

4.4 Stage 2 - Remediation Works

4.4.1 Remediation in Troy Lane

The remediation strategy in Troy Lane is expected to comprise:

- Excavation of contaminated soil and fluids in Troy Lane;
- Backfilling of the excavation and reinstatement of the roadway;
- The contaminated material (soil and water) from the excavation will be removed for treatment on site or offsite and disposal to landfill or backfilled.

Troy Lane will need to be closed during the works and sewer pipes and power lines in Troy Lane will need to be relocated. Temporary access to gardens of residential houses bordering Troy Lane will also be required for movement of plant and equipment.

4.4.2 Removal of Underground Storage Tanks

There are at least two former kerosene USTs in the source area. These tanks will first be removed and any contaminated fluids or free phase liquids in the tank pits will be pumped out.

Following removal of two former kerosene USTs, free phase liquid drainage will commence. Depending on observations of conditions during tank removal it is anticipated that the procedure may include some or all of the following tasks:

- Drilling on a close grid to define the distribution of free phase liquids in the source area;
- Installation of a network of drainage wells and/or excavation of drainage trenches in areas of identified mobile free phase liquids;
- Collection of contaminated fluids and mobile free phase liquids in an on-site tank for periodic removal by a liquid waste disposal contractor.

4.4.3 Remediation of Source Area

Remediation of the source area will comprise the following elements:

- Removal of pavement and demolition of parts of site buildings above and surrounding the areas to be remediated;
- Progressive excavation of contaminated soil and fluids and stockpiling of the contaminated material inside site buildings;

- The contaminated soil may be treated on site by drying, crushing and landfilling to promote volatilisation and degradation of the chemicals, or removed and treated offsite prior to disposal to landfill;
- The excavated areas will be backfilled with treated soil or clean fill and compacted to the original ground levels.

If treatment is conducted on site, the operation will be performed inside a building which will be maintained under slight negative pressure. Air emissions will be treated prior to release to the atmosphere. It is expected that the excavation and remediation of Troy Lane and the source area will be conducted as a single continuous operation. However priority will be given to completing the works in Troy Lane as quickly as possible in order to minimise the period of closure of the road and effects on local residents.

4.4.4 Remediation of Other Areas

Depending on the results of further investigations outlined in Section 4.2, any necessary remediation of other areas of the site will be conducted in a manner similar to the source area. The programme will be detailed in the RAP.

4.5 Groundwater Plume Strategy

The observed presence of degradation products of the TCE in the groundwater (including dichloroethene and vinyl chloride) indicates that some natural degradation of TCE by micro-organisms is occurring in the subsurface at this site. Therefore a process of monitored natural attenuation (MNA) is potentially suitable for this site in combination with remediation of the source area. Further site characterisation, groundwater flow modelling, and risk assessment will be conducted (Stage 1) to assess whether the capacity of these natural processes to passively degrade and attenuate the contaminants in the plume, is sufficient to be protective of human health and the environment; and to assess acceptable residual concentrations of contaminants in the source area and plume. During and after remediation, groundwater monitoring will be conducted to monitor and assess the progress of migration, degradation and attenuation and over time. In the event that natural attenuation on its own is judged unlikely to be sufficient to degrade contaminants in the plume, additional remediation measures for the plume will be considered. Such measures may include:

- Groundwater pumping or vacuum extraction of residual contaminants;
- In-situ chemical oxidation of the residual contaminants;
- Enhanced bioremediation of the residual contaminants.

4.6 Environment, Health and Safety

A comprehensive Environmental Management Plan (EMP) and Health and Safety Plan (OH&S Plan) will be developed and implemented to ensure protection of site personnel, local residents and the environment during the remedial works.

Proposed Cleanup Target Levels

SECTION 5

It is proposed that site specific soil and groundwater cleanup targets for the offsite area, the source area and the groundwater plume will be established and agreed with EPA and Auditor at the end of Stage 1 when further investigations and risk assessments have been completed. The site specific targets will be based on site specific human health, environmental risk assessment and practicality of remediation considering the site conditions. In the absence of agreed site specific values, it is proposed that default target cleanup levels will be based on the following guidelines:

Soil:

VHCs - Dutch Intervention Levels, 1999 (Aliphatic Hydrocarbons)
TPH/BTEX – NSW EPA Service Station Guidelines

Metals – Guidelines for NSW Site Auditor Scheme, Commercial/Industrial
(NEHF F)

Groundwater:

VHCs - ANZECC 2000, Australian Water Quality Guidelines for the Protection
of Freshwater Ecosystems.
BTEX – NSW EPA Service Station Guidelines

Default target cleanup levels for the key contaminants are listed in Table 1.

TABLE 1 DEFAULT TARGET CLEANUP LEVELS

Contaminant	Soil (mg/kg)	Groundwater (mg/L)
Tetrachloroethene (PCE)	4	0.070
Trichloroethene (TCE)	60	0.330
1,1 Dichloroethene (DCE)	0.3	0.090
Vinyl Chloride	0.1	0.100
Benzene	1	0.30
Toluene	130	0.3
Ethylbenzene	50	0.14
Total Xylenes	25	0.38
TPH C6-C9	65	-
TPH C10-C36	1,000	-
Copper	5,000	-
Zinc	14,000	-
Cadmium	100	-
Nickel	3,000	-

Values

Site specific cleanup values will be determined by consideration of human health and environmental risks and "remediation to the extent practicable" according to the following procedures and criteria.

6.1 Human Health Risks

Human health risks will be assessed for residential use of the land north of Troy Lane, public use of Troy Lane itself, and approved industrial use of the site. The health risk assessment will be conducted in accordance with EPA guidelines and consider:

- Concentrations of the contaminants in the soil and groundwater offsite, in the source area and in the plume, and elsewhere on the site;
- Exposure to and toxicity of the contaminants by all relevant pathways including contact, ingestion, volatilisation and inhalation;
- Potential long term future migration of the chemicals and their expected degradation products in groundwater.

Subject to practicality, residual concentrations of the contaminants in soil and groundwater shall be reduced such that long term risks to human health are within acceptable levels both on-site and off-site.

6.2 Environmental Risks

Environmental risks will be assessed for aquatic ecosystems at the nearest downgradient aquatic receptor. The environmental risk assessment will be conducted in accordance with EPA/NEPM guidelines considering:

- Residual concentrations of the contaminants in the soil and groundwater offsite, in the source area and in the plume and elsewhere on the site;
- Potential long term future migration of the chemicals and their expected degradation products in groundwater between the source area and the nearest downgradient aquatic receptor;
- Toxicity of the contaminants to aquatic ecosystems by reference to the water quality guidelines listed in Table 1.

Groundwater migration and attenuation assessment shall be conducted using established and validated modelling software and modelling parameters based on site measurements or obtained from the scientific literature.

Subject to practicality, residual concentrations of the contaminants in soil and groundwater in the source area and plume shall be such that modelled future concentrations of contaminants in the groundwater at the nearest down gradient aquatic receptor do not exceed the values listed in Table 1.

Values

6.3 Remediation to the Extent Practicable

Remediation "to the extent practicable" shall be judged to have been achieved when the removal of contaminants in the source area and offsite will not achieve significant improvement in protection of human health or the environment and further remedial works are deemed impractical and/or uneconomical by the auditor and/or the EPA.

During and/or after remediation, a network of groundwater monitoring wells will be established. At minimum the network will comprise wells in the following locations:

- One in Troy Lane adjacent to the contaminated area;
- One in the source area;
- One in the contaminated groundwater plume downgradient of the source

Monitoring of the groundwater will continue at six monthly intervals for 24 months after completion of remediation or such other period as may be directed by EPA or auditor, to demonstrate that the remedial works have been effective in eliminating offsite migration of contamination and limiting downgradient migration of the plume to acceptable levels.

On completion of remediation, a site remediation and validation report will be prepared for review by a Site Auditor accredited under the Contaminated Land Management Act 1997. The Site Auditor will submit to the EPA, a Site Audit Statement and Summary Site Audit Report, certifying that the tasks as identified in this proposal and the RAP have been successfully completed and the objectives have been met.

The proposed timeframe indicating the estimated targets for commencement and completion of remediation activities is set out in Table 2.

TABLE 2 PROPOSED TIMEFRAME

Activity	Commence Within	Duration	Complete Within
1. Further investigation, risk assessment	2 months	4 months	6 months
2. Preparation of RAP and regulatory approvals	6 months	6 months	12 months
3. Offsite remediation – Troy Lane	12 months	6 months	18 months
4. UST removal & DNAPL drainage	12 months	6 months	18 months
5. Source and other areas remediation	18 months	18 months	36 months
6. Groundwater plume remediation	18 months	42 months	60 months
7. Groundwater monitoring	18 months	42 months	60 months

Note: The time schedule for commencement of remediation works (Tasks 3-7) is dependent on obtaining all necessary regulatory approvals and may need to be varied.

The contingency plan provides alternative options for remediation of the plume in the event that the proposed techniques are judged by EPA and/or Auditor to be ineffective or not sufficiently effective. The elements of the plan are as follows:

- Levels of contaminants in selected monitoring bores in the source area, in the groundwater plume, inside and outside the site boundary will be monitored at agreed intervals during and after the remediation programme;
- Within a period of 36 months from commencement, a determination will be made as to whether or not the level of contaminants in the soil and groundwater is likely to be reduced to below the target levels as defined by the procedures outlined in Sections 6 and 7 within an acceptable timeframe.
- If the level of contaminants is judged unlikely to be reduced to the agreed target levels within an acceptable timeframe, an alternative remediation strategy will be devised and implemented in consultation with the EPA as part of this VRRP. Possible alternative remedial options include
 - Intensification of groundwater pumping or vacuum extraction;
 - Intensification of in-situ chemical oxidation of the residual contaminants;
 - Intensification of bioremediation of the residual contaminants;
 - Selective excavation of areas of the plume in combination with the above.
- Within a period of 48 months from commencement a report will be provided to the EPA detailing:
 - the level of contamination still affecting the soil and groundwater, the proposed alternative remediation strategy (if required), the time frame for its implementation and the anticipated timeframe for it to reduce the level of contaminants to below the relevant target levels.