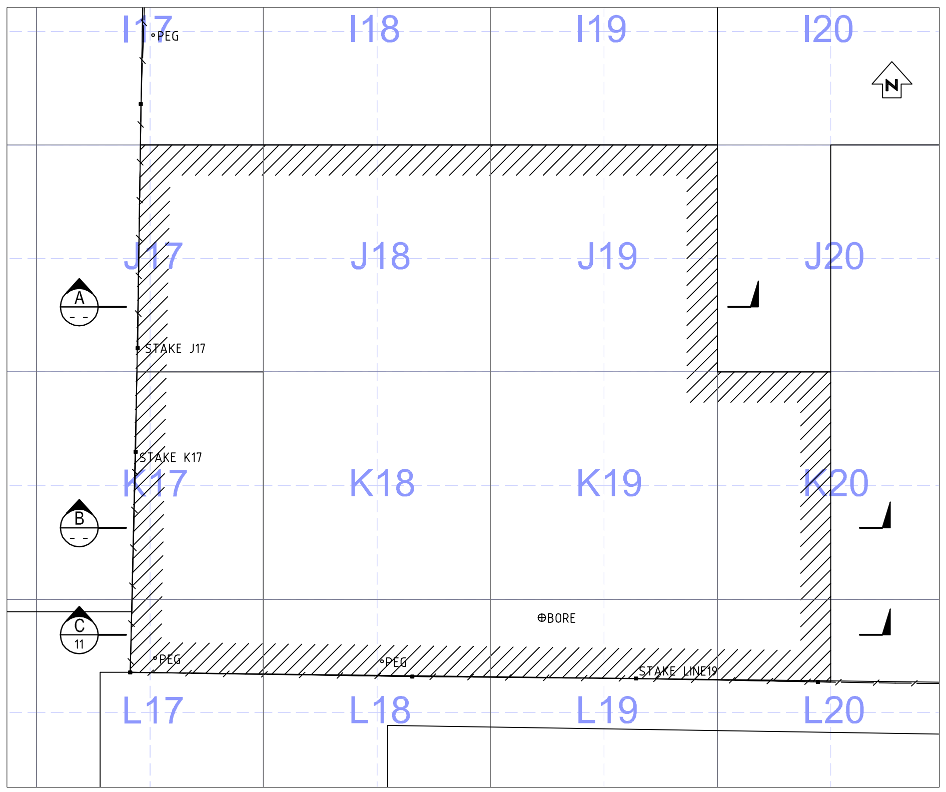
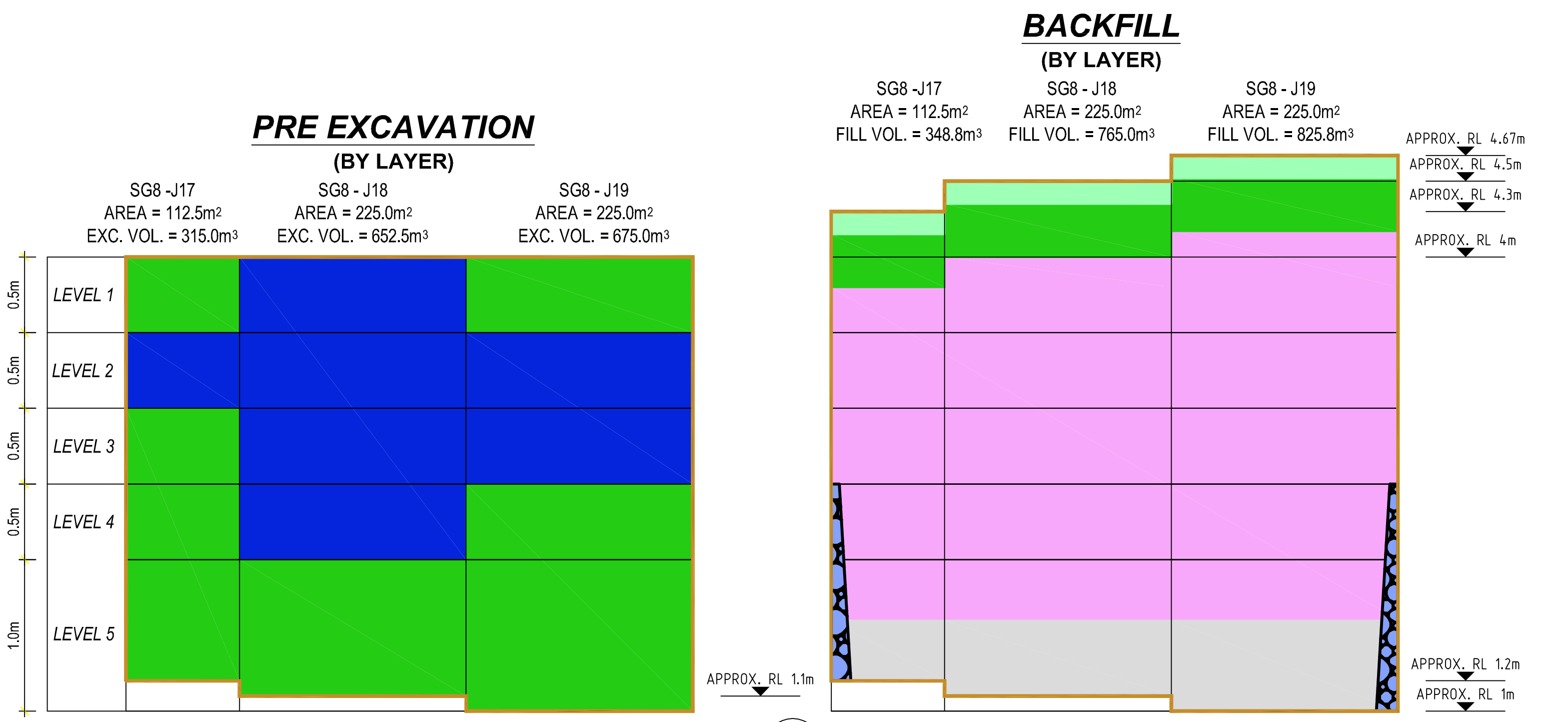


LOCATION OF SG8 (04 OCT 2005)

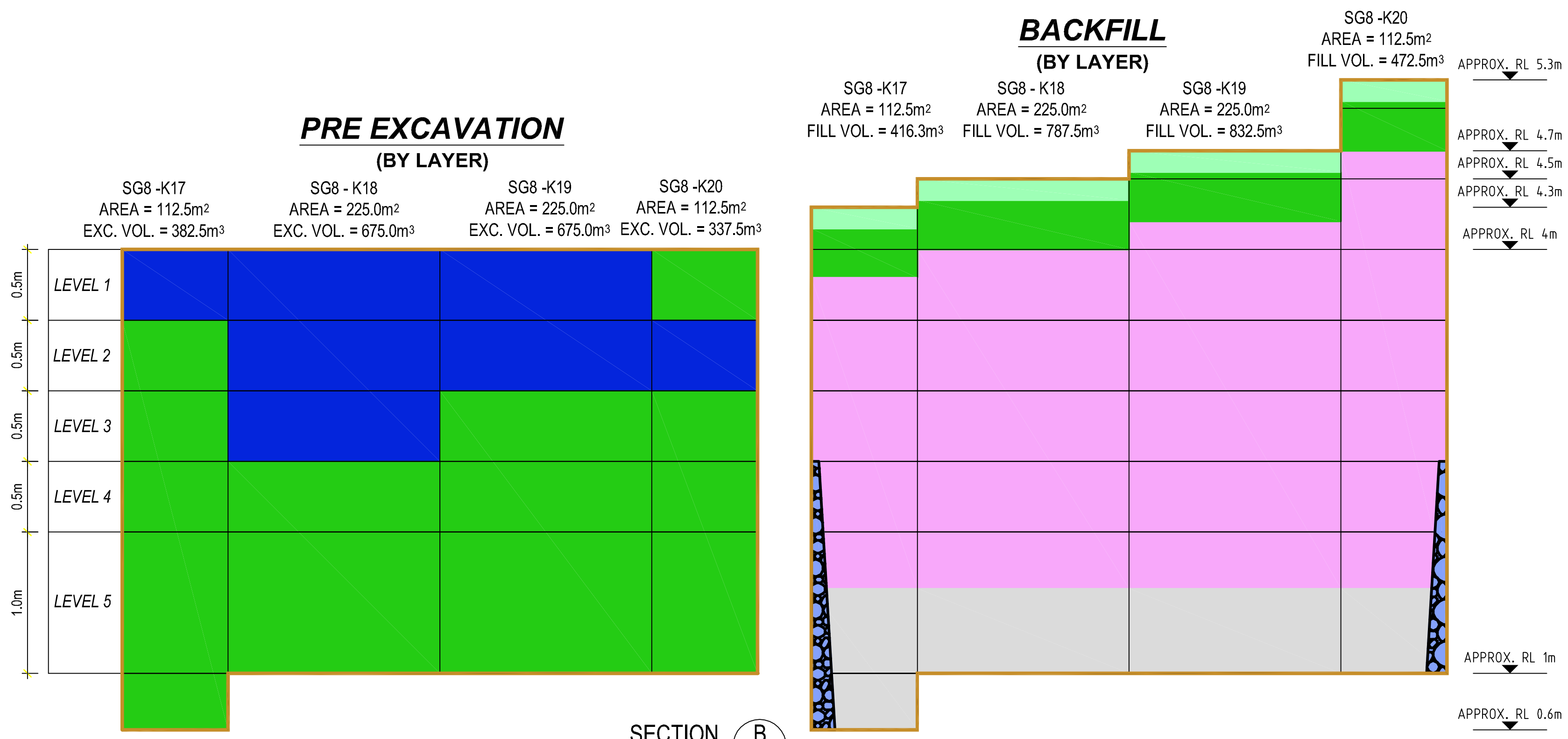
1:250



SECTION A

NTS

SCHEMATIC SECTION OF SG8



SECTION B

NTS

SCHEMATIC SECTION OF SG8

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES + COMMERCIAL + OVER SIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	DATE	APPROVED INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PKB	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03

TAB/DWG : E10 - SG8 / AB_EAST_02-16.dwg

SERVER : NELSON (NZNEL1S01)

XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG8 - PRE EXCAVATION AND BACKFILL
SECTIONS A&B OF SECTIONS A-C

Status Stamp: AS BUILT

Date Stamp: 12 SEPTEMBER 2008

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s10	E10	AB1

12 September 2008 - 10:27am

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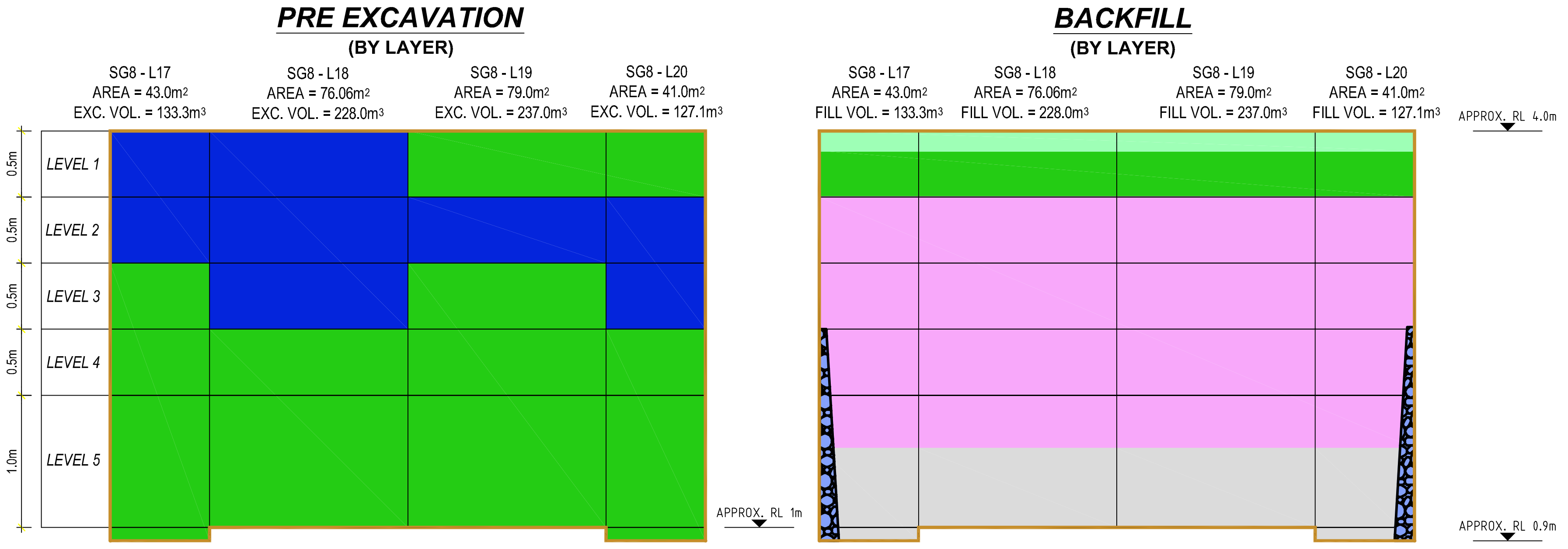

SECTION C 10
NTS

SCHEMATIC SECTION OF SG8

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES + COMMERCIAL + OVER SIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:27am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PKB	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E11 - SG8 (2) / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P. F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG8 - PRE EXCAVATION AND BACKFILL
SECTION C OF SECTIONS A-C

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s11 | Sheet No. E11 | Rev. AB1

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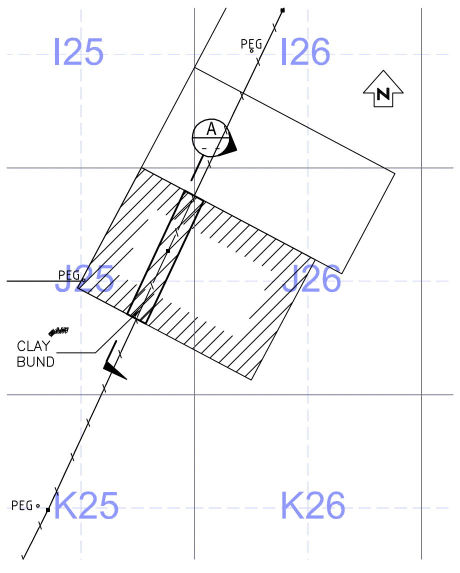
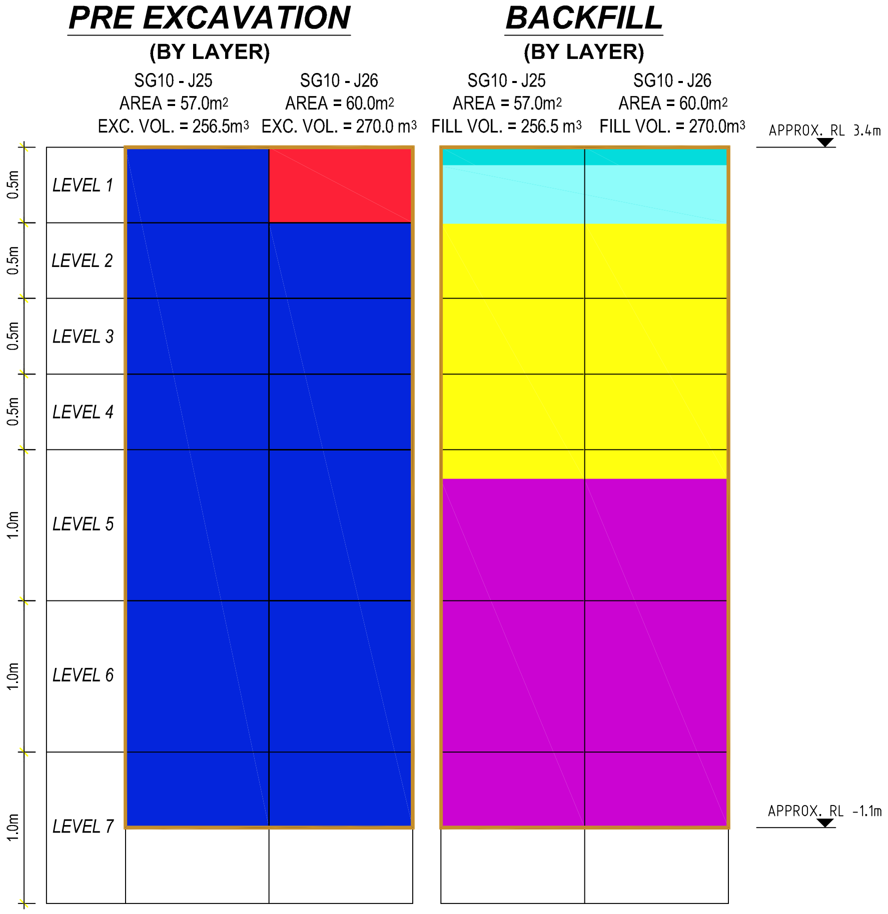
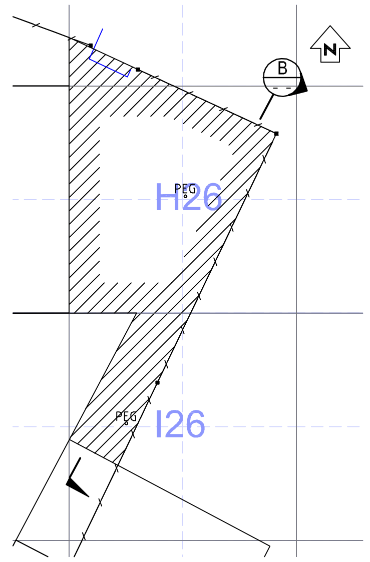


LOCATION OF SG10 (28 JUL 2005)
1:250

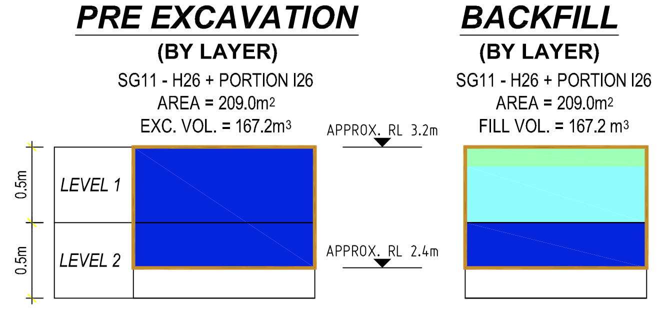


SECTION A
NTS

SCHEMATIC SECTION OF SG10



LOCATION OF SG11 (29 JUL 2005)
1:250

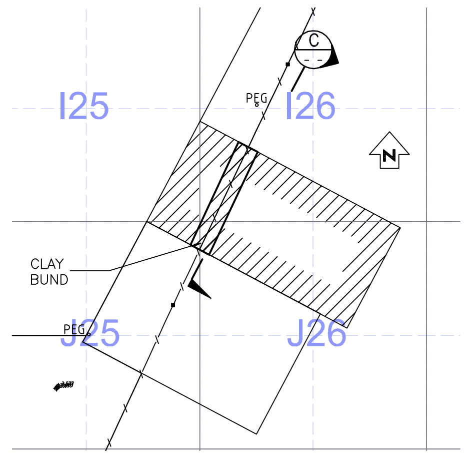


SECTION B
NTS

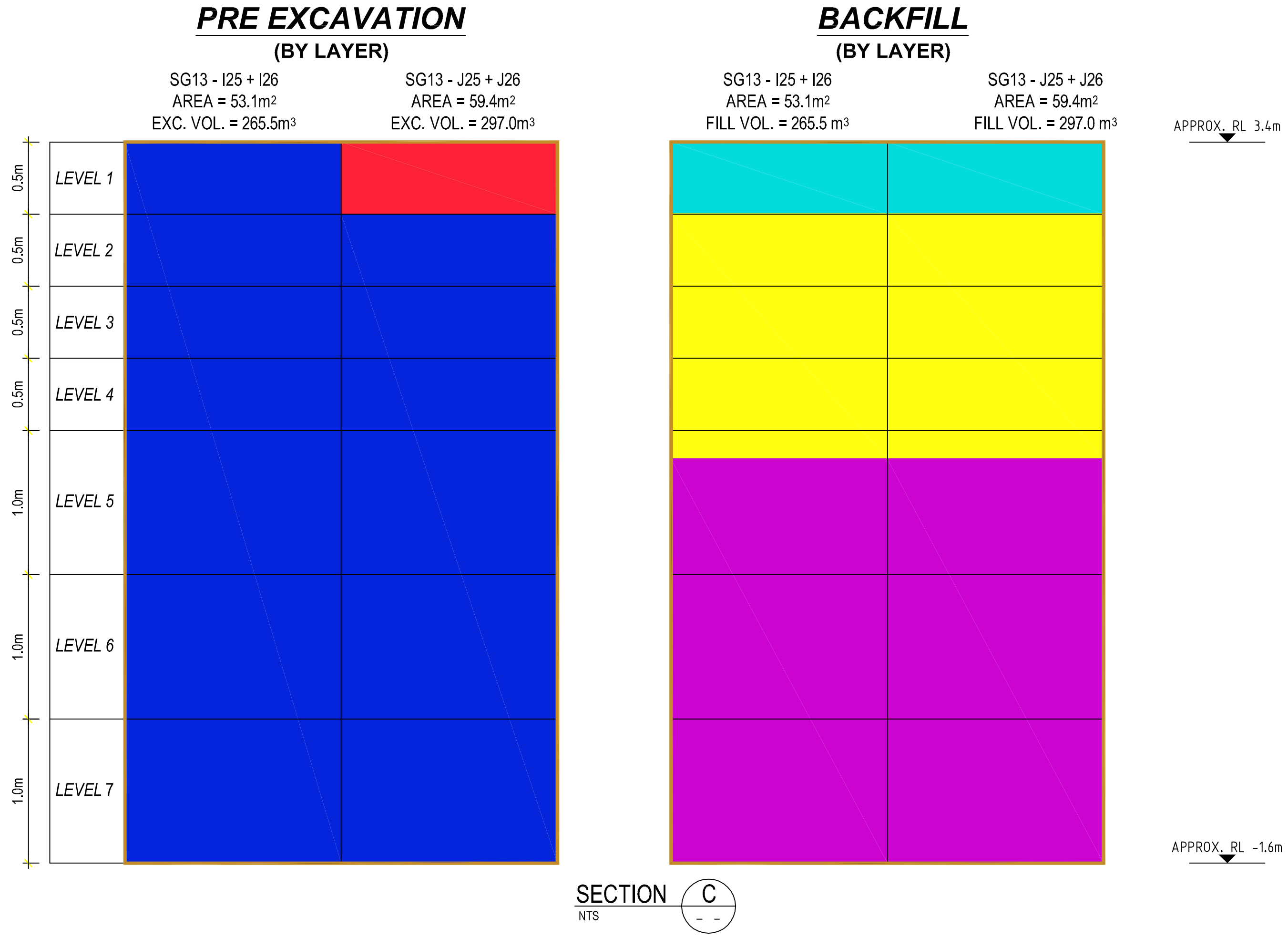
SCHEMATIC SECTION OF SG11

L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
COMMERCIAL DDX >5 OR A+D+(L/10) >3	TOPSOIL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	RESIDENTIAL
EXCAVATION BOUNDARY	PATH & ROCKS
	MARINE SEDIMENTS
	COMMERCIAL
	IMPORTED GRAVEL
	CLAY

NOTE:
FLOORS OK AS COMMERCIAL



LOCATION OF SG13 (29 JUL 2005)
1:250



SECTION C
NTS

SCHEMATIC SECTION OF SG13

ORIGINAL SIZE A1 DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 10:18am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E12 - SG10&11&13 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	[signature]	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG10, SG11 & SG13
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s12
Sheet No. E12
Rev. AB1

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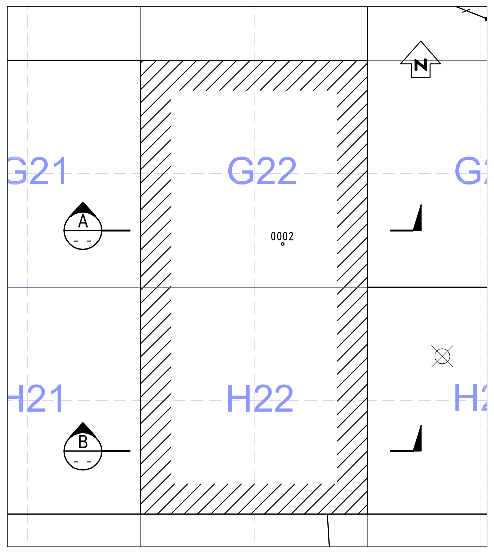
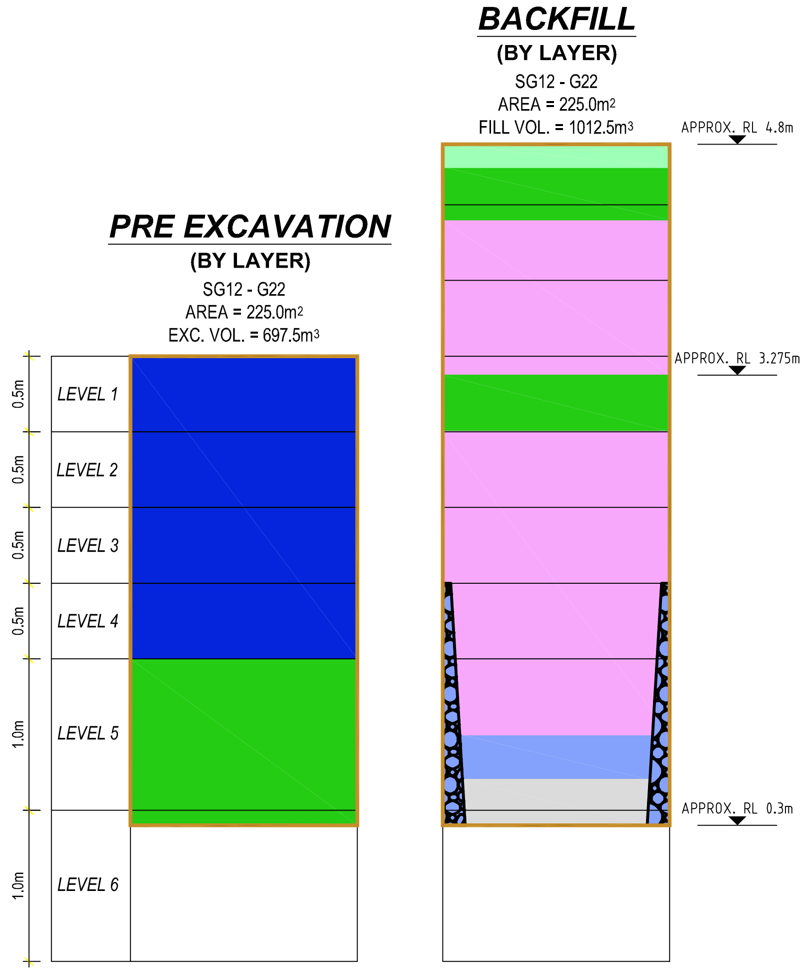
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

12 September 2008 - 10:18am

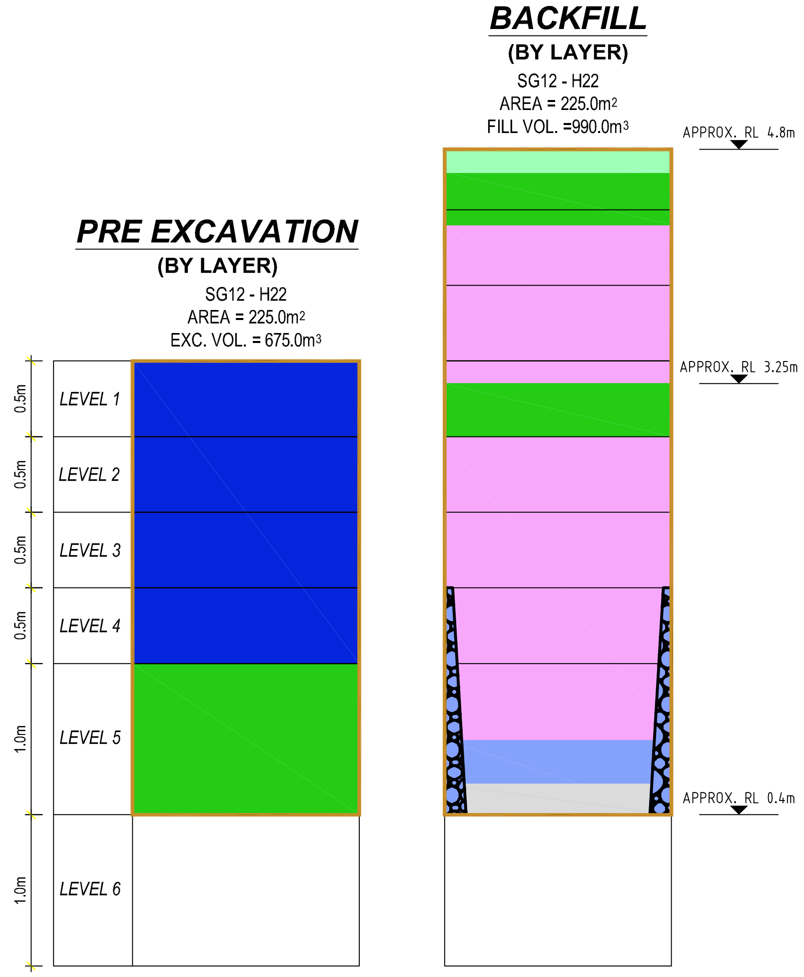


LOCATION OF SG12 (12 NOV 2005)
1:250



SECTION A
NTS

SCHEMATIC SECTION OF SG12



SECTION B
NTS

SCHEMATIC SECTION OF SG12

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	COMMERCIAL
	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E13 - SG12 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE
SG12
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s13	E13	AB1

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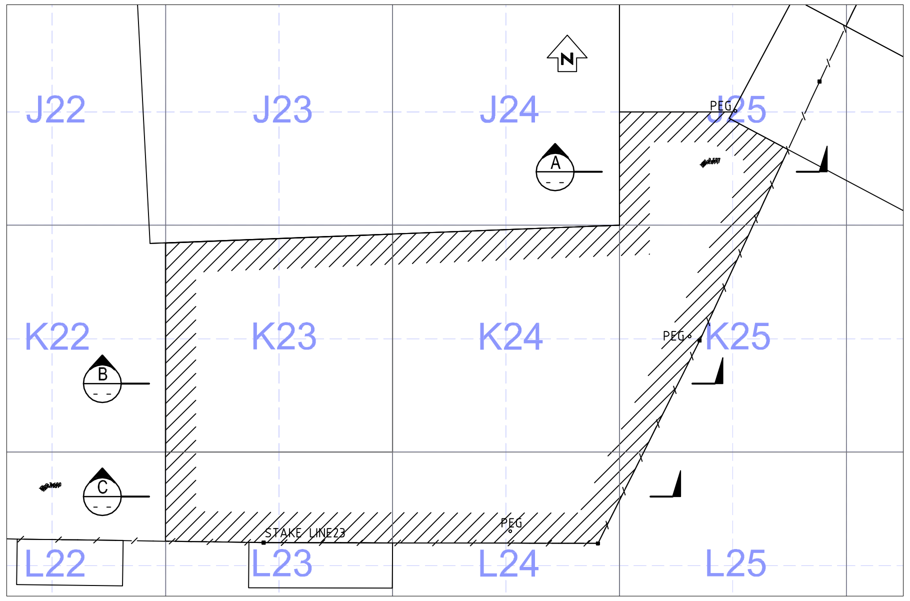
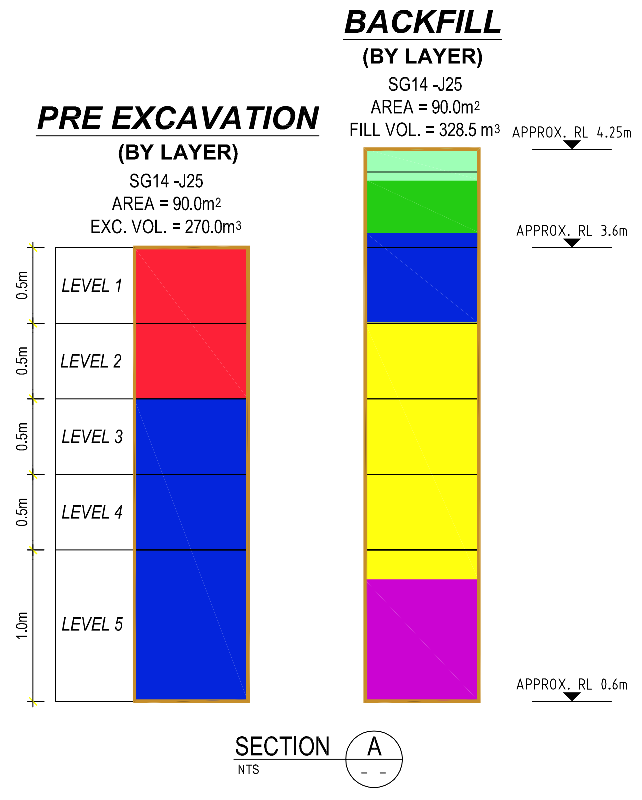
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

ORIGINAL SIZE A1 DO NOT SCALE - IF IN DOUBT, ASK



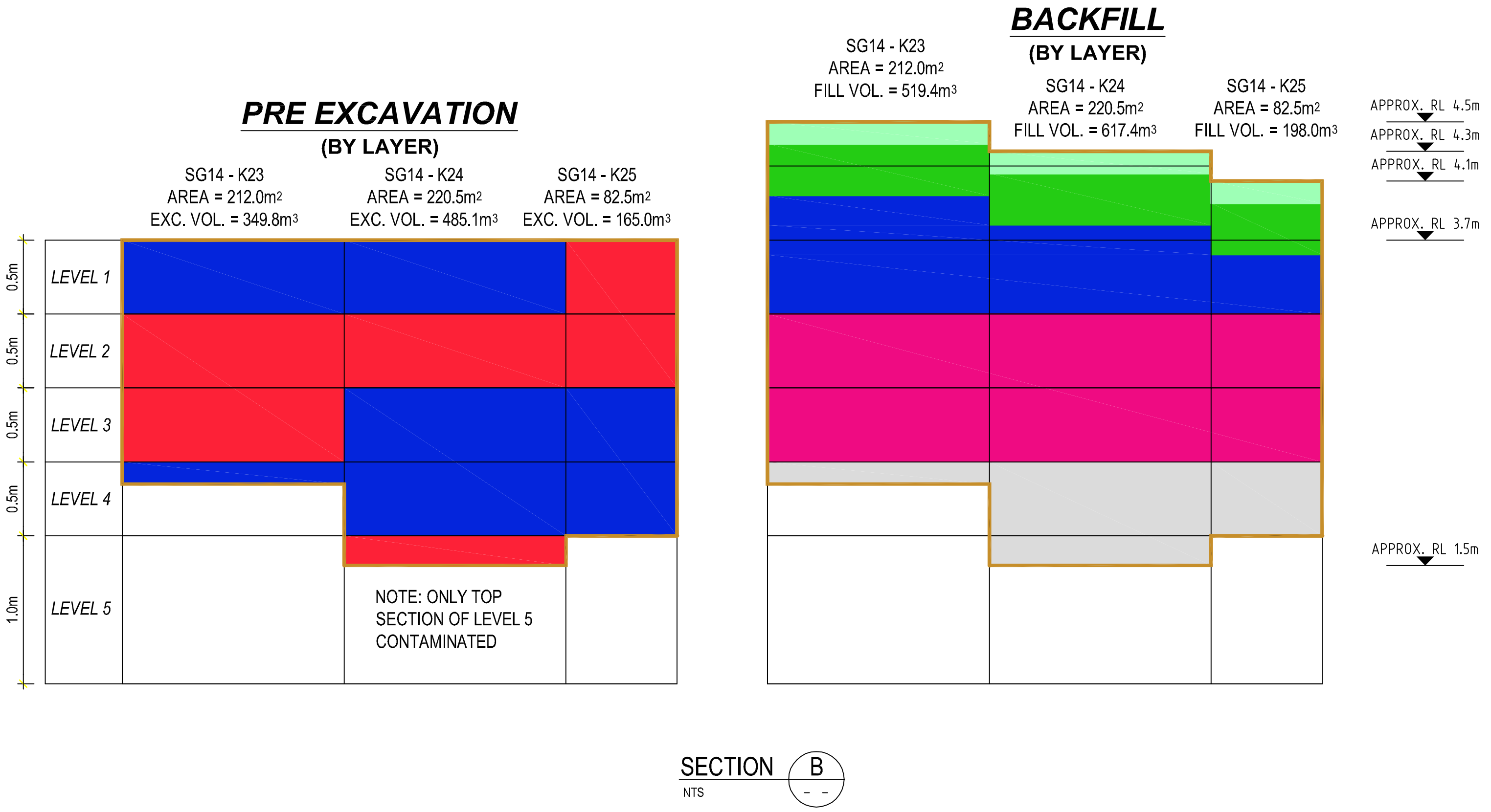
LOCATION OF SG14 (19 AUG 2005)

1:250

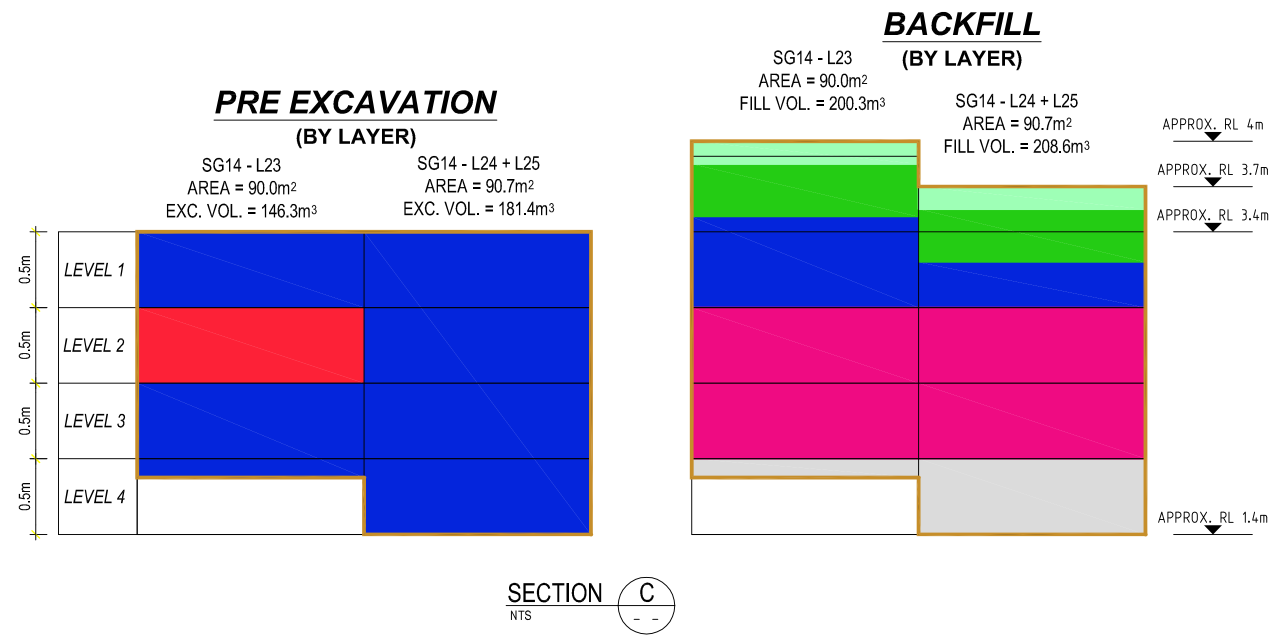


SCHEMATIC SECTION OF SG14

L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
COMMERCIAL DDX >5 OR A+D+(L/10) >3	TOPSOIL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	RESIDENTIAL
EXCAVATION BOUNDARY	COMMERCIAL
	TREATED FINES + OVER SIZE + MARINE SEDIMENTS
	IMPORTED GRAVEL
	CLAY
	CONCRETE



SCHEMATIC SECTION OF SG14



SCHEMATIC SECTION OF SG14

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E14 - SG14 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P. F. Russell	09-04

MWH

Ministry for the Environment
Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG14
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s14	E14	AB1

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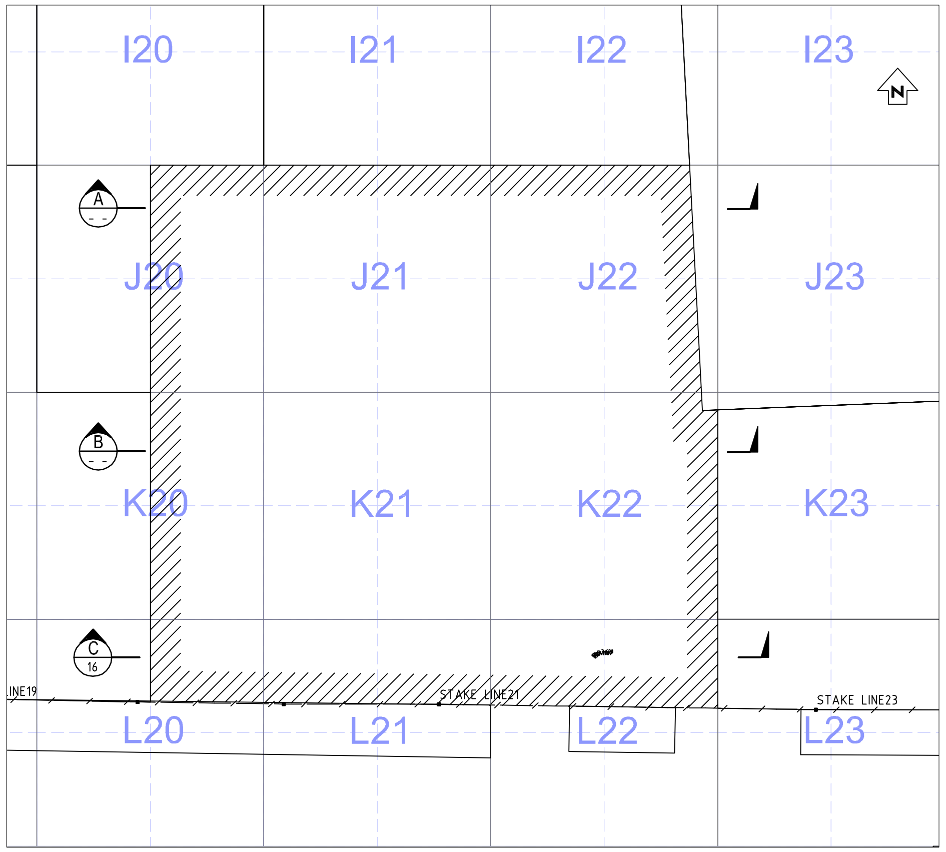
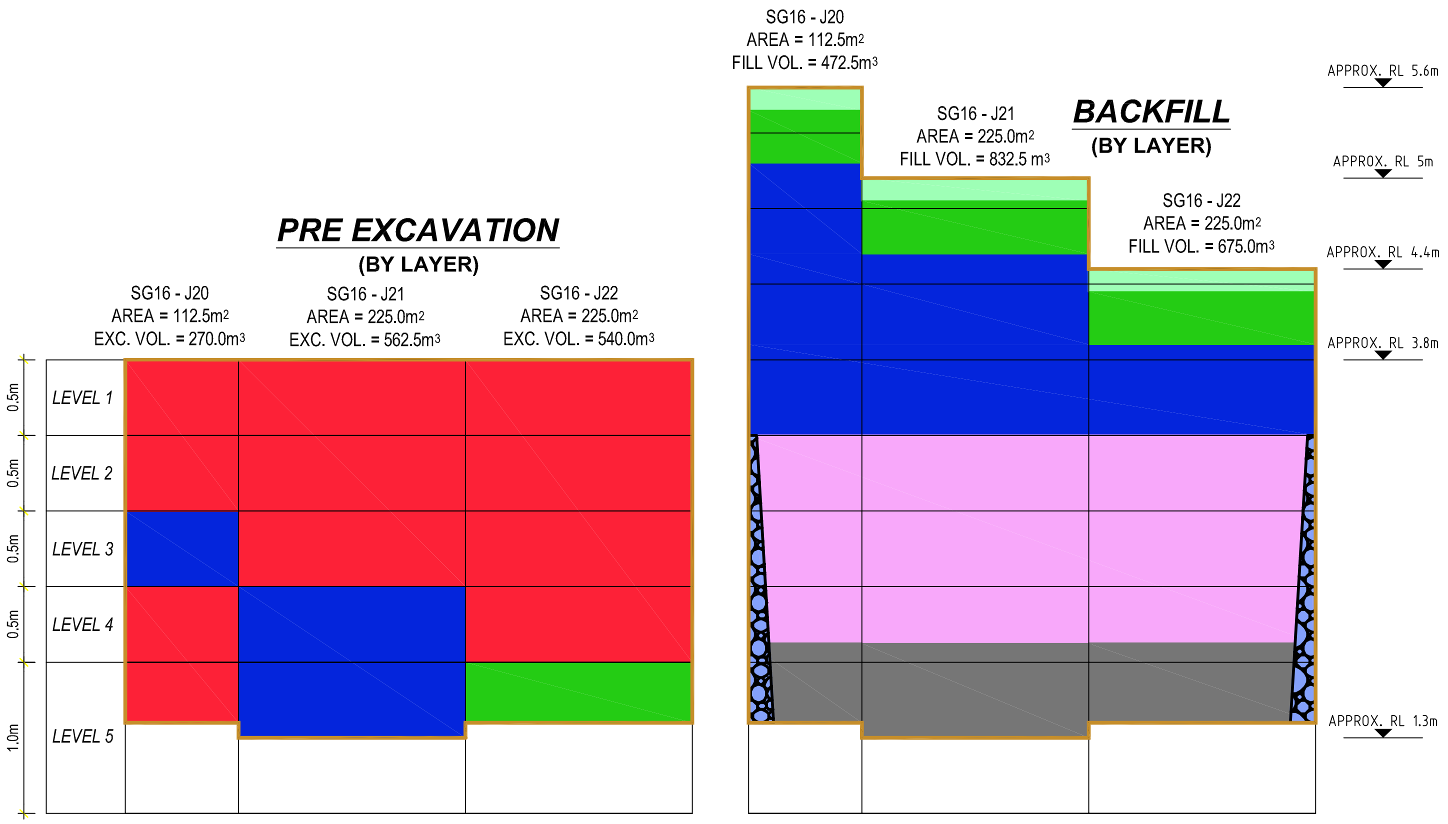
12 September 2008 - 10:17am



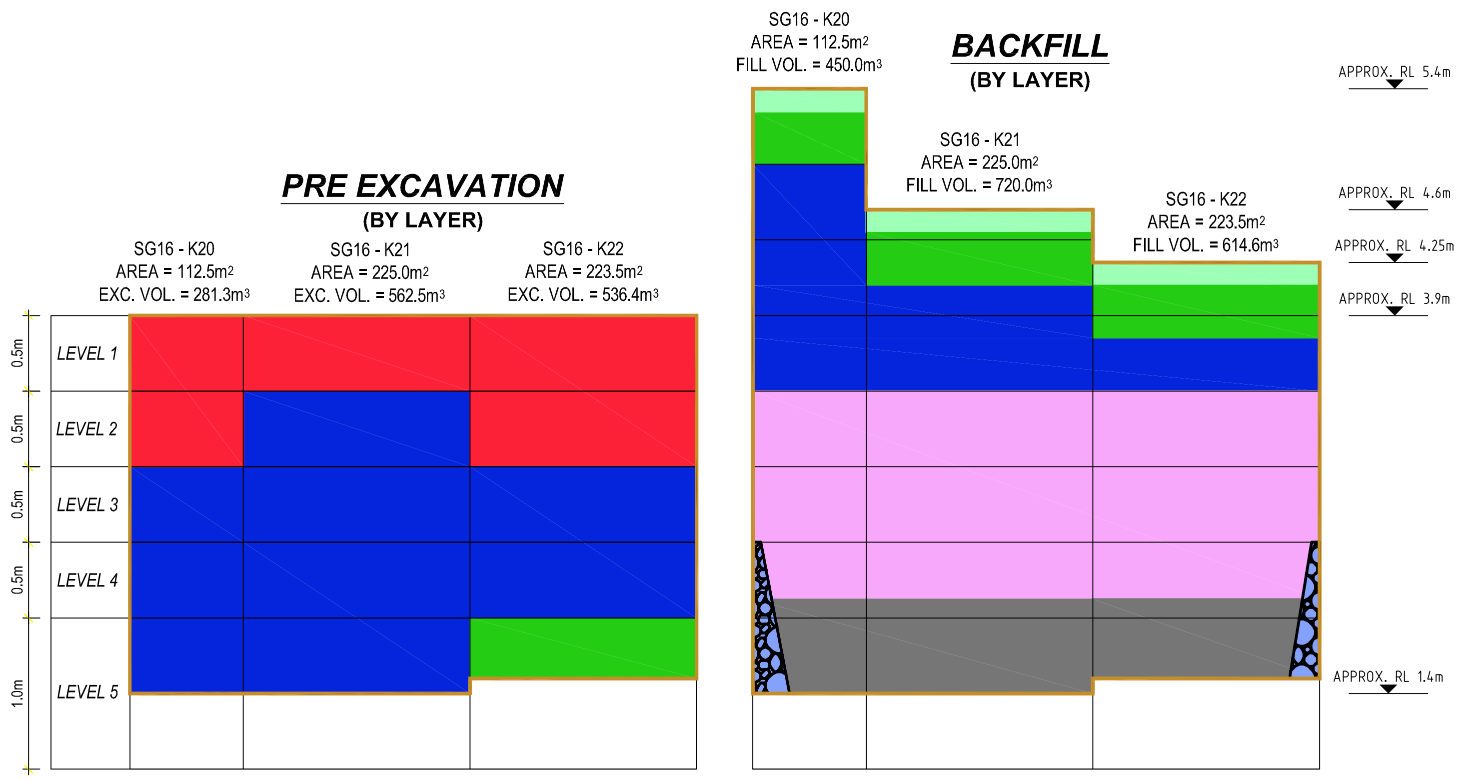
LOCATION OF SG16 (15 NOV 2005)

1:250



SECTION A
NTS

SCHEMATIC SECTION OF SG16



SECTION B
NTS

SCHEMATIC SECTION OF SG16

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE + CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

ORIGINAL SIZE A1

DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 10:17am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03

TAB/DWG : E15 - SG16 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)

XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG16 - PRE EXCAVATION AND BACKFILL
SCETIONS A&B OF SECTIONS A-C

Status Stamp: AS BUILT

Date Stamp: 12 SEPTEMBER 2008

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s15	E15	AB1

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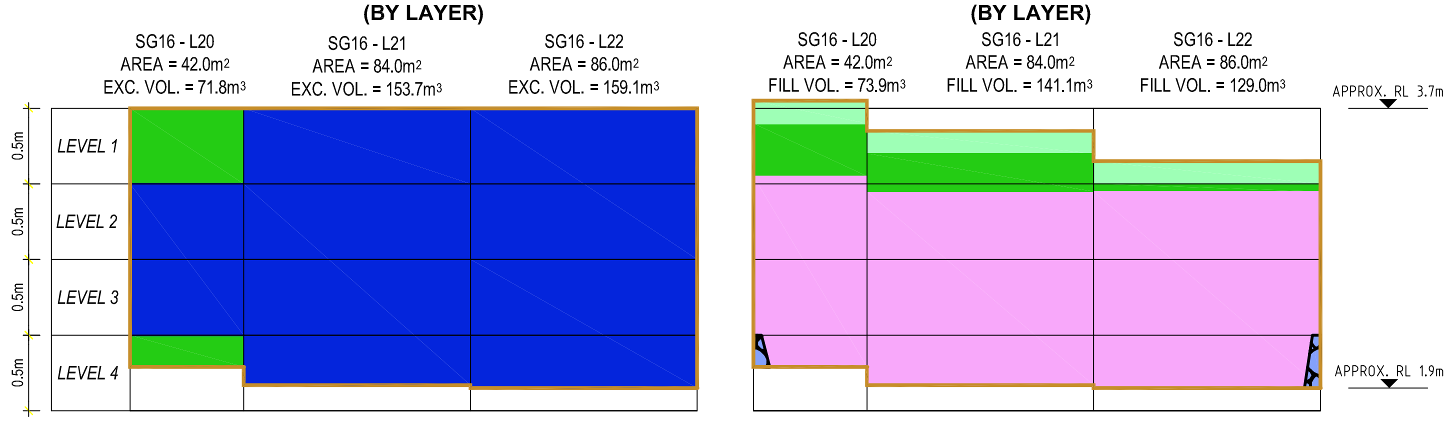
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

PRE EXCAVATION
(BY LAYER)

BACKFILL
(BY LAYER)



SECTION C 15
NTS

SCHEMATIC SECTION OF SG16

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE + CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E16 - SG16 (2) / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG16 - PRE EXCAVATION AND BACKFILL
SECTION C OF SECTIONS A-C

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s16	E16	AB1

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 10:16am
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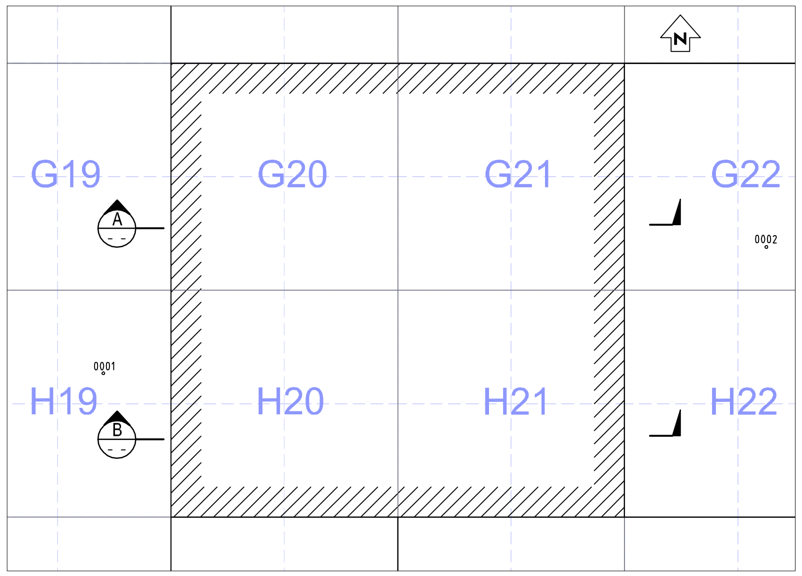
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg

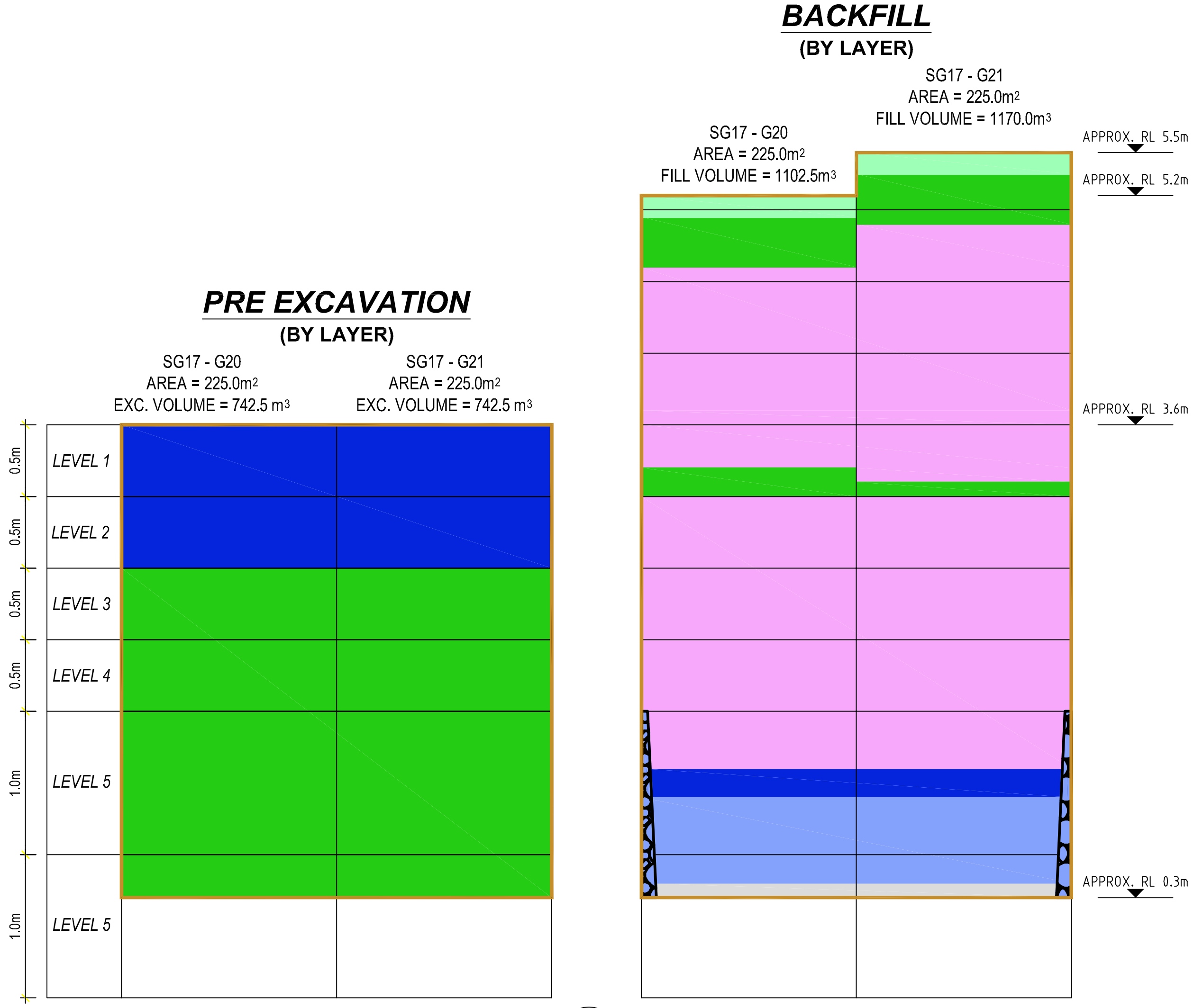


LOCATION OF SG17 (JUL 2005)

1:250

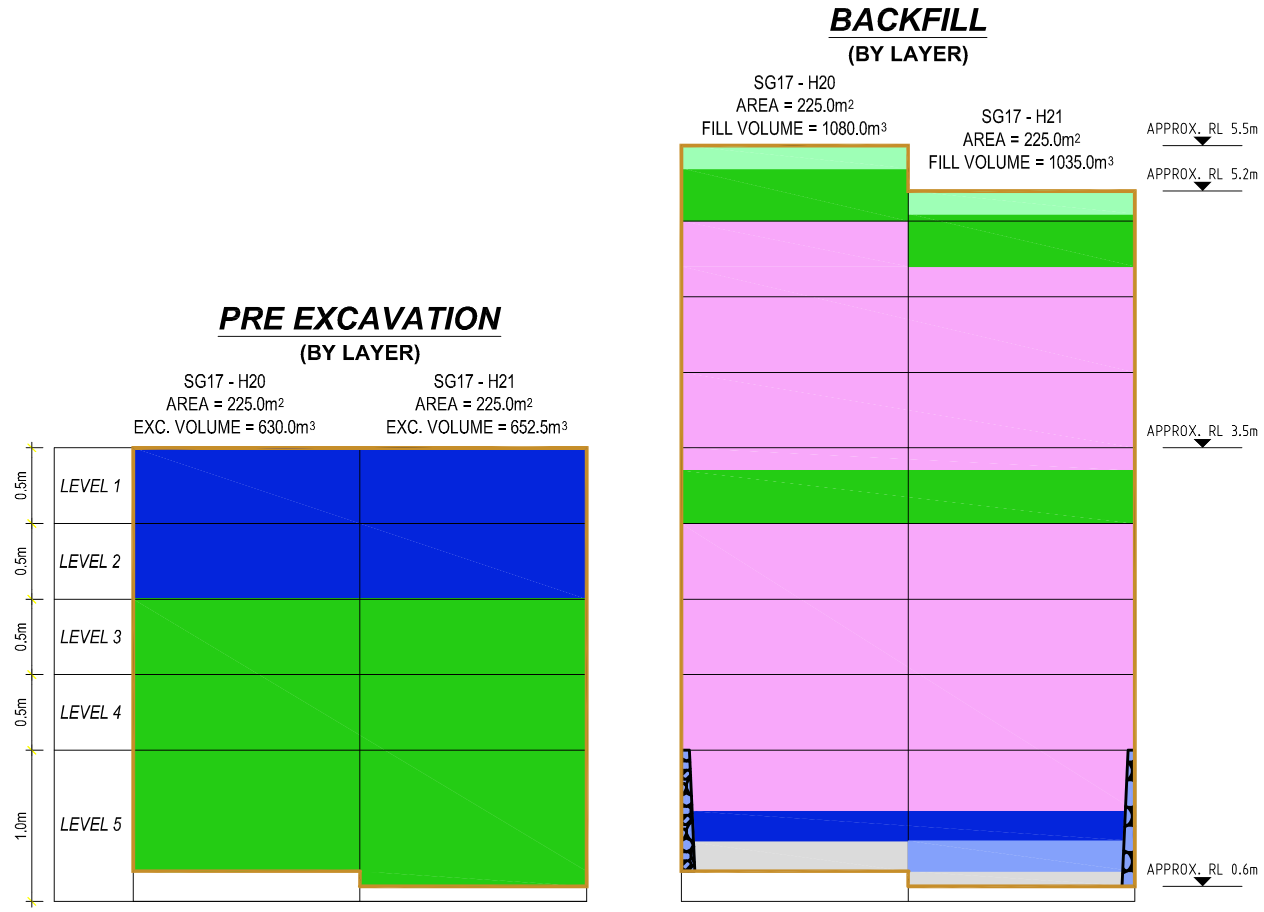
LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	COMMERCIAL
	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE
	CONCRETE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)



SECTION A
NTS

SCHEMATIC SECTION OF SG17



SECTION B
NTS

SCHEMATIC SECTION OF SG17

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E17 - SG17 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE
SG17
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s17 | Sheet No. E17 | Rev. AB1

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1

12 September 2008 - 10:15am

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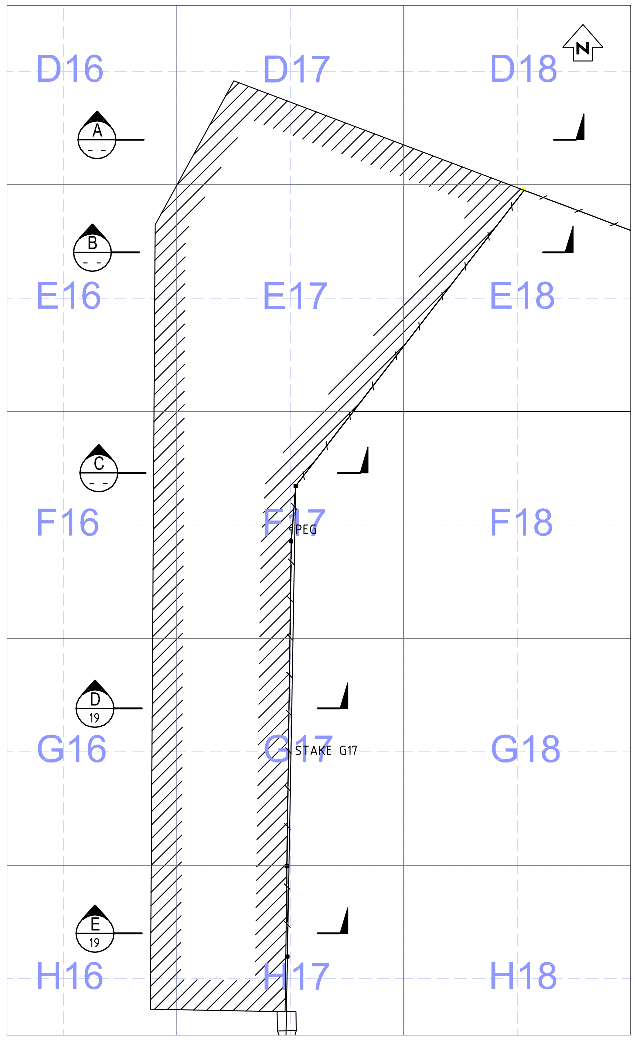
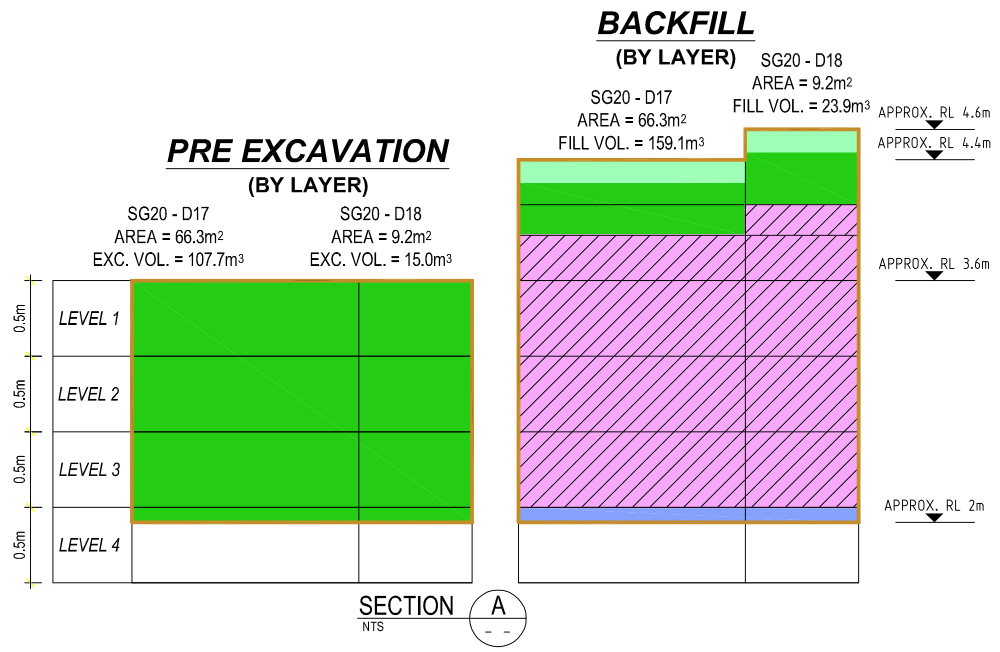
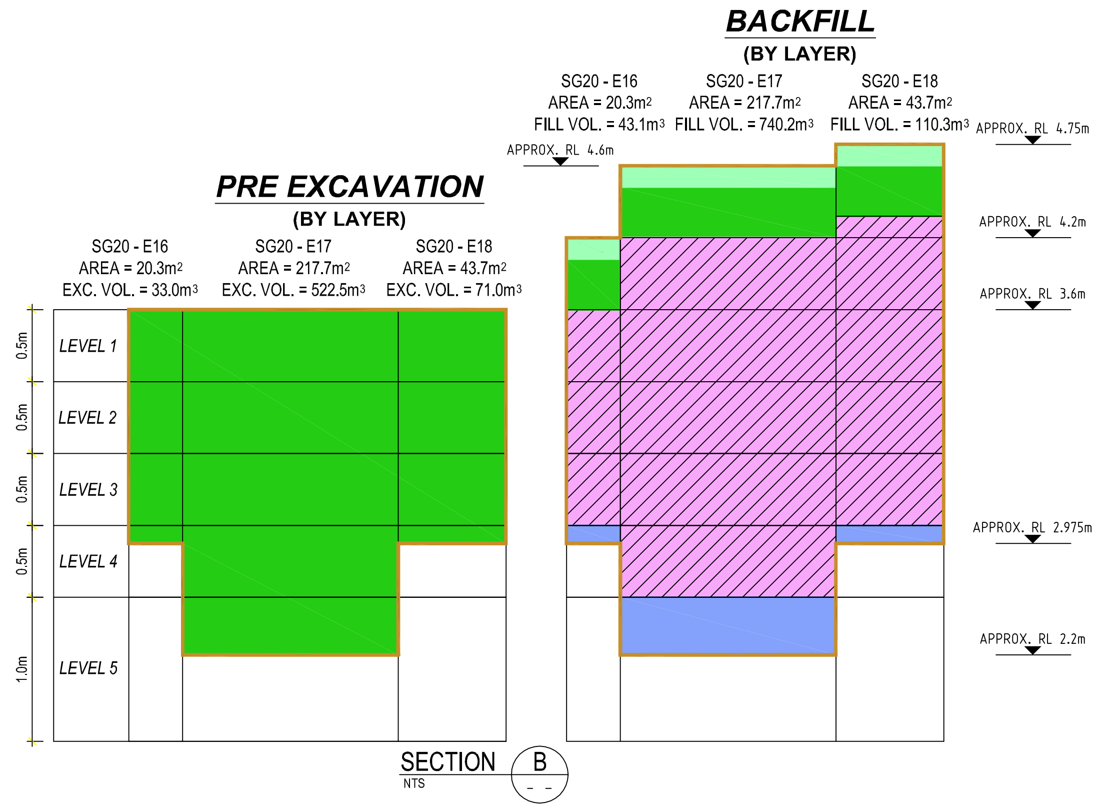


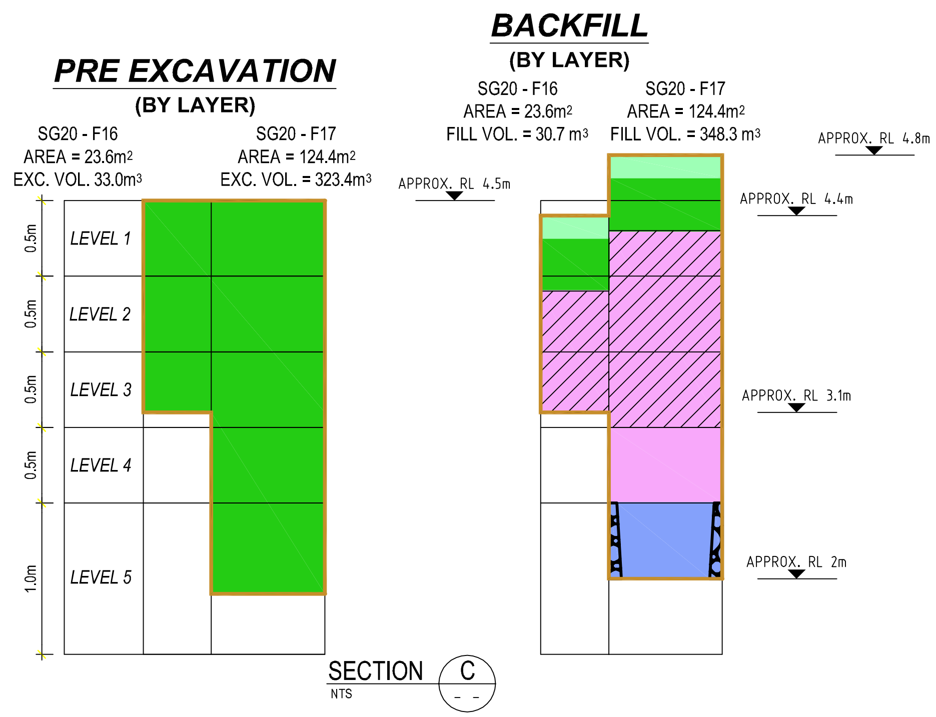
LOCATION OF SG20 (20 APRIL 2005)
1:250



SCHEMATIC SECTION OF SG20



SCHEMATIC SECTION OF SG20



SCHEMATIC SECTION OF SG20

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
EXCAVATION BOUNDARY	RESIDENTIAL
	COMMERCIAL
	TREATED FINES
	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07

Job No: 1724-03
TAB/DWG : E18 - SG20 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	[signature]	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG20 - PRE EXCAVATION AND BACKFILL
SECTIONS A-C OF SECTIONS A-E

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s18	E18	AB1

12 September 2008 - 10:14am

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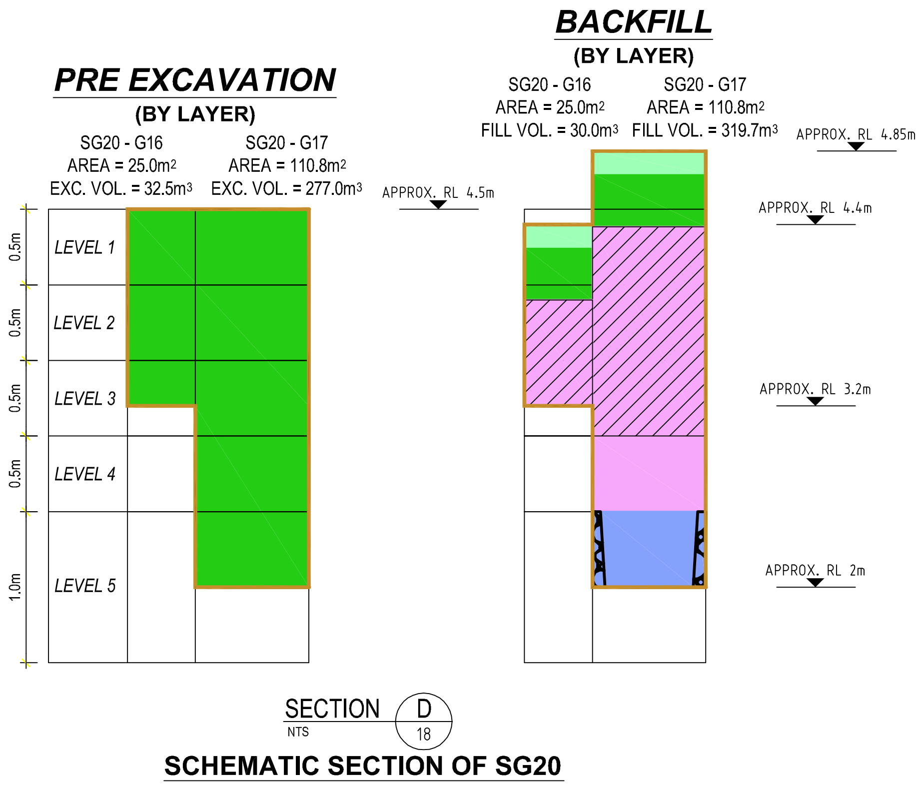
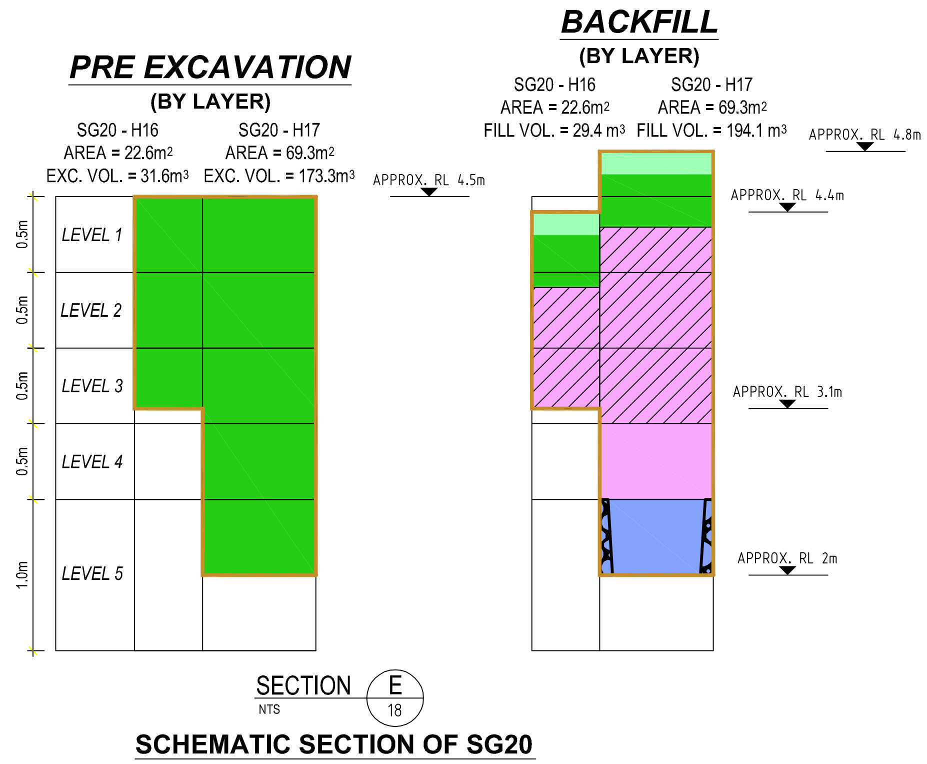


SCHEMATIC SECTION OF SG20



SCHEMATIC SECTION OF SG20

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
EXCAVATION BOUNDARY	RESIDENTIAL
	COMMERCIAL
	TREATED FINES
	TREATED FINES + COMMERCIAL + OVER SIZE
	OVERSIZE
	OVERSIZE (TRENCH) THIS IS A 'V' TRENCH AROUND THE CIRCUMFERENCE OF THE REBURIAL PIT FILLED WITH OVERSIZE)

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 20-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E19 - SG20 (2) / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED		09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG20 - PRE EXCAVATION AND BACKFILL
SECTIONS D&E OF SECTIONS A-E

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487s19
Sheet No. E19
Rev. AB1

12 September 2008 - 10:14am

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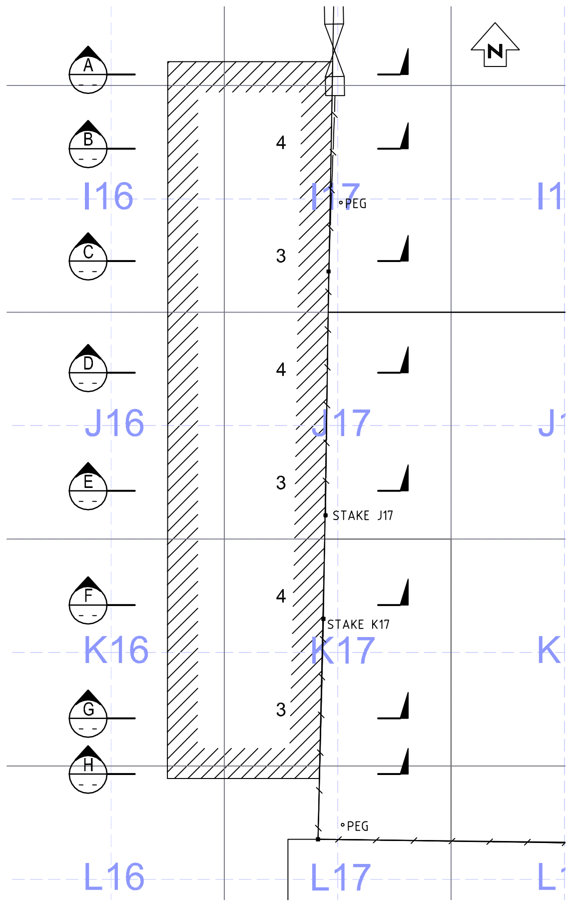
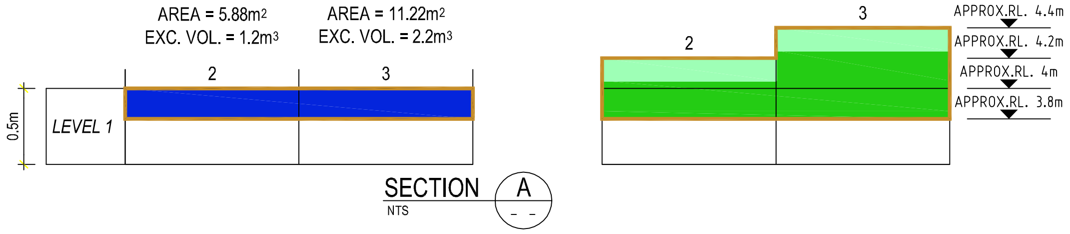
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg



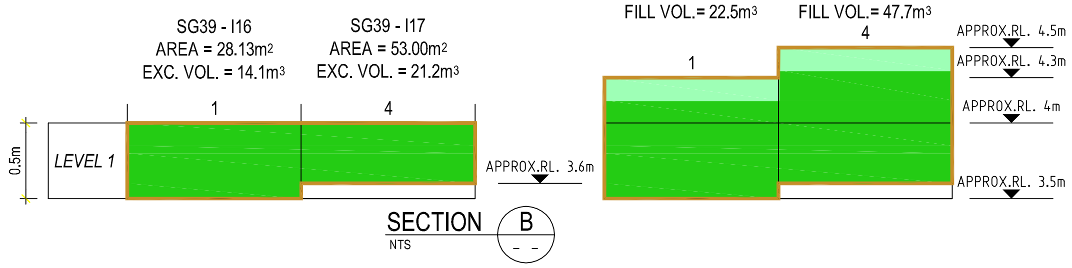
LOCATION OF SG39 (27 SEPTEMBER 2007)
1:250

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - H16	SG39 - H17	SG39 - H16	SG39 - H17
AREA = 5.88m2	AREA = 11.22m2	AREA = 5.88m2	AREA = 11.22m2
EXC. VOL. = 1.2m3	EXC. VOL. = 2.2m3	FILL VOL.= 2.4m3	FILL VOL.= 6.7m3



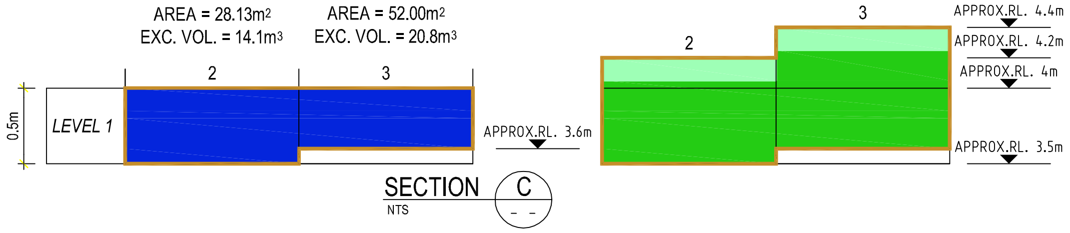
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - I16	SG39 - I17	SG39 - I16	SG39 - I17
AREA = 28.13m2	AREA = 53.00m2	AREA = 28.13m2	AREA = 53.00m2
EXC. VOL. = 14.1m3	EXC. VOL. = 21.2m3	FILL VOL.= 22.5m3	FILL VOL.= 47.7m3



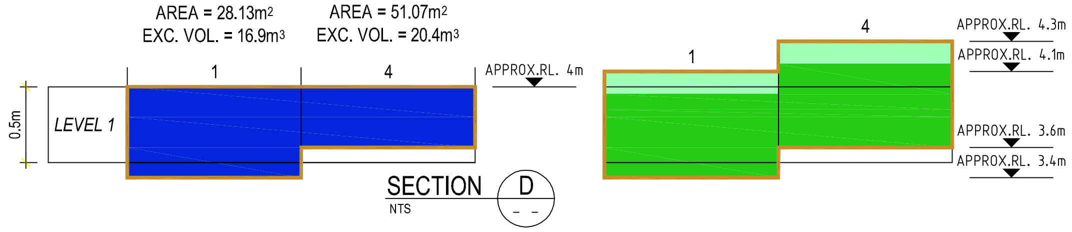
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - I16	SG39 - I17	SG39 - I16	SG39 - I17
AREA = 28.13m2	AREA = 52.00m2	AREA = 28.13m2	AREA = 52.00m2
EXC. VOL. = 14.1m3	EXC. VOL. = 20.8m3	FILL VOL.= 19.7m3	FILL VOL.= 41.6m3



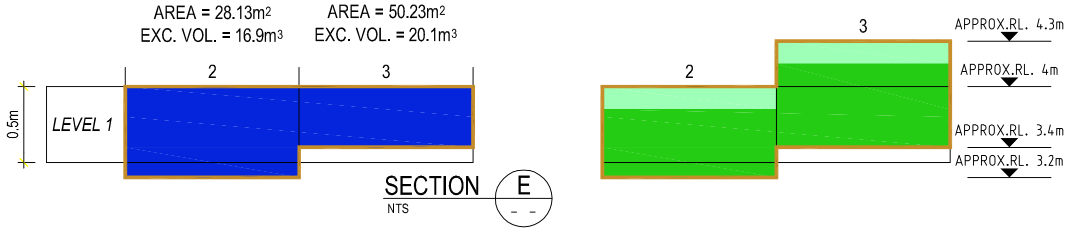
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - J16	SG39 - J17	SG39 - J16	SG39 - J17
AREA = 28.13m2	AREA = 51.07m2	AREA = 28.13m2	AREA = 51.07m2
EXC. VOL. = 16.9m3	EXC. VOL. = 20.4m3	FILL VOL.= 19.7m3	FILL VOL.= 35.7m3



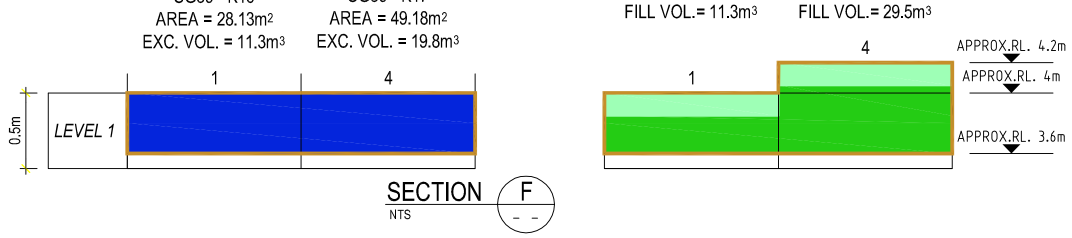
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - J16	SG39 - J17	SG39 - J16	SG39 - J17
AREA = 28.13m2	AREA = 50.23m2	AREA = 28.13m2	AREA = 50.23m2
EXC. VOL. = 16.9m3	EXC. VOL. = 20.1m3	FILL VOL.= 16.9m3	FILL VOL.= 35.2m3



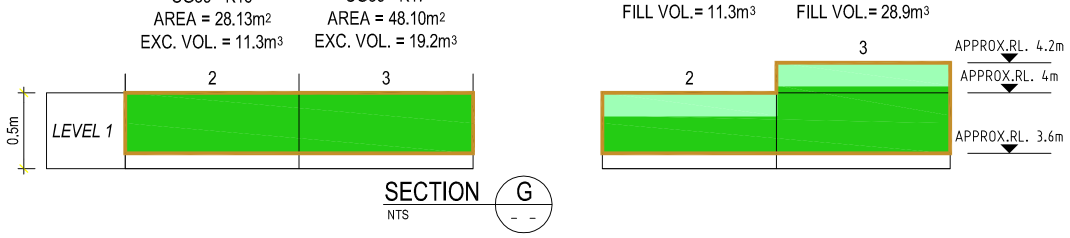
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - K16	SG39 - K17	SG39 - K16	SG39 - K17
AREA = 28.13m2	AREA = 49.18m2	AREA = 28.13m2	AREA = 49.18m2
EXC. VOL. = 11.3m3	EXC. VOL. = 19.8m3	FILL VOL.= 11.3m3	FILL VOL.= 29.5m3



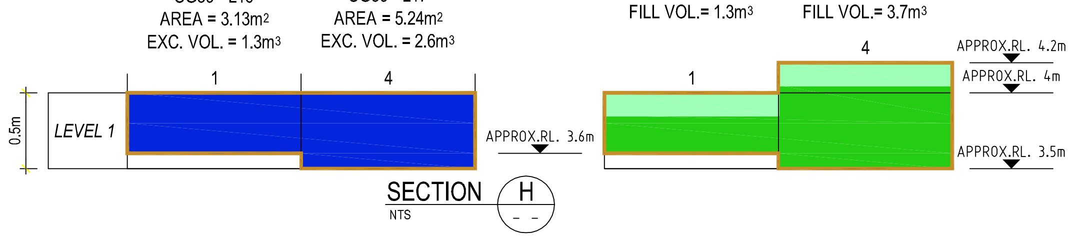
SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - K16	SG39 - K17	SG39 - K16	SG39 - K17
AREA = 28.13m2	AREA = 48.10m2	AREA = 28.13m2	AREA = 48.10m2
EXC. VOL. = 11.3m3	EXC. VOL. = 19.2m3	FILL VOL.= 11.3m3	FILL VOL.= 28.9m3



SCHEMATIC SECTION OF SG39

PRE EXCAVATION (BY LAYER)		BACKFILL (BY LAYER)	
SG39 - L16	SG39 - L17	SG39 - L16	SG39 - L17
AREA = 3.13m2	AREA = 5.24m2	AREA = 3.13m2	AREA = 5.24m2
EXC. VOL. = 1.3m3	EXC. VOL. = 2.6m3	FILL VOL.= 1.3m3	FILL VOL.= 3.7m3



SCHEMATIC SECTION OF SG39

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB1	AS BUILT - AS AT COMPLETION OF WORK 28-03-08	JCW	03-08	PFR	03-08
AB	AS BUILT - CURRENT DATA AS OF 05-04-07	JCW	04-07	PFR	04-07
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : E20 - SG39 / AB_EAST_02-16.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt EAST areas

FIELDBOOK	Name	Date
SURVEYED	MAH	09-04
DESIGNED	JCW	09-04
DRAWN	V L	09-04
CHECKED	JCW	09-04
APPROVED	P.F. Russell	09-04

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
EAST FCC SITE

SG39
PRE EXCAVATION AND BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487s20	E20	AB1

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_EAST_02-16.dwg
12 September 2008 - 10:13am
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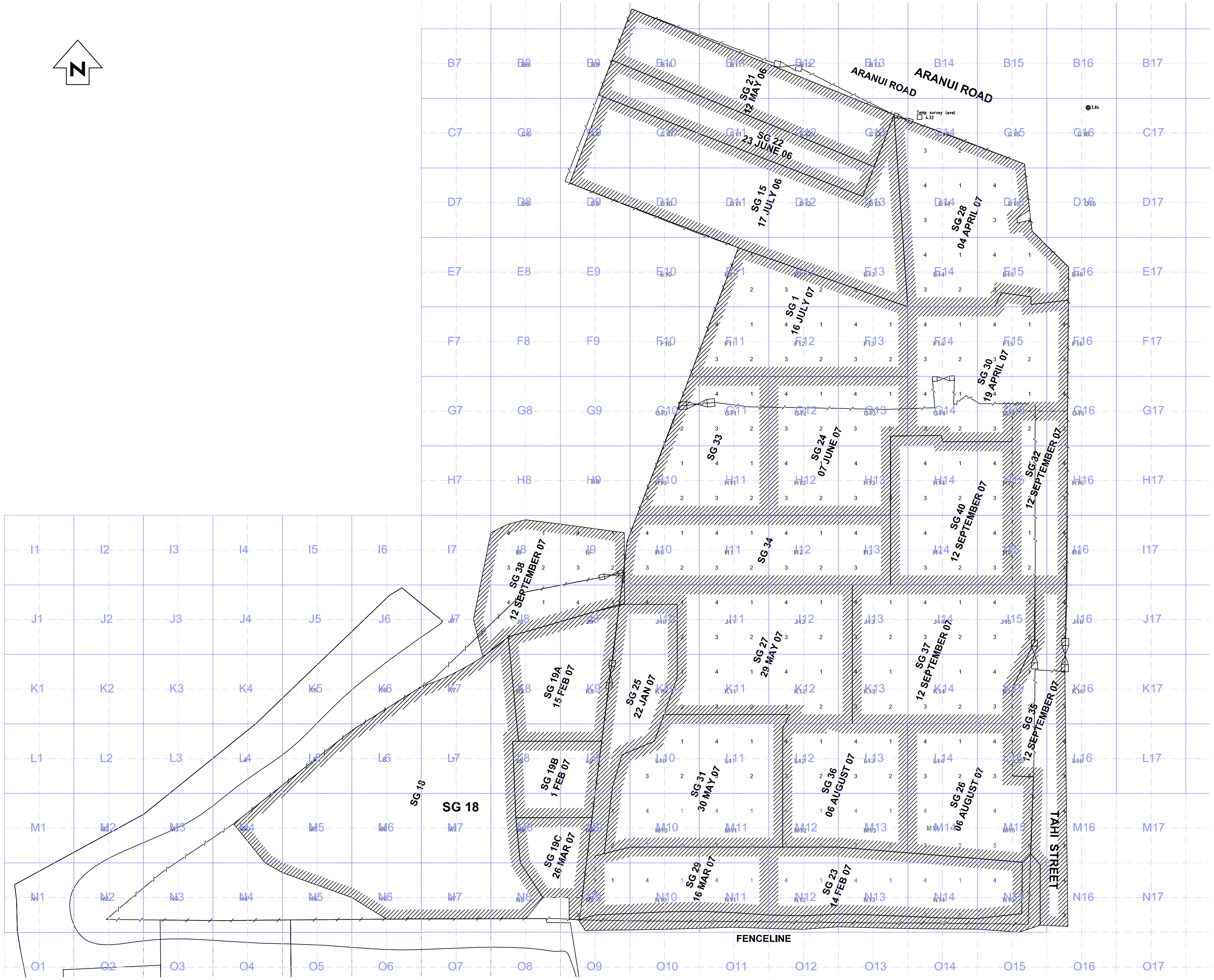
DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1



SITE LOCATION PLAN

1:500

12 September 2008 - 10:12am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03

TAB/DWG : W1 - SITE LOCATION / AB_WEST_ 01 Cover.dwg

SERVER : NELSON (NZNEL1S01)

XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P. F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

WEST SITE LAYOUT
PRE EXCAVATION vs BACKFILL

Status Stamp: **AS BUILT**

Date Stamp: **12 SEPTEMBER 2008**

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s1	W1	AB

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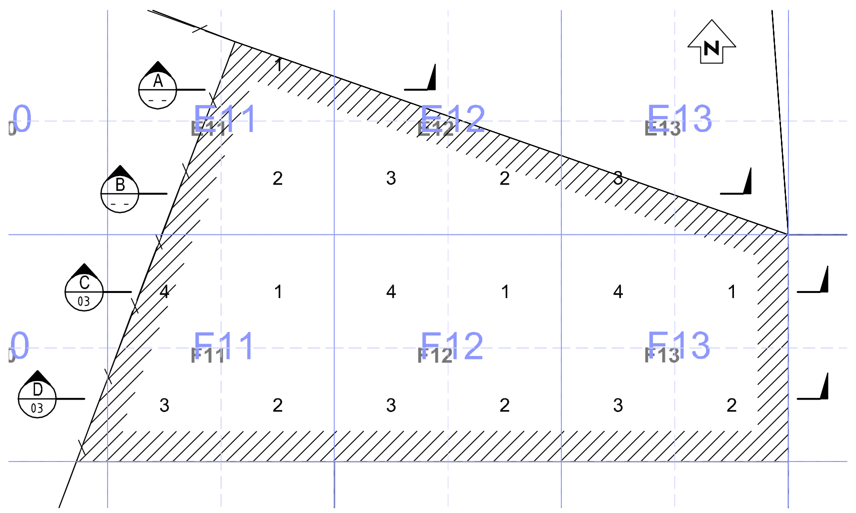
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_ 01 Cover.dwg

DO NOT SCALE - IF IN DOUBT, ASK

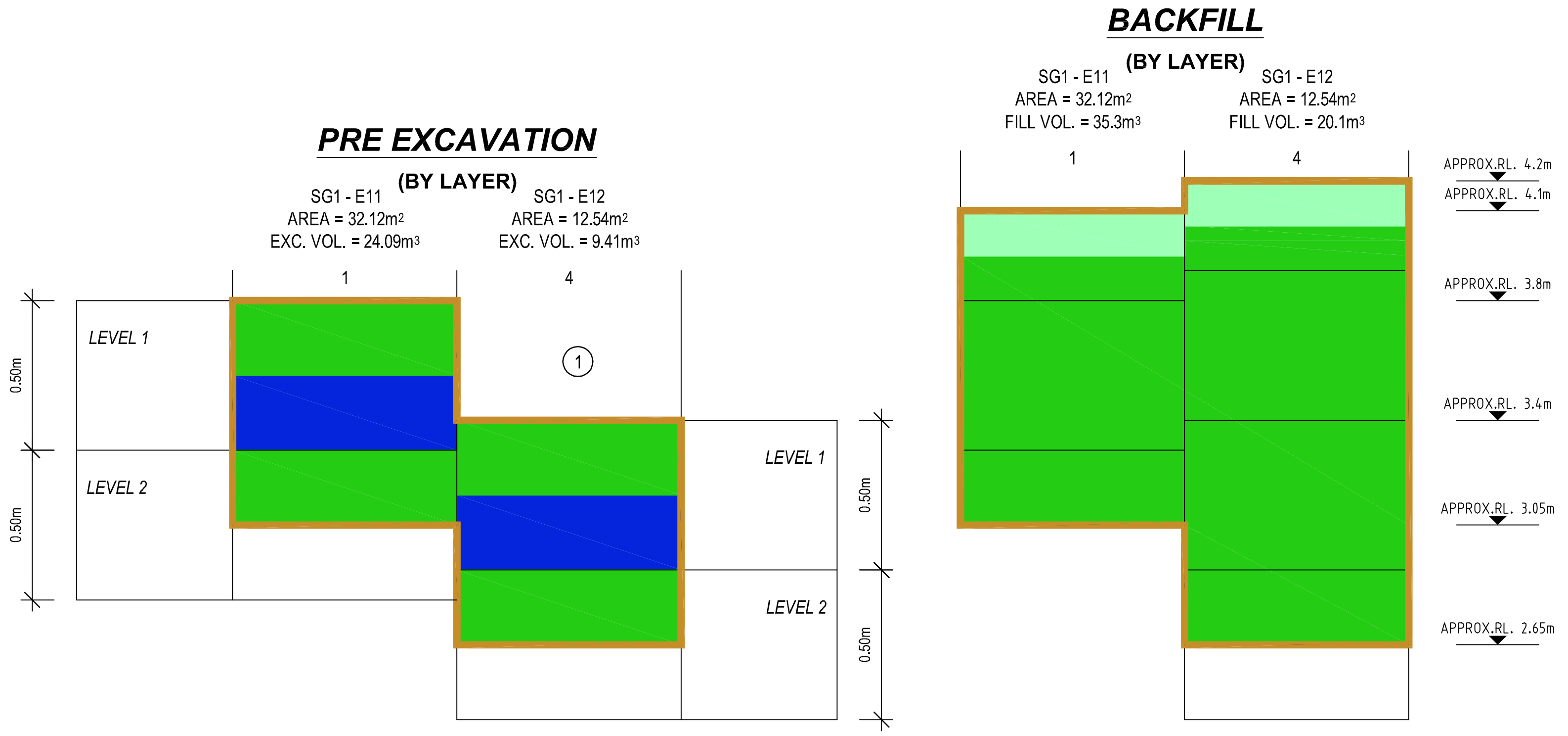


LOCATION OF SG1 (16 JULY 2007)

1:250

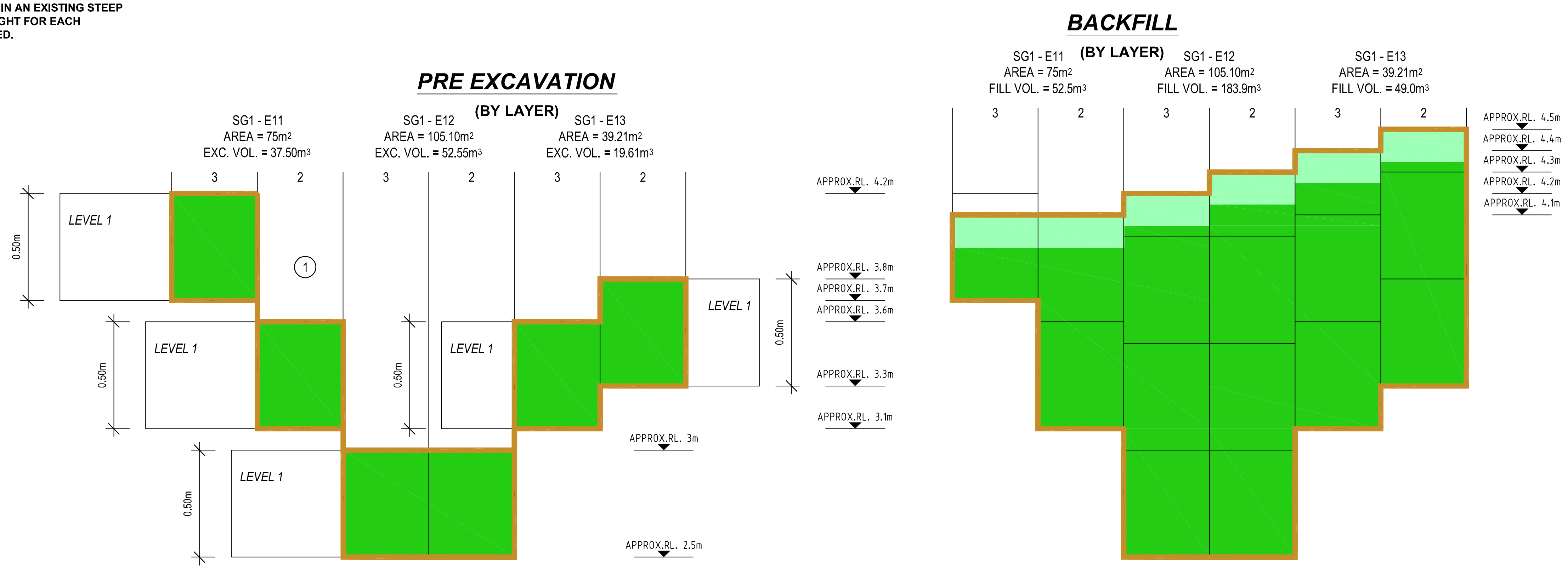
L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

(1) CELLS E11, E12, E13, F12, & F13 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH QUADRANT IS SHOWN STEPPED RATHER THAN SLOPED.



SECTION A
NTS

SCHEMATIC SECTION OF SG1



SECTION B
NTS

SCHEMATIC SECTION OF SG1

ORIGINAL SIZE A1

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W2 - SG1 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG1 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s2	W2	AB

12 September 2008 - 10:11am

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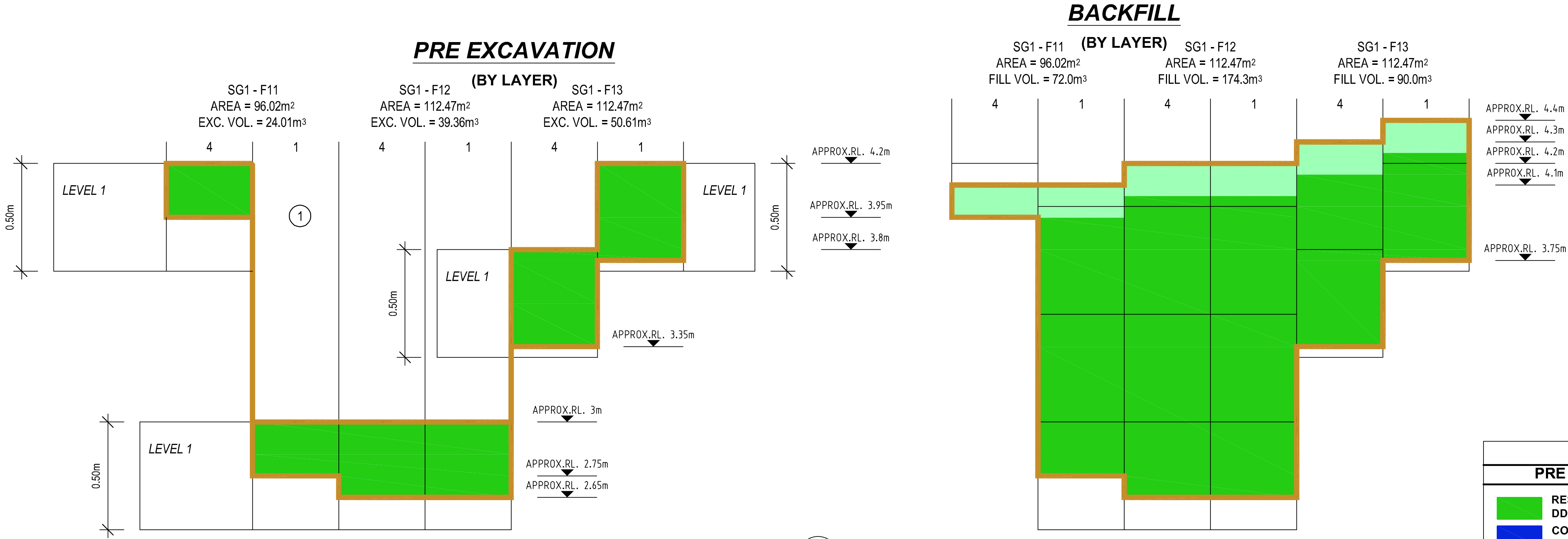


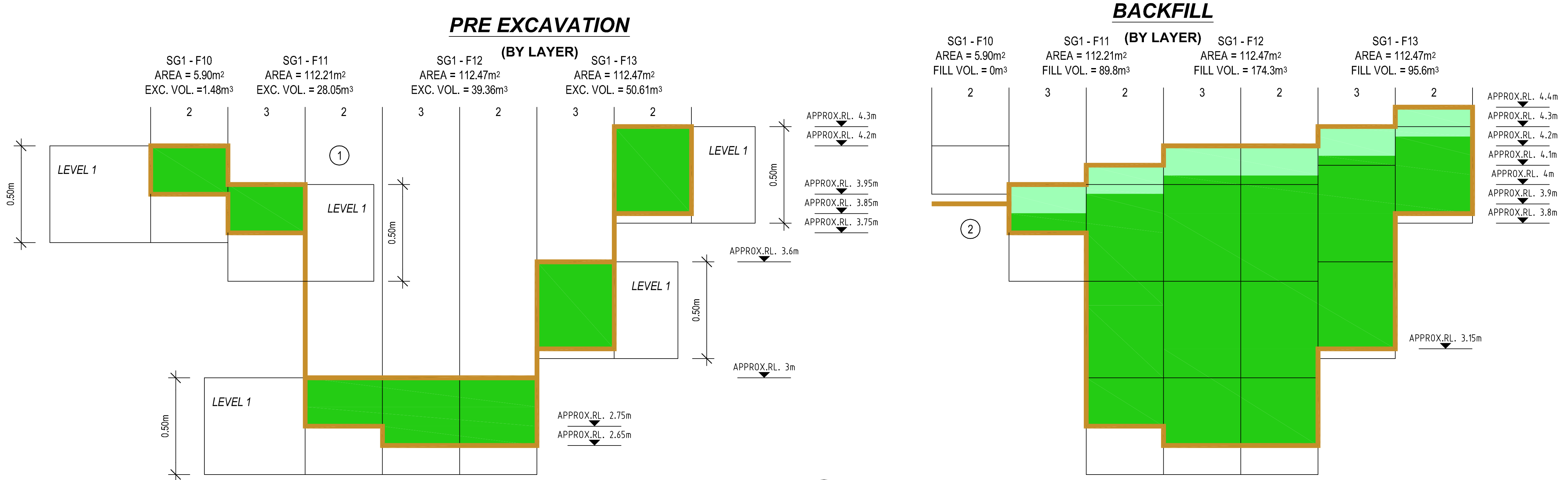
SECTION C
NTS 02

SCHEMATIC SECTION OF SG1

L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

(1) CELLS E11, E12, E13, F12, & F13 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH QUADRANT IS SHOWN STEPPED RATHER THAN SLOPED.

(2) LEVEL REDUCED AFTER SITE RECONTOURING



SECTION D
NTS 02

SCHEMATIC SECTION OF SG1

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:10am

REV	AMENDMENTS	CHECKED INITIAL	DATE	APPROVED INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W3 - SG1 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG1 - PRE EXCAVATION vs BACKFILL
SECTIONS C&D OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s3 | Sheet No. W3 | Rev. AB

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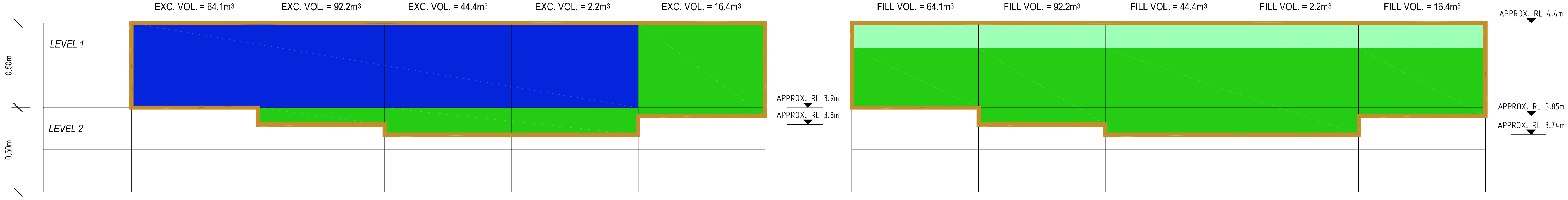
SECTION A (NTS) — SCHEMATIC SECTION OF SG15

PRE EXCAVATION (BY LAYER)

	SG15 - C9	SG15 - C10	SG15 - C11	SG15 - C12	SG15 - C13
AREA	128.15m²	153.66m²	67.32m²	3.38m²	29.83m²
EXC. VOL.	64.1m³	92.2m³	44.4m³	2.2m³	16.4m³

BACKFILL (BY LAYER)

	SG15 - C9	SG15 - C10	SG15 - C11	SG15 - C12	SG15 - C13
AREA	128.15m²	153.66m²	67.32m²	3.38m²	29.83m²
FILL VOL.	64.1m³	92.2m³	44.4m³	2.2m³	16.4m³



SECTION A
NTS

SCHEMATIC SECTION OF SG15

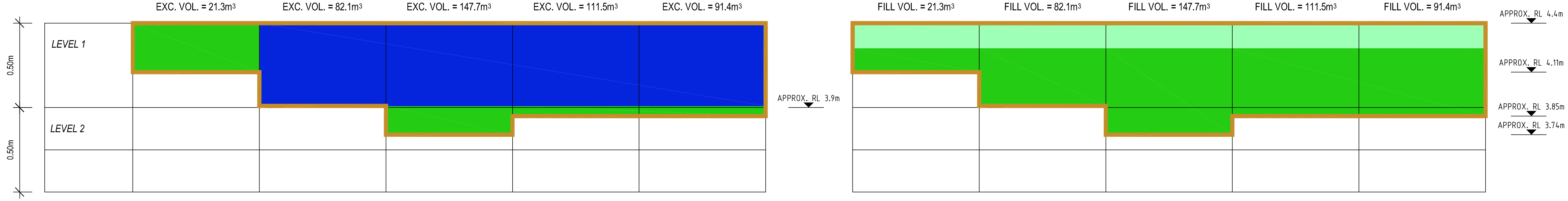
SECTION B (NTS) — SCHEMATIC SECTION OF SG15

PRE EXCAVATION (BY LAYER)

	SG15 - D9	SG15 - D10	SG15 - D11	SG15 - D12	SG15 - D13
AREA	73.39m²	167.45m²	223.80m²	203.63m²	166.25m²
EXC. VOL.	21.3m³	82.1m³	147.7m³	111.5m³	91.4m³

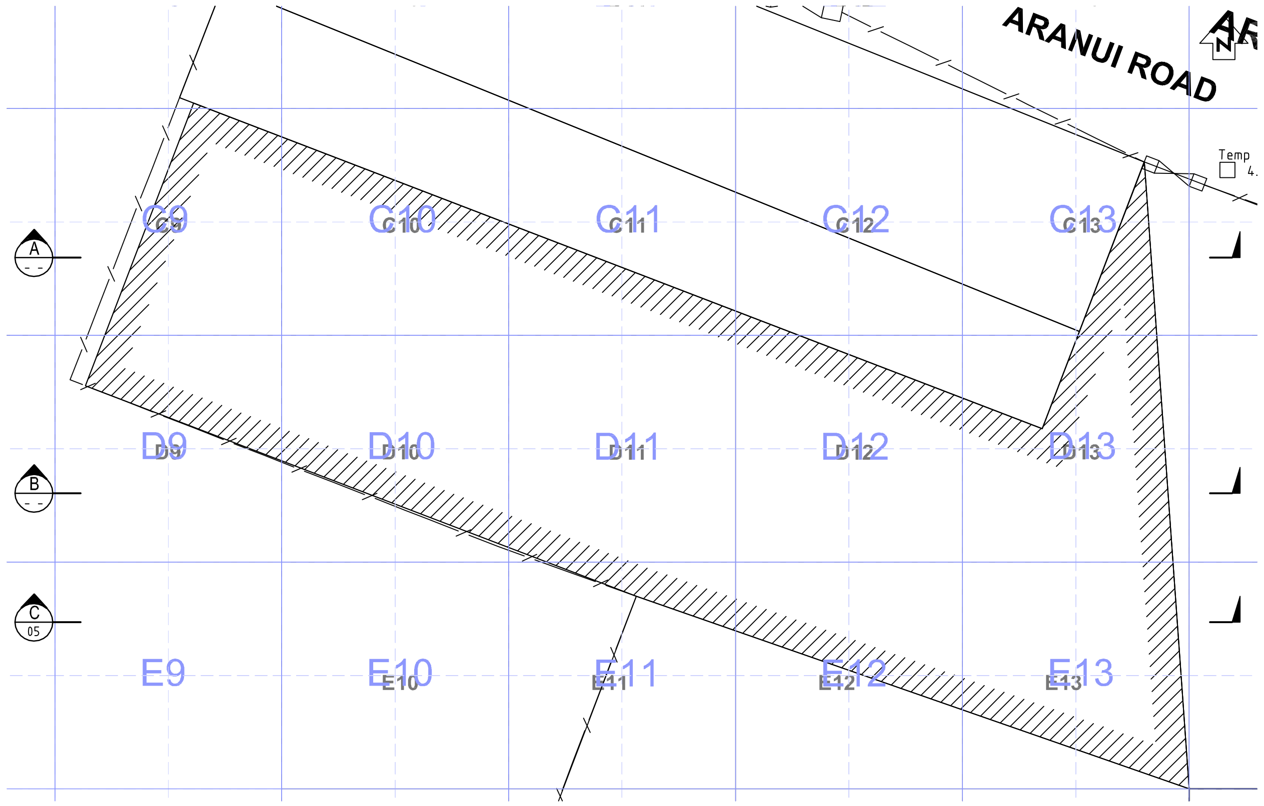
BACKFILL (BY LAYER)

	SG15 - D9	SG15 - D10	SG15 - D11	SG15 - D12	SG15 - D13
AREA	73.39m²	167.45m²	223.80m²	202.63m²	166.25m²
FILL VOL.	21.3m³	82.1m³	147.7m³	111.5m³	91.4m³



SECTION B
NTS

SCHEMATIC SECTION OF SG15



LOCATION OF SG15 (17 JULY 2006)
1:250

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

(1) CELLS E12 & E13 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN STEPPED RATHER THAN SLOPED.

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W4 - SG15 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG15 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-C

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s4
Sheet No. W4
Rev. AB

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1

12 September 2008 - 10:09am

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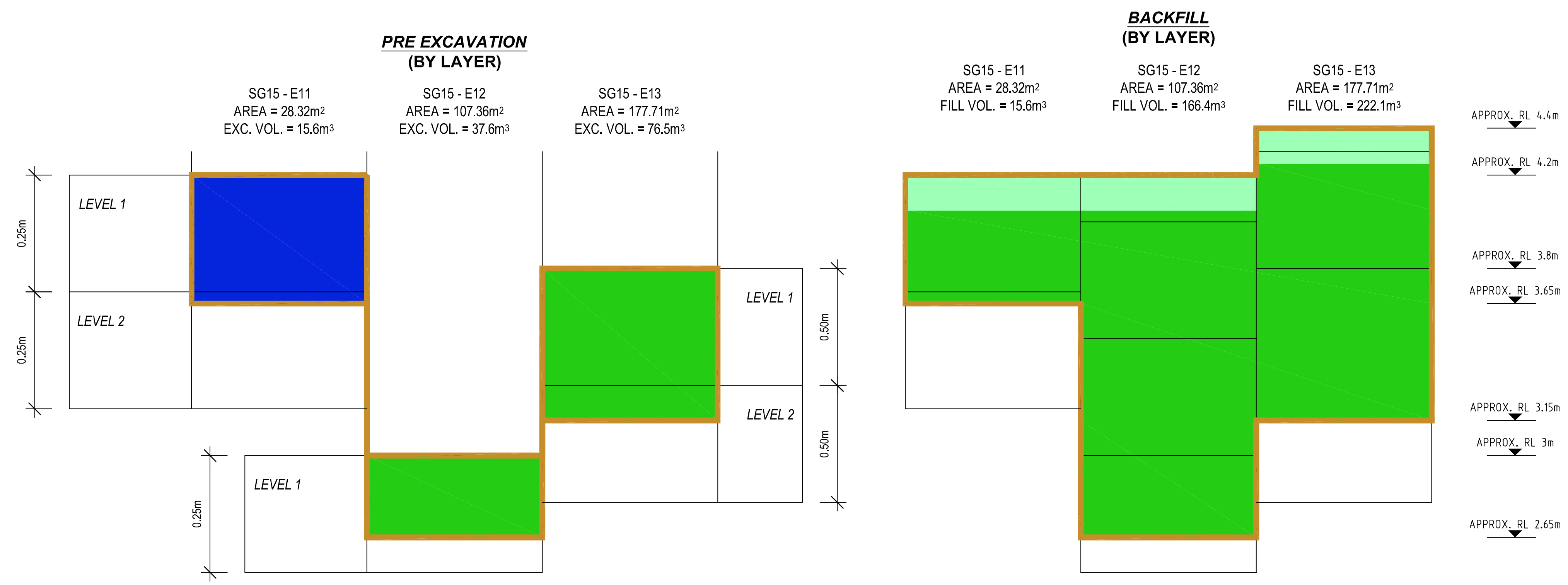
L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

(1) CELLS E12 & E13 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN STEPPED RATHER THAN SLOPED.



SECTION C 04
NTS

SCHEMATIC SECTION OF SG15

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W5 - SG15 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG15 - PRE EXCAVATION vs BACKFILL
SECTION C OF SECTIONS A-C

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s5	W5	AB

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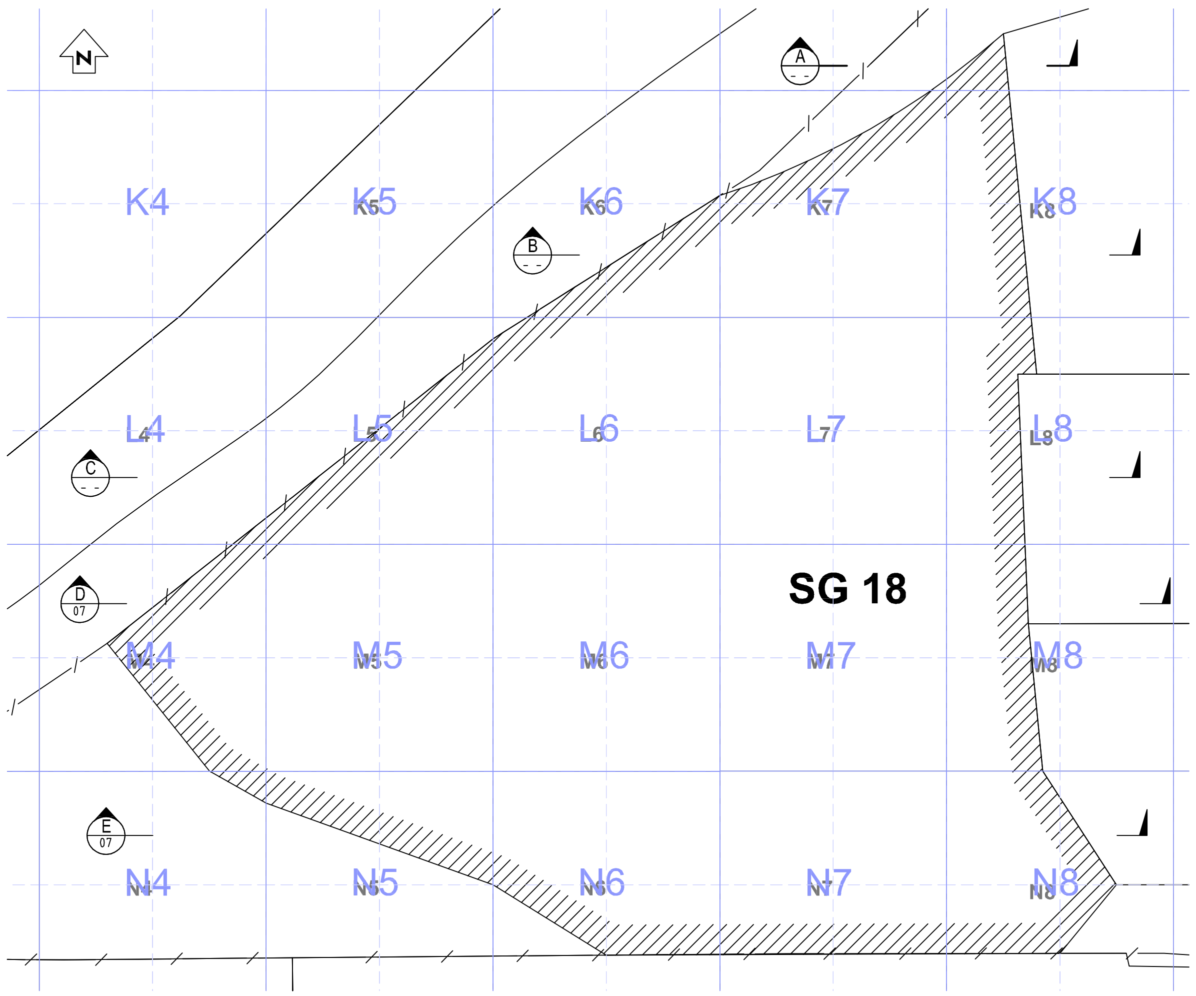
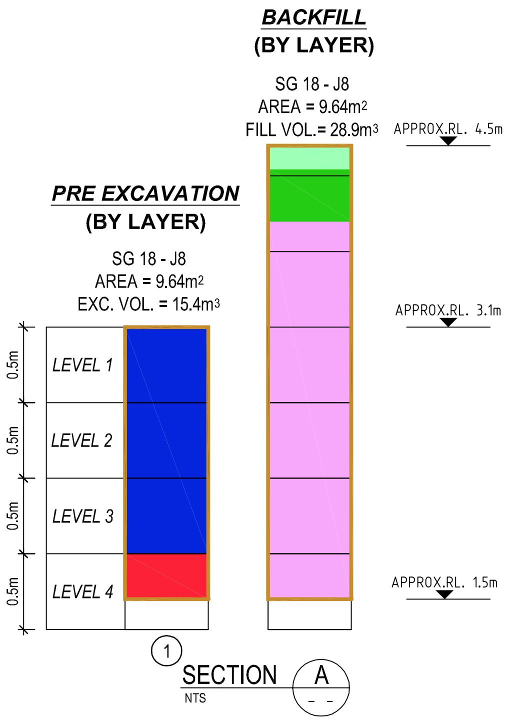
12 September 2008 - 10:07am

ORIGINAL SIZE A1
DO NOT SCALE - IF IN DOUBT, ASK

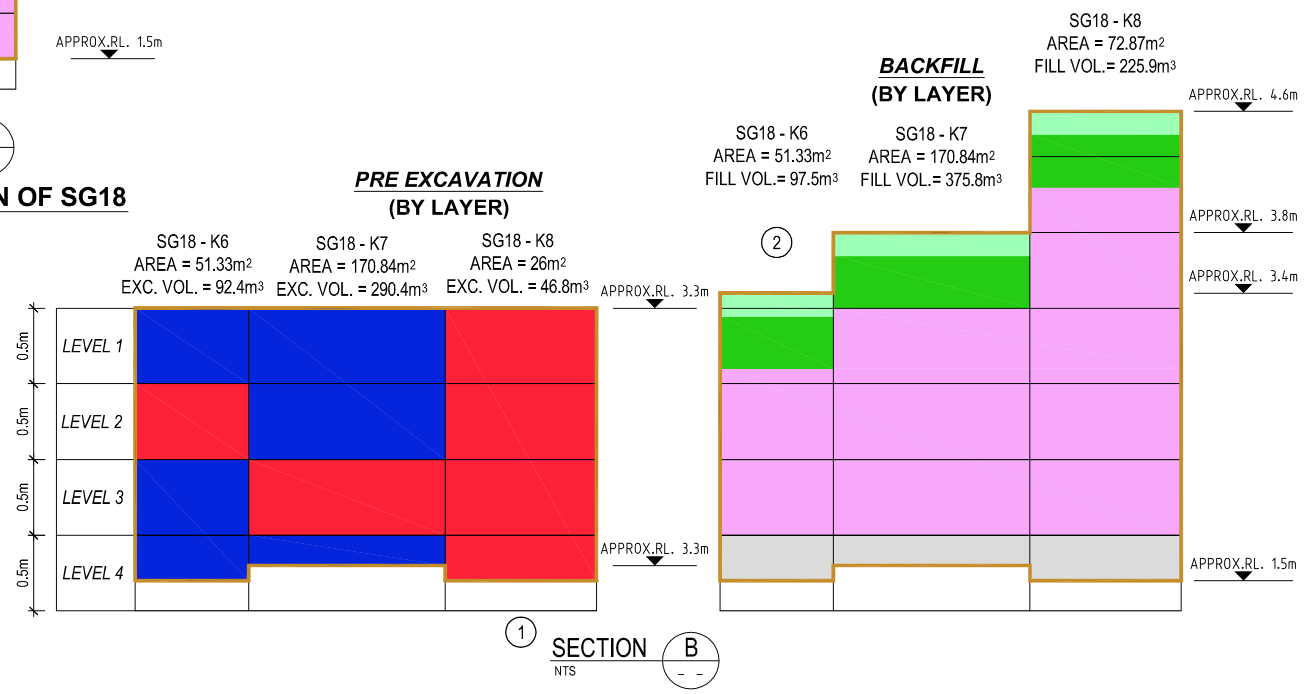


LOCATION OF SG18 (2007)

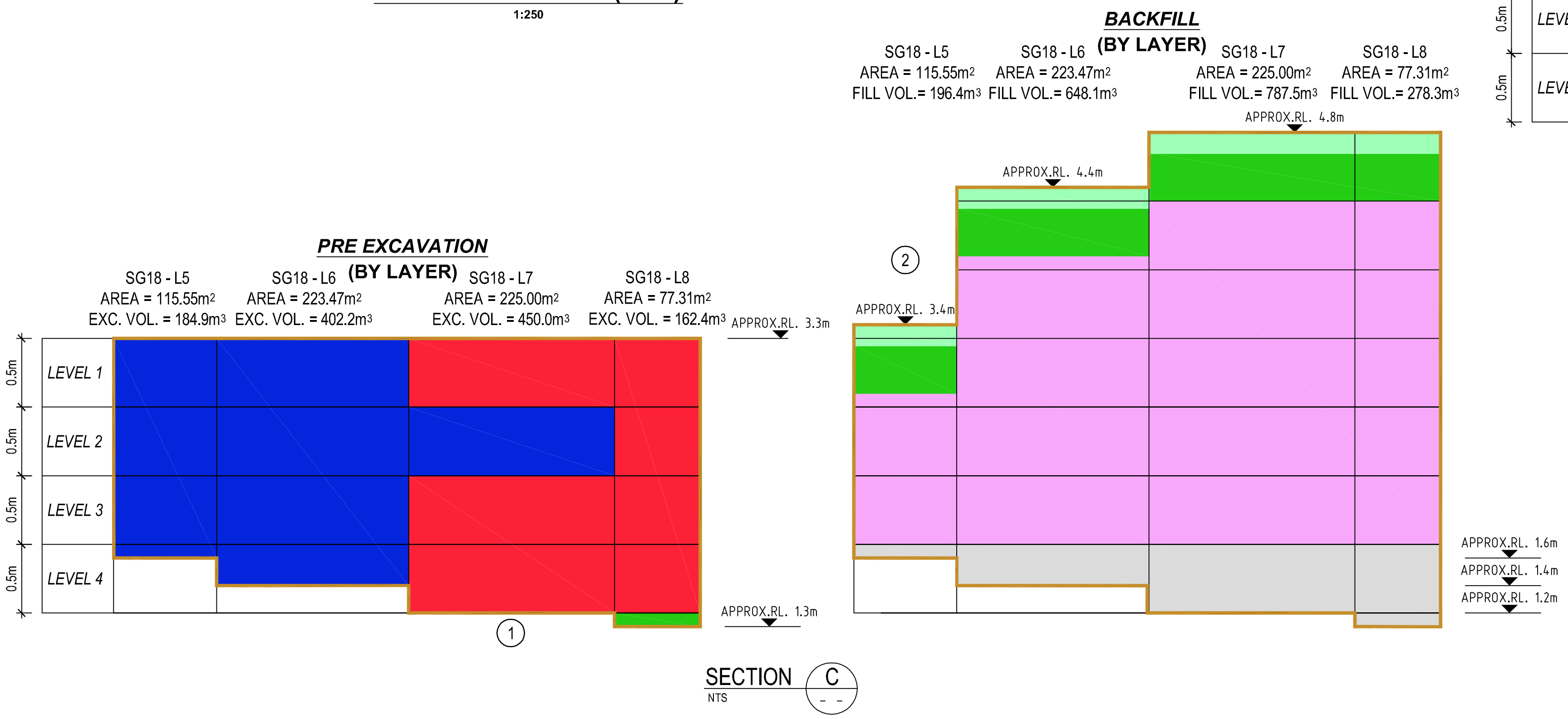
1:250



SCHEMATIC SECTION OF SG18



SCHEMATIC SECTION OF SG18



SCHEMATIC SECTION OF SG18

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES - COMMERCIAL - OVER SIZE
	CONCRETE

1 FLOOR VALIDATED AS RESIDENTIAL

2 SITE ACTUALLY SLOPED, HOWEVER FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W6 - SG18 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
LANDFILL FCC SITE

SG18 - PRE EXCAVATION vs BACKFILL
SECTIONS A-C OF SECTIONS A-E

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s6	W6	AB

12 September 2008 - 10:07am

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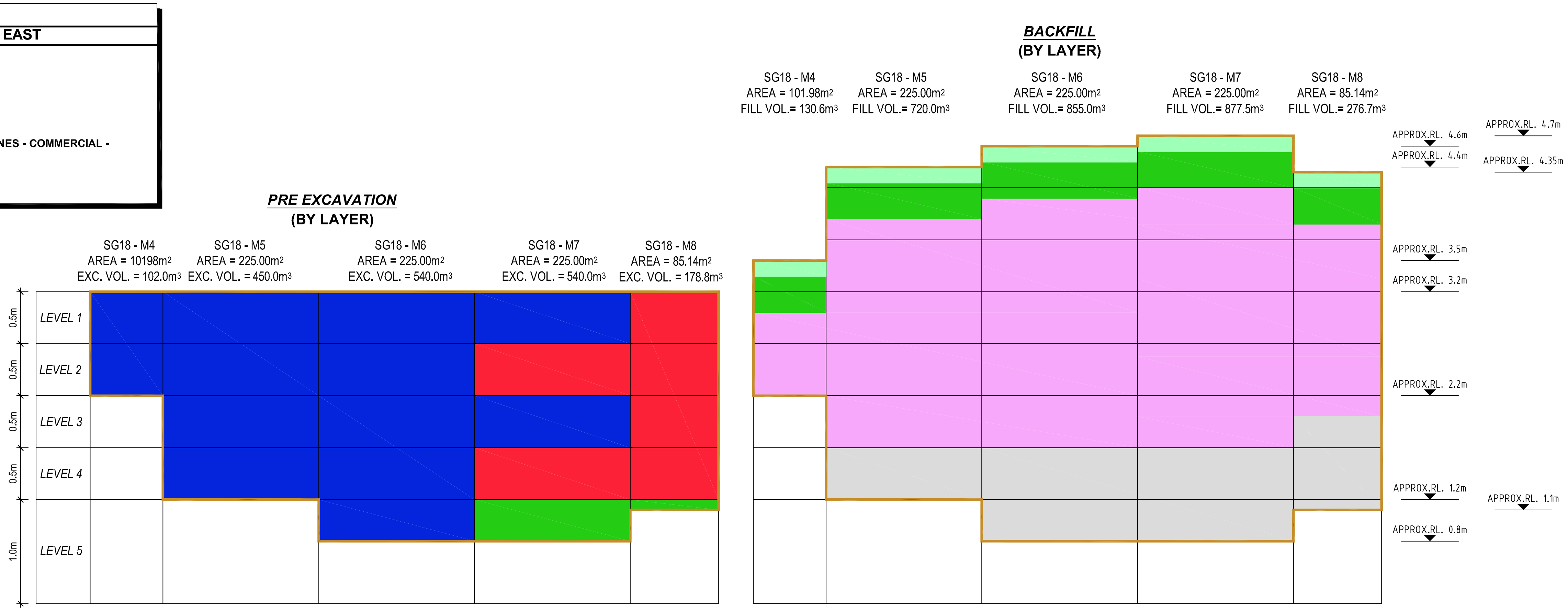
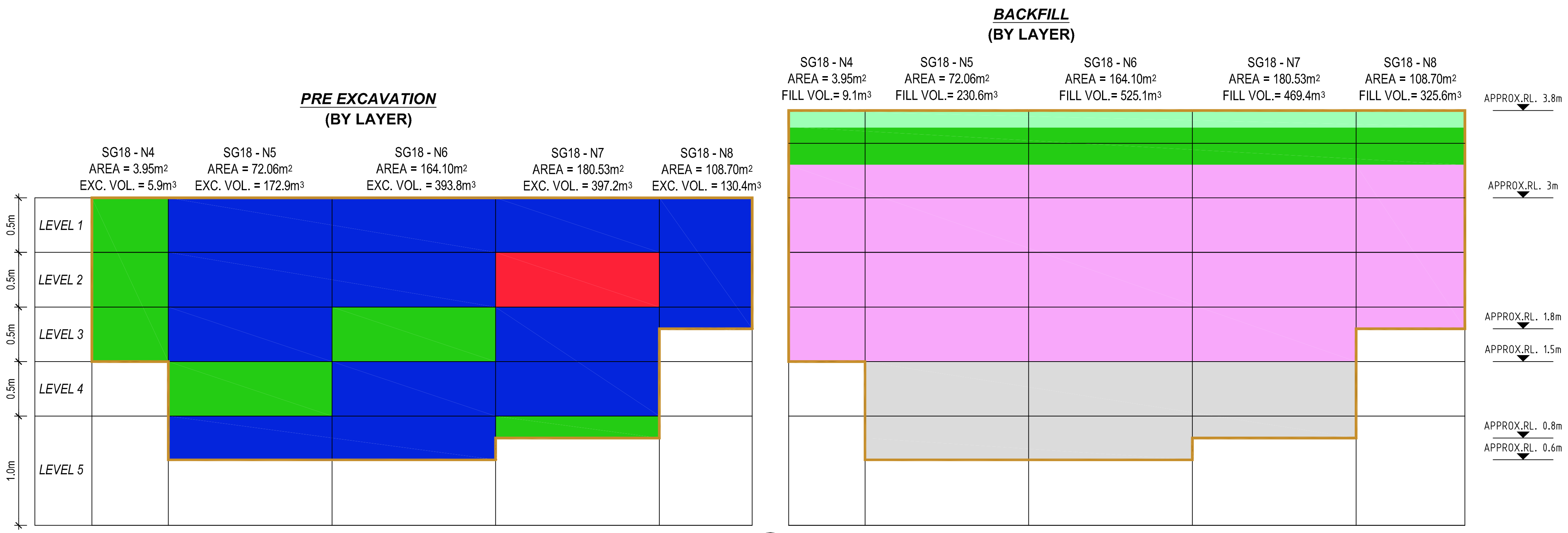
L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES - COMMERCIAL - OVER SIZE
	CONCRETE



SECTION D 06
NTS

SCHEMATIC SECTION OF SG18



SECTION E 06
NTS

SCHEMATIC SECTION OF SG18

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:06am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W7 - SG18 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
LANDFILL FCC SITE

SG18 - PRE EXCAVATION vs BACKFILL
SECTIONS D&E OF SECTIONS A-E

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s7	W7	AB

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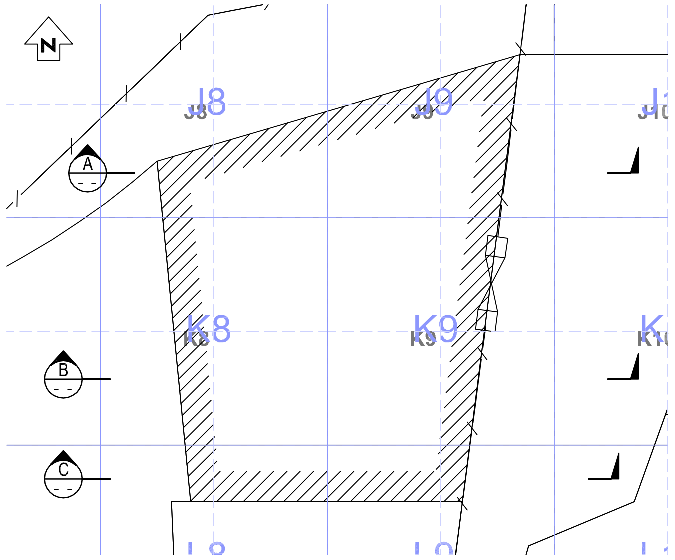
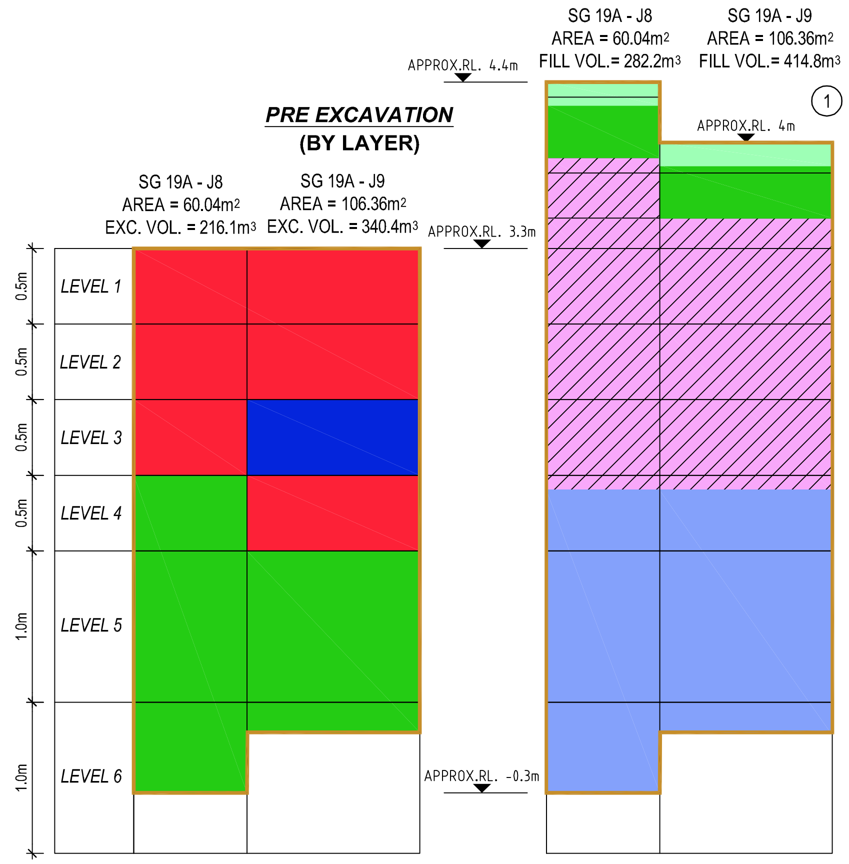
LOCATION OF SG19A (15 FEBRUARY 2007)

1:250



BACKFILL (BY LAYER) | **PRE EXCAVATION (BY LAYER)**



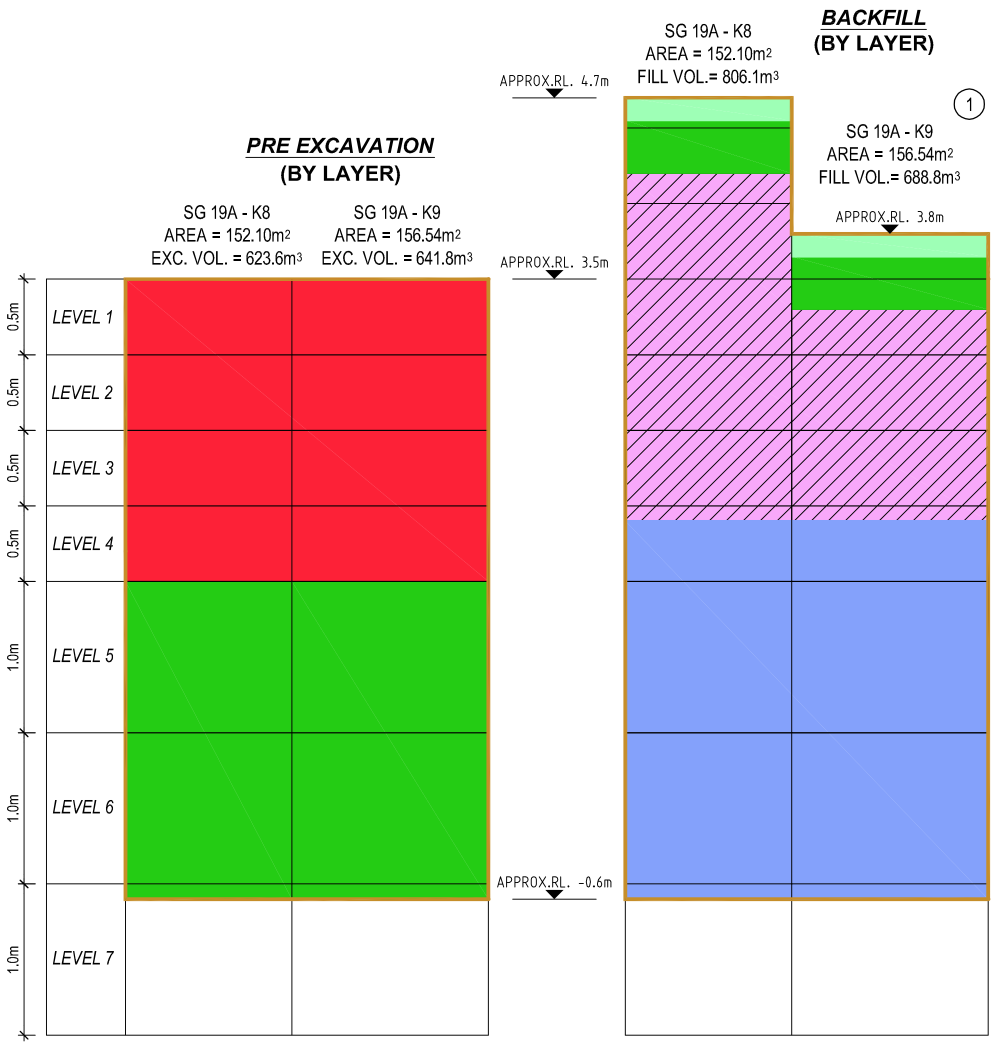
SECTION A
NTS

SCHEMATIC SECTION OF SG19A

LEGEND

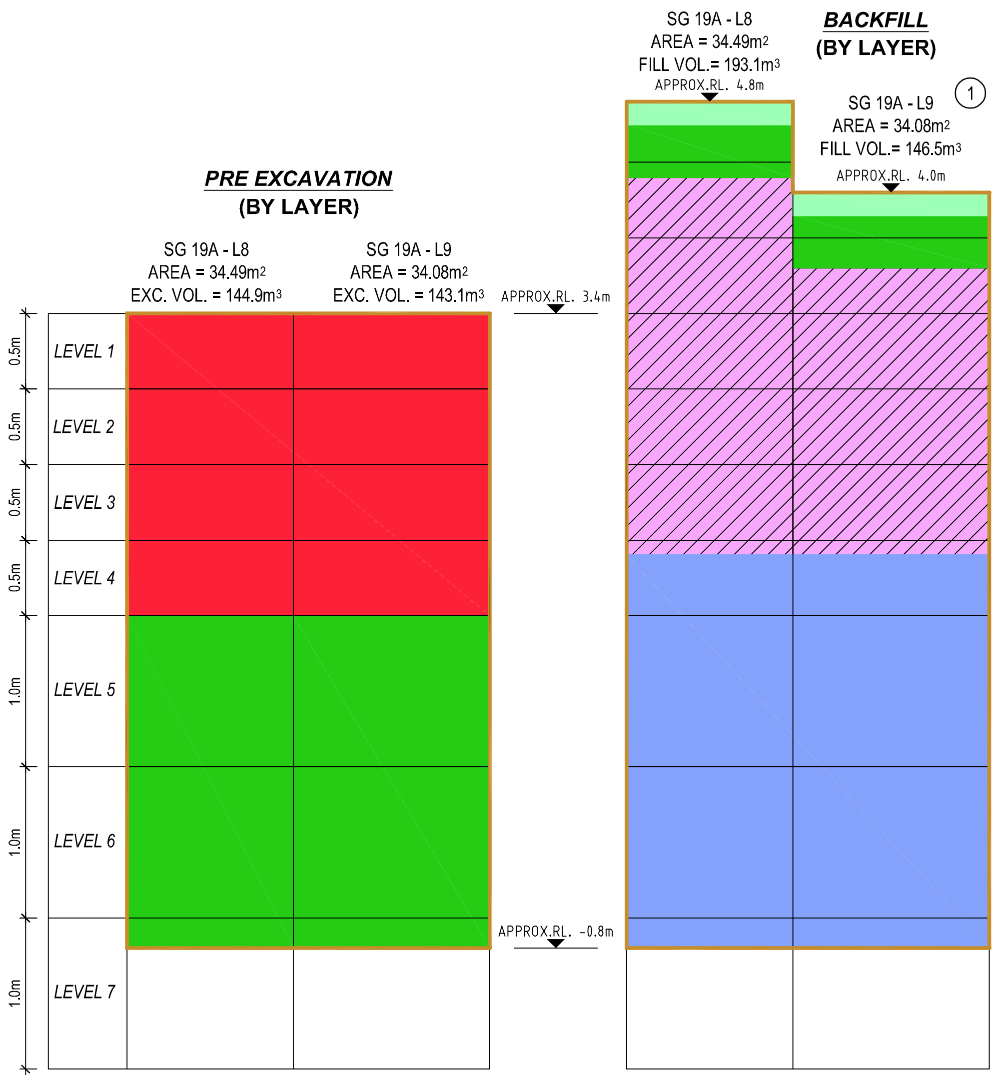
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	150mm TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	350mm RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES - COMMERCIAL - OVER SIZE
	CONCRETE
	OVERSIZE
	TREATED FINES

1 SITE ACTUALLY SLOPED, HOWEVER FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN



SECTION B
NTS

SCHEMATIC SECTION OF SG19A



SECTION C
NTS

SCHEMATIC SECTION OF SG19A

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W8 - SG19A / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
LANDFILL FCC SITE

SG19A - PRE EXCAVATION vs BACKFILL

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s8	W8	AB

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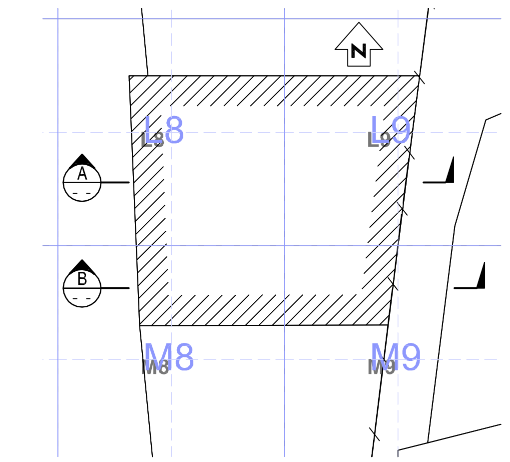
12 September 2008 - 10:05am

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1



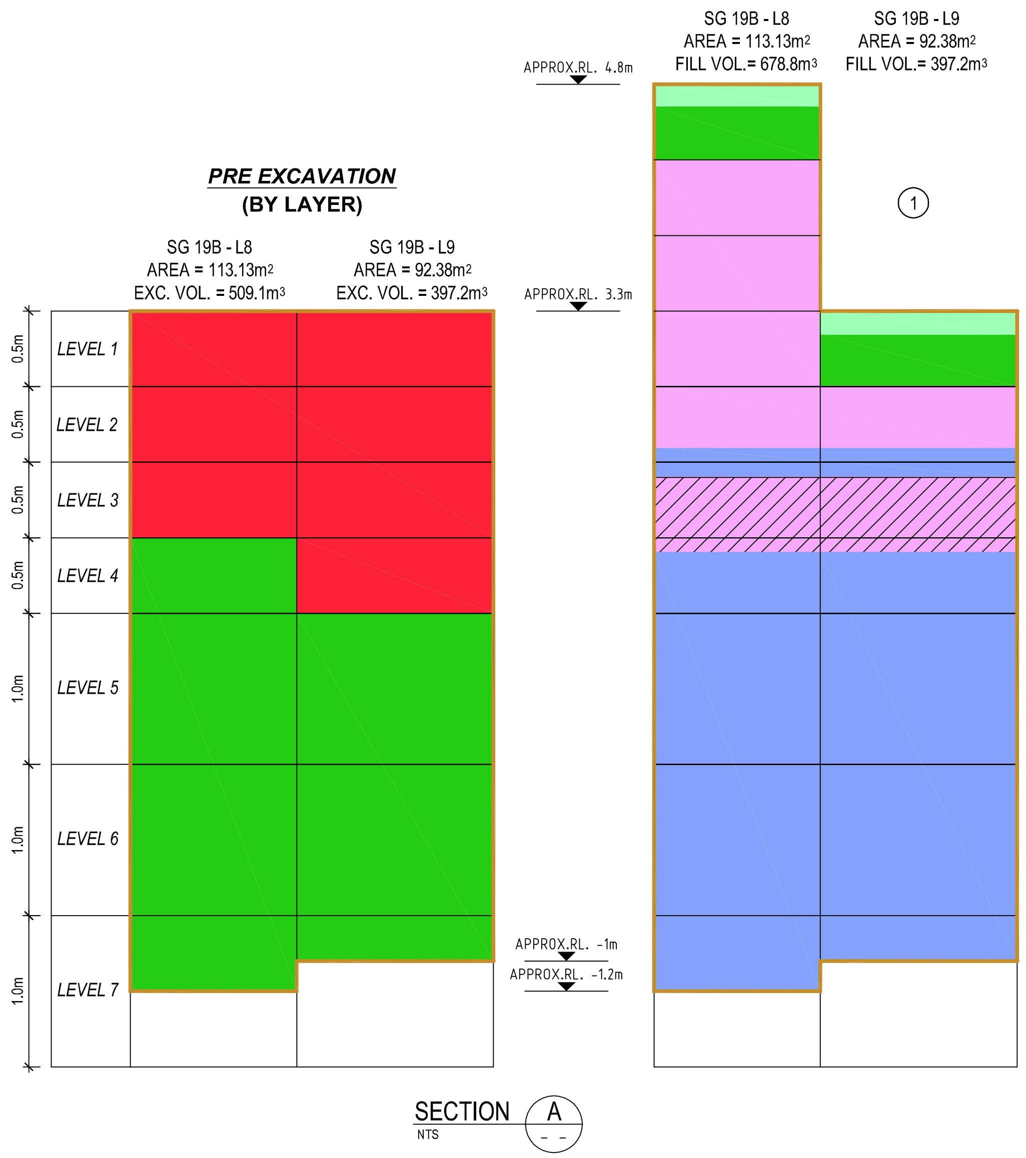
LOCATION OF SG19B (1 FEBRUARY 2007)

1:250

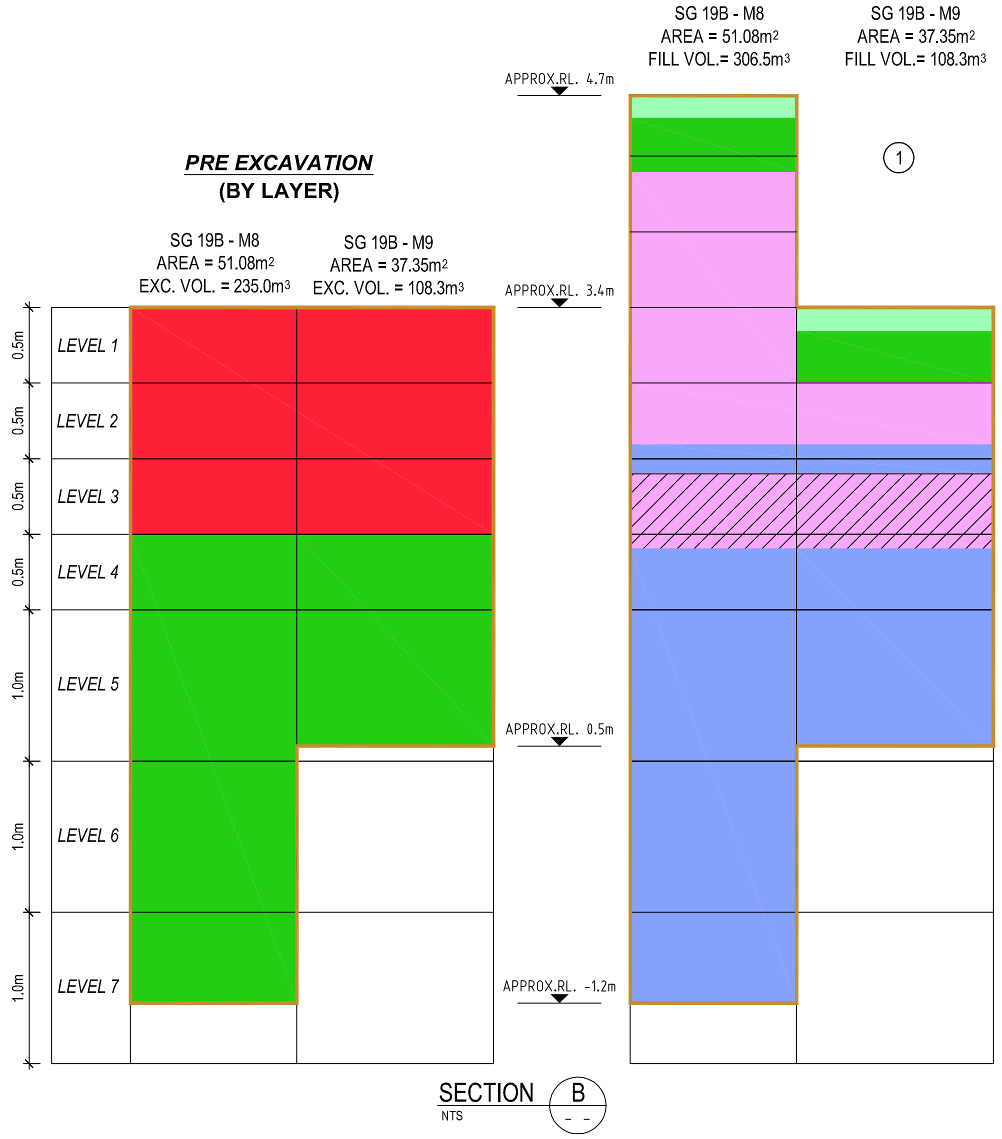
LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	COMMERCIAL
EXCAVATION BOUNDARY	TREATED FINES - COMMERCIAL - OVER SIZE
	CONCRETE
	OVERSIZE
	TREATED FINES

1 SITE ACTUALLY SLOPED, HOWEVER FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN



SCHEMATIC SECTION OF SG19B



SCHEMATIC SECTION OF SG19B

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 10:04am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W9 - SG19B / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

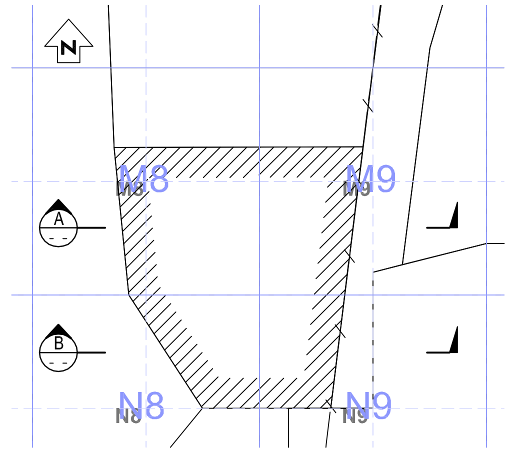
REMEDIATION OF THE FCC SITE
WEST FCC SITE
SG19B - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s9	W9	AB

P:\801\001724\03 MFE\Cad\As Built\AB_WEST_02-19.dwg

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_02-19.dwg



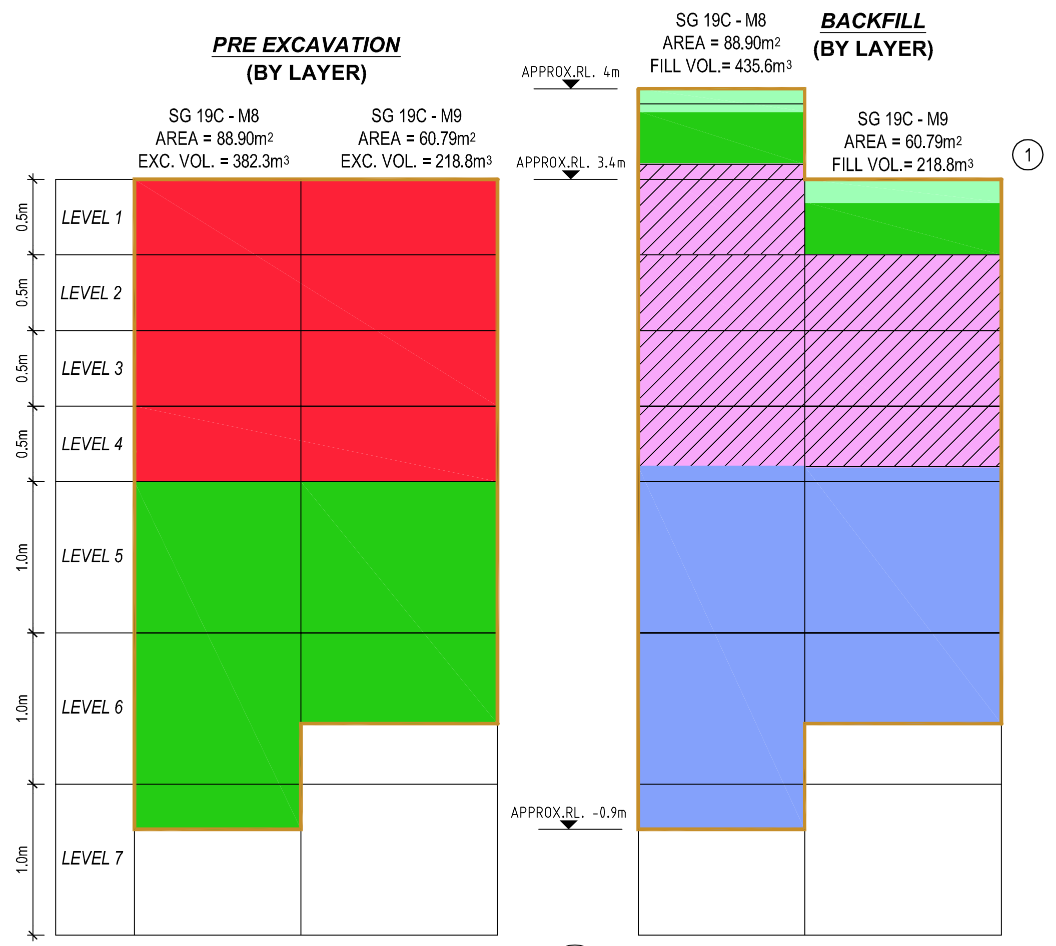
LOCATION OF SG19C (26 MARCH 2007)

1:250

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	RESIDENTIAL
EXCAVATION BOUNDARY	COMMERCIAL
	TREATED FINES - COMMERCIAL - OVER SIZE
	CONCRETE
	OVERSIZE
	TREATED FINES

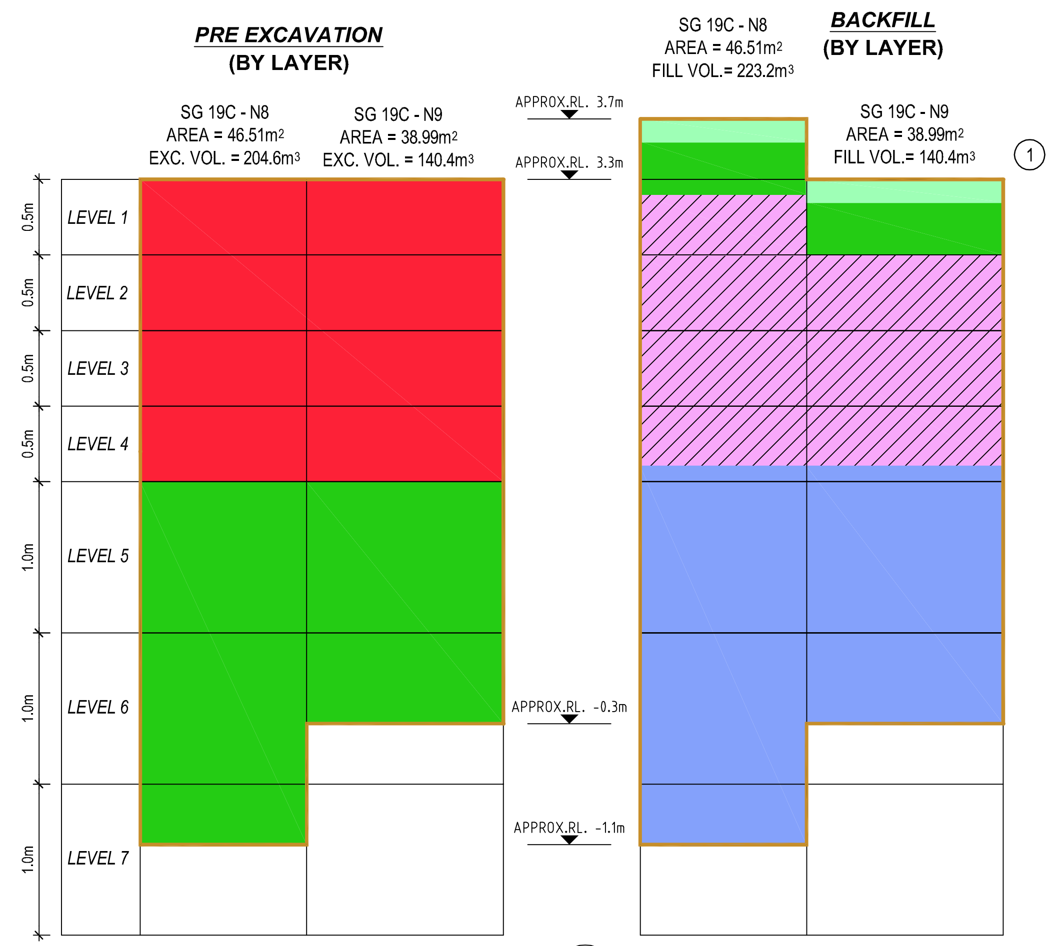
1 SITE ACTUALLY SLOPED, HOWEVER FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN



SECTION A

NTS

SCHEMATIC SECTION OF SG19C



SECTION B

NTS

SCHEMATIC SECTION OF SG19C

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03

TAB/DWG : W10 - SG19C / AB_WEST_02-19.dwg

SERVER : NELSON (NZNEL1S01)

XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG19C - PRE EXCAVATION vs BACKFILL

Status Stamp: **AS BUILT**

Date Stamp: **12 SEPTEMBER 2008**

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s10	W10	AB

ORIGINAL SIZE A1

DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 10:03am

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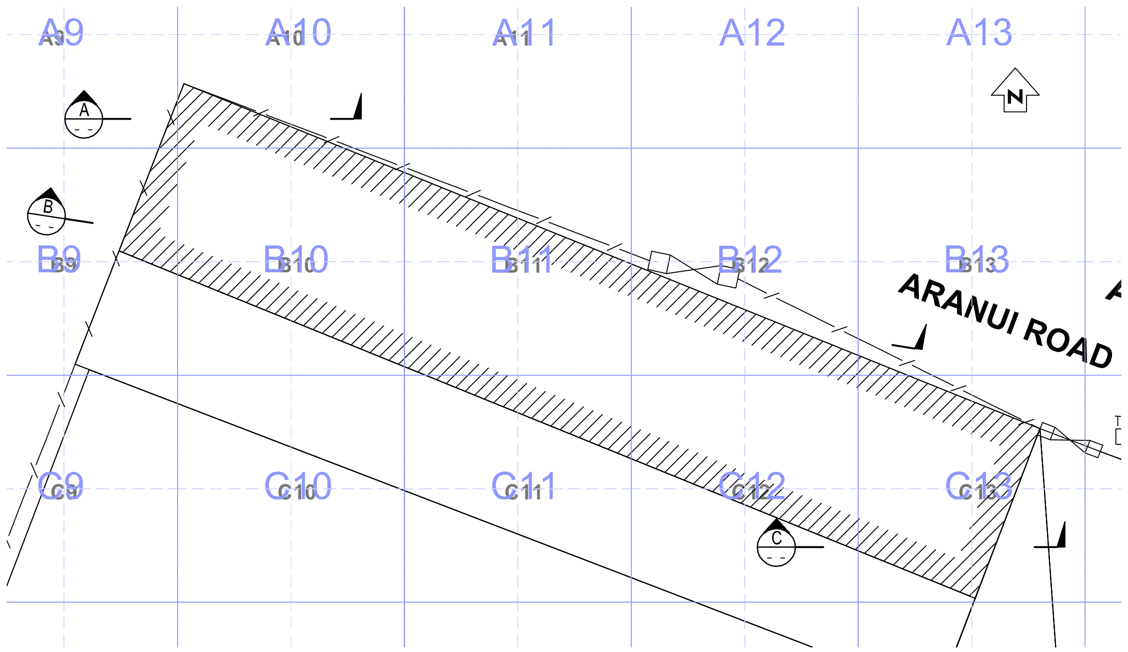


LOCATION OF SG21 (21 MAY 2006)

1:250

PRE EXCAVATION

(BY LAYER)

SG21 - A9
AREA = 1.95m²
EXC. VOL. = 2.1m³

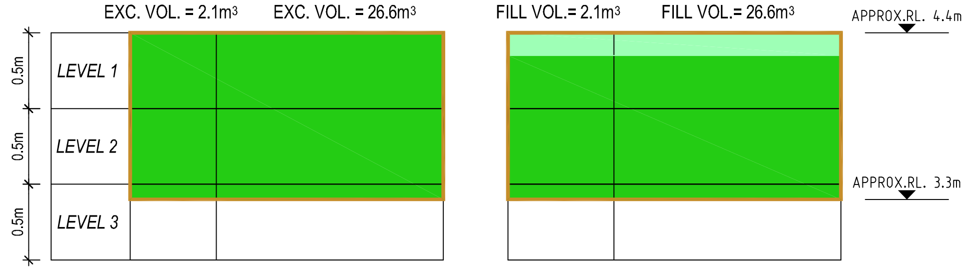
SG21 - A10
AREA = 24.16m²
EXC. VOL. = 26.6m³

BACKFILL

(BY LAYER)

SG21 - A9
AREA = 1.95m²
FILL VOL.= 2.1m³

SG3 - A10
AREA = 24.16m²
FILL VOL.= 26.6m³



SECTION A
NTS

SCHEMATIC SECTION OF SG21

PRE EXCAVATION

(BY LAYER)

SG21 - B9
AREA = 20.43m²
EXC. VOL. = 22.5m³

SG21 - B10
AREA = 167.85m²
EXC. VOL. = 201.4m³

SG21 - B11
AREA = 155.20m²
EXC. VOL. = 170.7m³

SG21 - B12
AREA = 64.92m²
EXC. VOL. = 71.4m³

SG21 - B13
AREA = 2.12m²
EXC. VOL. = 2.1m³

BACKFILL

(BY LAYER)

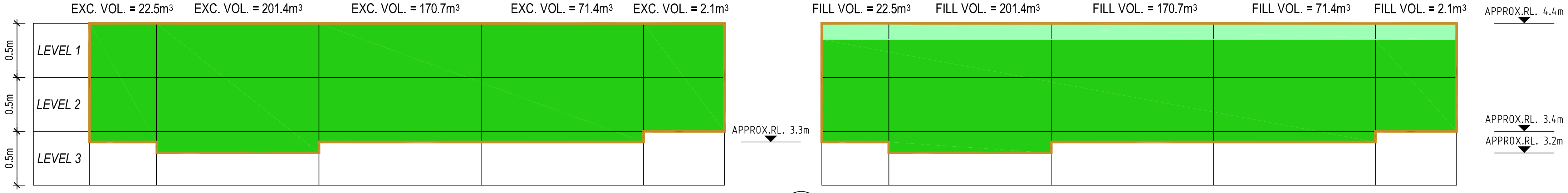
SG21 - B9
AREA = 20.43m²
FILL VOL. = 22.5m³

SG21 - B10
AREA = 167.85m²
FILL VOL. = 201.4m³

SG21 - B11
AREA = 155.20m²
FILL VOL. = 170.7m³

SG21 - B12
AREA = 64.92m²
FILL VOL. = 71.4m³

SG21 - B13
AREA = 2.12m²
FILL VOL. = 2.1m³



SECTION B
NTS

SCHEMATIC SECTION OF SG21

PRE EXCAVATION

(BY LAYER)

SG21 - C11
AREA = 37.67m²
EXC. VOL. = 45.2m³

SG21 - C12
AREA = 128.53m²
EXC. VOL. = 141.4m³

SG21 - C13
AREA = 125.59m²
EXC. VOL. = 125.6m³

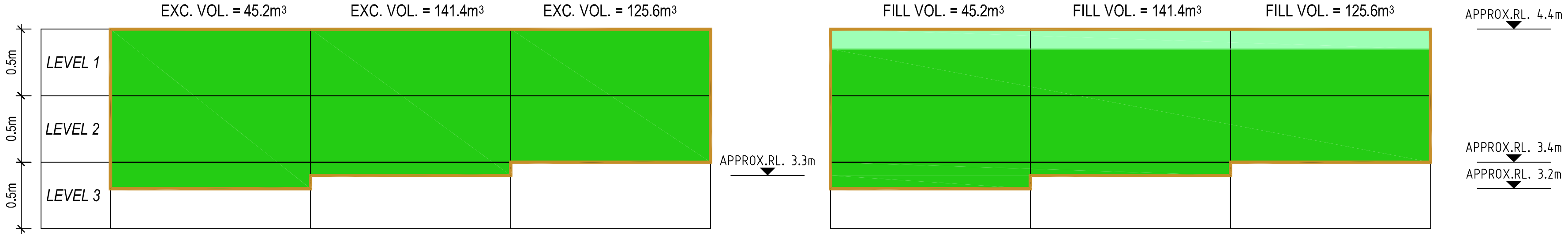
BACKFILL

(BY LAYER)

SG21 - C11
AREA = 37.67m²
FILL VOL. = 45.2m³

SG21 - C12
AREA = 128.53m²
FILL VOL. = 141.4m³

SG21 - C13
AREA = 125.59m²
FILL VOL. = 125.6m³



SECTION C
NTS

SCHEMATIC SECTION OF SG21

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

NOTE:
A DIESEL SPILL WAS EXPECTED IN THIS AREA, BUT WAS NOT FOUND.

REV	AMENDMENTS	CHECKED		APPROVED	
AB	AS BUILT	GKB	03-08	PFR	03-08
		INITIAL	DATE	INITIAL	DATE

Job No: 1724-03
TAB/DWG : W11 - SG21 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG21 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s11	W11	AB

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1

12 September 2008 - 9:36am

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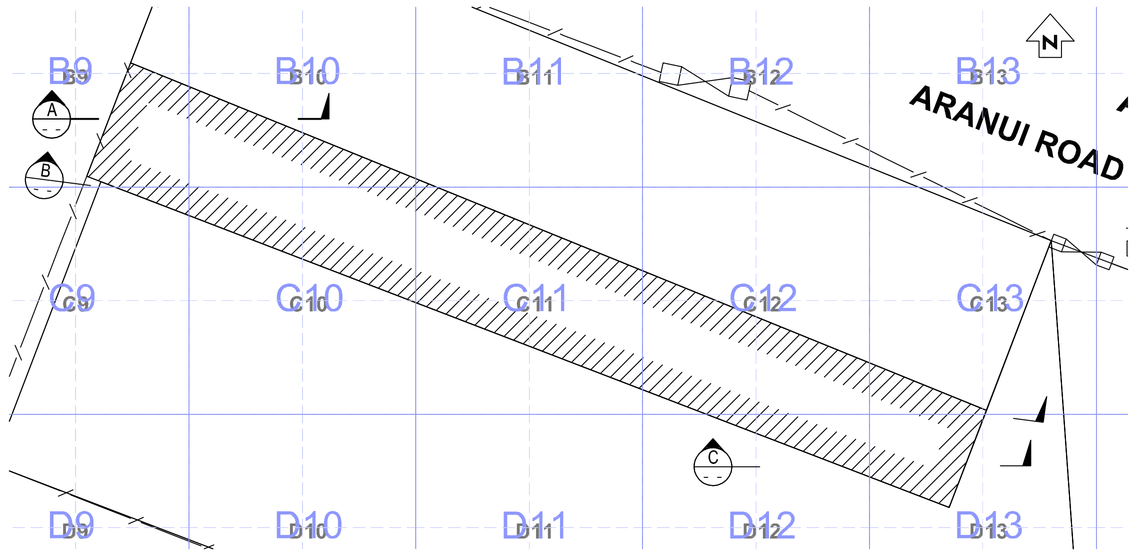


LOCATION OF SG22 (22 JUNE 2006)

1:250

PRE EXCAVATION

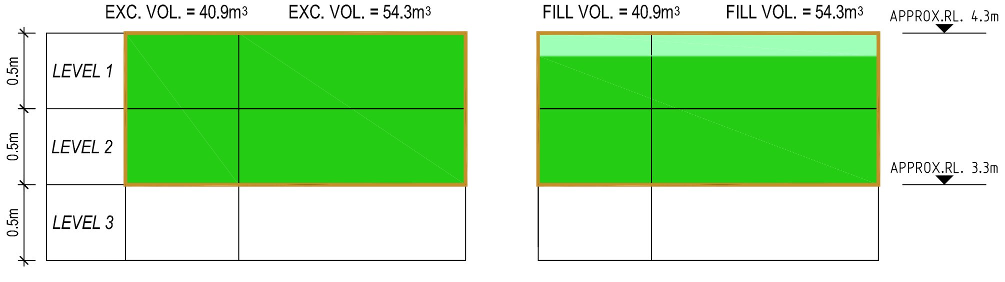
(BY LAYER)

SG22 - B9	SG22 - B10
AREA = 40.93m²	AREA = 54.33m²
EXC. VOL. = 40.9m³	EXC. VOL. = 54.3m³

BACKFILL

(BY LAYER)

SG22 - B9	SG22 - B10
AREA = 40.93m²	AREA = 54.33m²
FILL VOL. = 40.9m³	FILL VOL. = 54.3m³



SECTION A
NTS

SCHEMATIC SECTION OF SG22

PRE EXCAVATION

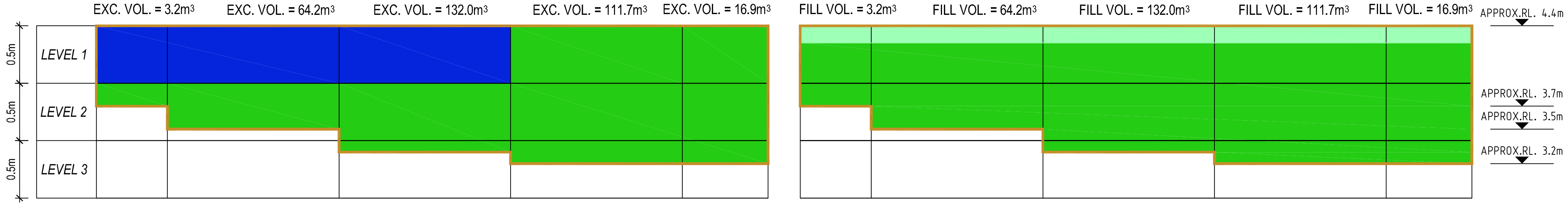
(BY LAYER)

SG22 - C9	SG22 - C10	SG22 - C11	SG22 - C12	SG22 - C13
AREA = 4.59m²	AREA = 71.33m²	AREA = 120.00m²	AREA = 93.09m²	AREA = 14.08m²
EXC. VOL. = 3.2m³	EXC. VOL. = 64.2m³	EXC. VOL. = 132.0m³	EXC. VOL. = 111.7m³	EXC. VOL. = 16.9m³

BACKFILL

(BY LAYER)

SG22 - C9	SG22 - C10	SG22 - C11	SG22 - C12	SG22 - C13
AREA = 4.59m²	AREA = 71.33m²	AREA = 120.00m²	AREA = 93.09m²	AREA = 14.08m²
FILL VOL. = 3.2m³	FILL VOL. = 64.2m³	FILL VOL. = 132.0m³	FILL VOL. = 111.7m³	FILL VOL. = 16.9m³



SECTION B
NTS

SCHEMATIC SECTION OF SG22

PRE EXCAVATION

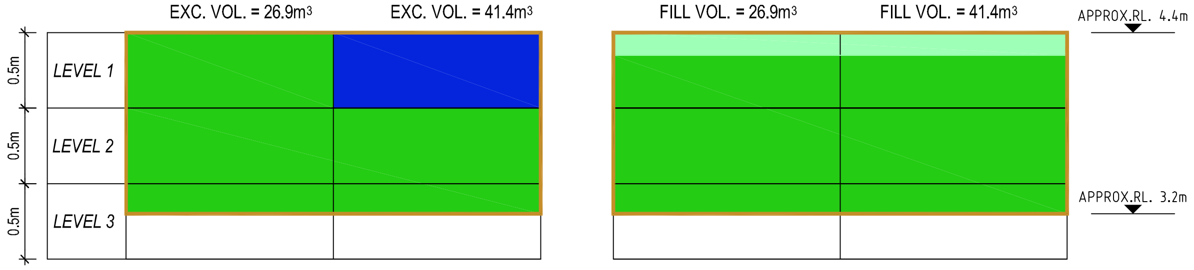
(BY LAYER)

SG22 - D12	SG22 - D13
AREA = 22.39m²	AREA = 34.50m²
EXC. VOL. = 26.9m³	EXC. VOL. = 41.4m³

BACKFILL

(BY LAYER)

SG22 - D12	SG22 - D13
AREA = 22.39m²	AREA = 34.50m²
FILL VOL. = 26.9m³	FILL VOL. = 41.4m³



SECTION C
NTS

SCHEMATIC SECTION OF SG22

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W12 - SG22 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG22 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s12 | Sheet No. W12 | Rev. AB

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 9:35am
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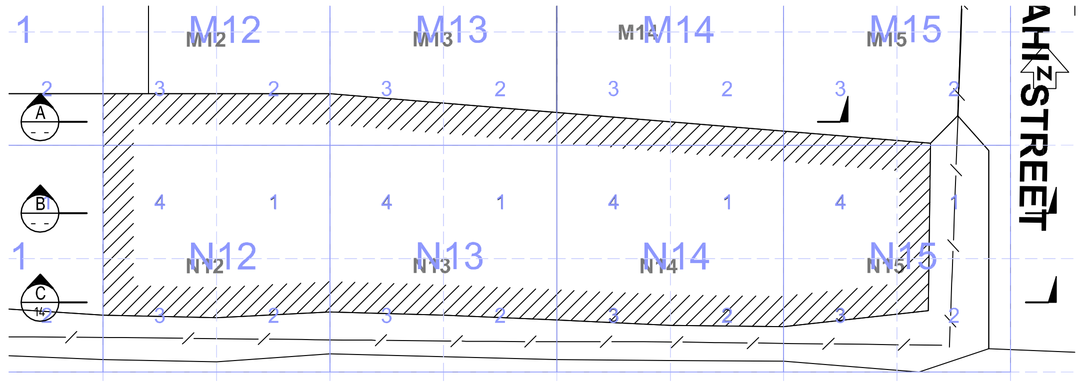


LOCATION OF SG23 (14 FEBRUARY 2007)
1:250

L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

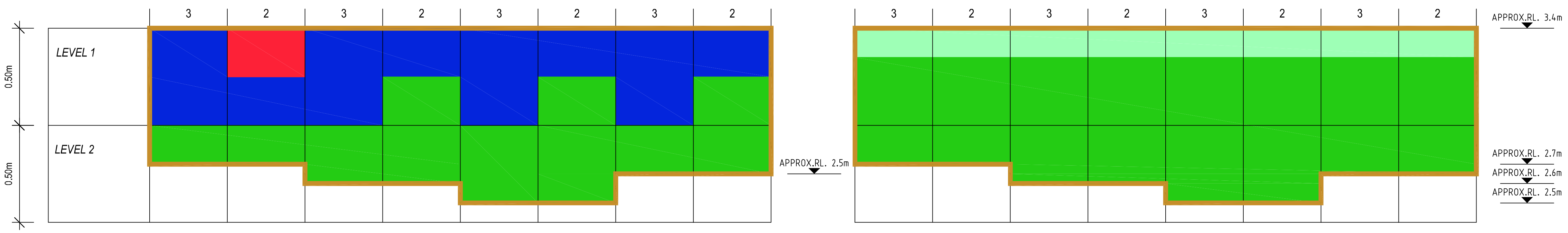
NOTE:
DUE TO SUSPECTED CONTAMINATION, MOST OF LEVEL 1 IN SG23 WAS REMOVED AND TREATED AS COMMERCIAL.

PRE EXCAVATION
(BY LAYER)

SG23 - M12 AREA = 51.01m2 EXC. VOL. = 35.7m3
SG23 - M13 AREA = 41.78m2 EXC. VOL. = 33.4m3
SG23 - M14 AREA = 23.32m2 EXC. VOL. = 21.0m3
SG23 - M15 AREA = 5.39m2 EXC. VOL. = 4.0m3

BACKFILL
(BY LAYER)

SG23 - M12 AREA = 51.01m2 FILL VOL. = 35.7m3
SG23 - M13 AREA = 41.78m2 FILL VOL. = 33.4m3
SG23 - M14 AREA = 23.32m2 FILL VOL. = 21.0m3
SG23 - M15 AREA = 5.39m2 FILL VOL. = 4.0m3



SECTION A
NTS

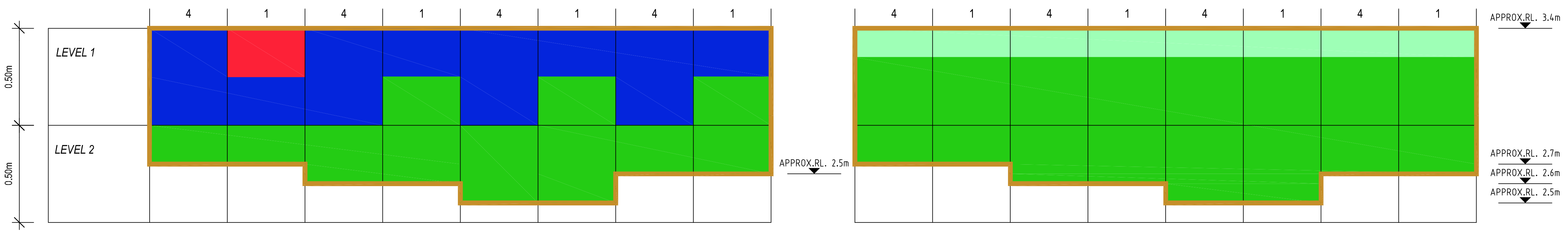
SCHEMATIC SECTION OF SG23

PRE EXCAVATION
(BY LAYER)

SG23 - N12 AREA = 112.52m2 EXC. VOL. = 78.8m3
SG23 - N13 AREA = 112.50m2 EXC. VOL. = 90.0m3
SG23 - N14 AREA = 112.47m2 EXC. VOL. = 101.2m3
SG23 - N15 AREA = 77.72m2 EXC. VOL. = 58.3m3

BACKFILL
(BY LAYER)

SG23 - N12 AREA = 112.52m2 FILL VOL. = 78.8m3
SG23 - N13 AREA = 112.50m2 FILL VOL. = 90.0m3
SG23 - N14 AREA = 112.47m2 FILL VOL. = 101.2m3
SG23 - N15 AREA = 77.72m2 FILL VOL. = 58.3m3



SECTION B
NTS

SCHEMATIC SECTION OF SG23

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 9:34am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W13 - SG23 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH
Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG23 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-C

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s13	W13	AB

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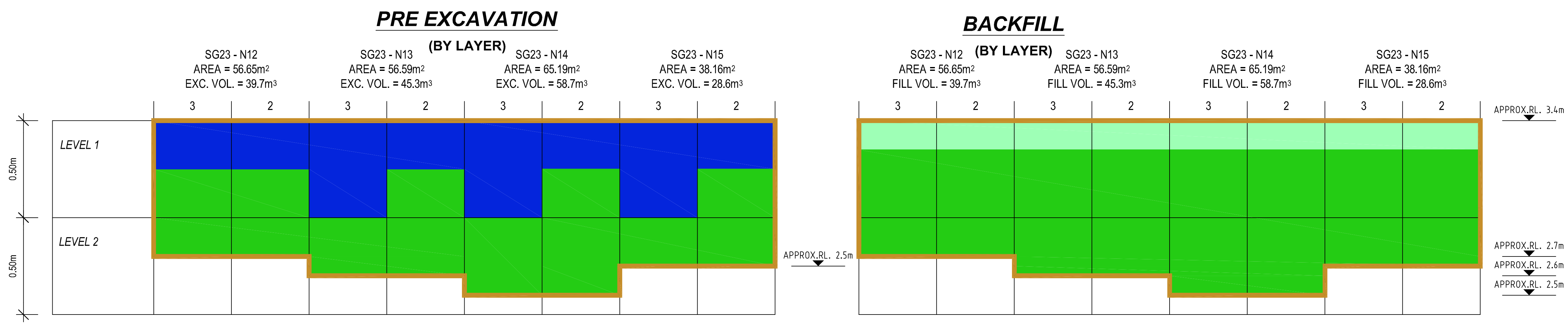

SECTION C / 13
NTS

SCHEMATIC SECTION OF SG23

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

NOTE:
DUE TO SUSPECTED CONTAMINATION, MOST OF LEVEL 1 IN SG23 WAS REMOVED AND TREATED AS COMMERCIAL.

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:34am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W14 - SG23 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG23 - PRE EXCAVATION vs BACKFILL
SECTION C OF SECTIONS A-C

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s14	W14	AB

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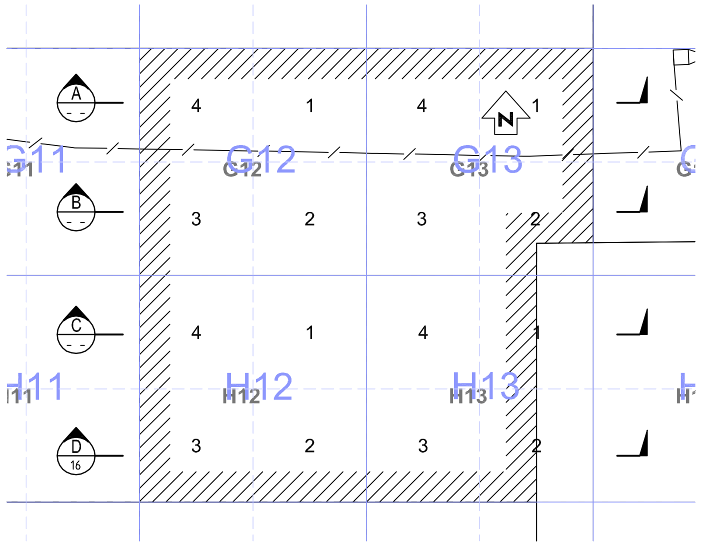
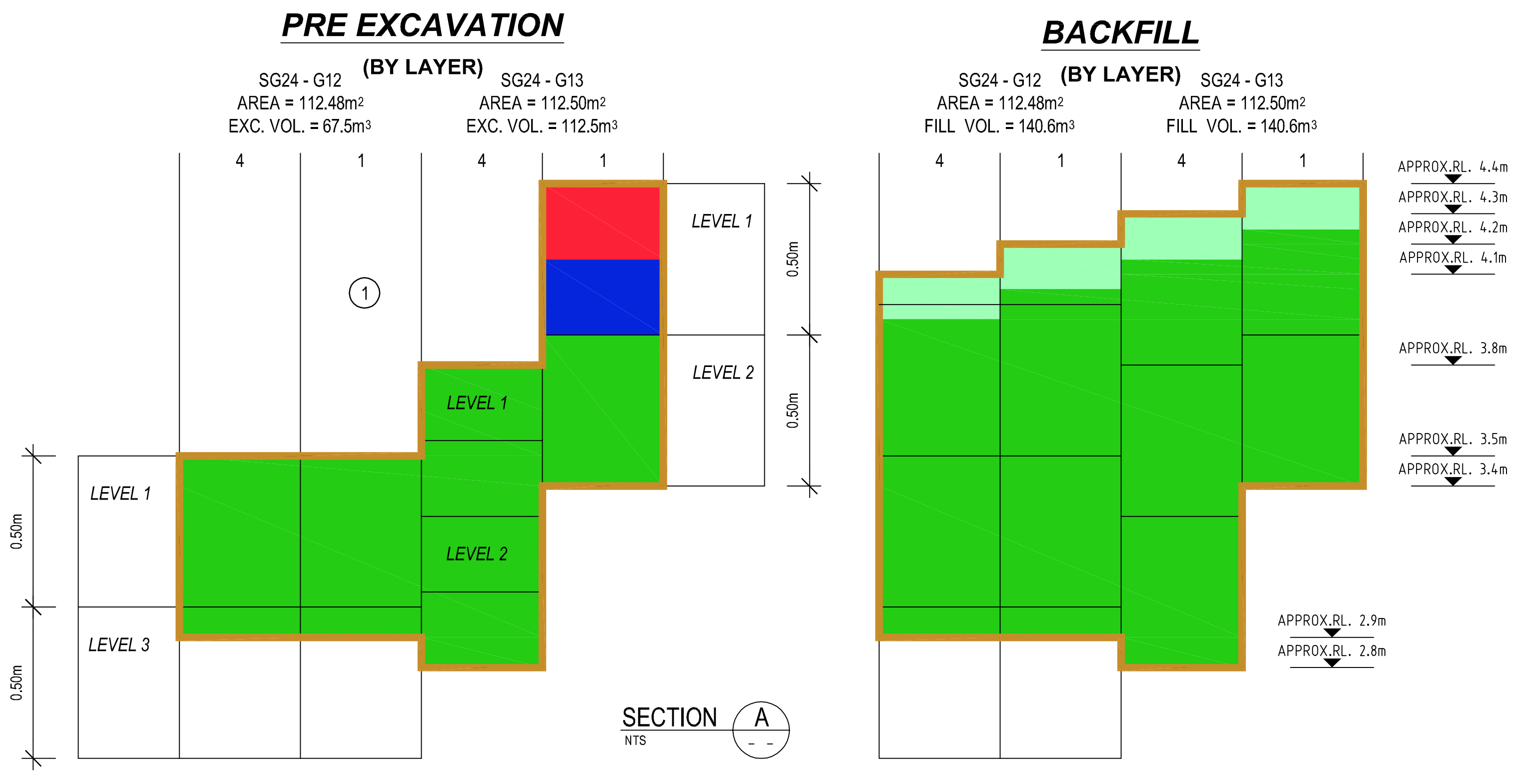


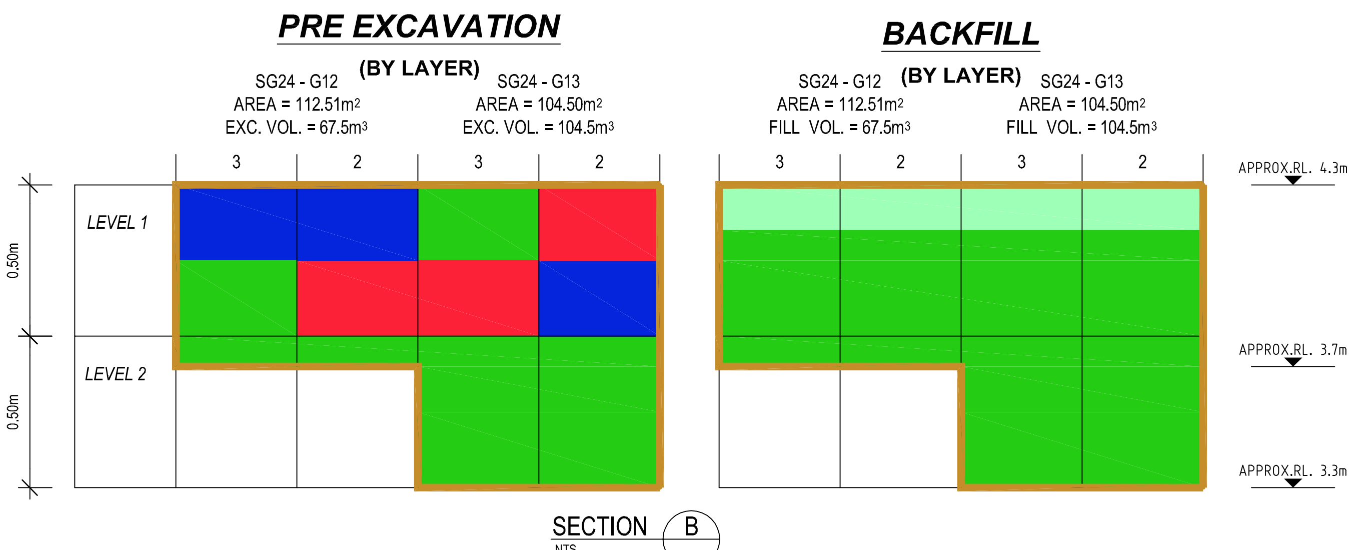
LOCATION OF SG24 (7 JUNE 2007)
1:250

L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

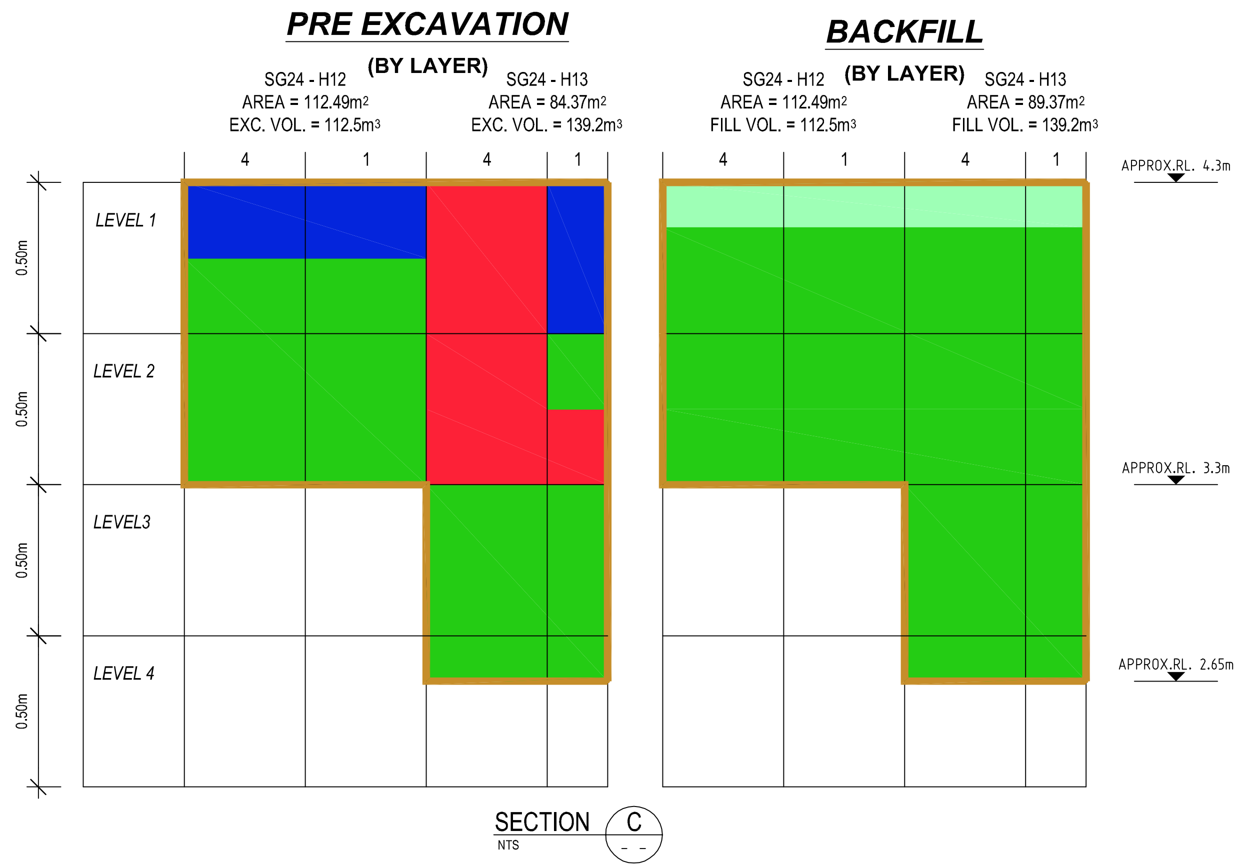
(1) G12 QUAD1 & QUAD4 AND G13 QUAD4 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH QUADRANT IS SHOWN STEPPED RATHER THAN SLOPED.



SCHEMATIC SECTION OF SG24



SCHEMATIC SECTION OF SG24



SCHEMATIC SECTION OF SG24

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:33am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W15 - SG24 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG24 - PRE EXCAVATION vs BACKFILL
SECTIONS A-C OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s15	W15	AB

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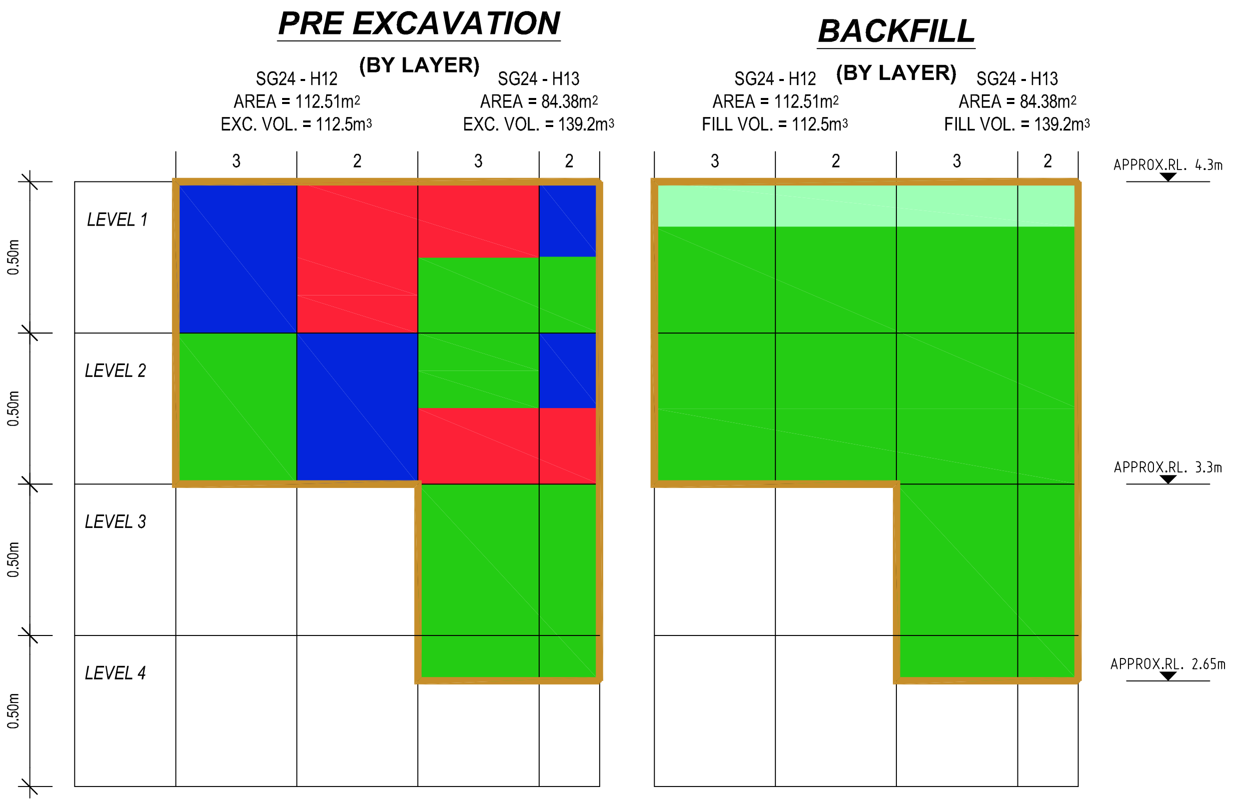
DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

1. G12 QUAD1 & QUAD4 AND G13 QUAD4 WERE LOCATED WITHIN AN EXISTING STEEP SIDED EXCAVATION. FOR CLARITY THE AVERAGE HEIGHT FOR EACH QUADRANT IS SHOWN STEPPED RATHER THAN SLOPED.



SECTION D / 15
NTS

SCHEMATIC SECTION OF SG24

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W16 - SG24 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

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Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG24 - PRE EXCAVATION vs BACKFILL
SECTION D OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s16	W16	AB

12 September 2008 - 9:32am

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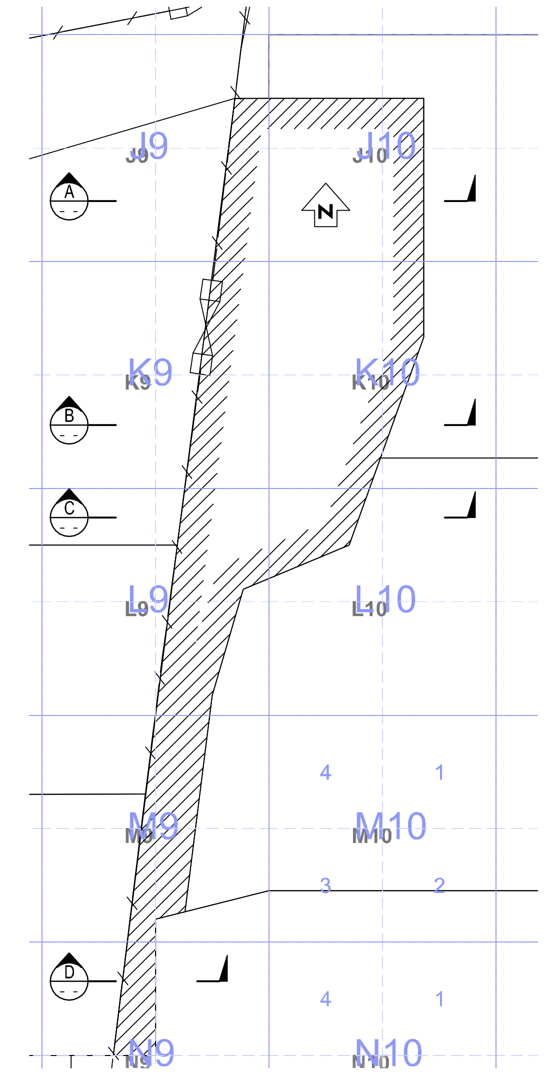
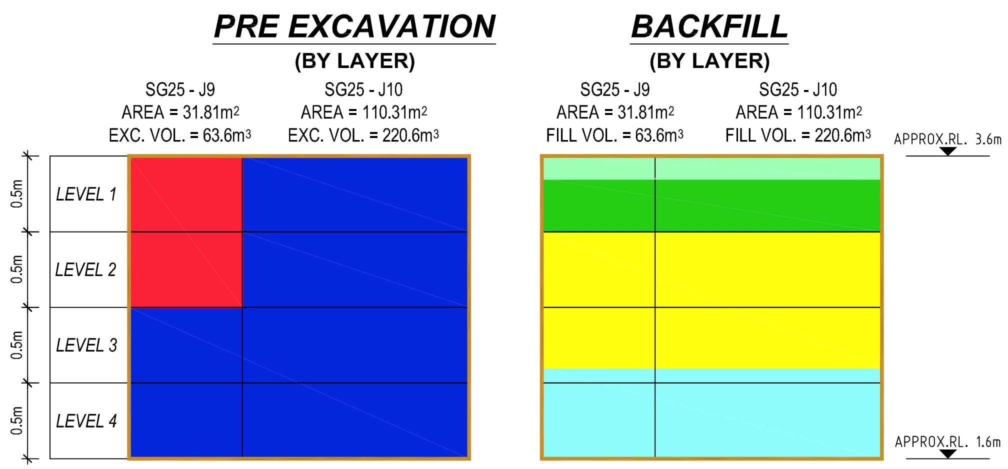
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_02-19.dwg



LOCATION OF SG25 (22 JANUARY 2007)

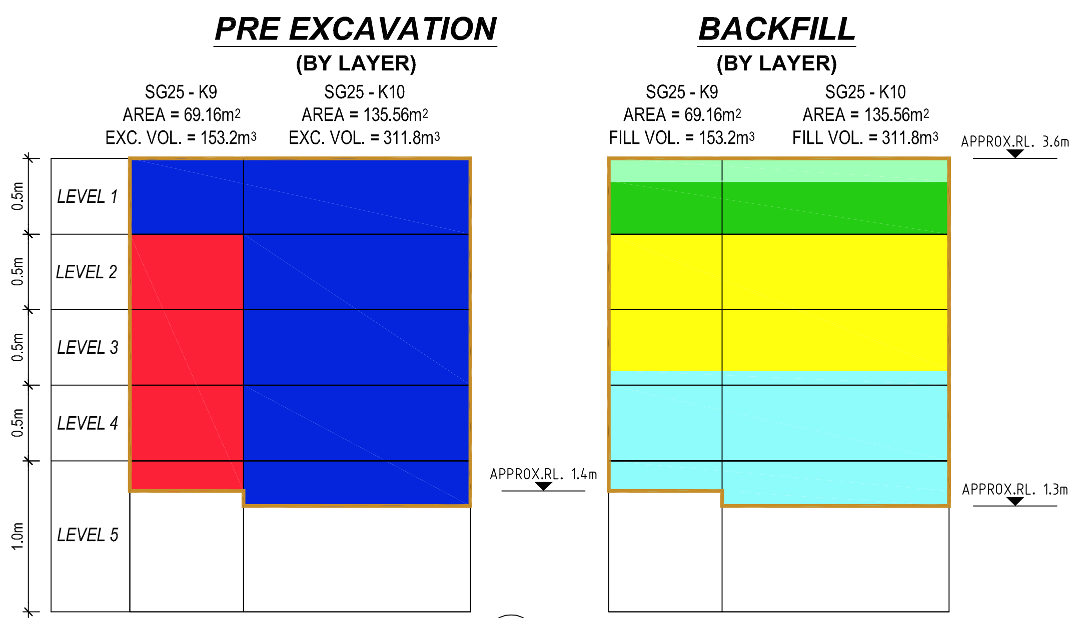
1:250



SECTION A

NTS

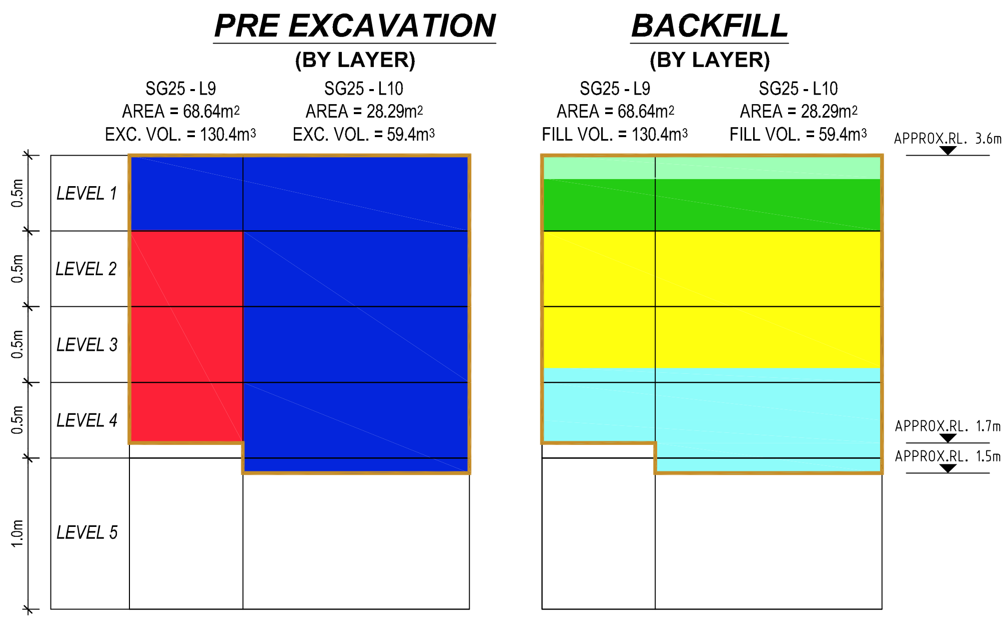
SCHEMATIC SECTION OF SG25



SECTION B

NTS

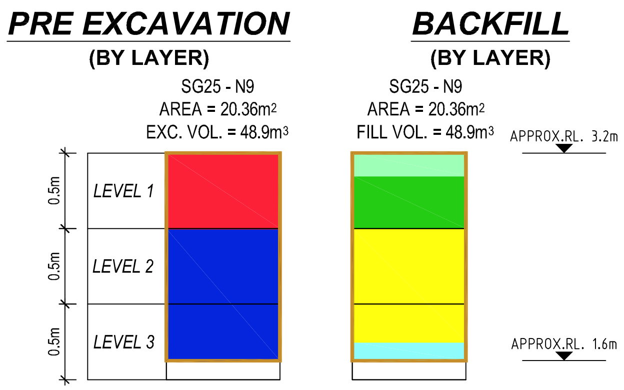
SCHEMATIC SECTION OF SG25



SECTION C

NTS

SCHEMATIC SECTION OF SG25



SECTION D

NTS

SCHEMATIC SECTION OF SG25

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	150mm TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	350mm RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	CLAY
EXCAVATION BOUNDARY	COMMERCIAL
	MARINE SEDIMENTS

ORIGINAL SIZE A1 — DO NOT SCALE - IF IN DOUBT, ASK

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W17 - SG25 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG25 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s17	W17	AB

12 September 2008 - 9:32am

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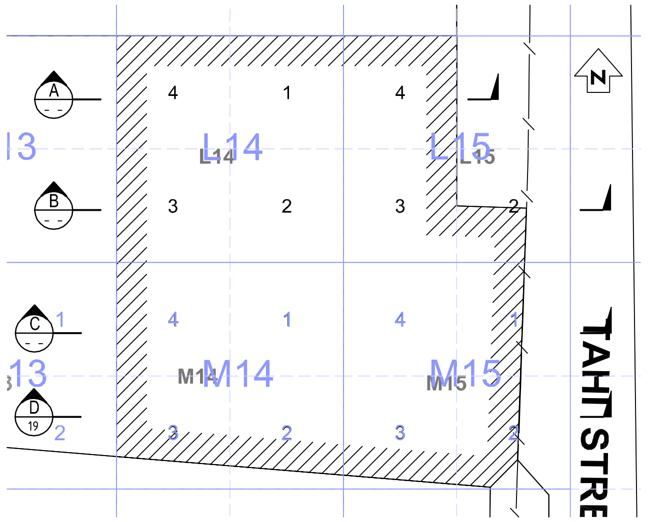
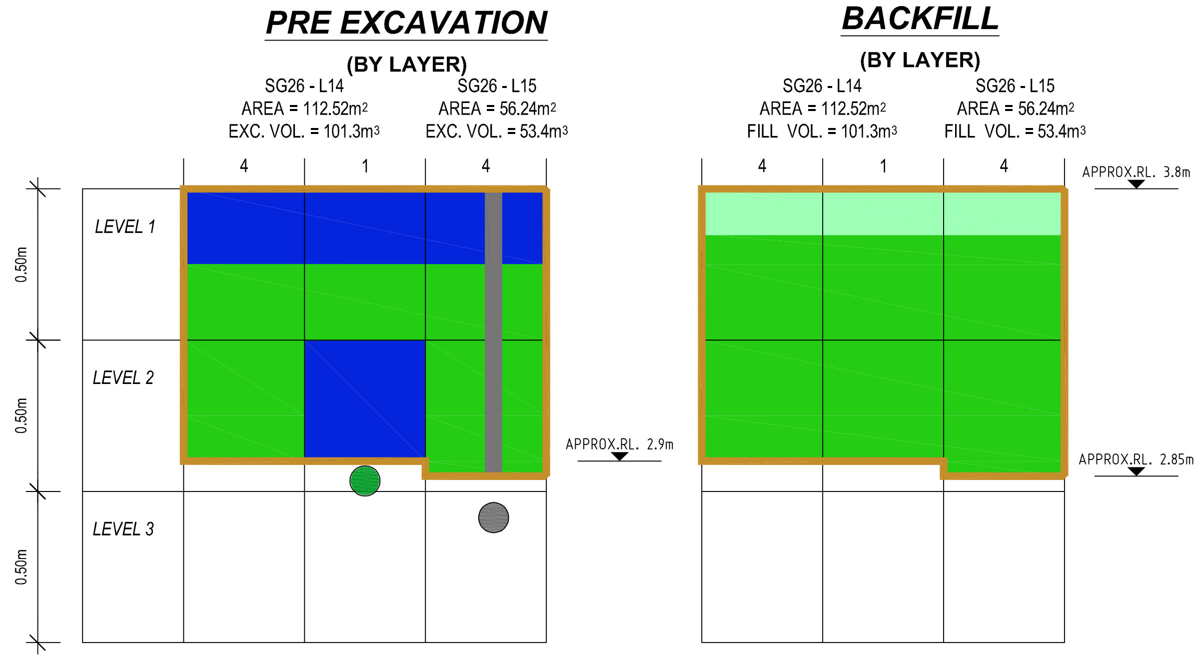


LOCATION OF SG26 (06 AUGUST 2007)
1:250



SECTION A
NTS

SCHEMATIC SECTION OF SG26

LEGEND

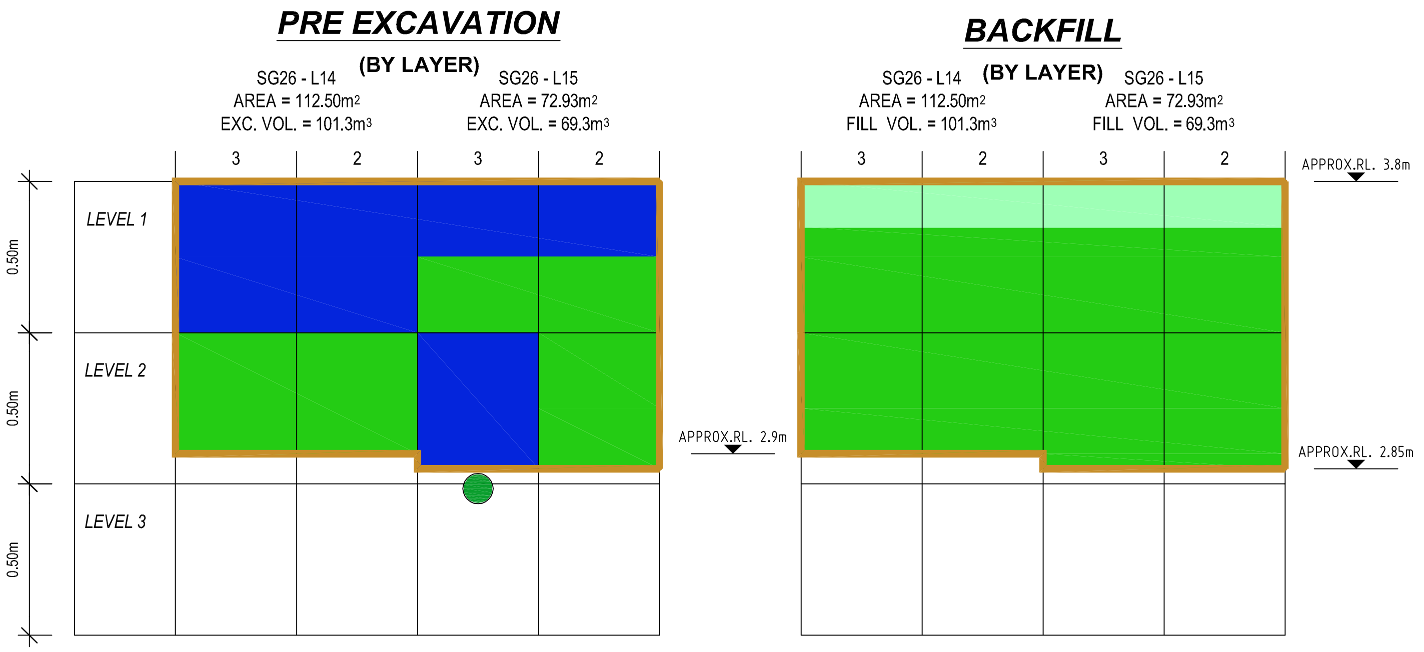
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

APPROXIMATE FLOOR DEPTH

FLOOR VALIDATED AS RESIDENTIAL

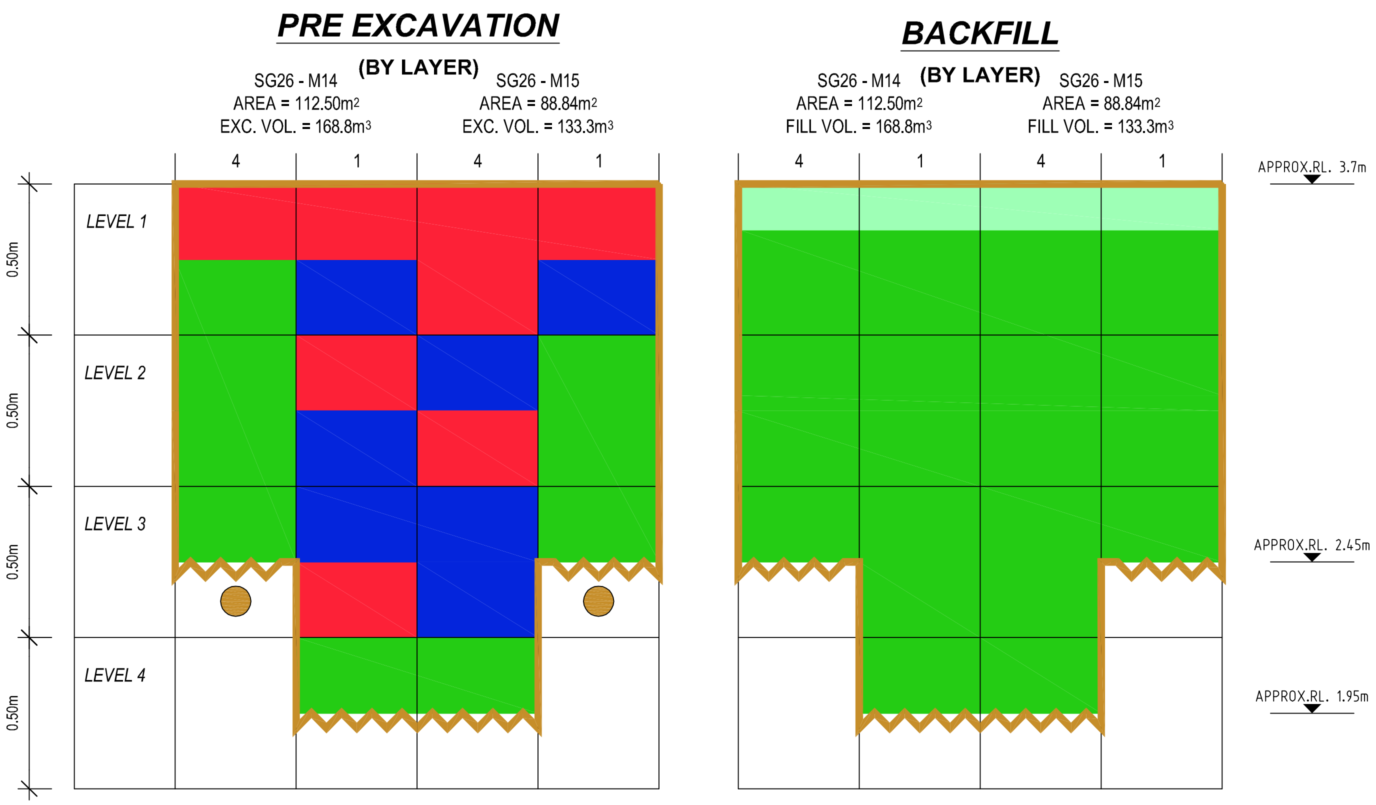
SUMP LOCATED IN L15Q4 VALIDATED AS RESIDENTIAL

RESIDENTIAL MATERIAL VALIDATED DOWN TO APPROXIMATELY 3.1 - 3.3m IN M14Q1 AND M15Q4



SECTION B

SCHEMATIC SECTION OF SG26



SECTION C
NTS

SCHEMATIC SECTION OF SG26

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:31am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W18 - SG26 / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG26 - PRE EXCAVATION vs BACKFILL
SECTIONS A-C OF SECTION A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s18	W18	AB

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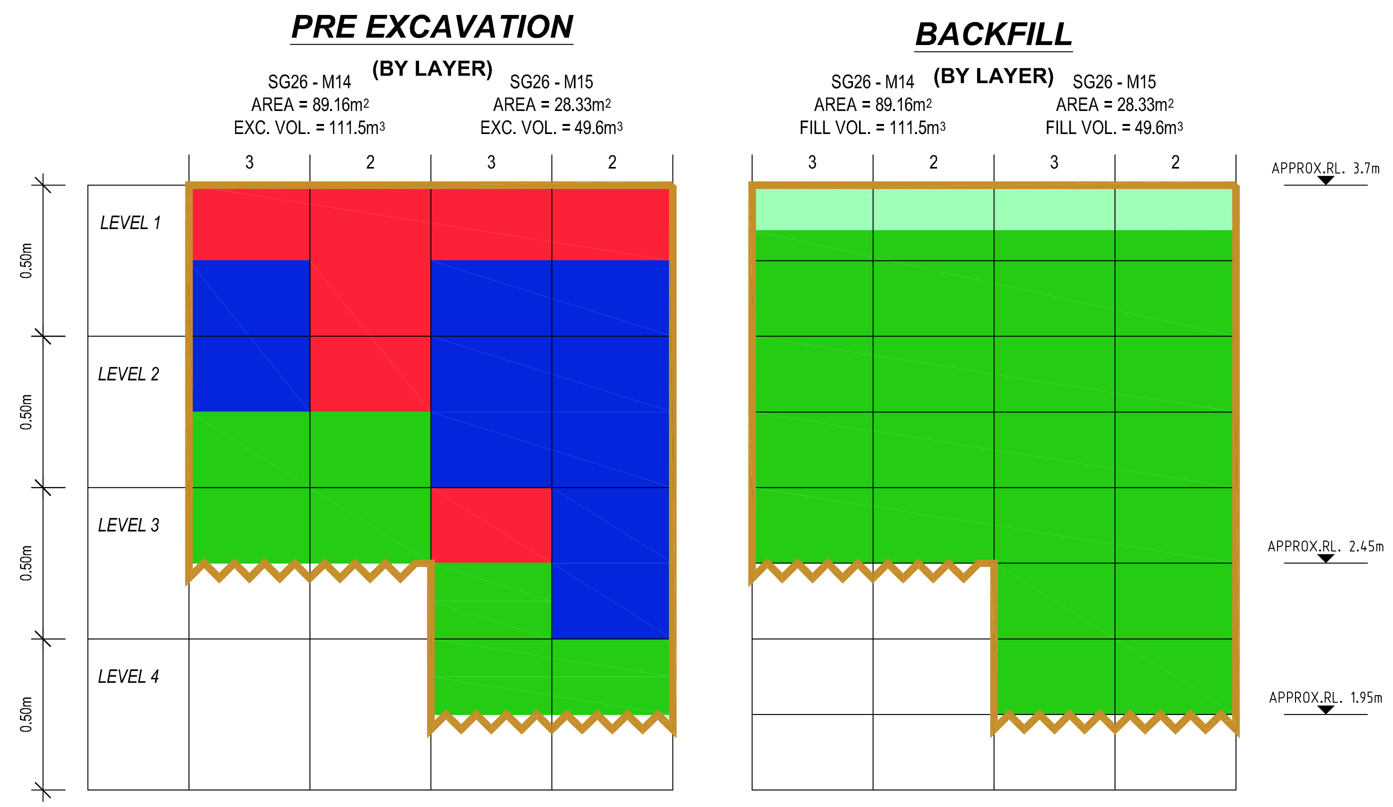
LEGEND	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

APPROXIMATE FLOOR DEPTH



SECTION D / 18
NTS

SCHEMATIC SECTION OF SG26

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:31am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03

TAB/DWG : W19 - SG26 (2) / AB_WEST_02-19.dwg
SERVER : NELSON (NZNEL1S01)

XREFS : x_gridtext, x_grid, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG26 - PRE EXCAVATION vs BACKFILL
SECTION D OF SECTIONS A-D

Status Stamp: **AS BUILT**

Date Stamp: **12 SEPTEMBER 2008**

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s19	W19	AB

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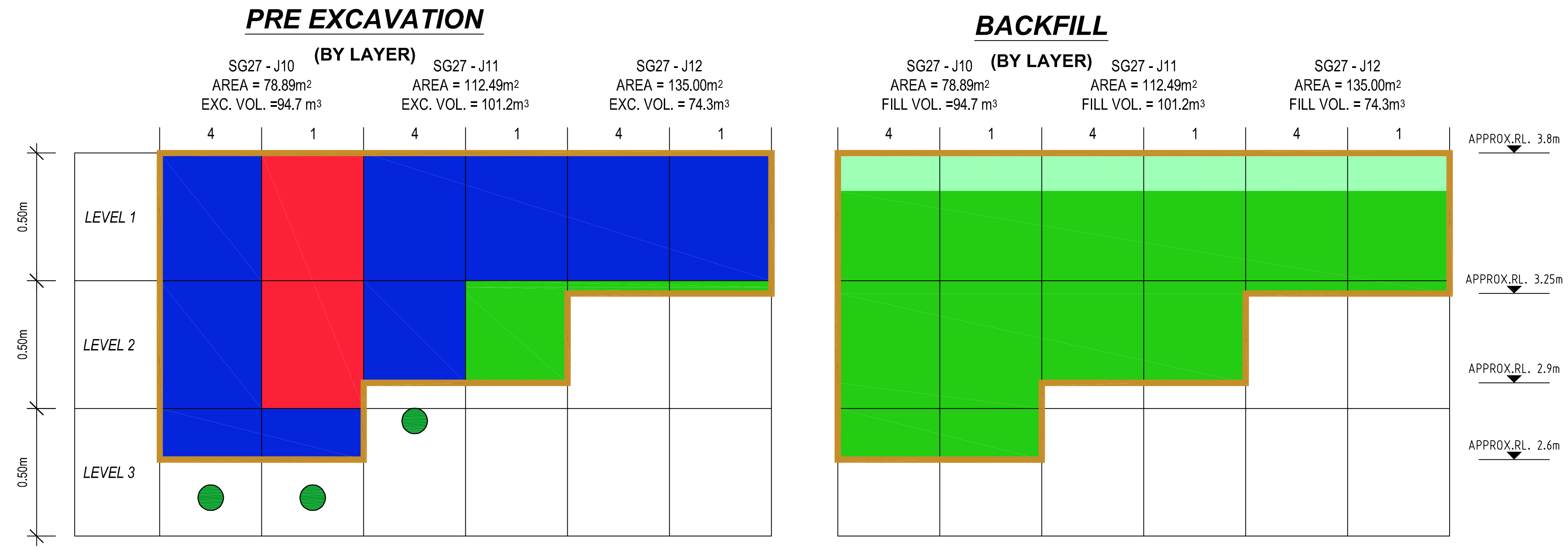
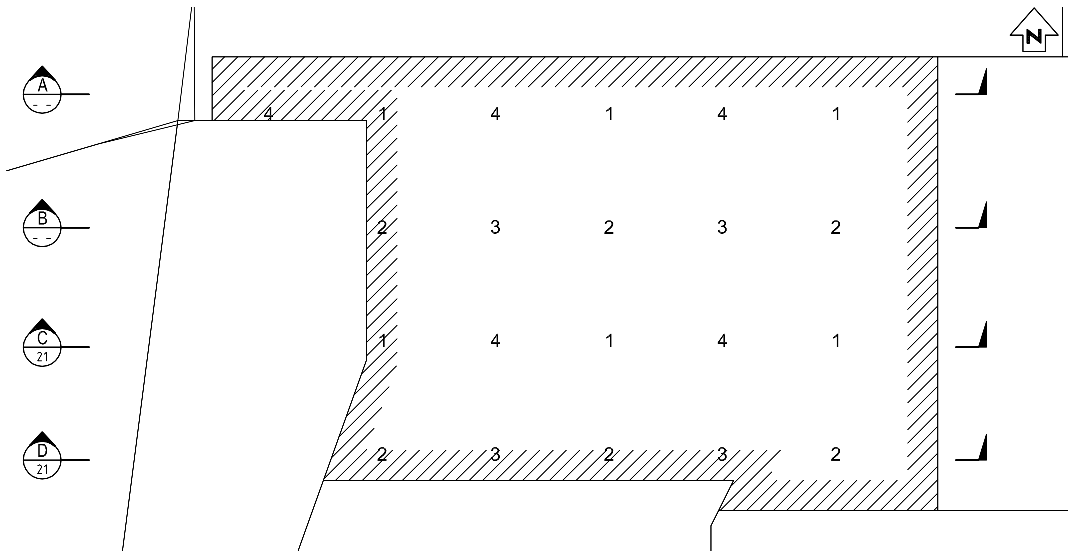
L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

FLOOR VALIDATED AS RESIDENTIAL



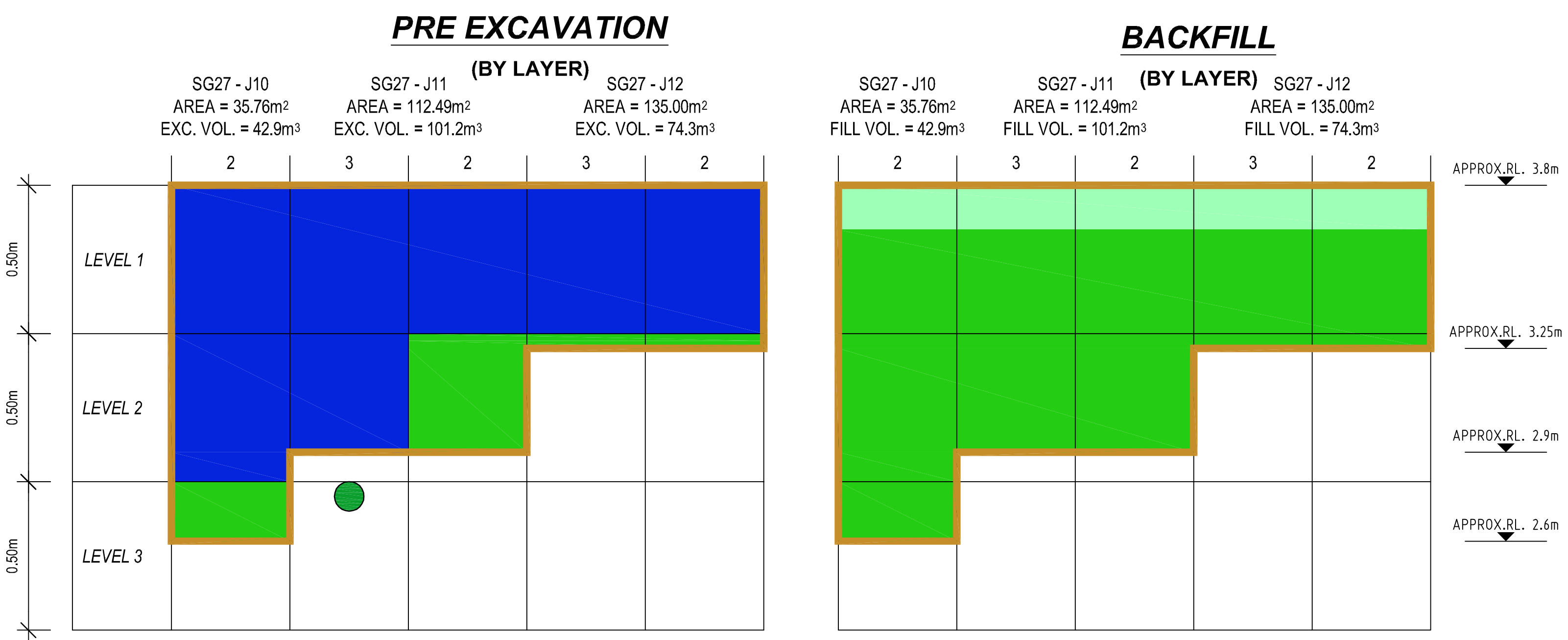
SECTION A
NTS

SCHEMATIC SECTION OF SG27



LOCATION OF SG27 (29 MAY 2007)

1:250



SECTION B
NTS

SCHEMATIC SECTION OF SG27

AB	AS BUILT	GKB	03-08	PFR	03-08
REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W20 - SG27 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P. F. Russell	14-03-08

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG27 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s20
Sheet No. W20
Rev. AB

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ORIGINAL SIZE A1
DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 9:30am
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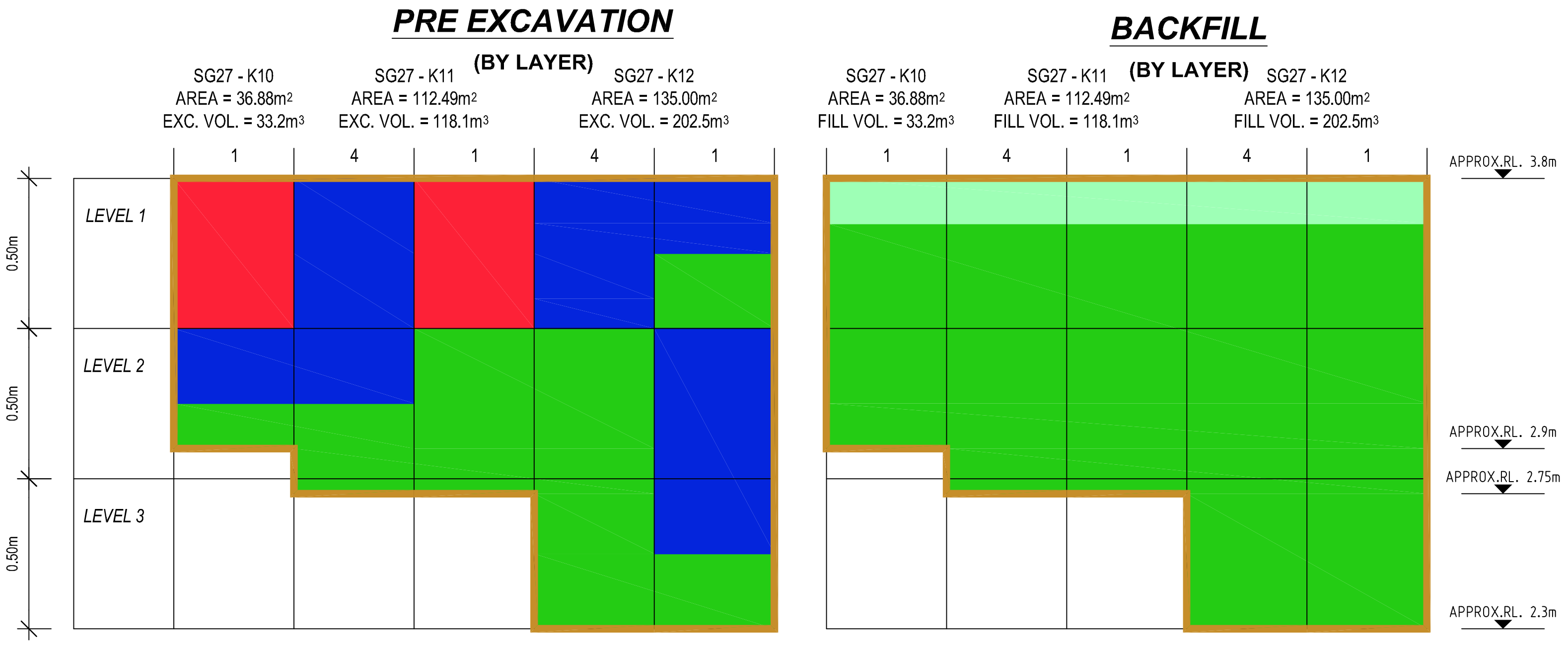
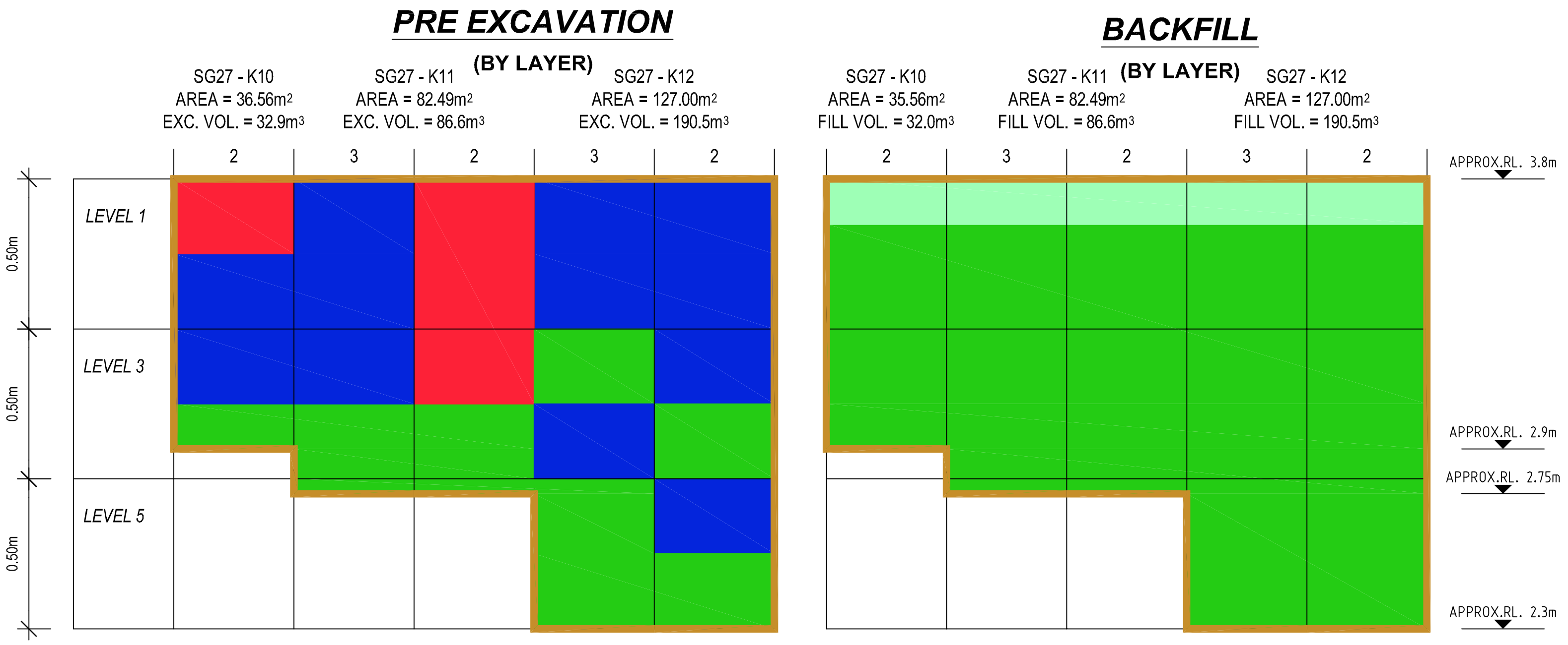


SECTION C
NTS 20

SCHEMATIC SECTION OF SG27



SECTION D
NTS 20

SCHEMATIC SECTION OF SG27

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

ORIGINAL SIZE A1
DO NOT SCALE - IF IN DOUBT, ASK
12 September 2008 - 9:29am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W21 - SG27 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG27 - PRE EXCAVATION vs BACKFILL
SECTIONS C&D OF SECTIONS A-D

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s21	W21	AB

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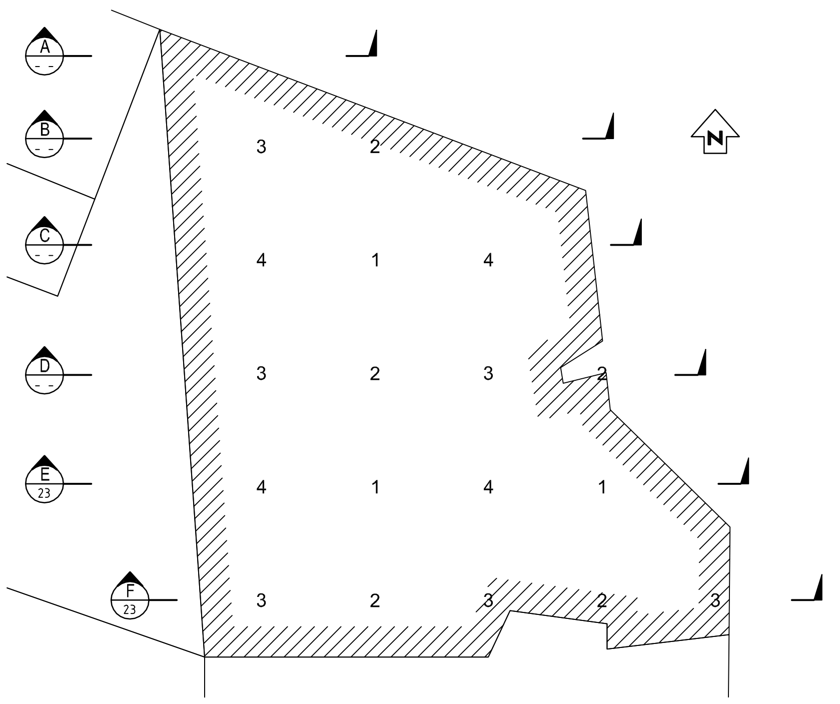
DO NOT SCALE - IF IN DOUBT, ASK

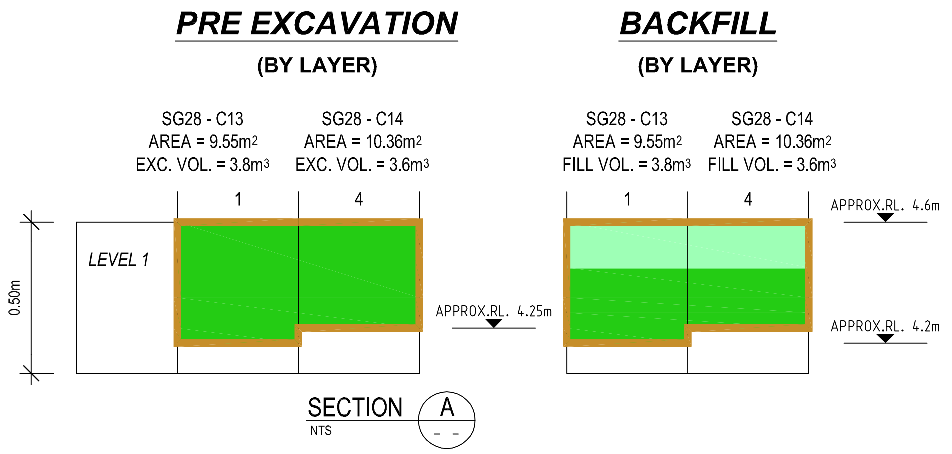
ORIGINAL SIZE A1

12 September 2008 - 9:29am

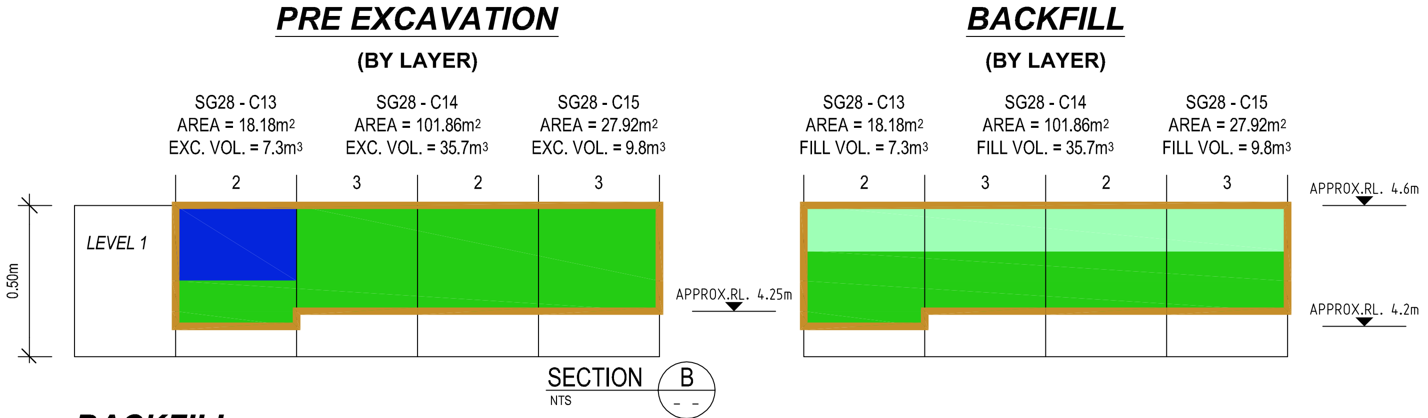


LOCATION OF SG28 (4 APRIL 2007)

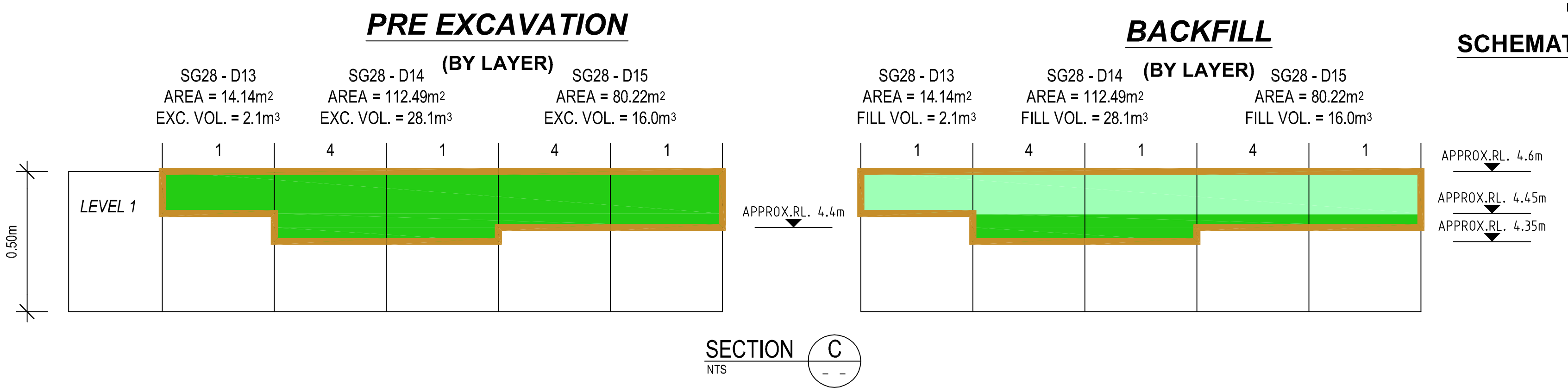
1:250



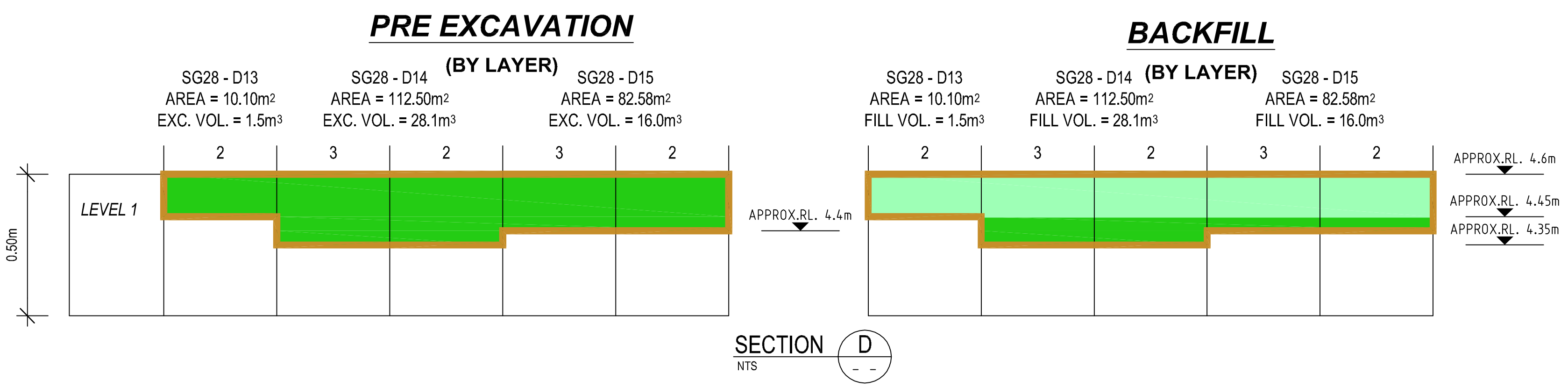
SCHEMATIC SECTION OF SG28



SCHEMATIC SECTION OF SG28



SCHEMATIC SECTION OF SG28



SCHEMATIC SECTION OF SG28

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W22 - SG28 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG28 - PRE EXCAVATION vs BACKFILL
SECTIONS A-D OF SECTIONS A-F

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s22	W22	AB

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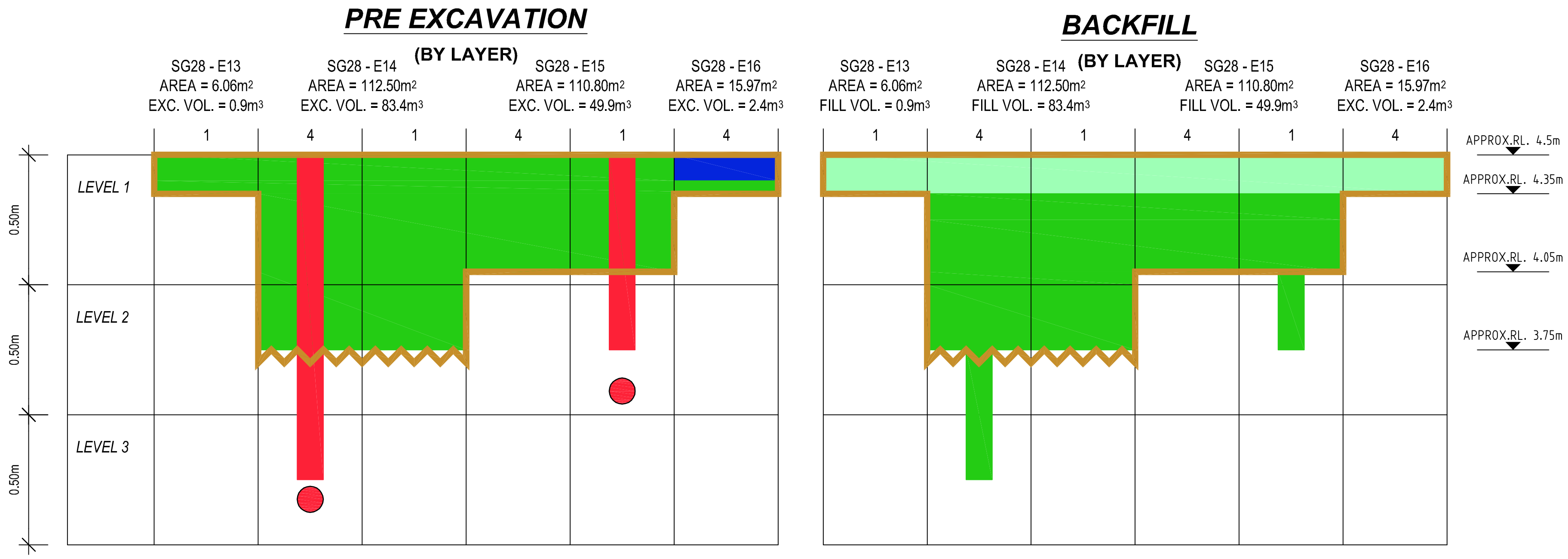
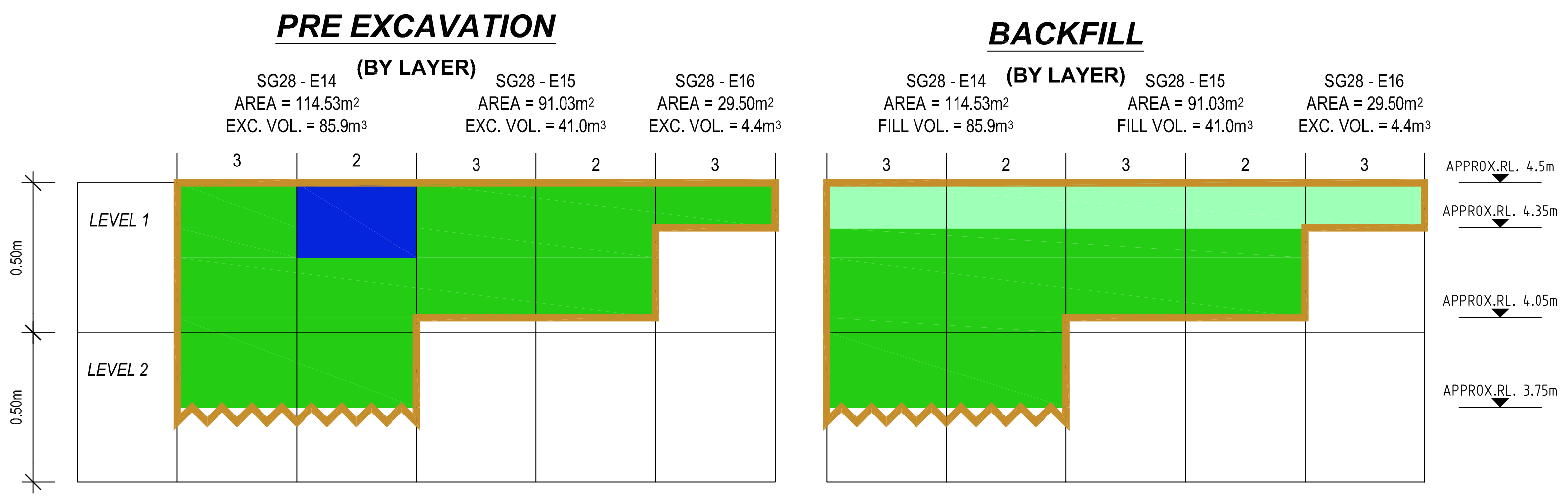


SECTION E
NTS
22

SCHEMATIC SECTION OF SG28



SECTION F
NTS
22

SCHEMATIC SECTION OF SG28

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

APPROXIMATE FLOOR DEPTH

A SUMP HOLES WERE DISCOVERED IN E14, QUAD4 AND E15, QUAD1. BOTH SUMPS WERE FOUND TO CONTAIN CONTAMINATED MATERIAL DOWN TO LEVEL 5 AND 3 RESPECTIVELY. THESE WERE EXCAVATED AND REFILLED WITH RESIDENTIAL MATERIAL.

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:28am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W23 - SG28 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG28 - PRE EXCAVATION vs BACKFILL
SECTIONS E&F OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s23
Sheet No. W23
Rev. AB

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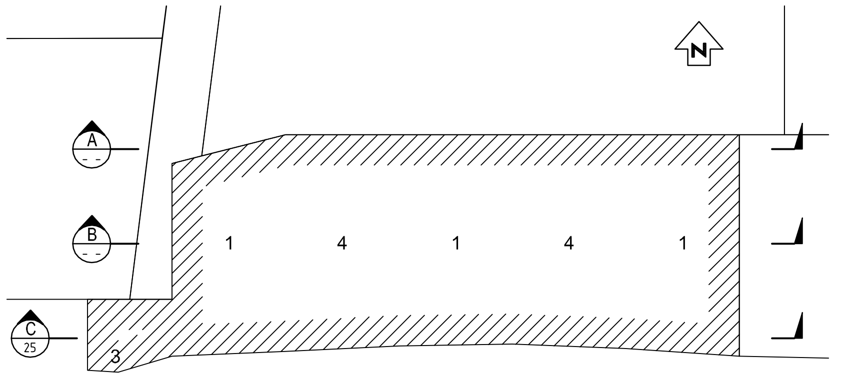
12 September 2008 - 9:27am

ORIGINAL SIZE A1 — DO NOT SCALE - IF IN DOUBT, ASK

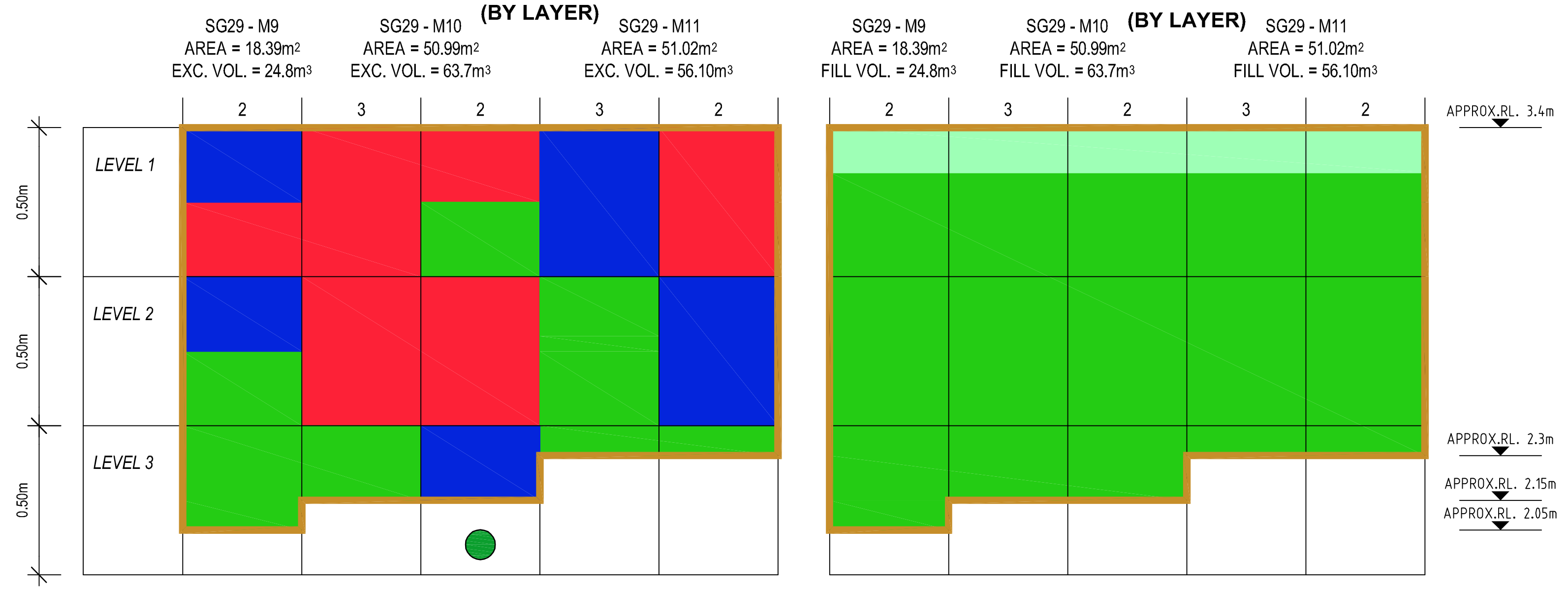


LOCATION OF SG29 (16 MARCH 2007)

1:250

PRE EXCAVATION (BY LAYER)

BACKFILL (BY LAYER)

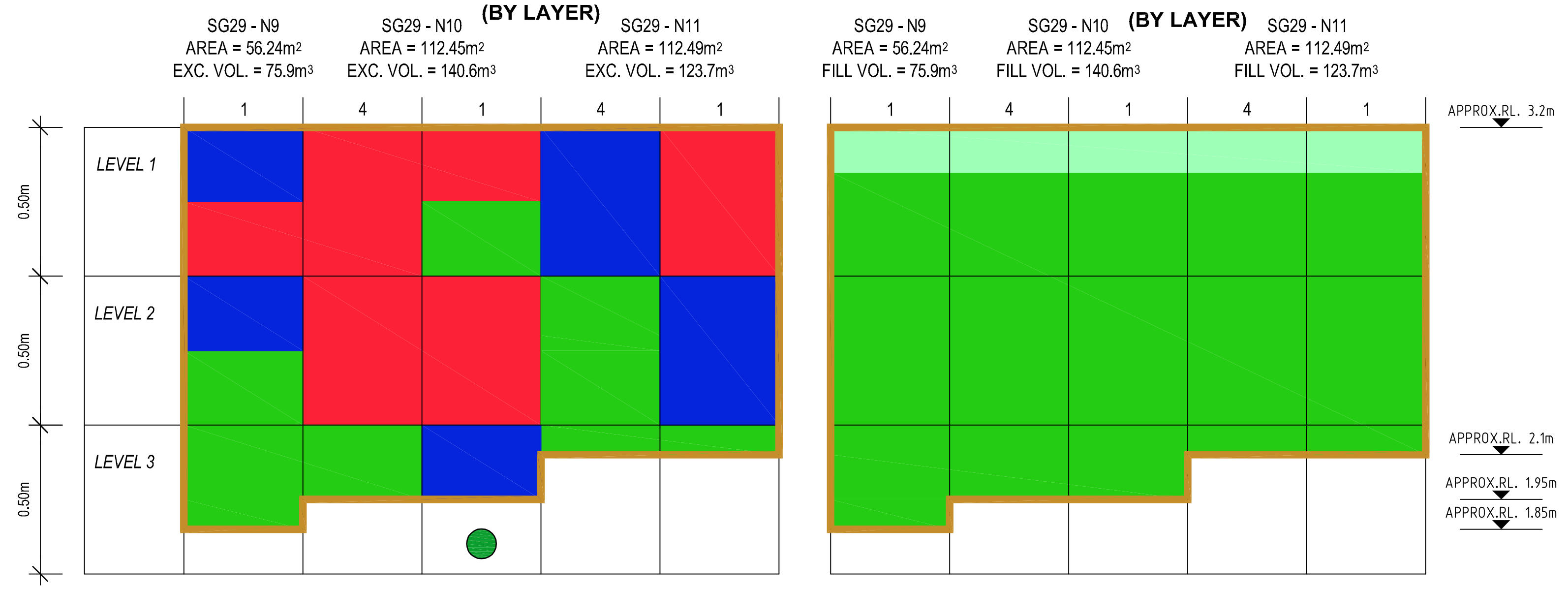


SECTION A (NTS)

SCHEMATIC SECTION OF SG29

PRE EXCAVATION (BY LAYER)

BACKFILL (BY LAYER)



SECTION B (NTS)

SCHEMATIC SECTION OF SG29

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	150mm TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

FLOOR VALIDATED AS RESIDENTIAL

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W24 - SG29 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

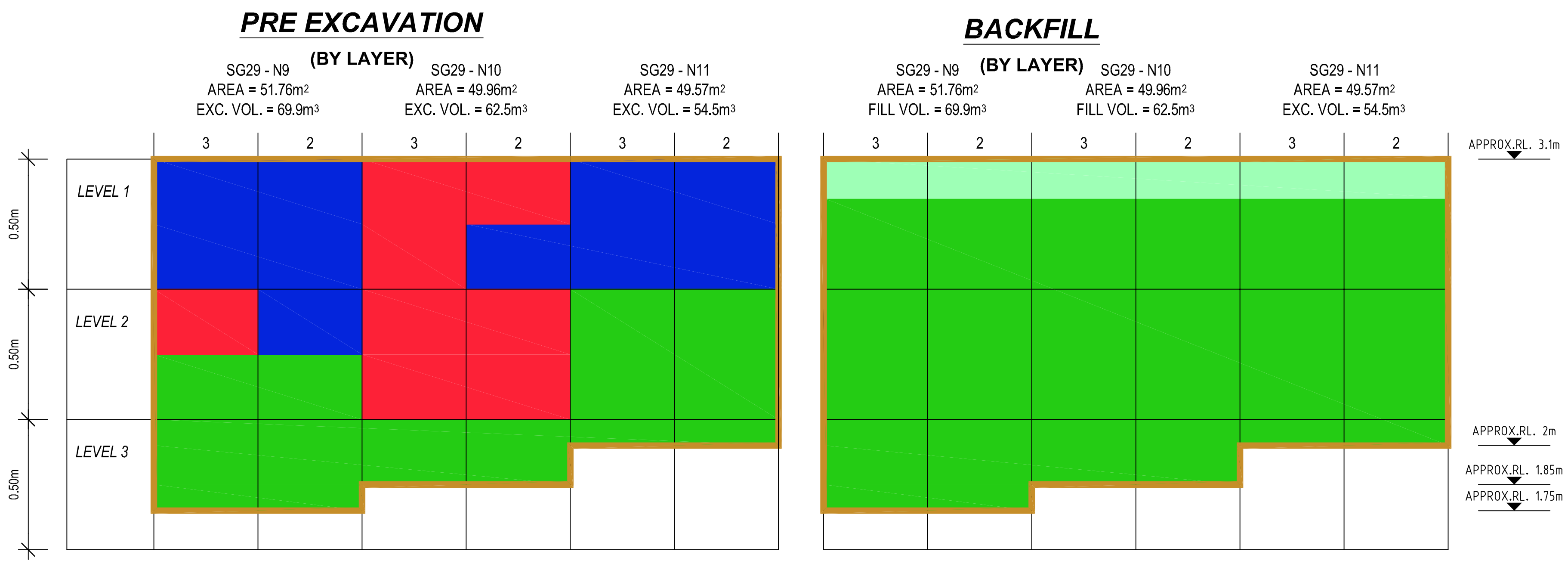
REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG29 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-C

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s24	W24	AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg



SECTION C 24
NTS

SCHEMATIC SECTION OF SG29

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	150mm TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

FLOOR VALIDATED AS RESIDENTIAL

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:27am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W25 - SG29 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK

	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG29 - PRE EXCAVATION vs BACKFILL
SECTION C OF SECTIONS A-C

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s25	W25	AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg

PRE EXCAVATION
(BY LAYER)

SG30 - F14
AREA = 112.46m2
EXC. VOL. = 22.5m3

SG30 - F15
AREA = 133.93m2
EXC. VOL. = 33.5m3

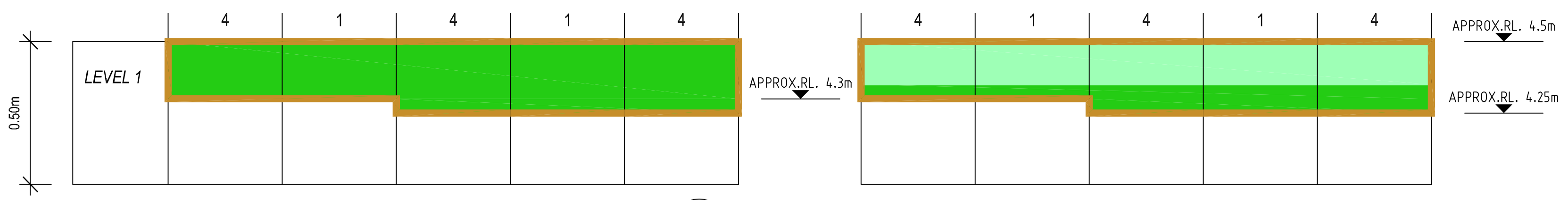
SG30 - F16
AREA = 40.13m2
EXC. VOL. = 10.0m3

BACKFILL
(BY LAYER)

SG30 - F14
AREA = 112.46m2
FILL VOL. = 22.5m3

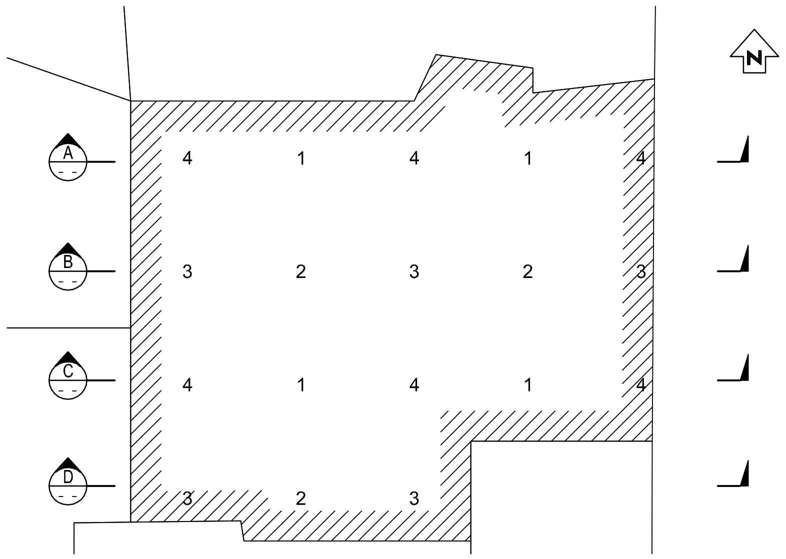
SG30 - F15
AREA = 133.93m2
FILL VOL. = 33.5m3

SG30 - F16
AREA = 40.13m2
FILL VOL. = 10.0m3



SECTION A NTS

SCHEMATIC SECTION OF SG30



LOCATION OF SG30 (19 APRIL 2007)
1:250

PRE EXCAVATION
(BY LAYER)

SG30 - F14
AREA = 112.49m2
EXC. VOL. = 22.5m3

SG30 - F15
AREA = 112.50m2
EXC. VOL. = 28.1m3

SG30 - F16
AREA = 34.23m2
EXC. VOL. = 8.6m3

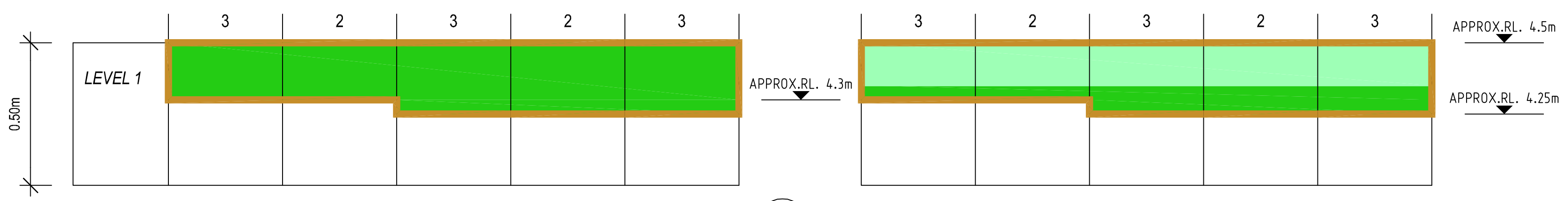
BACKFILL
(BY LAYER)

SG30 - F14
AREA = 112.49m2
FILL VOL. = 22.5m3

SG30 - F15
AREA = 112.50m2
FILL VOL. = 28.1m3

SG30 - F16
AREA = 34.23m2
FILL VOL. = 8.6m3

L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
EXCAVATION BOUNDARY	RESIDENTIAL



SECTION B NTS

SCHEMATIC SECTION OF SG30

PRE EXCAVATION
(BY LAYER)

SG30 - G14
AREA = 112.53m2
EXC. VOL. = 33.8m3

SG30 - G15
AREA = 112.49m2
EXC. VOL. = 28.1m3

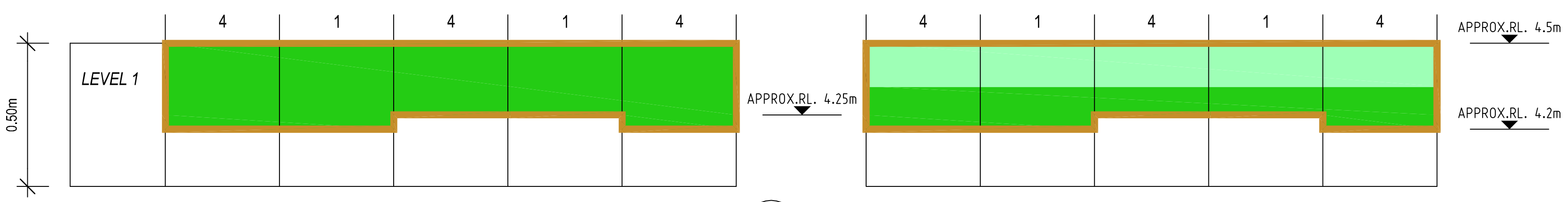
SG30 - G16
AREA = 34.00m2
EXC. VOL. = 10.2m3

BACKFILL
(BY LAYER)

SG30 - G14
AREA = 112.53m2
FILL VOL. = 33.8m3

SG30 - G15
AREA = 112.49m2
FILL VOL. = 28.1m3

SG30 - G16
AREA = 34.00m2
FILL VOL. = 10.2m3



SECTION C NTS

SCHEMATIC SECTION OF SG30

PRE EXCAVATION
(BY LAYER)

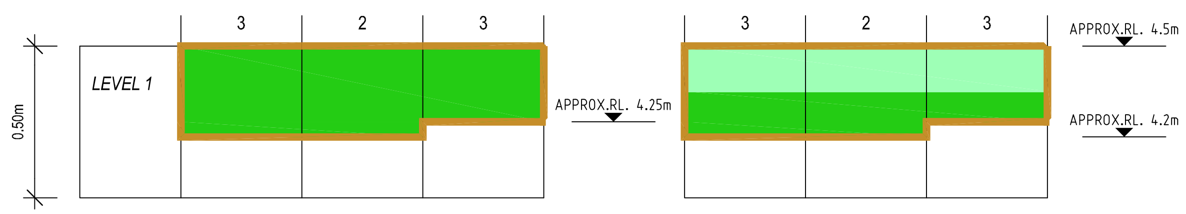
SG30 - G14
AREA = 89.40m2
EXC. VOL. = 26.8m3

SG30 - G15
AREA = 49.48m2
EXC. VOL. = 12.4m3

BACKFILL
(BY LAYER)

SG30 - G14
AREA = 89.40m2
FILL VOL. = 26.8m3

SG30 - G15
AREA = 49.48m2
FILL VOL. = 12.4m3



SECTION D NTS

SCHEMATIC SECTION OF SG30

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W26 - SG30 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

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Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG30 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s26	W26	AB

12 September 2008 - 9:26am

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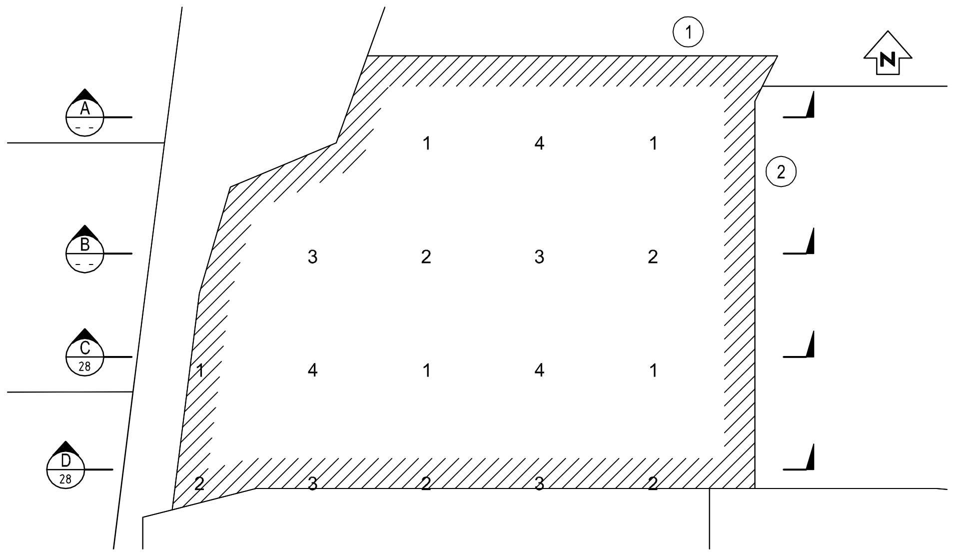
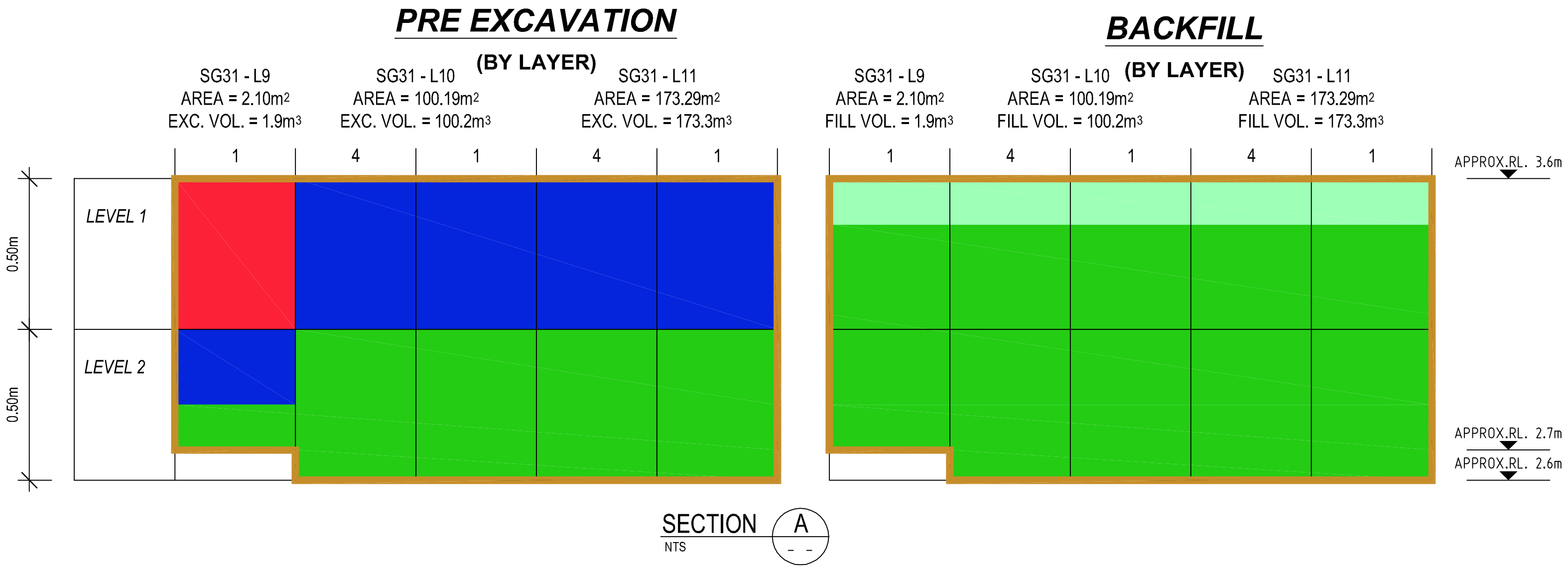
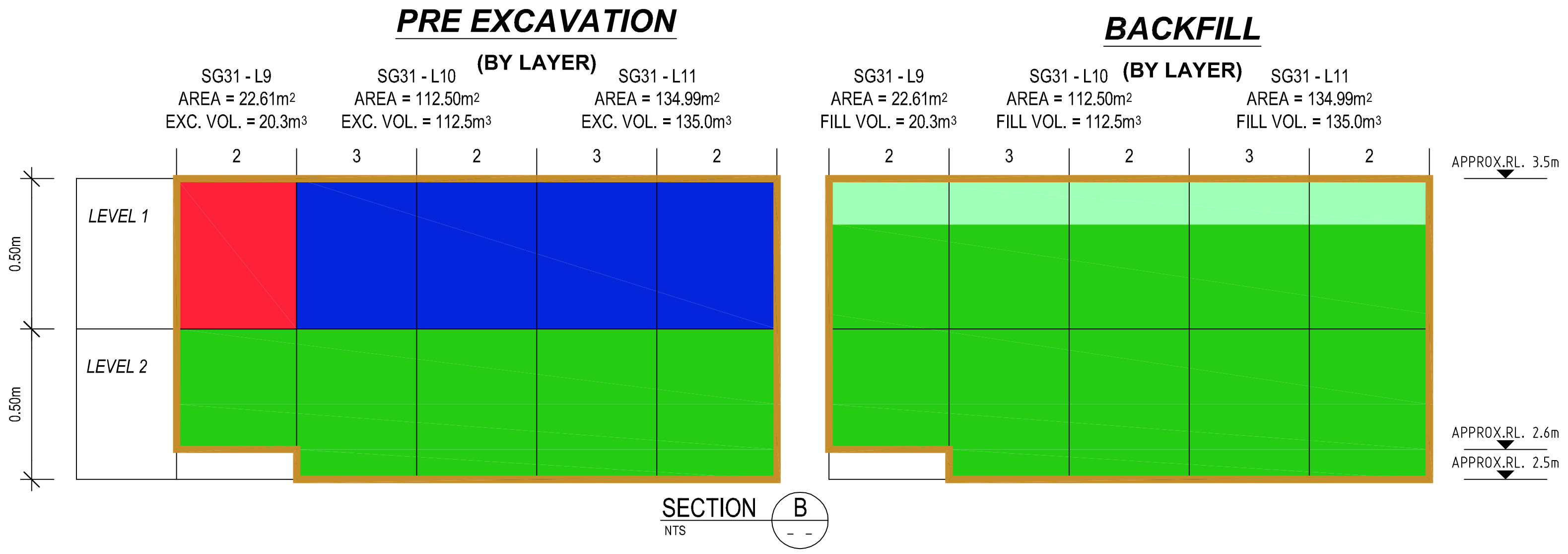
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg



LOCATION OF SG31 (30 MAY 2007)
1:250



SCHEMATIC SECTION OF SG31



SCHEMATIC SECTION OF SG31

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

APPROXIMATE FLOOR DEPTH

1 DATA FROM THE EDGE OF K10, K11 AND K12 IS IDENTICAL TO SECTION A

2 DATA FROM THE EDGE OF L12 AND M12 IS IDENTICAL TO L11 AND M11 RESPECTIVELY

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W27 - SG31 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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Ministry for the Environment
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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG31 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s27	W27	AB

P:\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg
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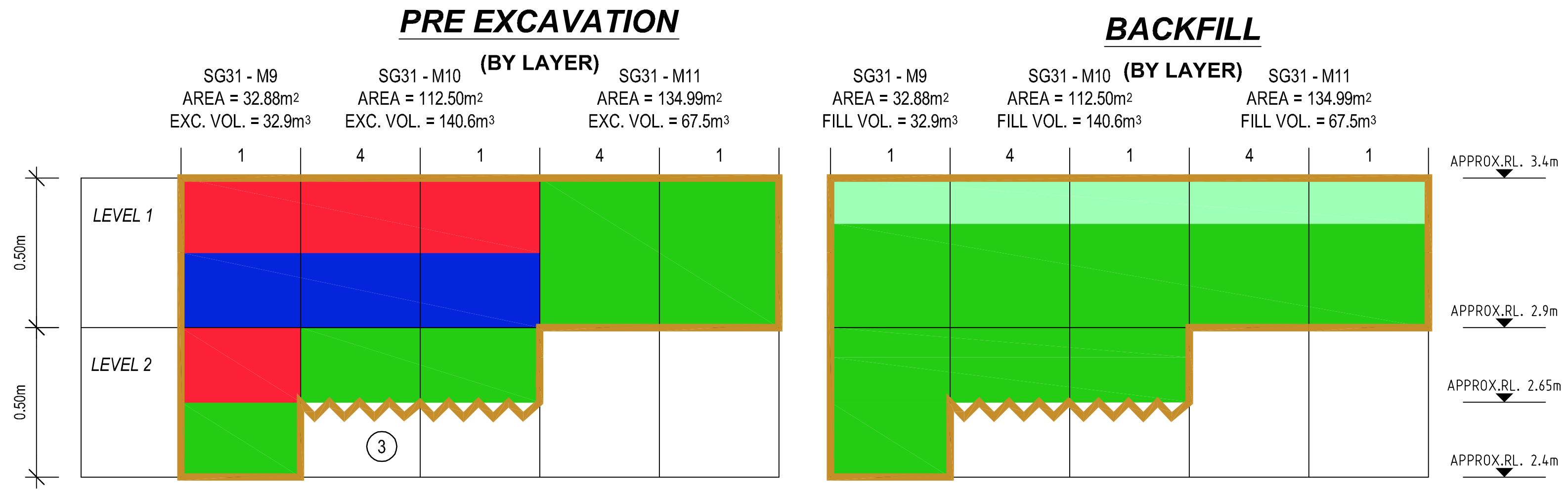


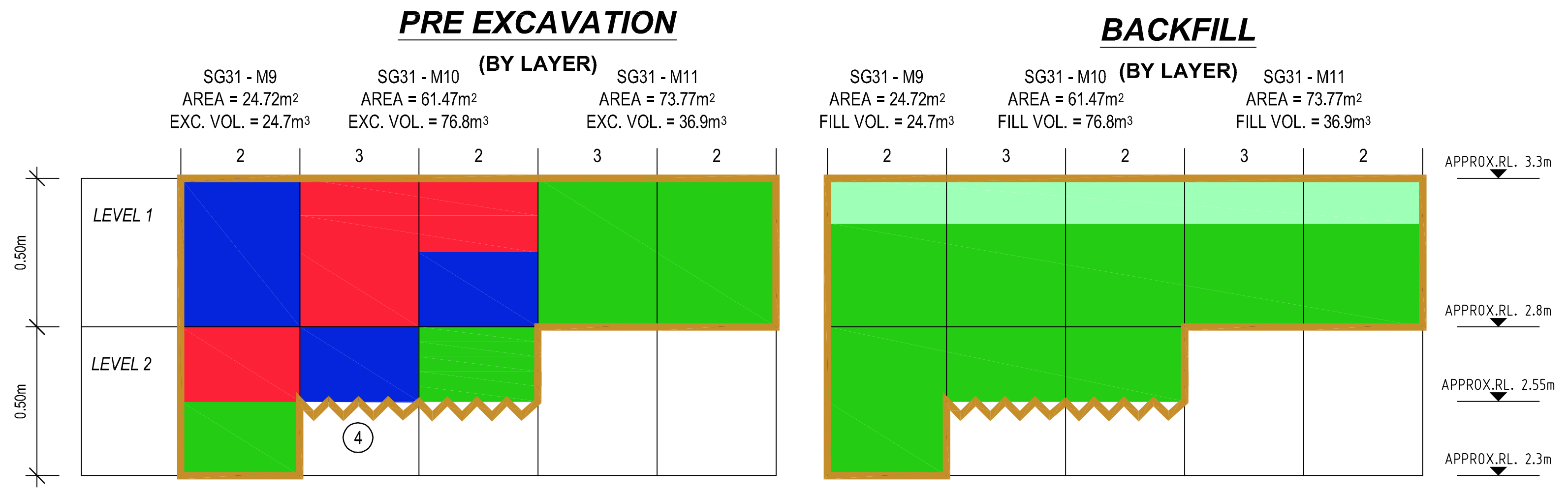
SECTION C / 27
NTS

SCHEMATIC SECTION OF SG31

L E G E N D	
PRE EXCAVATION	**BACKFILL FCC EAST**
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

APPROXIMATE FLOOR DEPTH

1. DATA FROM THE EDGE OF K10, K11 AND K12 IS IDENTICAL TO SECTION A
2. DATA FROM THE EDGE OF L12 AND M12 IS IDENTICAL TO L11 AND M11 RESPECTIVELY
3. EXCAVATION WAS MADE OF TRENCH LOCATED IN M10. THE DEPTH REACHED LEVEL 5 AND CONTAINED ONLY RESIDENTIAL MATERIAL
4. FLOOR VALIDATED AS RESIDENTIAL



SECTION D / 27
NTS

SCHEMATIC SECTION OF SG31

ORIGINAL SIZE A1
DO NOT SCALE - IF IN DOUBT, ASK

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W28 - SG31 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG31 - PRE EXCAVATION vs BACKFILL
SECTIONS C&D OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s28	W28	AB

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12 September 2008 - 9:25am
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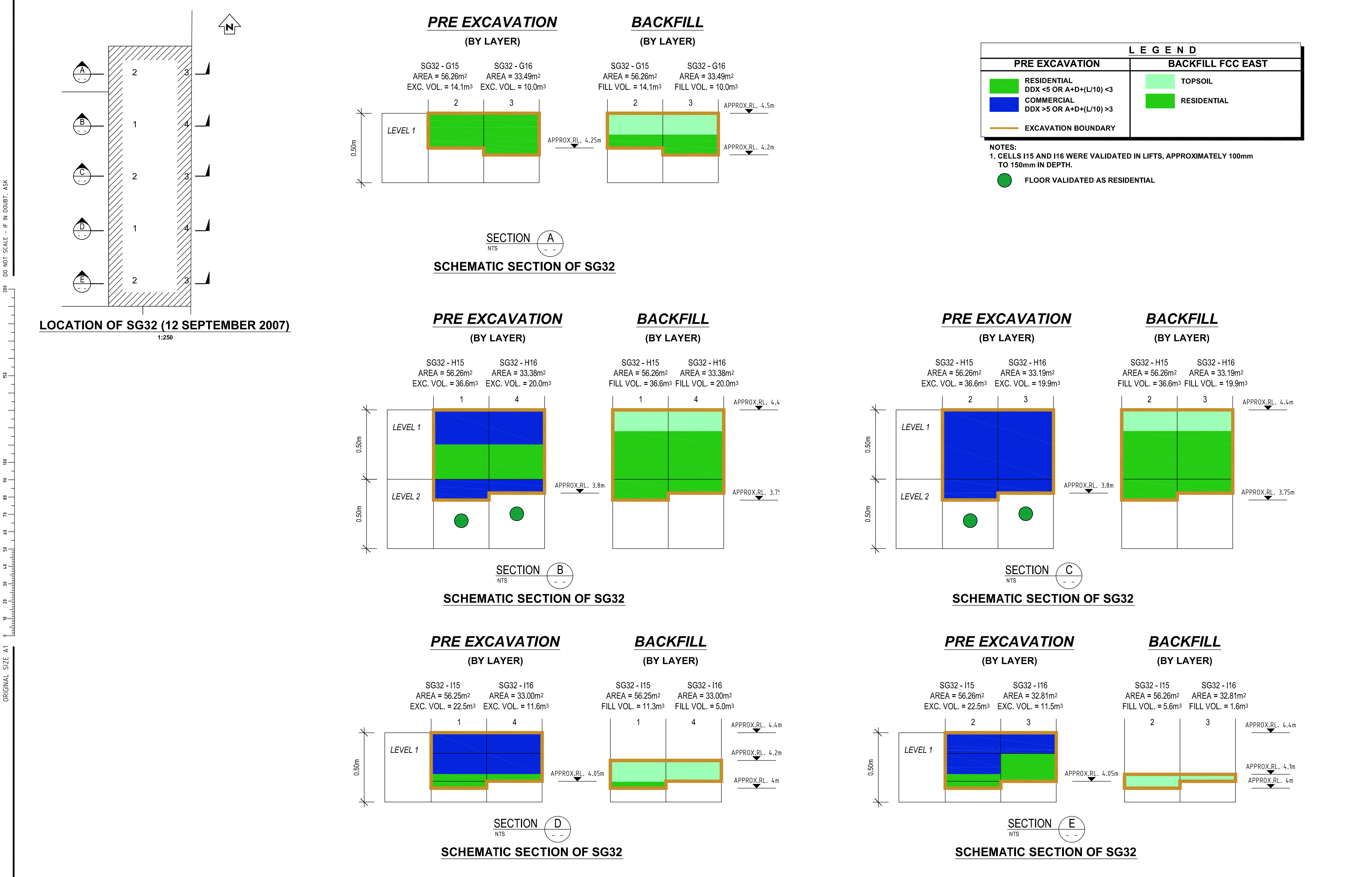

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W29 - SG32 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

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REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG32 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s29	W29	AB

12 September 2008 - 9:24am

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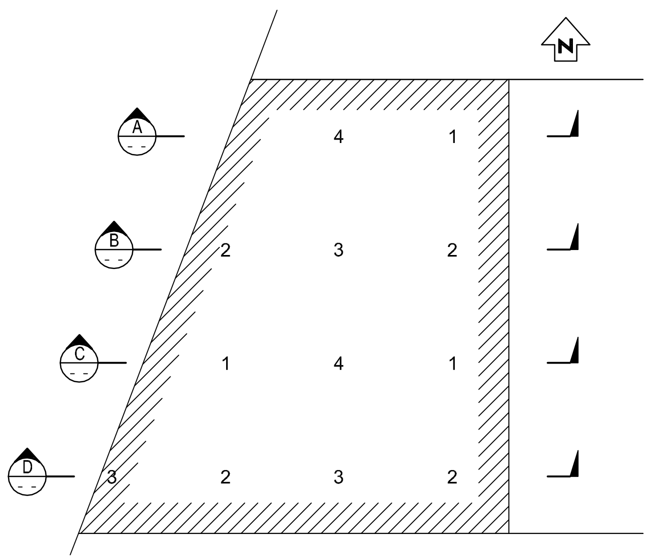
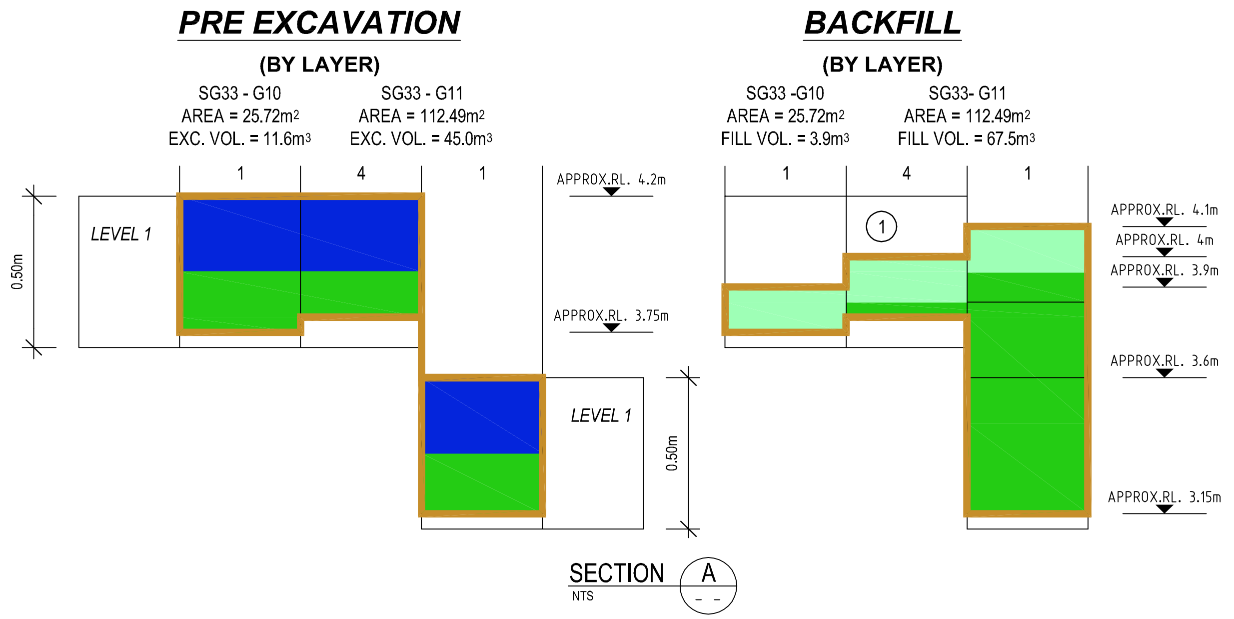
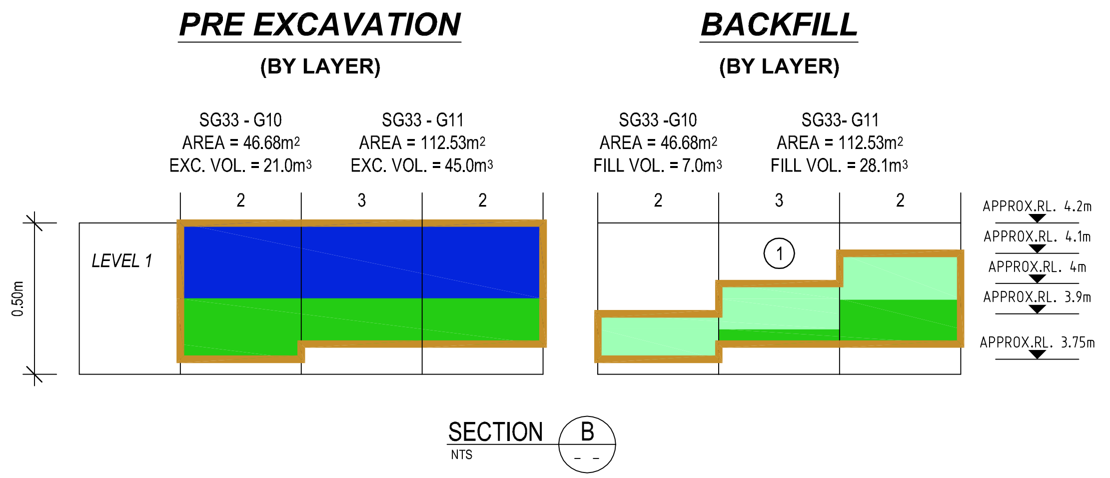
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg



LOCATION OF SG33 (2007)
1:250



SCHEMATIC SECTION OF SG33

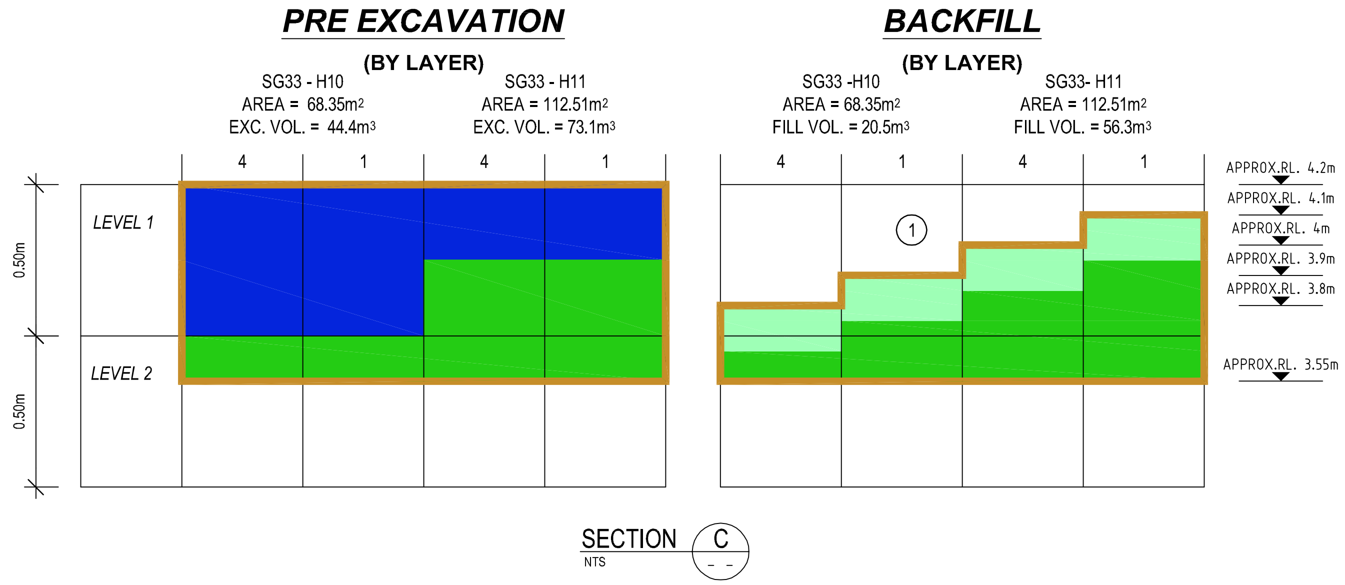


SCHEMATIC SECTION OF SG33

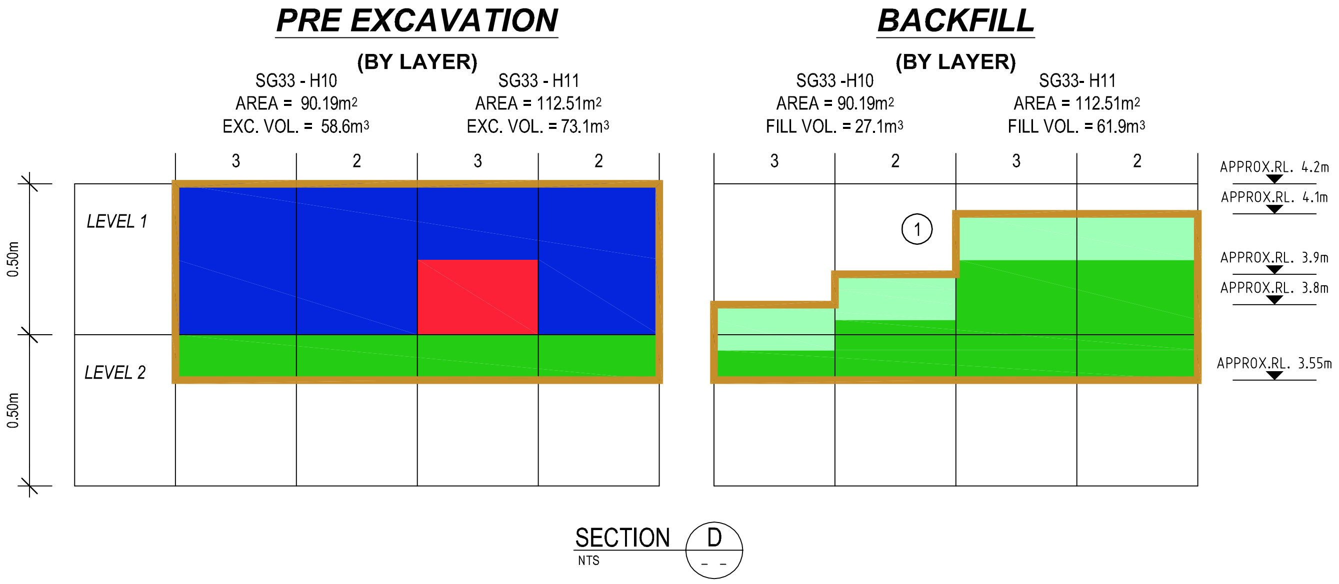
L E G E N D	
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

NOTES:
1. CELL G11 QUAD1 WASLOCATED ON THE EDGE OF AN EXISTING EXCAVATION

(1) SITE ACTUALLY SLOPED, HOWEVER FOR CLARITY THE AVERAGE HEIGHT FOR EACH CELL IS SHOWN



SCHEMATIC SECTION OF SG33



SCHEMATIC SECTION OF SG33

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:23am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W30 - SG33 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

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Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG33 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s30
Sheet No. W30
Rev. AB

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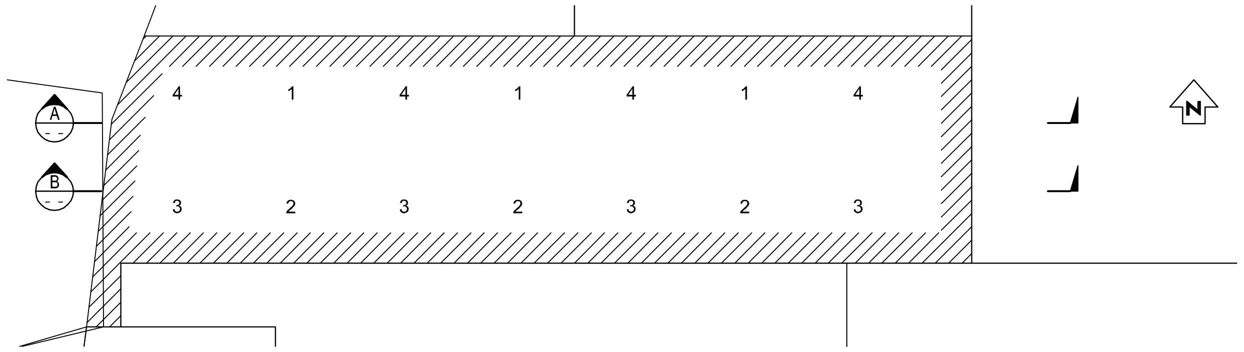


LOCATION OF SG34 (2007)

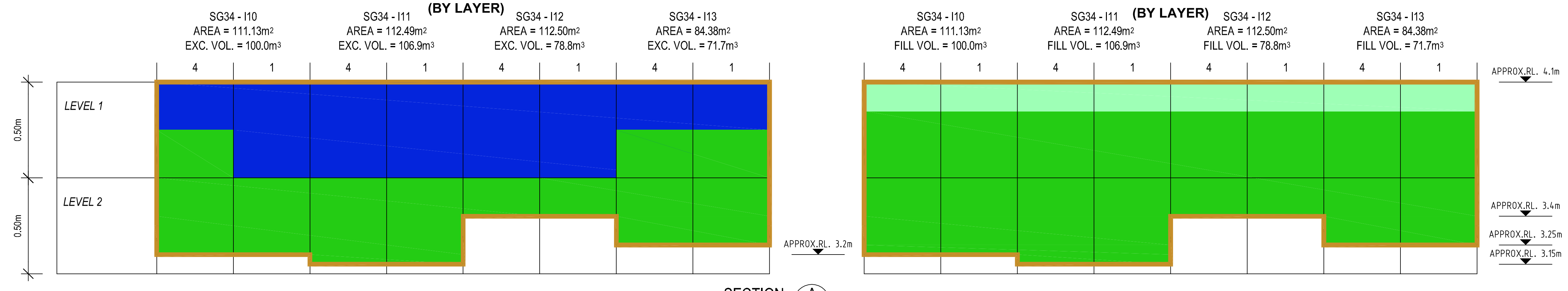
1:250

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

SUMP LOCATED IN I11, Q3, CONTAINING COMMERCIAL MATERIAL WITH WALLS AND FLOORS VALIDATED AS RESIDENTIAL.

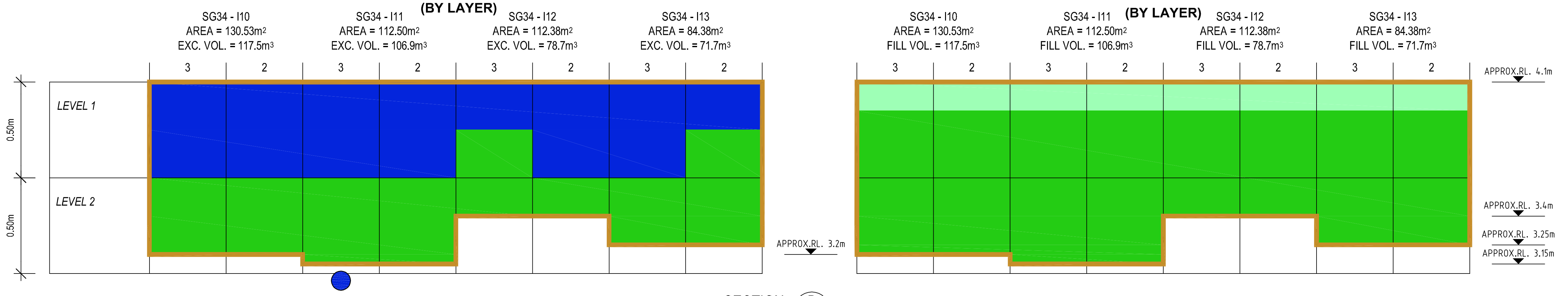
PRE EXCAVATION (BY LAYER) — BACKFILL (BY LAYER)



SECTION A
NTS

SCHEMATIC SECTION OF SG34

PRE EXCAVATION (BY LAYER) — BACKFILL (BY LAYER)



SECTION B
NTS

SCHEMATIC SECTION OF SG34

ORIGINAL SIZE A1 — DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 9:22am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W31 - SG34 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the **Environment** Manatû Mô Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG34 - PRE EXCAVATION vs BACKFILL

Status Stamp: **AS BUILT**
Date Stamp: **12 SEPTEMBER 2008**
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s31	W31	AB

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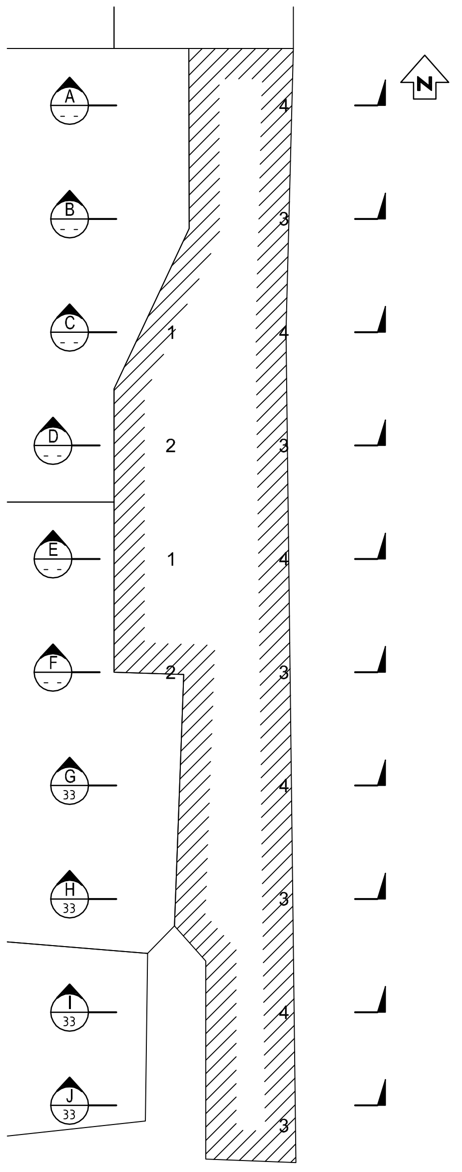
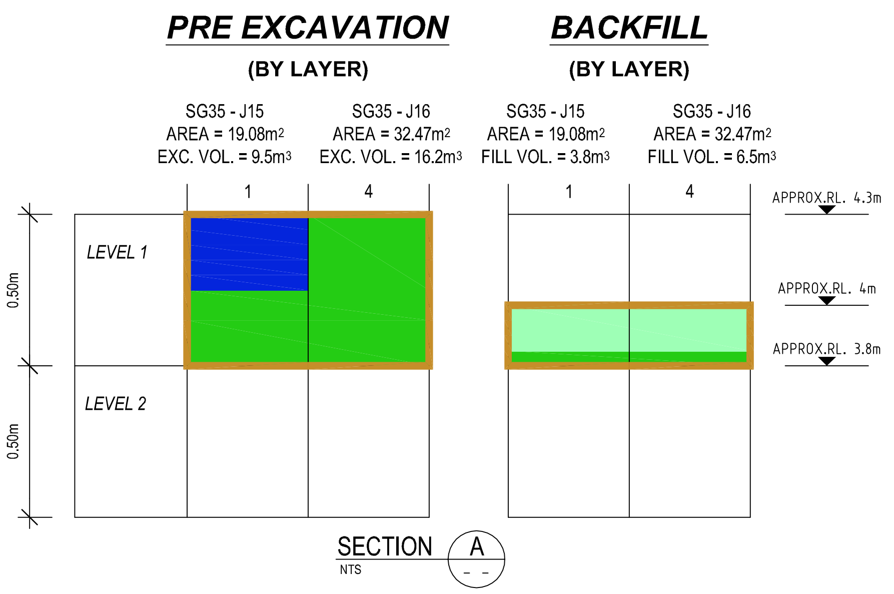
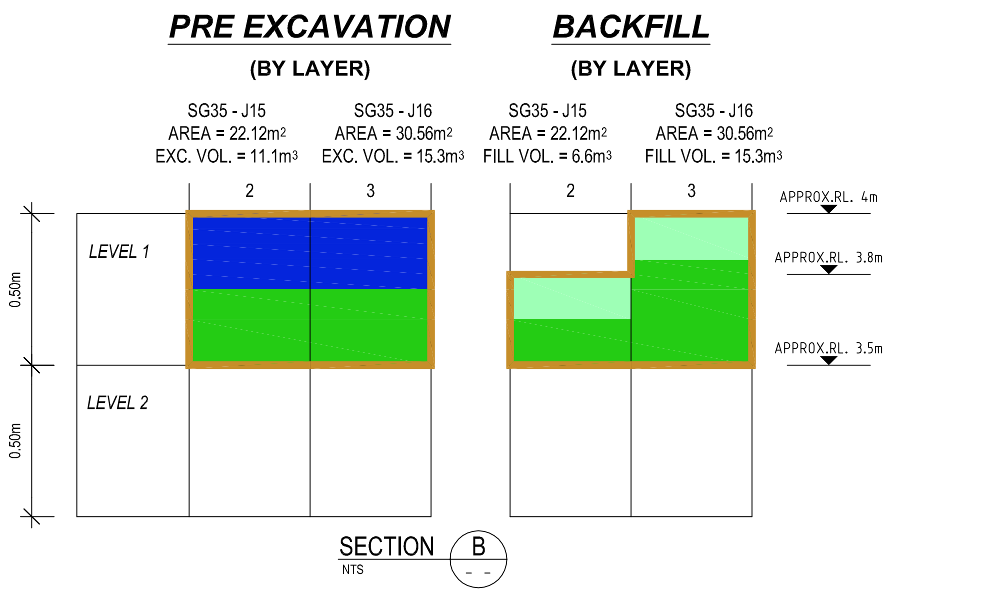


LOCATION OF SG35 (12 SEPTEMBER 2007)

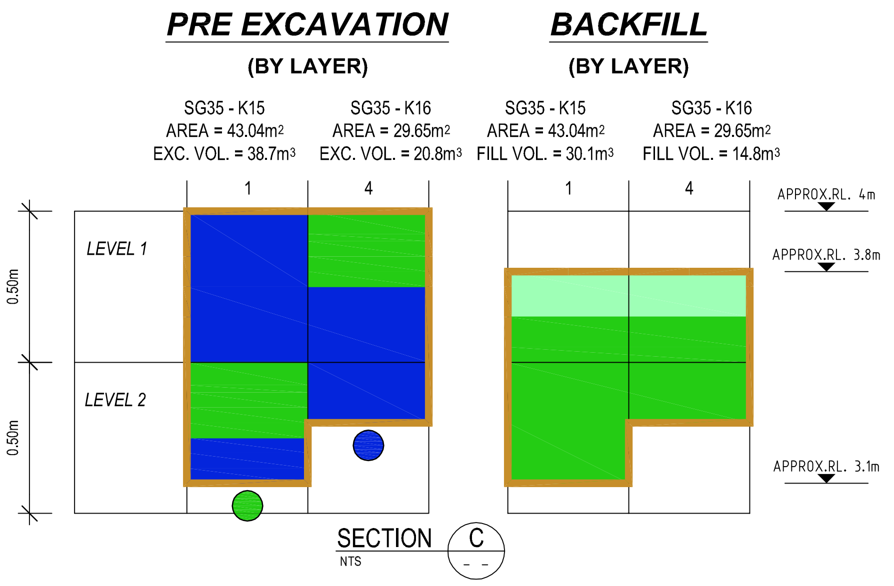
1:250



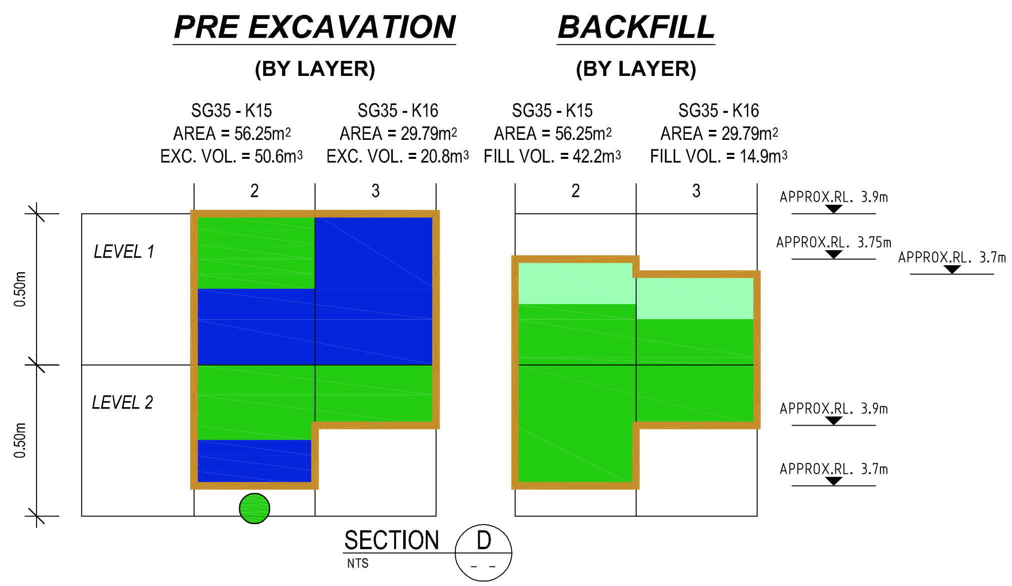
SCHEMATIC SECTION OF SG35



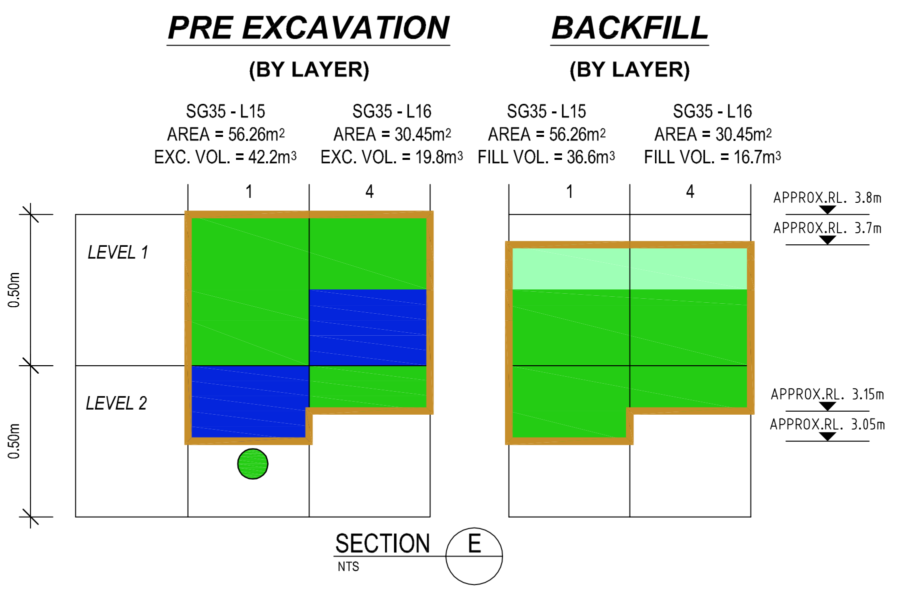
SCHEMATIC SECTION OF SG35



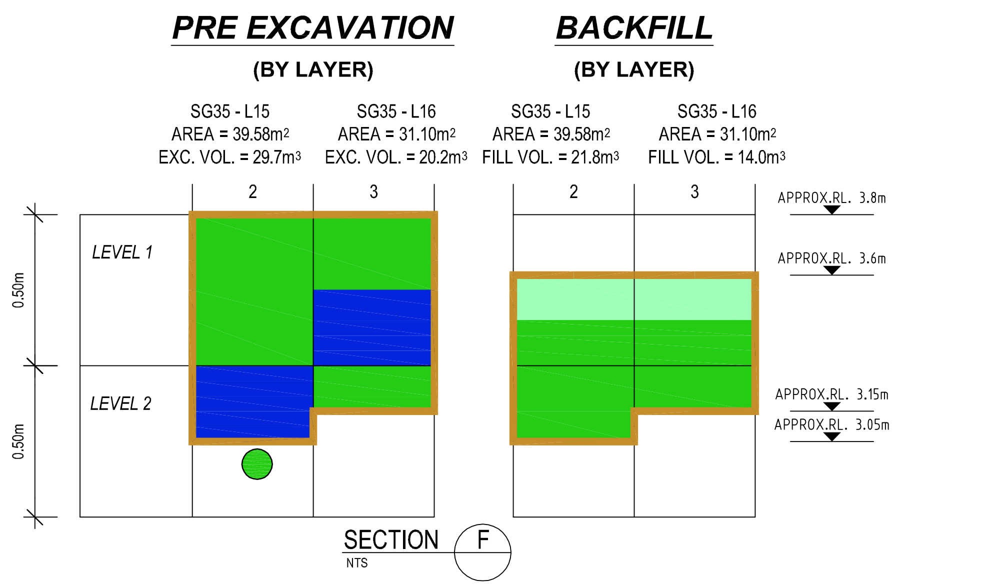
SCHEMATIC SECTION OF SG35



SCHEMATIC SECTION OF SG35



SCHEMATIC SECTION OF SG35



SCHEMATIC SECTION OF SG35

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

FLOOR VALIDATED AS RESIDENTIAL

FLOOR ACCEPTABLE AS COMMERCIAL

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:22am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W32 - SG35 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

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Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG35 - PRE EXCAVATION vs BACKFILL
SECTIONS A-F OF SECTIONS A-J

Status Stamp: AS BUILT

Date Stamp: 12 SEPTEMBER 2008

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s32	W32	AB

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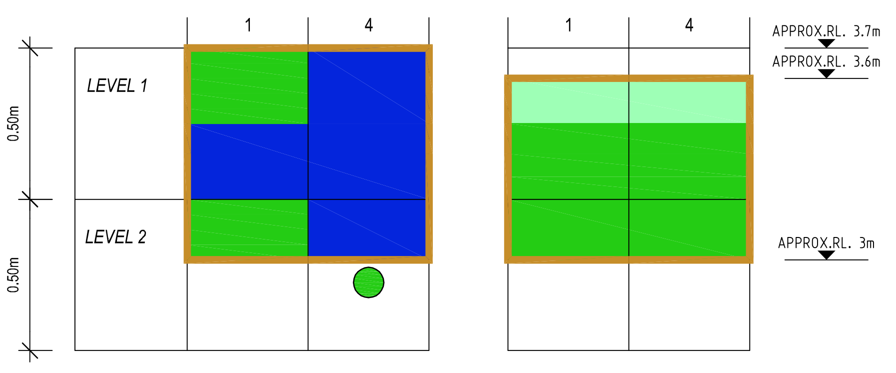
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg

PRE EXCAVATION (BY LAYER) — *BACKFILL* (BY LAYER)

SG35 - M15 AREA = 23.54m² EXC. VOL. = 16.5m³ | SG35 - M16 AREA = 31.76m² EXC. VOL. = 22.2m³ | SG35 - M15 AREA = 23.54m² FILL VOL. = 14.1m³ | SG35 - M16 AREA = 31.76m² FILL VOL. = 19.1m³

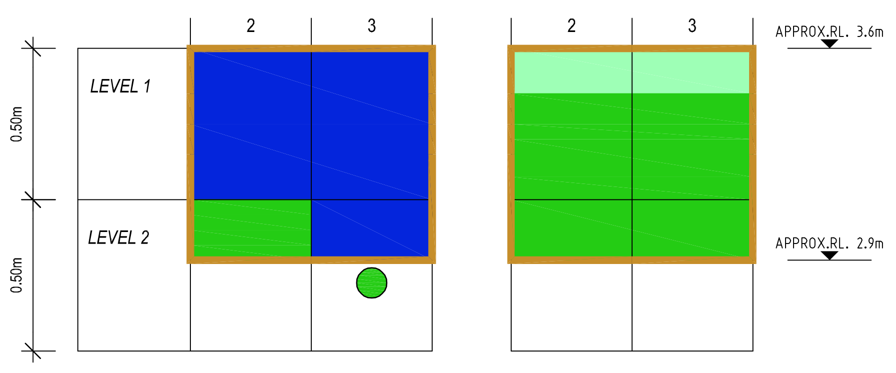


SECTION G/32 NTS

SCHEMATIC SECTION OF SG35

PRE EXCAVATION (BY LAYER) — *BACKFILL* (BY LAYER)

SG35 - M15 AREA = 23.94m² EXC. VOL. = 16.8m³ | SG35 - M16 AREA = 32.42m² EXC. VOL. = 22.7m³ | SG35 - M15 AREA = 23.94m² FILL VOL. = 16.8m³ | SG35 - M16 AREA = 32.42m² FILL VOL. = 22.7m³



SECTION H/32 NTS

SCHEMATIC SECTION OF SG35

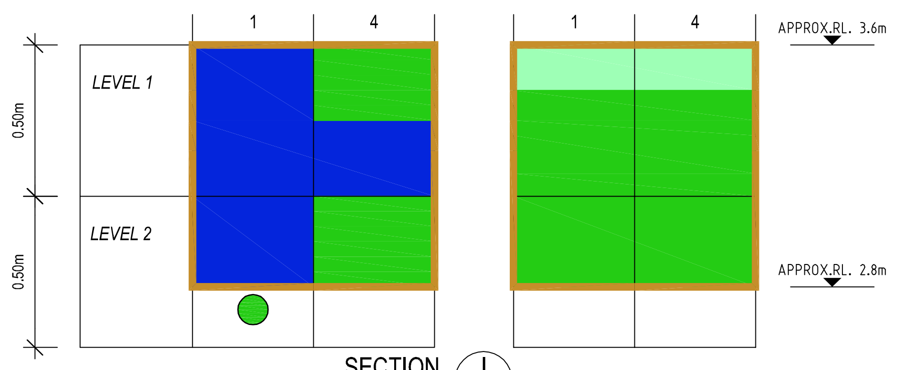
LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

FLOOR VALIDATED AS RESIDENTIAL

PRE EXCAVATION (BY LAYER) — *BACKFILL* (BY LAYER)

SG35 - N15 AREA = 10.79m² EXC. VOL. = 8.6m³ | SG35 - N16 AREA = 33.09m² EXC. VOL. = 26.5m³ | SG35 - N15 AREA = 10.79m² FILL VOL. = 8.6m³ | SG35 - N16 AREA = 33.09m² FILL VOL. = 26.5m³

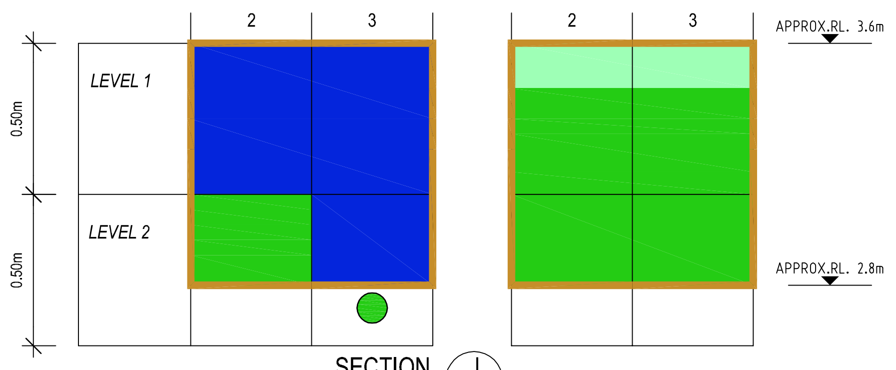


SECTION I/32 NTS

SCHEMATIC SECTION OF SG35

PRE EXCAVATION (BY LAYER) — *BACKFILL* (BY LAYER)

SG35 - N15 AREA = 8.57m² EXC. VOL. = 6.9m³ | SG35 - N16 AREA = 27.43m² EXC. VOL. = 21.9m³ | SG35 - N15 AREA = 8.57m² FILL VOL. = 6.9m³ | SG35 - N16 AREA = 27.43m² FILL VOL. = 21.9m³



SECTION J/32 NTS

SCHEMATIC SECTION OF SG35

ORIGINAL SIZE A1 — DO NOT SCALE - IF IN DOUBT, ASK

REV	AMENDMENTS	CHECKED INITIAL	DATE	APPROVED INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG: W33 - SG35 (2) / AB_WEST_20-41.dwg
SERVER: NELSON (NZNEL1S01)
XREFS: x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG35 - PRE EXCAVATION vs BACKFILL
SECTIONS G-J OF SECTIONS A-J

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s33	W33	AB

12 September 2008 - 9:21am

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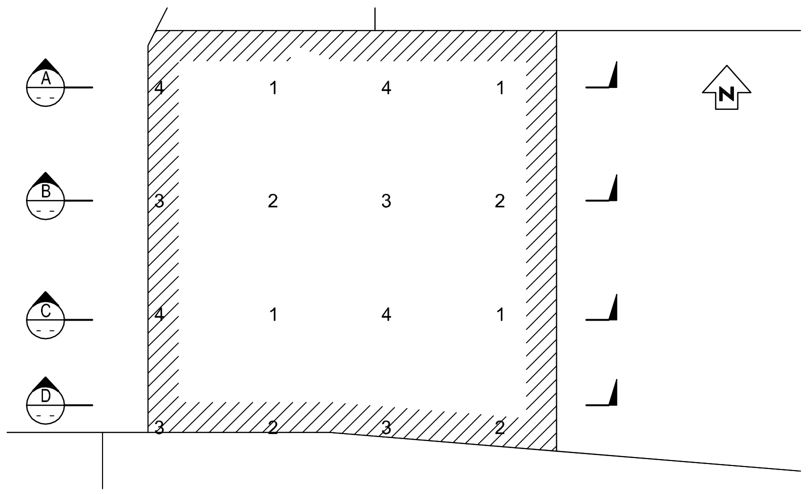
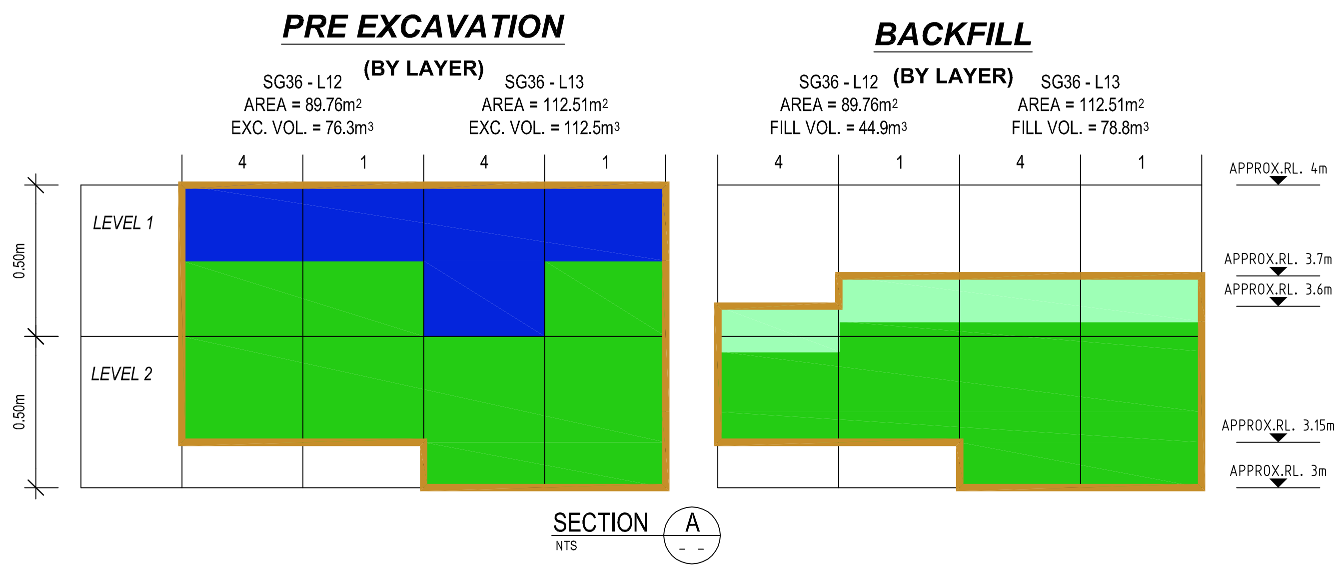
\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg



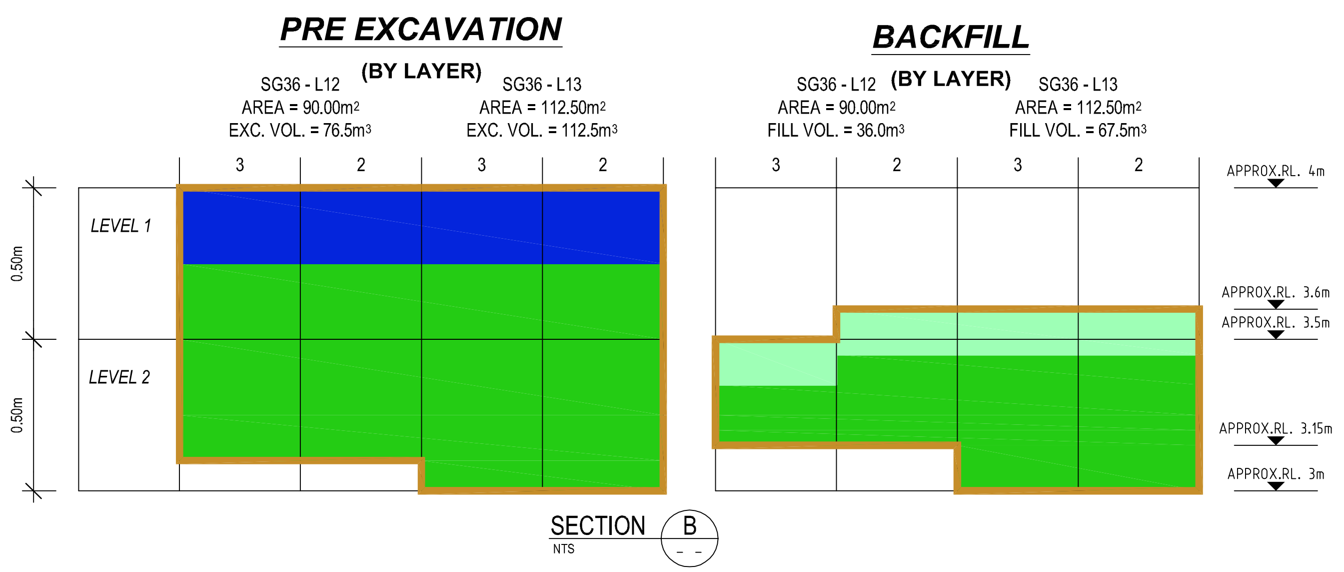
LOCATION OF SG36 (6 AUGUST 2007)
1:250

LEGEND

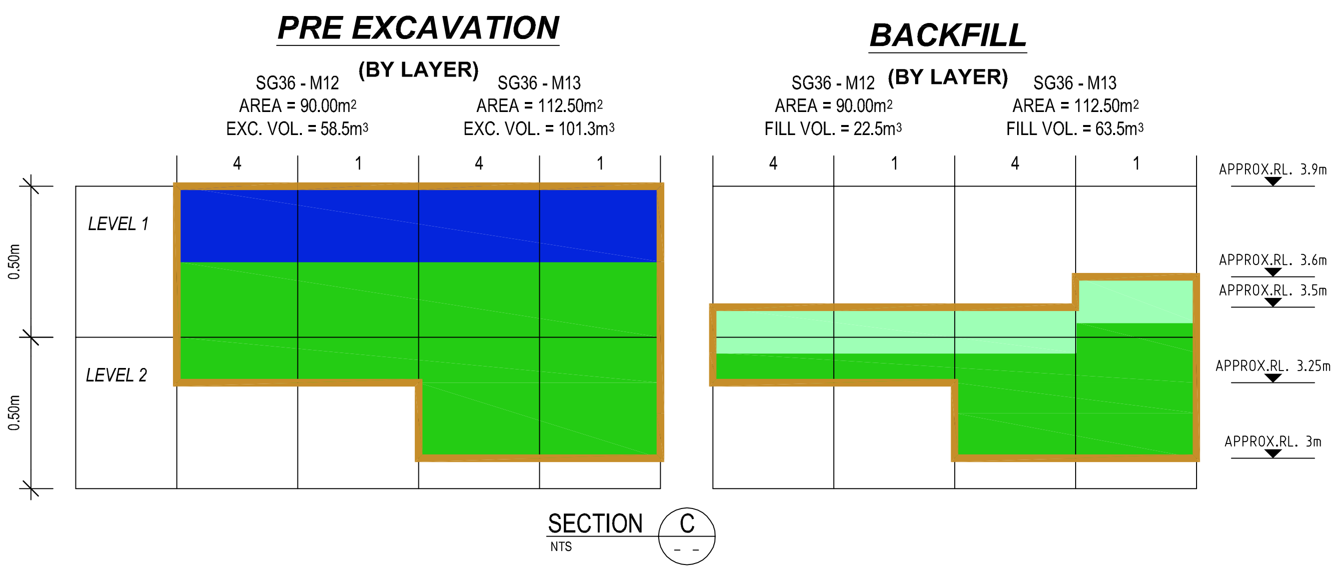
PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	



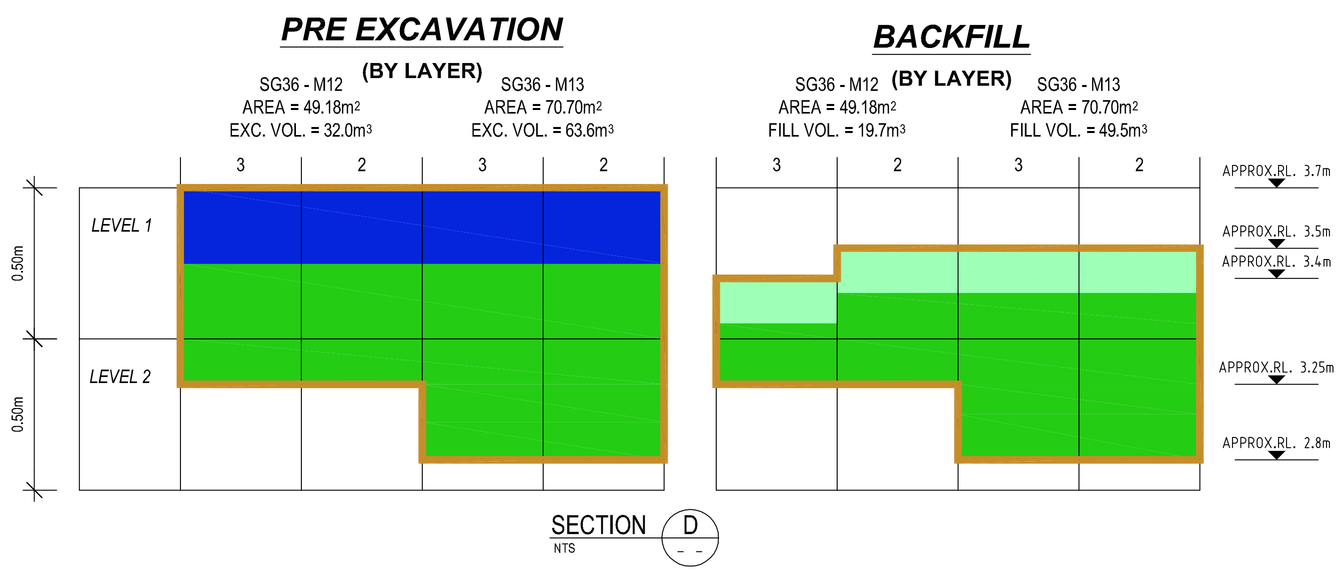
SCHEMATIC SECTION OF SG36



SCHEMATIC SECTION OF SG36



SCHEMATIC SECTION OF SG36



SCHEMATIC SECTION OF SG36

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:21am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W34 - SG36 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG36 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s34	W34	AB

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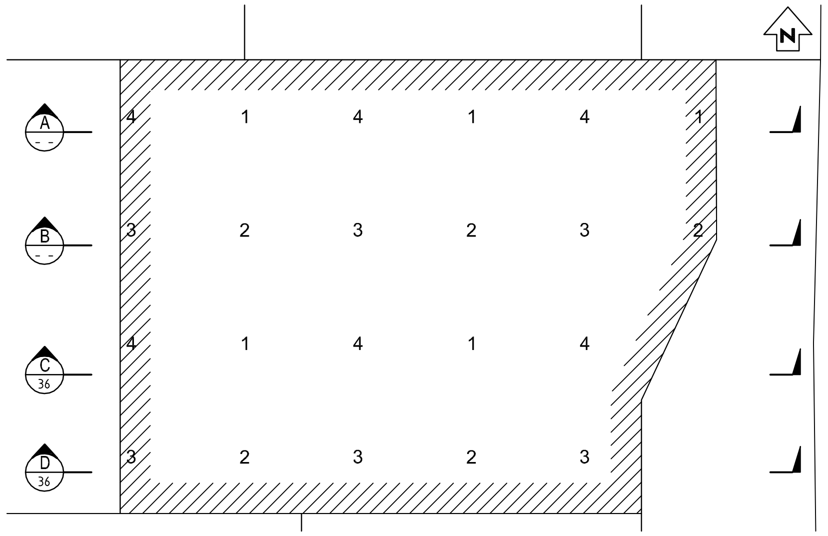


LOCATION OF SG37 (12 SEPTEMBER 2007)

1:250

PRE EXCAVATION

(BY LAYER)

SG37 - J13
AREA = 90.00m2
EXC. VOL. = 76.5m3

SG37 - J14
AREA = 112.49m2
EXC. VOL. = 129.4m3

SG37 - J15
AREA = 93.05m2
EXC. VOL. = 102.4m3

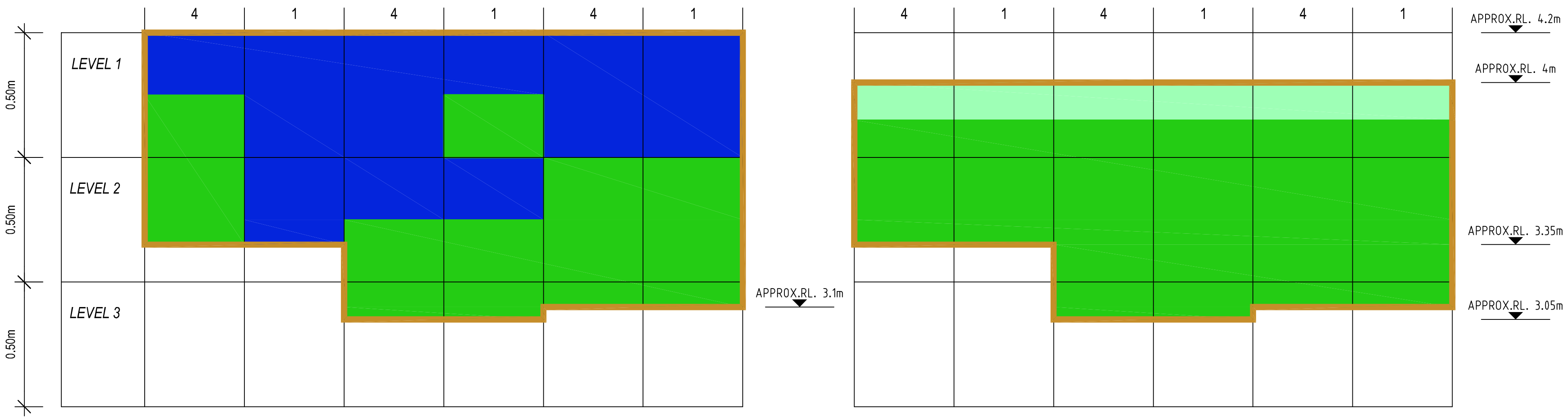
BACKFILL

(BY LAYER)

SG37 - J13
AREA = 90.00m2
FILL VOL. = 58.5m3

SG37 - J14
AREA = 112.49m2
FILL VOL. = 106.9m3

SG37 - J15
AREA = 93.05m2
FILL VOL. = 83.7m3



SECTION A
NTS

SCHEMATIC SECTION OF SG37

PRE EXCAVATION

(BY LAYER)

SG37 - J13
AREA = 90.00m2
EXC. VOL. = 76.5m3

SG37 - J14
AREA = 112.49m2
EXC. VOL. = 129.4m3

SG37 - J15
AREA = 91.32m2
EXC. VOL. = 100.5m3

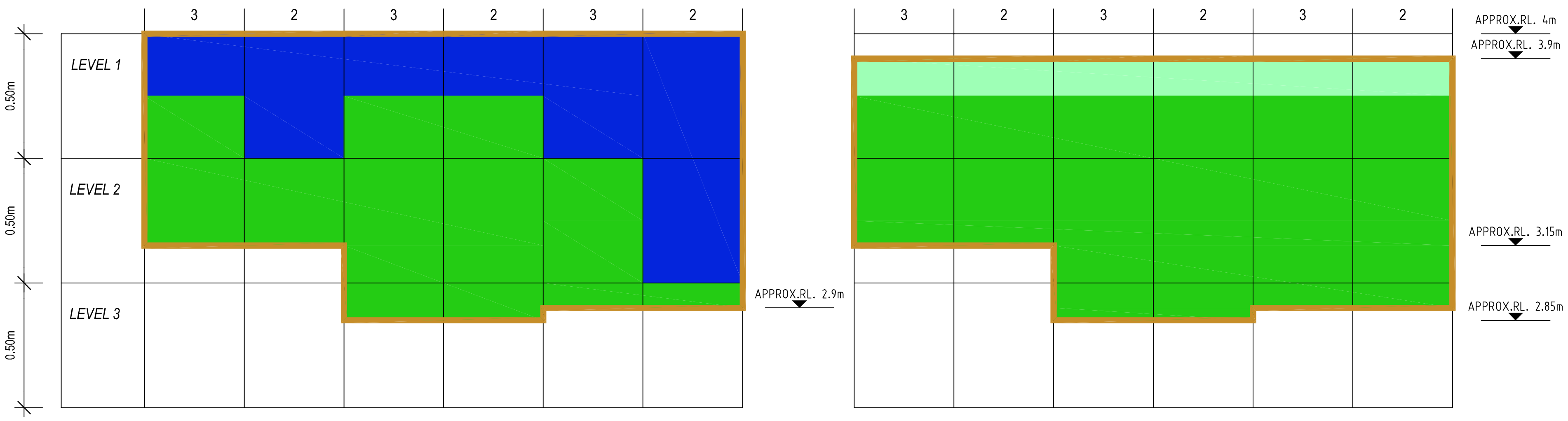
BACKFILL

(BY LAYER)

SG37 - J13
AREA = 90.00m2
FILL VOL. = 37.5m3

SG37 - J14
AREA = 112.49m2
FILL VOL. = 118.1m3

SG37 - J15
AREA = 91.32m2
FILL VOL. = 91.3m3



SECTION B
NTS

SCHEMATIC SECTION OF SG37

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

ORIGINAL SIZE A1

DO NOT SCALE - IF IN DOUBT, ASK

12 September 2008 - 9:20am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W35 - SG37 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

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Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG37 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-D

Status Stamp: AS BUILT

Date Stamp: 12 SEPTEMBER 2008

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s35	W35	AB

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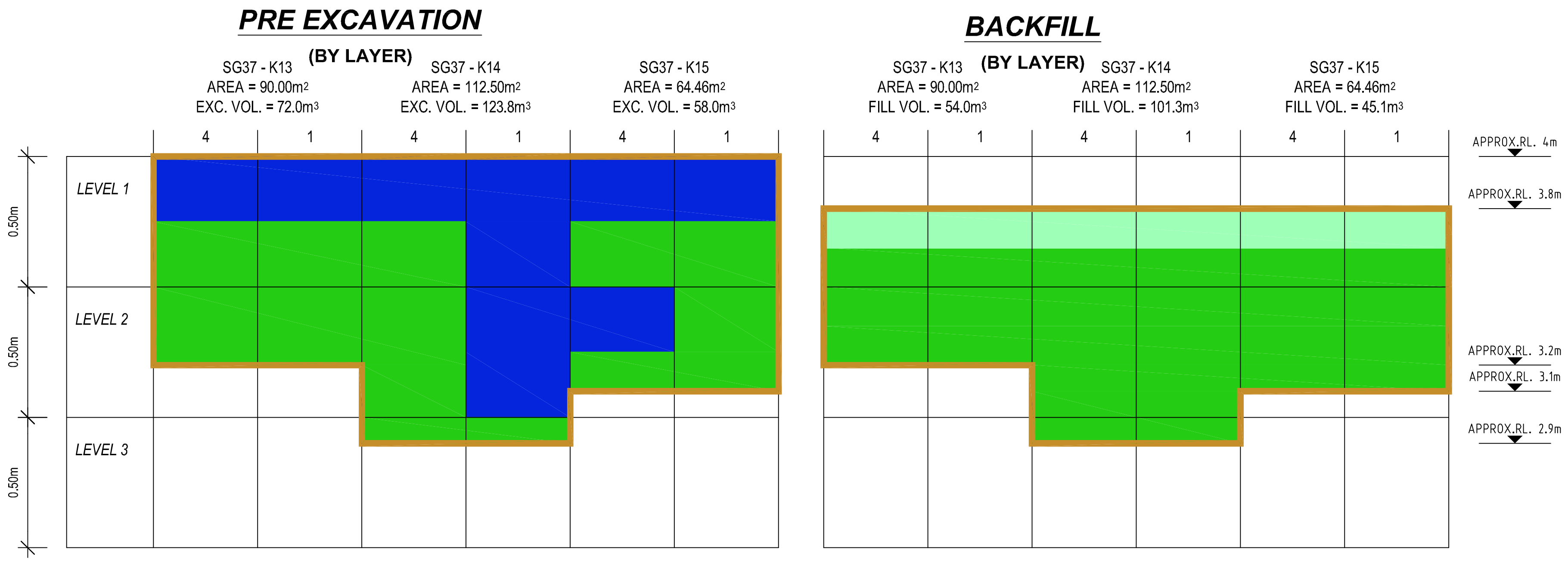
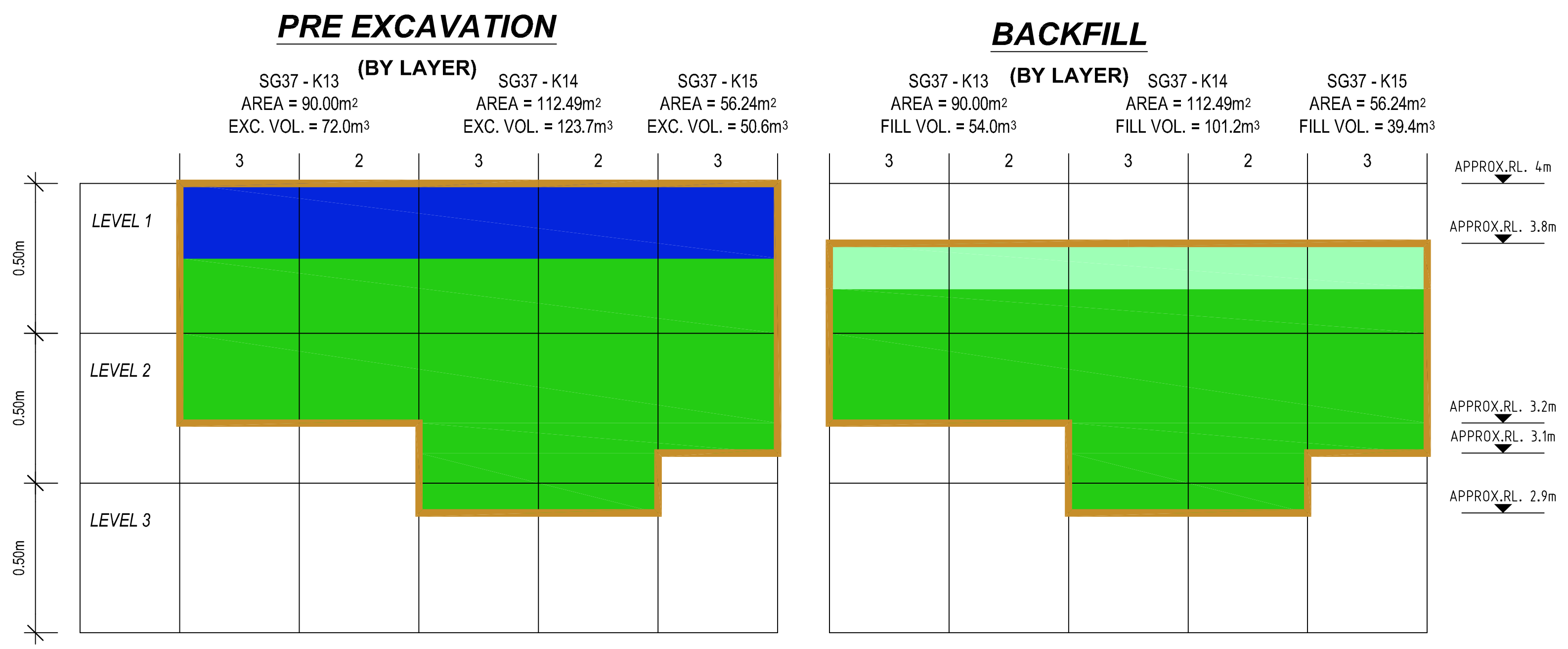


SECTION C / 35
NTS

SCHEMATIC SECTION OF SG37

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	



SECTION D / 35
NTS

SCHEMATIC SECTION OF SG37

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:19am

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W36 - SG37 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG37 - PRE EXCAVATION vs BACKFILL
SECTIONS C&D OF SECTIONS A-D

Status Stamp: **AS BUILT**

Date Stamp: **12 SEPTEMBER 2008**

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s36	W36	AB

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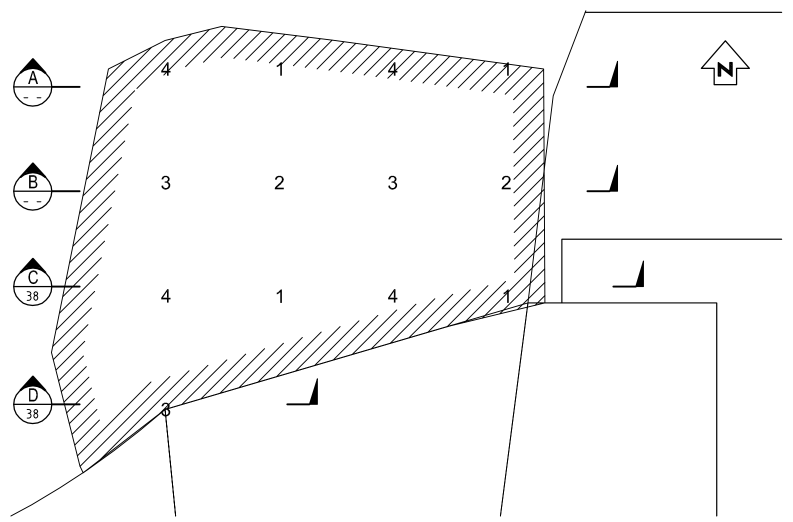
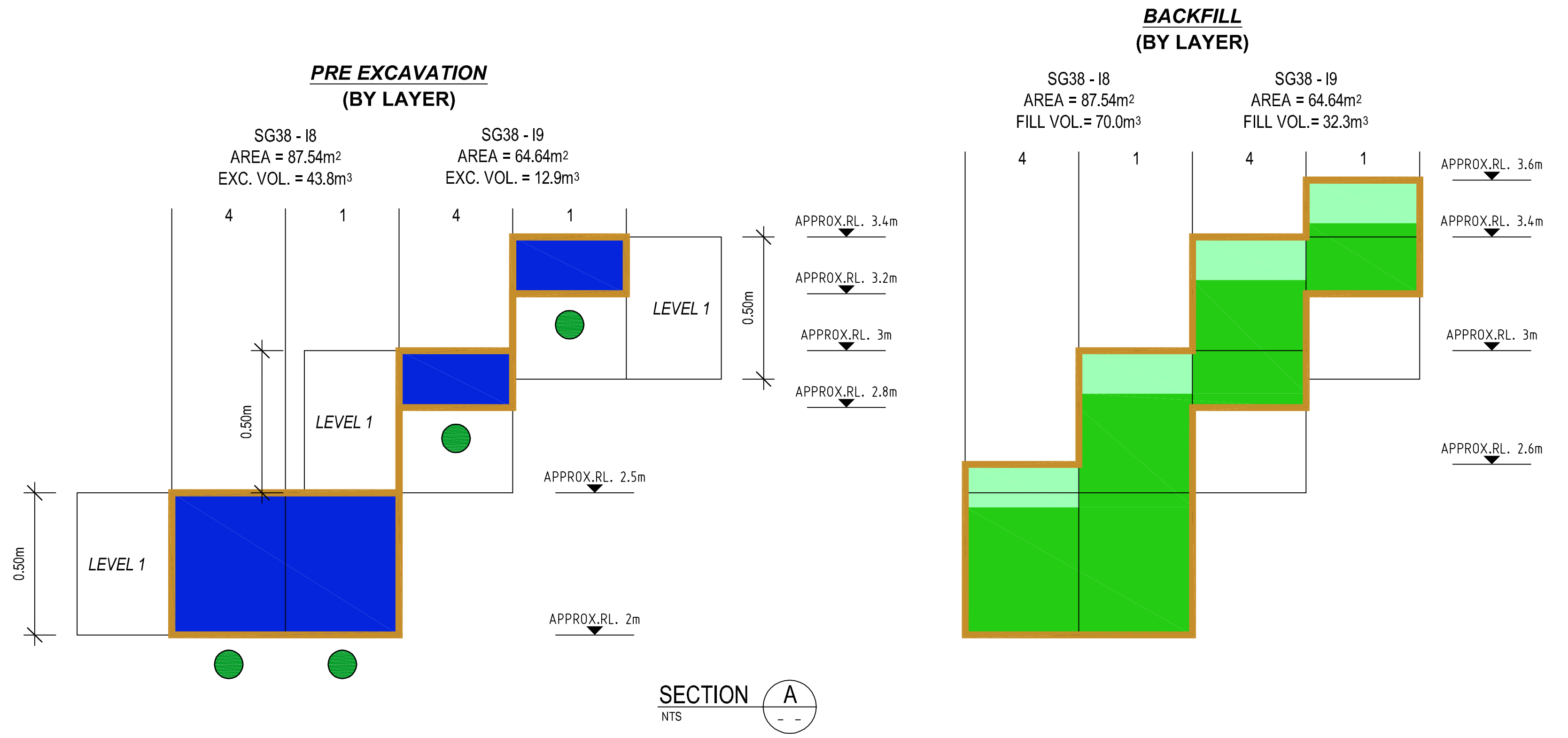
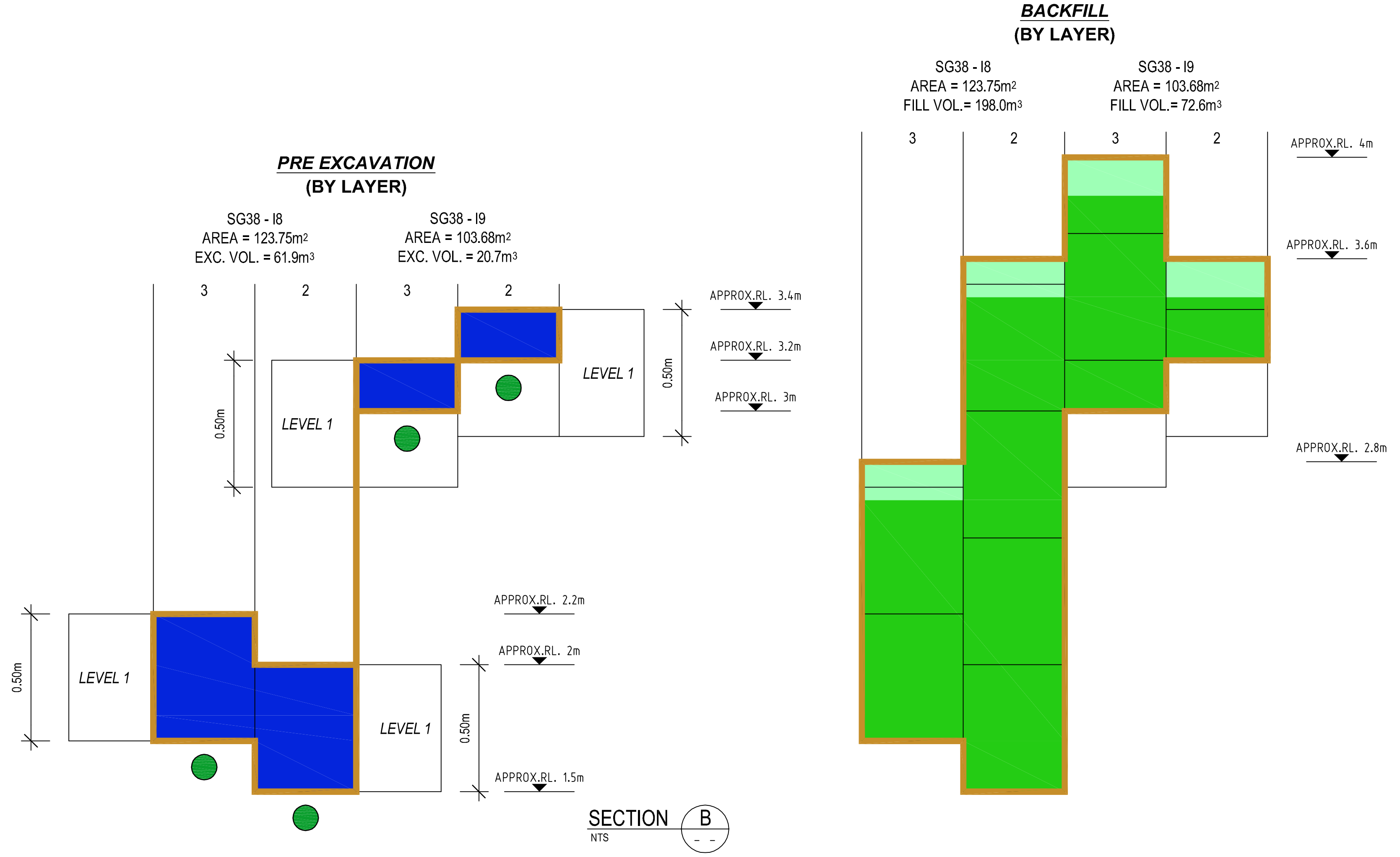


LOCATION OF SG38 (12 SEPTEMBER 2007)

1:250



SCHEMATIC SECTION OF SG38



SCHEMATIC SECTION OF SG38

L E G E N D

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

NOTES:

1. AN EXISTING EXCAVATION WAS LOCATED IN THE CENTRE OF SG38. IT LAY ACROSS CELL I8 QUAD2 & QUAD 3, CELL J8 QUAD1 & QUAD4 AND CELL J9 QUAD3

FLOOR VALIDATED AS RESIDENTIAL

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:19am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03

TAB/DWG : W37 - SG38 / AB_WEST_20-41.dwg

SERVER : NELSON (NZNEL1S01)

XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

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FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG38 - PRE EXCAVATION vs BACKFILL
SECTIONS A&B OF SECTIONS A-D

Status Stamp: AS BUILT

Date Stamp: 12 SEPTEMBER 2008

SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s37	W37	AB

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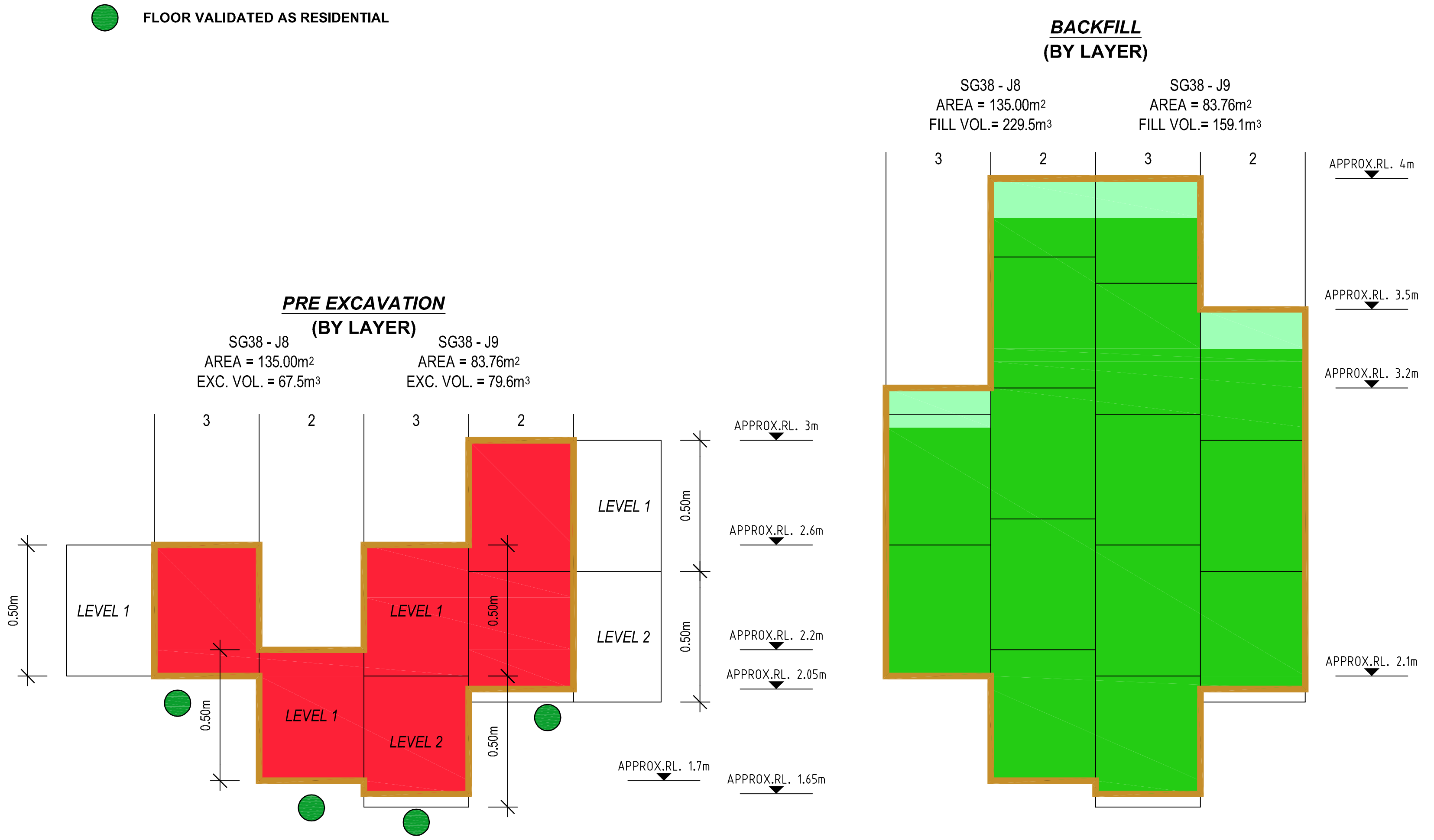
LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
CONTAMINATED DDX >200 OR A+D+(L/10) >60	
EXCAVATION BOUNDARY	

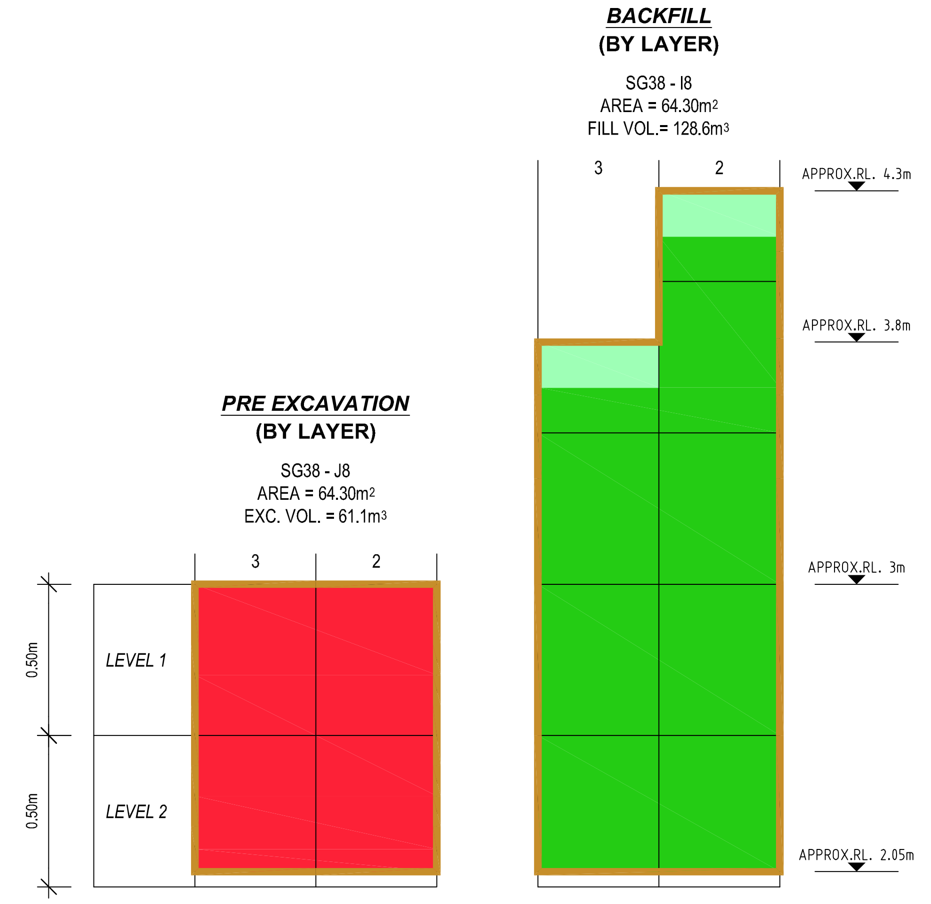
NOTES:
1. AN EXISTING EXCAVATION WAS LOCATED IN THE CENTRE OF SG38. IT LAY ACROSS CELL I8 QUAD2 & QUAD 3, CELL J8 QUAD1 & QUAD4 AND CELL J9 QUAD3

FLOOR VALIDATED AS RESIDENTIAL



SECTION C
NTS 37

SCHEMATIC SECTION OF SG38



SECTION D
NTS 37

SCHEMATIC SECTION OF SG38

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

12 September 2008 - 9:18am

REV	AMENDMENTS	INITIAL	DATE	INITIAL	DATE
AB	AS BUILT	GKB	03-08	PFR	03-08
		CHECKED		APPROVED	

Job No: 1724-03
TAB/DWG : W38 - SG38 (2) / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG38 - PRE EXCAVATION vs BACKFILL
SECTIONS C&D OF SECTIONS A-D

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s38	W38	AB

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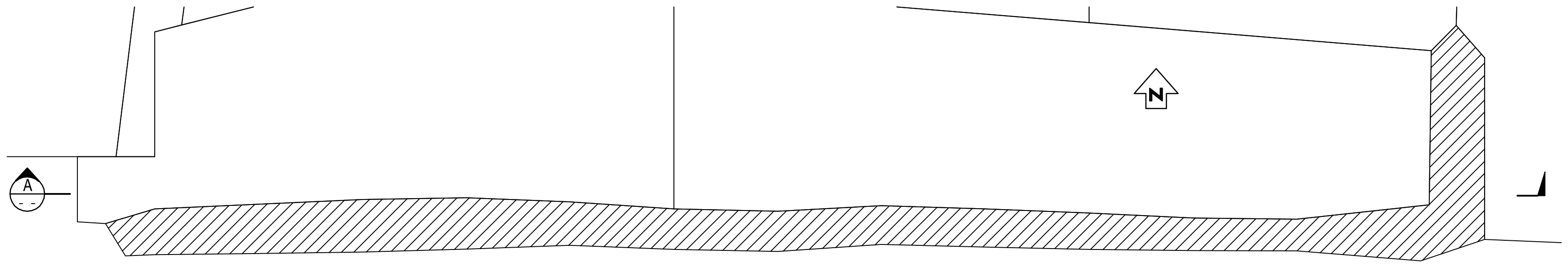
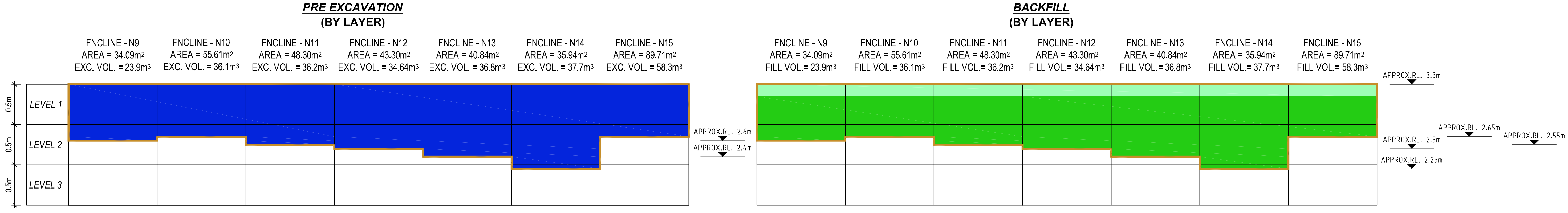


LOCATION OF FENCELINE (16 JULY 2007)

1:250



SECTION A
NTS

SCHEMATIC SECTION OF FNCLINE

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

NOTES:
1. N15 QUAD1 IS IDENTICAL TO QUAD2
2. WALLS AND FLOORS WERE ALL VALIDATED AS RESIDENTIAL.

DO NOT SCALE - IF IN DOUBT, ASK

ORIGINAL SIZE A1

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W40 - FENCELINE / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED	P.F. Russell	14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

FENCELINE - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250

TDC Plan No.	Sheet No.	Rev.
6487/1s40	W40	AB

12 September 2008 - 9:17am

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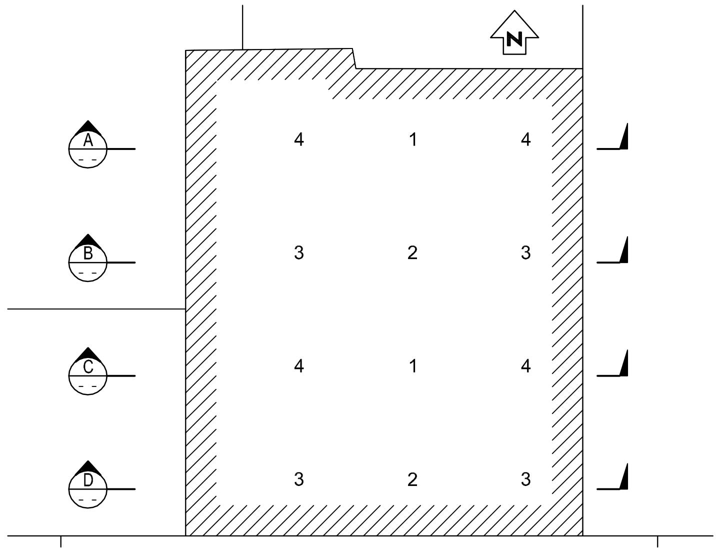
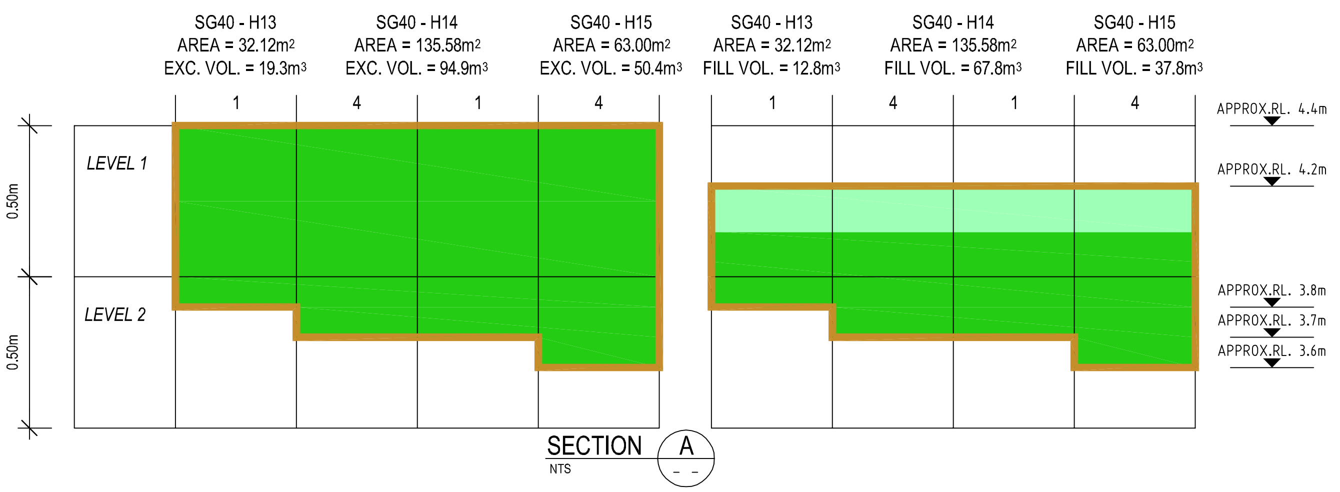
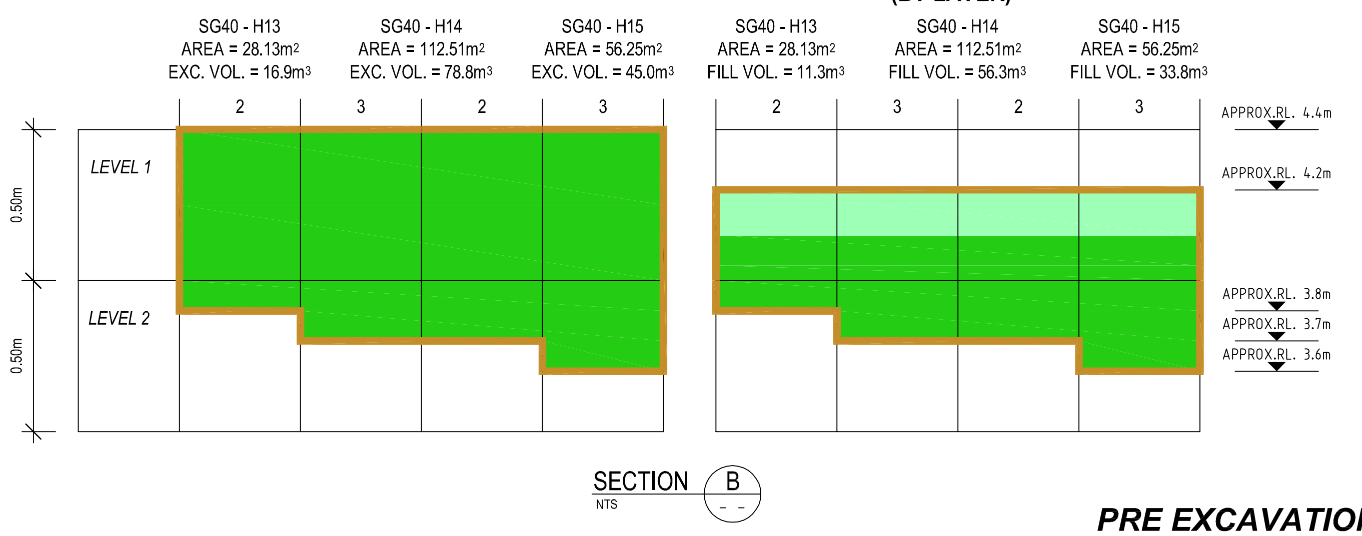


LOCATION OF SG40 (12 SEPTEMBER 2007)

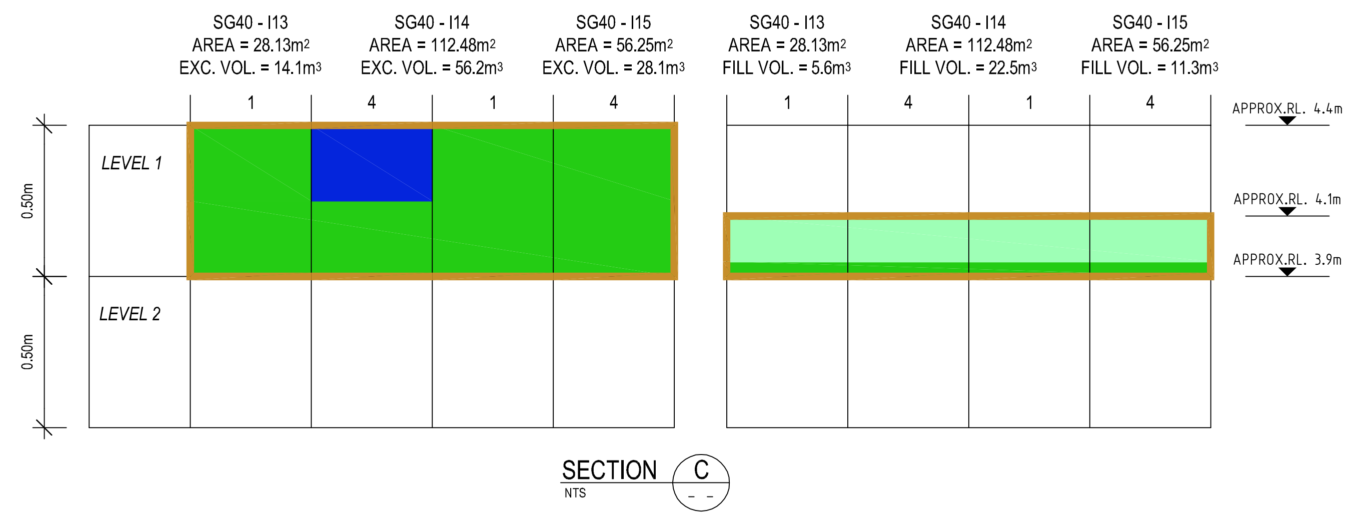
1:250



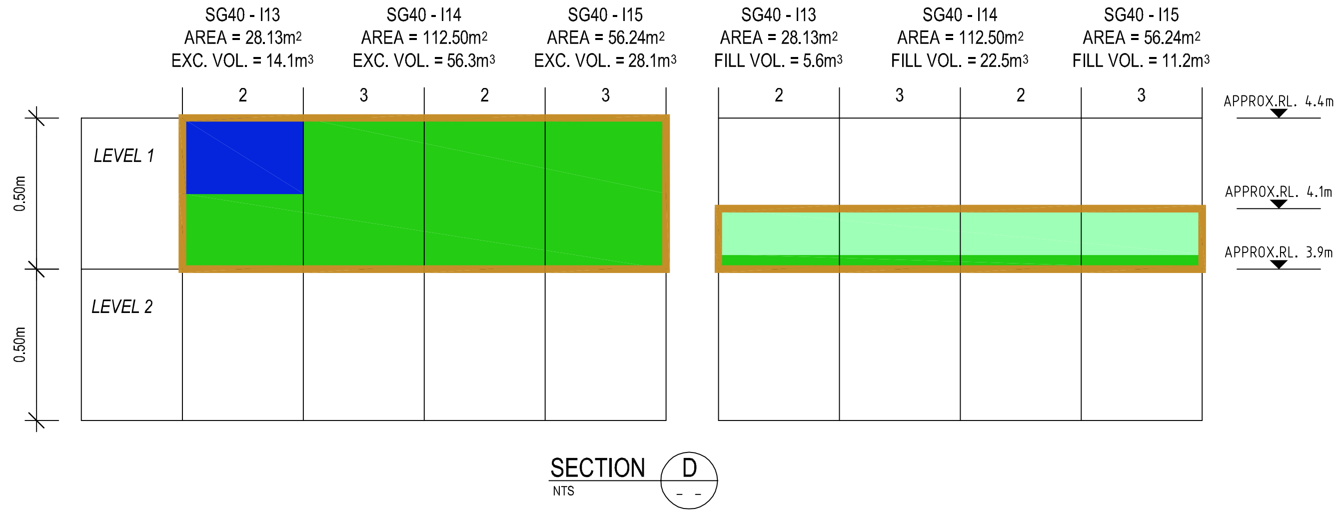
SCHEMATIC SECTION OF SG40



SCHEMATIC SECTION OF SG40



SCHEMATIC SECTION OF SG40



SCHEMATIC SECTION OF SG40

LEGEND

PRE EXCAVATION	BACKFILL FCC EAST
RESIDENTIAL DDX <5 OR A+D+(L/10) <3	TOPSOIL
COMMERCIAL DDX >5 OR A+D+(L/10) >3	RESIDENTIAL
EXCAVATION BOUNDARY	

NOTES:
1. DATA FROM THE OF G13, G14 &G15 IS IDENTICAL TO H13, H14 & H15.

REV	AMENDMENTS	CHECKED INITIAL	CHECKED DATE	APPROVED INITIAL	APPROVED DATE
AB	AS BUILT	GKB	03-08	PFR	03-08

Job No: 1724-03
TAB/DWG : W39 - SG40 / AB_WEST_20-41.dwg
SERVER : NELSON (NZNEL1S01)
XREFS : x_grid, x_gridtext, x_asbuilt WEST areas

FIELDBOOK	Name	Date
SURVEYED		
DESIGNED		
DRAWN	RMN	03-08
CHECKED	GKB	03-08
APPROVED		14-03-08

MWH

Ministry for the Environment
Manatū Mō Te Taiao

REMEDIATION OF THE FCC SITE
WEST FCC SITE

SG40 - PRE EXCAVATION vs BACKFILL

Status Stamp: AS BUILT
Date Stamp: 12 SEPTEMBER 2008
SCALES (A1) A3 = 1:500; A1=1:250
TDC Plan No. 6487/1s39 | Sheet No. W39 | Rev. AB

\\nznel1s01\projects\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg

DO NOT SCALE - IF IN DOUBT, ASK
ORIGINAL SIZE A1
12 September 2008 - 9:18am
P:\801\001724\03 MFE\Cad\As Built\AB_WEST_20-41.dwg