Appendix E

Water Management

Proposed Resource Recovery and Recycling Facility, Kyle Street Rutherford – Water Management

January 2006

Transpacific Industries Group Pty Ltd

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1. The Development

TPI proposes to build and operate a resource recovery and recycling facility at Rutherford to treat a wide range of industrial, commercial and domestic wastes including oily water wastes, wash waters, agricultural and mining operations, and other non-sewerable industrial wastes. The objective of the Facility is to provide environmental management services to support industry and public authorities throughout New South Wales. The Facility will incorporate the following units:

- administration
- recovery and recycling of lubricant oils from oily waters, waste oil and oil filters
- manufacture of lubricant oils using hydrogenation
- collection and treatment of non-sewerable industrial wastes
- a drum and packaged goods store (for Dangerous Goods and non-Dangerous Goods)
- industrial cleaning and protective coating services
- wastewater treatment plant
- laboratory
- transport vehicle depot and car park
- truck wash
- workshop.

Four treatment processes are to be established at the Facility:

- oil recovery and recycling including oily water treatment and waste oil recovery by chemical treatment and phase separation
- manufacture of re-refined base lubricant oils by hydrogenation
- treatment of non-sewerable industrial wastes by chemical fixation, stabilisation and solidification (CFS)
- wastewater treatment for effluent reuse and sewer discharge.

The wastewater treatment plant will be established to treat water generated from onsite activities and directly imported industrial wastewater.

Used oils will be recovered and recycled to lubricant specifications, aqueous-based industrial wastes will be treated to a level that poses negligible risk to the receiving environment, and waters from industrial wastes will be treated to a quality suitable for reuse on-site such as washdown water and use in soil conditioner manufacture. Alternatively waste water will be discharged to sewer.

1.1 Oily Water and Industrial Waste Water Treatment Plant

The oily water and industrial waste water treatment plant (WWTP) will treat industrial wastewaters generated from the various onsite processes and directly imported industrial wastewater to a level acceptable for effluent reuse or discharge to the sewer. The proposed maximum capacity of the plant will be 13 million litres per year. It is proposed that the WWTP will operate as required, seven days per week, 24 hours a day.

Process Inputs

Inputs into the Wastewater Treatment Plant include:

- oily waters collected from generators (following recovery of the oil phase)
- process and wash waters – from onsite activities including floor washdowns, truck washing, and vehicle and equipment maintenance. Plant wash waters will be collected within bunded areas and transferred from blind sumps to the WWTP
- CFS process water - from the CFS treatment
- condensate – from the hydrogenation process; and
- chemicals additives – possible chemicals that may be used include lime, polyelectrolytes and phase separating chemicals such as ferric chloride and hydrochloric acid.

Waste Processing Description

The Waste Water Treatment Plant process will consist of:

- phase separation using chemical additives - utilised to destabilise emulsions and separate oils from water
- coagulation, flocculation and precipitation
- settling and clarification
- filtration
- treated water storage tanks to ensure suitability for discharge to sewer or effluent reuse.

Process Outputs

Outputs from the Waste Water Treatment Plant include:

- oil from phase separation – recovered for recycling
- sludge and solids – dewatered and transferred to the CFS Plant for further treatment; and
- treated and filtered water phase – stored and, following analysis, transferred for effluent reuse or discharge to sewer in accordance with Hunter Water criteria.

1.2 Waste Oil Recovery

Waste oil will be collected from generators by road tankers for consolidation and storage at the Facility prior to being transferred to Transpacific Industries 're-refinery in Sydney for recycling. During storage, any water separating from the oil phase will be decanted and transferred to the WWTP for treatment.

Waste oil recovered from the Wastewater Treatment Plant and the CFS process will be transferred to the Waste Oil Storage Tanks.

Used oil filters will be crushed and/or shredded to recover the residual oil. The metal wastes will be forwarded to scrap metal merchants for recycling.

All storage and processing areas, and equipment are to be installed within sealed, imperviously bunded areas fitted with blind sumps to prevent loss of product.

1.3 Oil Hydrogenation

The treatment of waste oil is to be completed at the Facility as two separate activities:

- the collection and initial dewatering of oily wastes and waste oils; and
- the hydrogenation of re-refined mineral oils to base lube oil specifications.

1.4 Chemical Fixation, Stabilisation and Solidification (CFS) of Non-sewerable Industrial Wastes

The CFS process is used for non-sewerable liquid waste and sludges to reduce the hazard potential of wastes by converting potentially hazardous contaminants to the least soluble, least mobile or least toxic form. CFS involves the addition of solidifying agents that mechanically binds the contaminants to produce a soil like product resistant to leaching or breakdown.

1.5 Dangerous Goods Storage

A Dangerous Goods store for Classes 3, 5, 6, 8 and 9 raw materials and wastes is to be established. The storage area will be within an imperviously bunded concrete area fitted with a blind sump.

The Facility will also operate as a transfer station for used cooking oils collected from the NSW region. The cooking oils will be stored in drums within a bunded, purpose built drum store that drains to a blind sump before shipment to TPI's used cooking oil reprocessing plant in Brisbane.

2. Existing Environment

2.1 Geology

The 1:250,000 Singleton Regional Geology Sheet (Geological Survey of New South Wales, 1966) indicates that the site is underlain by alluvium and the Permian Rutherford Formation. The Rutherford Formation consists of mudstone, conglomeritic sandstone, sandstone and shale.

From site investigation (ERM, 2001) the geology below the site was found to be predominantly a clayey-silt alluvium to a depth of approximately 2m. In addition a surficial ash fill to a depth of 0.4 m was also encountered in 29 of 56 pits across the site and a unit of silty sand fill approximately 2m thick was found adjacent to the eastern boundary (an area referred to as the “ash disposal area”). Furthermore, at two locations across the site weathered sandstone was reported to be encountered at 1.5m below ground level.

Lithology encountered during more recent drilling works (PB, 2005) consisted of gravely clayey sand fill to a depth of between 0.8m and 1.0mBGL overlying alluvial sandy clays to at least 7.0mBGL. Below 7m the lithology was coarse sand. No bedrock was encountered. A generalised summary of the subsurface geological profile is presented in Table 1 below.

Table 1 Generalised Stratigraphic Log

Depth (mBGL)	Lithology
0.0-0.7mBGL	Fill – Gravelly Clayey SAND, fine to coarse, grey/brown, gravel fine to medium, low plasticity fines.
0.7-7.0mBGL	ALLUVIAL: Sandy CLAY, dark brown, fine-coarse grained sand, with some fine to coarse grained gravels.
7.0-20.0mBGL(end of hole)	ALLUVIAL: gravelly SAND, fine to coarse grained, orange/brown, fine to coarse grained gravels and low plasticity fines.

Notes: mBGL (metres below ground level)

2.2 Topography

The site is at an approximate elevation of 22-23mAHD. There is a gentle slope across the site towards the south-west.

2.3 Surface Water

2.3.1 Hydrology

Surface water runoff from the site flows to a wide trapezoidal concrete drain that runs along the western boundary. This drain collects water from other properties on the Racecourse Business Park (and the New England Highway). For much of the time there is little or no flow in the drain and water stands and stagnates. However, following periods of rainfall it may overflow and discharge into the headwaters of Stony Creek approximately 800m to the south of the site. Stony Creek flows 4km eastwards to discharge into an area of low lying swampy ground (Wentworth Swamp) south of Telarah. This in turn drains into Fishery Creek (also known as Swamp Creek) which drains after approximately 3km into Wallis Creek (combining with effluent from the Farley Waste Water Treatment Plant). Wallis Creek flows approximately a further 5km to drain into the Hunter River east of Maitland. The distance from the site to the Hunter River along the channel of the tributaries is therefore approximately 13 km.

2.3.2 Quality

The quality of the water (sampled from the drain above the point of site discharge) was tested by PB on 23 June 2005. The results of the field and laboratory analysis are shown below, alongside the appropriate water quality objectives. The water quality objectives (WQO) for the Hunter River have been published by DEC using data from ANZECC (1992). As ANZECC (1992) has been superseded by ANZECC (2000) data from the more recent document have been used as applicable. Both sets of data are derived from water quality monitoring carried out in NSW by the Department of Land and Water Conservation (DLWC now Department of Natural Resources) and are the 80th percentile of the dataset. Therefore, they are intended to be trigger values above which the water quality identifying the higher level of the parameter in question (i.e. 20 % of values would lie above this trigger value).

Table 2 documents the results of field and laboratory testing conducted on water samples collected on 23 June 2005. These results are compared against the water quality objectives (WQO) for the Hunter River.

Table 2 Water quality testing results and corresponding water quality objectives

	23 June 2005 (μg/L unless shown)	WQO Lowland River (μg/L unless shown)
Total phosphorous	**80**	50
Total nitrogen	500	600
Chlorophyll-a	**14**	3
NOx as N	**50**	5
Salinity	588 μS/cm	300-900[1]
Dissolved oxygen	**30%** (3.2 mg/L)	60%-120%
pH	**5.4**	6.5 – 9.0
Temperature	11.4 C	-

Notes: [1] Salinity WQO for an "unspecified tributary" of the Hunter River (from Hunter River Management Committee). Figures in **bold** indicate concentrations above the WQO

With the necessary caveat that a single sample cannot determine the normal water quality of the receiving waters it appears that the quality of the water in the drain is likely to be generally poor. The dissolved oxygen is low (there was little or no through-flow on the day of sampling) and with a rise in temperature (the sample was taken on a cold day) the oxygen saturation would be lower still. The levels of nutrients (NO_2 and NO_3 and phosphorous) are above the 80th-percentile trigger value and the chlorophyll-a is high. Using the chlorophyll-a alone as an indicator of the trophic status of the water is an indication that potential eutrophic conditions exist (see the following table from ANZECC 2000).

Table 3 Annual mean and maximum chlorophyll-a concentration for reservoirs and lakes

Annual Mean Chlorophyll-a (μg/L)	Annual Maximum Chlorophyll-a (μg/L)	Trophic Status
<2	<5	Oligotrophic, aesthetically pleasing, very low phytoplankton levels
2-5	5-15	Mesotrophic, some algal turbidity
5-15	15-40	Eutrophic, obvious algal turbidity and oxygen depletion
>5	>40	Hyper-eutrophic, extensive algal turbidity, loss of amenity, serious oxygen depletion

No previous water quality monitoring was known at the time of reporting.

2.4 Groundwater

2.4.1 Hydrology

During August 2005 PB was engaged to install and monitor one (1) deep and eight (8) shallow wells across the site.

The groundwater level in monitoring well MW01 measured in the underlying alluvial sand was 12.75mbgl (metres below ground). No groundwater was encountered in the shallow fill.

The groundwater gradient in the underlying alluvium could not be determined with the single deep well currently available on site (MW01). Given the lithology of fine to coarse grained gravely sand the likely hydraulic conductivity is between 10^{-2} m/s and 10^{-4} m/s (Freeze and Cherry 1979). If a groundwater gradient the same as the surface gradient (0.0025) is assumed Groundwater flow beneath the site is likely to be very slow 0.02 m/d and 2 m/d.

There are no visible areas of groundwater recharge or discharge on the site.

2.4.2 Quality

Groundwater in the alluvial sand is protected from surface contamination by overlying sandy clay alluvium. The vulnerability of this groundwater is therefore considered to be low. However groundwater analysis of extracted samples has shown that the groundwater has been impacted by contaminants.

The following table indicates analysis above detection limits in MW01 and compares this with the ANZECC trigger values (where available).

Table 4 Groundwater sample results (MW01)

Analyte	Concentration in MW01 (ug/L)	ANZECC 2000 Guidelines 95% species Level of Protection, Trigger Values for Freshwater
TPH (C_6-C_9)	160	n/a
TPH (C_{10}-C_{14})	100	n/a
TPH (C_{15}-C_{28})	276	n/a
Total TPH	536	n/a
Cadmium	0.2	0.2
Cobalt	40	90
Chromium	<1	1
Copper	3	1.4
Manganese	1,026	1,900
Nickel	**47**	11
Lead	<1	3.4
Strontium	892	n/a
Zinc	**32**	8
Mercury	<1	0.6
Iron	160	300
Total Nitrogen	**1,000**	500
Total Phosphorus	**300**	50
Chloroform	6	370
Tetrachloroethene	**78**	70
Conductivity at 25^0C	4,300(us/cm)	n/a

Notes:
n/a No investigation levels available
Figures in **bold** indicate analysis above trigger value

Groundwater impacts detected at MW01 consist of C_6-C_{28} fractions, which could indicate fuel and oil impacts. Groundwater impacts of tetrachloroethene (PCE) and chloroform could originate from the textile manufacturing or ammunition manufacturing processes that were formerly carried out on this and/or surrounding sites. Further monitoring wells are to be installed to determine the extent of the contamination of PCE and chloroform.

2.4.3 Summary

The following summarises the key results of the groundwater monitoring undertaken at the site on 24 August 2005:

- groundwater was encountered at the site at 12.75mBGL
- field parameters suggest the groundwater is slightly acidic to neutral, moderately saline, with low dissolved oxygen and a low oxidising potential

- the shallow monitoring wells (MW02-MW07), installed to target a suspected perched groundwater table within the fill/ash layer, remained dry after installation. It is possible however that the wells may produce groundwater following a heavy rain event
- TPH (C_6-C_{28})was detected in monitoring wells MW01 at 536µg/L however there are currently no applicable guidelines for TPH in waters
- copper and nickel were detected marginally above guideline value in MW01 all other metals were below detection or below guideline level except strontium. There is no guideline level for strontium.
- chloroform was detected in low levels of 6µg/L and tetrachloroethene was found at 78µg/L. Tetrachloroethene (also known as tetrachloroethylene, perchlorethylene or PCE) and chloroform are used for dry cleaning of fabric and metal degreasing and there is a good chance that they originated from this and/or similar sites considering their previous usage.

2.5 Climate

The Hunter Valley generally has a warm temperate climate with warm to hot summers and mild winters. The nearest currently monitored rainfall station (with a record beginning in 1997) is located at Maitland Visitor Centre (Maitland VC) which is approximately 6km east at an elevation of 5mAHD. The nearest station measuring potential evaporation (PE) with records dated from 1967 is located at the Tocal Agricultural College (site referred to as "Paterson AWS" – an Automatic Weather Station) which is 12km north-east at an elevation of 30mAHD.

2.5.1 Annual Rainfall and Potential Evaporation

Annual rainfall and potential evaporation (PE) data for the period 1998 – 2004 is summarised in the following table. Records from Maitland VC started mid way through 1997 so this year is excluded.

Table 5 Annual Rainfall and Potential Evaporation (1998 - 2004)

Year	Total Annual Rainfall Maitland VC (mm/a)	Total Annual PE Paterson AWS (mm/a)
1998	965	1,488
1999	840	1,243
2000	791	1,449
2001	791	1,538
2002	738	1,632
2003	657	1,413
2004	838	1,502
Mean (1997-2004)	803	1,460

This data is illustrated in the following figure.

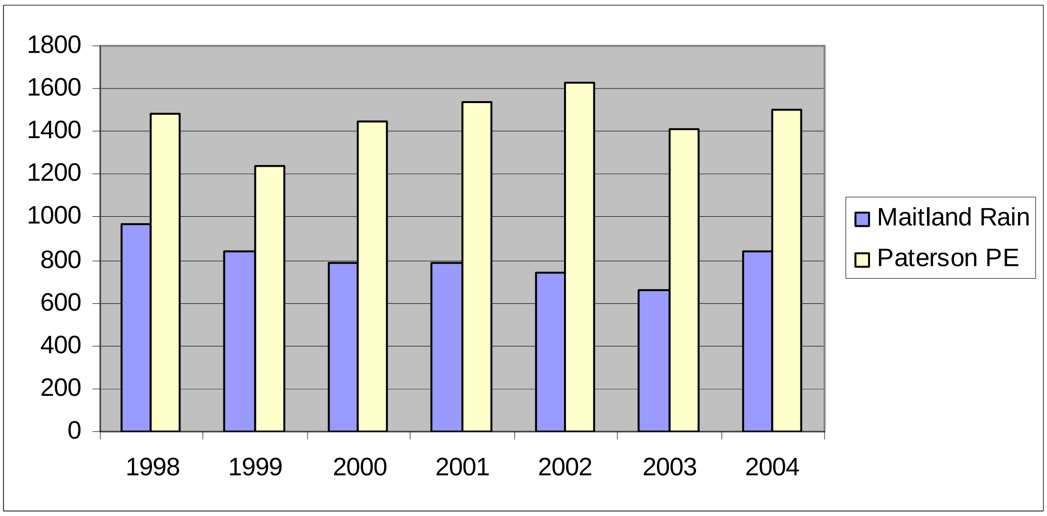

Figure 1 Annual Rainfall and Potential Evaporation (1998-2004)

The data shows that in all years there is significantly more evaporation than rainfall.

Seven complete year's data was determined to be insufficient for statistical analysis and frequency distribution. Therefore, the annual rainfall from Paterson AWS (1998-2004) was correlated with the annual rainfall at Maitland VC (1998-2004). This correlation was then used to synthesise the rainfall at Maitland VC between 1967-1997 using annual rainfall data from Paterson and this was combined with the recorded data at Maitland VC. A statistical frequency analysis was applied to this combined data for Maitland VC and the resultant distribution (using 38 years data) used to determine "wet" and "dry" years. A wet year for the purposes of this report is defined at the 90th percentile whereas a dry year is defined as the 10th percentile. The results were as follows:

Table 6 Annual Rainfall Statistics – Maitland VC 1967 - 2004

Percentile (1967-2004)	Wet/dry	Annual Rainfall (mm)	Comparable Year (1998-2004)	Comparable Year Rainfall
10	Dry	687	2003	657
50	Normal	799	2000	771
90	Wet	893	1998	965

The values for these "wet", "normal" and "dry" years where not much different from the recorded data for 1998, 2000 and 2003 respectively. Hence for the calculation of water balance later in this report these values are used, this enabled a realistic value of potential evaporation.

2.5.2 Monthly Rainfall and Potential Evaporation

To understand rainfall and potential evaporation distribution it is useful to examine monthly rainfall and potential evaporation. For the purposes of easy comparison and convenience, and because of a greater period of record (1902-1993) it was decided for this purpose to use a statistical summary provided by the Bureau of Meteorology (BoM) for the "East Maitland" site (discontinued). This data (obtained from the BoM. website) is illustrated below in Figure 2 Monthly Rainfall and Potential Evaporation.

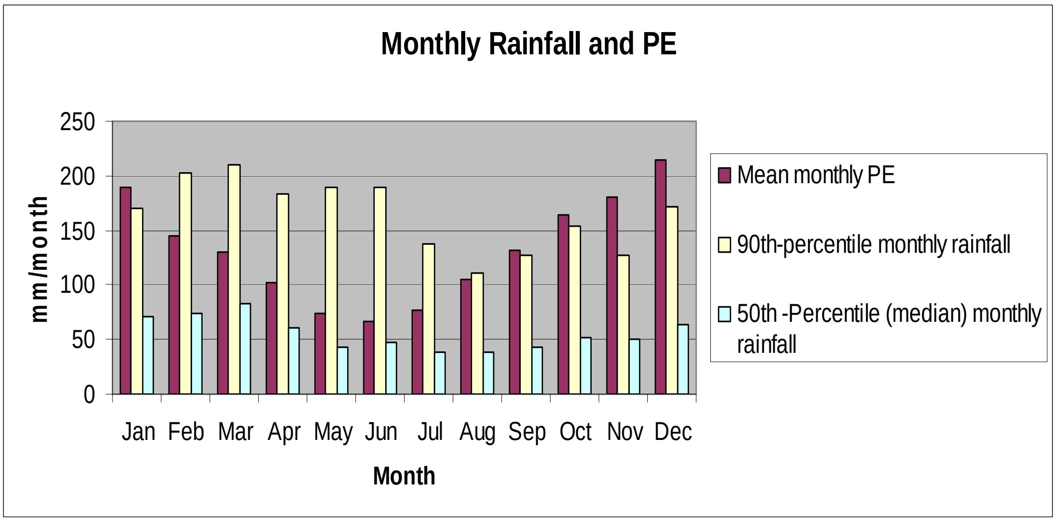

Figure 2 Monthly Rainfall and Potential Evaporation

The significant feature of this graph is that it shows that on average (as indicated by the 50th-percentile), and apart from two months in winter, there is significantly more monthly potential evaporation than monthly rainfall. However, in a wet year (indicated by the 90th-percentile) then for half the year (between February and August) rainfall is significantly greater than PE. The greatest disparity between monthly rainfall and PE is in the month of June when rainfall could be greater than twice PE. During such months there will be significant excess rainfall runoff, which must either be stored and used on site or discharged to surface watercourse or sewer.

2.5.3 Daily Rainfall and Potential Evaporation

Daily rainfall and potential evaporation data is summarised in the following table. Data (obtained from the Bureau of Meteorology) from both Maitland VC and Paterson AWS stations has been used.

Table 7 Daily Rainfall and Potential Evaporation

	Rainfall (mm/d)*			PE (mm/d)*	
Station Name	**Maitland VC**	**Paterson AWS**	**Paterson AWS**	**Paterson AWS**	**Paterson AWS**
Period of Record	**1997-2005**	**1967-2005**	**1997-2005**	**1967-2005**	**1997-2005**
Maximum Daily	104	194	143	0	0
Minimum Daily	0	0	0	21	21
Mean Daily	2	3	3	4	4
10th Percentile	0	0	0	1	1
50th Percentile	0	0	0	4	4
90th Percentile	6	7	6	8	8

	Rainfall (mm/d)*			PE (mm/d)*	
Station Name	**Maitland VC**	**Paterson AWS**	**Paterson AWS**	**Paterson AWS**	**Paterson AWS**
Period of Record	**1997-2005**	**1967-2005**	**1997-2005**	**1967-2005**	**1997-2005**
95th Percentile	14	15	16	10	9
99th Percentile	32	40	39	13	13

(*Data rounded to nearest mm)

The statistics above, extracted from the daily data (up to June 2005) for rainfall and PE provides a useful picture of the pattern of daily rainfall and PE distribution. It is possible to say for example that on more than 50% of days no rain would normally be expected whereas on 95% of days no "significant" rainfall would be expected ("significant" rainfall defined as 15mm/d for these purposes). Furthermore, PE has much less statistical variability with only 4mm/d difference between the median (the 50th-percentile) value and the 90th-percentile. Although this daily data analysis is useful in providing qualitative interpretation on the daily rainfall and PE distribution, no further use is made of this data in this report. For the purposes of calculating a water balance, annual data will be used and for stormwater runoff calculation, intensity-frequency-duration (IFD) data will be used. Daily data is however useful for detailed water balance modelling, but this is outside the scope of this report.

2.6 Flood Plain

According to Maitland City Council Flood Management Plan (2000) the site is not within:

- the "declared" flood plain
- the Hunter River "Floodway"
- the 1% (1 in 100 year) floodplain; or
- the area flooded in February 1955.

Reference to the Flood Management Plan shows that the 1% floodplain boundary for the Hunter River north of the proposed site is along the 20mAHD contour (the closest point is 1.5km north, beyond the airfield). The 1% floodplain boundary in the Stony Creek/Fishery Creek catchment is along the 10 mAHD contour which is located south of Telarah, approximately 4 km east of the site.

Therefore, the site is not considered at risk from flooding of the Hunter River or Stony Creek. Furthermore, localised flooding of the site is not considered likely due to the large capacity of the drain that runs along the west boundary.

2.7 Town Water Supply

Town water supply is provided by Hunter Water. Most water is sourced from Chichester Dam and is stored locally in the Rutherford Reservoir. An easement along the southern boundary of the site contains the Hunter Water main.

2.8 Sewerage

The site is connected to mains sewerage which runs to the Farley Waste Water Treatment plant approximately 3km south east of the site. This WWTP currently services a population of 24,000 but has a design capacity of 50,000 EP (equivalent persons). It services Telarah, Rutherford, Aberglassyn and Gilleston Heights and parts of Maitland as well as receiving septic effluent and commercial wastes via road tankers from neighbouring areas. Farley WWTP has recently received improvement expenditure of $350,000.

The Farley WWTP is located off Owl Pen Lane and consists of an extended aeration, activated sludge process which was commissioned in 1983. This treatment process is vulnerable to discharges of fats, oils, greases, petrol, paints, thinners and pesticides to sewer which can all have a detrimental impact on the treatment process.

3. Impact/Mitigation

3.1 Oily Water and Industrial Waste Water Treatment Plant

3.1.1 Water Supply

Apart from cleaning activities no additional water supply is required for the waste water treatment plant to operate.

3.1.2 Runoff

All activities are to be undertaken on sealed and bunded concrete areas fitted with blind sumps to prevent any contact with the external environment. Gradients of process and bunded areas will be towards blind sumps which will be periodically pumped out.

Sump drainage and any wash waters will be recovered and treated on-site.

Roof runoff water from this area will discharge via a first flush interceptor to be collected and reused on site where possible.

3.1.3 Surface Water

All activities, including transfer processes, are to be undertaken within sealed and bunded concrete areas fitted with blind sumps. There will be no discharges from the WWTP to surface water and hence zero impact on surface water quality is expected.

3.1.4 Groundwater

All activities, including transfer processes, are to be undertaken within sealed and bunded concrete areas fitted with blind sumps. No impact on groundwater is therefore expected.

3.2 Oil Hydrogenation

3.2.1 Water Supply

Water supply is required for cooling and heating the oil hydrogenation plant to operate, as well as cleaning operations.

3.2.2 Runoff

The hydrogenation process will be conducted within sealed and bunded concrete areas that drain to blind sumps.

Any wash waters will be recovered and treated on-site.

Roof runoff water from the control room and amenities building in this area will discharge via a first flush interceptor to be collected and reused on site where possible.

3.2.3 Surface Water Quality

There will be no discharges to surface water from hydrogenation plant and hence no impact on surface water quality is expected. Waste waters generated by the hydrogenation operation will be discharged to the waste water treatment plant.

3.2.4 Groundwater

As indicated above, the hydrogenation operation will be undertaken within a sealed and bunded concrete area that drains to a blind sump. No impact on groundwater is therefore expected.

3.3 Chemical Fixation, Stabilisation and Solidification (CFS) of Non-sewerable Industrial Wastes

3.3.1 Water Supply

Water supply is required for the CFS plant for cleaning waters, fire water and safety showers. Waste will be non-sewerable liquid wastes and sludges and therefore no additional liquid is required for the CFS process.

3.3.2 Runoff

All activities are to be undertaken under cover on a sealed and bunded concrete area that drains to a blind sump to prevent any contact with the external environment. Gradients of process and bunded areas will be towards blind sumps which will be periodically pumped out.

Sump drainage and any wash waters will be recovered and treated on-site.

Roof runoff water from this area will discharge via a first flush interceptor to be collected and reused on site where possible.

3.3.3 Surface Water Quality

There will be no discharges to surface water from the CFS process and hence no impact on surface water quality is expected. Waste waters will be discharged to the waste water treatment plant.

3.3.4 Groundwater

As indicated above, the CFS process will be undertaken undercover completely within sealed and bunded concrete area fitted with blind sumps. No impact on groundwater is therefore expected.

3.4 Dangerous Goods Storage

3.4.1 Water Supply

Apart from cleaning activities no additional water supply is required for the Dangerous Goods storage area to operate.

3.4.2 Runoff

All activities including loading and unloading are to be undertaken under cover on a sealed and bunded concrete area that drains to a blind sump to prevent any contact with the external environment. Gradients of process and bunded areas will be towards blind sumps which will be periodically pumped out.

Sump drainage and any wash waters will be recovered and treated on-site.

Roof runoff water from this area will discharge via a first flush interceptor to be collected and reused on site where possible.

3.4.3 Surface Water Quality

There will be no discharges from inside the dangerous goods storage area and hence zero impact on surface water quality is expected.

3.4.4 Groundwater

As indicated above, the storage operation will be undertaken undercover completely within a sealed and bunded concrete area draining to a blind sump. No impact on groundwater is therefore expected.

3.5 Transport Vehicle Depot and Car Park

The Facility will operate as a parking and transit depot for TPI's large transport fleet, associated with the collection and road transfer of liquid materials.

3.5.1 Water Supply

A water supply will be required for the cleaning of commercial vehicles. This supply will be primarily sourced from the reuse of collected roof runoff and treated effluent from the waste water treatment plant supplemented (as required) by clean potable water.

3.5.2 Runoff

Truck cleaning operations will be undertaken in a sealed and bunded concrete wash down area that drains to a blind sump which will fully contain dirty water. This water will be treated in the waste water treatment plant prior to discharge to sewer.

The bitumen entrance and car park drains into a central drain via a fist flush interceptor and oil interceptor which is piped to a grassy area to the south of the site to discharges into the surface watercourse drain.

3.5.3 Surface Water Quality

To minimise the chance of impact on surface water quality the car park run off will be discharged via a first flush interceptor and oil interceptor to a grassy swale area to the south of the site. From there the surface water drain that runs along the west of the site.

3.5.4 Groundwater

The vehicle depot and car park will be entirely covered by an impermeable surface (bitumen or concrete) and hence there is negligible potential for discharge to groundwater.

3.6 Other Areas

3.6.1 Roadways

Roadways around the site are to be constructed of crushed and compacted rock or gravel aggregate. Drainage from the road surfaces will be directed into grassed swales constructed alongside the road. These swales shall run into detention ponds. The location and size of these detention ponds will be specified in the Stormwater Management Plan which will be produced once the final site layout is established. The specification and management of these ponds will be in accordance with the “Blue Book” (Landcom, 2004 “Managing Urban Stormwater: Soils and Construction”).

These areas will be constructed so that runoff will be drained to one or both sides of the roadway. Runoff should be allowed to accumulate in swales and allowed to infiltrate and evaporate. These swales will be constructed at an early stage in the construction phase.

The remaining areas not covered by building, car park and roadways will retain existing vegetation. No discharges from the remainder of the site will be directed to these areas, unless that forms part of a secondary treatment process for runoff from the car parking areas. Any of these areas disturbed during the construction process will be reinstated to prevent sediment erosion.

3.7 During Construction

3.7.1 Sediment and Erosion Control

Swales (as described above) and sediment ponds and traps will be used to retain coarse suspended particles. Sediment and erosion control will be carried out according to the “Blue Book” (Landcom, 2004 “Managing Urban Stormwater: Soils and Construction”). Sediment traps are easy to construct, relatively inexpensive and easily moved as construction work proceeds. The most common forms of sediment traps are straw bales and sediment fences using geotextile fabrics, other effective sediment traps utilise bales of composted material. The application of loose composted material to an exposed surface is also a very effective measure to prevent soil erosion at source. All these measures are likely to be used to control runoff erosion and sediment migration on the site during the construction phase.

3.8 Fire and Emergency Services Water

The proposed building will be categorised in accordance with the Building Code of Australia (2005) as a class 7/8 building. The fire fighting system specifications for this building class are determined in accordance with AS2419.1 – 1994 (for fire hydrants) and AS2118.1, 1995 (for sprinklers).

4. Water Management Plan

4.1 Stormwater

A Stormwater Management Plan will be developed for the site which will include:

- potential environmental impacts as a result of stormwater contamination
- operational procedures to manage those impacts
- emergency response procedures for spills or loss of containment
- monitoring of the stormwater management system and inputs
- checking and maintenance programme to ensure the efficiency of the system
- provision of training to operational staff in the importance of stormwater management and in operation of the selected stormwater management system
- continual review and opportunities for improvement; and
- regular audits on the Stormwater Management Plan and containment system.

The following Intensity–Frequency-Duration (IFD) dataset have been used to calculate the design storm runoff (ARR 1997).

Table 8 Extract from IFD Table for Maitland

	Average Return Interval (ARI)						
Event Duration	1yr	2 yr	5 yr	**10 yr**	20 yr	50 yr	100yr
	Rainfall intensity (mm/hour)						
1hr	23.22	29.9	38.9	44.25	51.3	60.64	67.84
24hr	3.29	4.25	5.59	**6.4**	7.45	8.86	9.95

To calculate the design storm rainfall (a 1 in 10 year, 24 hour event the rainfall intensity (6.4mm) from the above table is multiplied by the event duration (24 hours). The design storm rainfall is therefore 153.6 mm. The following table calculates the maximum potential run off from the site sub catchments given the catchments areas indicated below.

Table 9 Design Storm Potential Runoff

Site Sub Catchments	Area (m^{2})	Design storm maximum Runoff (m^3)
Roof	15,000	2,310
Roadways and other hardstand	7,500	1,155
Grassed areas	27,500	4,235
Lagoon area	2,500	385
Car park and hard surface roadways	12,500	1,925

Site Sub Catchments	Area (m^2)	Design storm maximum Runoff (m^3)
Total	**65,000**	**10,010**

4.2 Water Balance

4.2.1 Input Data

A water balance has been carried out using annual rainfall and evaporation data from Maitland VC for a "dry", "normal" and "wet" year. Based upon statistical analysis of the rainfall data, as discussed previously, the years 2003, 2000 and 1998 respectively have been chosen for this water balance calculation.

Table 10 Data Used for Preliminary Water Balance Calculations

Wet/Dry/Normal Rainfall Year	Year	Rainfall (mm)	Potential Evaporation
Dry	2003	657	1,413
Normal	2000	771	1,449
Wet	1998	965	1,488

The following table shows approximate areas calculated for the preliminary site water balance.

Table 11 Site Sub Catchment Areas

Sub Catchments	Area m^2
Roof	15,000
Roadways and other hardstand	7,500
Grassed areas	27,500
Lagoon area	2,500
Car park and hard surface roadways	12,500
Total	**65,000**

4.2.2 Sub Catchment Annual Water Balance

Table 12 Roof Catchment Area Annual Water Balance

	Dry	Normal	Wet
Area (m^2)	15,000	15,000	15,000
Rainfall (m^3)	9,900	11,600	14,500
PE (m^3)	21,200	21,700	22,300
Runoff	100%	100%	100%
Storage	100%	100%	100%
Storage loss	3,500	3,600	3,700
Reuse	6,400	8,000	10,800

	Dry	Normal	Wet
Discharge to surface water	0%	0%	0%

Roof runoff will be directed to storage and reused where possible on site.

Table 13 Roadways Catchment Area Annual Water Balance

	Dry	Normal	Wet
Area (m^2)	7500	7500	7500
Rainfall (m^3)	4900	5800	7200
PE (m^3)	10600	10900	11200
Runoff and infiltration %	100%	100%	100%
Storage %	100%	100%	100%
Storage loss (evaporation and infiltration)	100%	100%	100%
Reuse	0%	0%	0%
Discharge to surface water	0%	0%	0%

Runoff from unsealed site roadways will be contained on site.

Table 14 Car Park Catchment Area Annual Water Balance

	Dry	Normal	Wet
Area (m^2)	12500	12500	12500
Rainfall (m^3)	8200	9600	12100
PE (m^3)	17700	18100	18600
Runoff %	100%	100%	100%
Storage %	0%	0%	0%
Storage loss %	0%	0%	0%
Reuse %	0%	0%	0%
Discharge to surface water %	100%	100%	100%

Runoff from car park areas will be discharged to surface water course off site.

4.3 Reuse of Water

In conformance with recognised best practice and DEC guidelines the maximum reuse of water will be achieved through collection and storage of roof runoff. An anticipated annual volume of 9,900 m^3 to 14,500 m^3 will be diverted to the on-site lined lagoon. A first flush system (in accordance with DEC guidelines) will be included to ensure the highest possible quality of water is stored in this way. This water will be then used for vehicle washing, irrigation and over uses on the site where non-potable water can be used.

4.4 Discharges to Sewer

The only discharges to sewer will be from:

- the treated effluent from the waste water treatment plant
- any excess leachate collected following a storm event
- discharges from administration and laboratory buildings.

Testing of effluent or leachate will be undertaken prior to any discharge to ensure that the discharge is compliant with the consent to discharge trade waste to sewer.

4.5 Discharges to Surface Water

The only discharge to surface water will be:

- runoff from the car park area via a first-flush system (in accordance with DEC guidelines), and oil water interceptor; and
- excess roof runoff, should the nominated storage capacity be in danger of being exceeded.

4.6 Discharges to Groundwater

There will be no discharges to groundwater.

5. Monitoring Programme

5.1 Groundwater

As well as the existing monitoring well (MW01) into the underlying alluvial sand, two additional groundwater monitoring boreholes will be established around the perimeter of the site. Regular monitoring will be undertaken of the groundwater in these three well and the groundwater will be tested for:

- pH
- dissolved oxygen
- electrical conductivity
- nutrients (Total N and Total P)
- volatile organics (including PCE and chloroform)
- total petroleum hydrocarbons (TPH)
- metals

5.2 Surface Water

Surface water will be sampled quarterly at the point of discharge and tested for:

- pH
- electrical conductivity
- nutrients (Total N and Total P)
- volatile organics (including PCE and chloroform)
- total petroleum hydrocarbons (TPH)
- dissolved oxygen
- chlorophyll-a (as an indicator of potential eutrophication)
- total petroleum hydrocarbons (TPH)
- metals

5.3 Leachate

Monitoring of leachate will be carried out prior to any discharge to sewer. Analysis of leachate samples will be dependant upon the discharge conditions agreed with Hunter Water.

6. References

Australian Standards AS2419.1:1994, Fire Hydrant Installations.

Australian Building Codes Board, 2005, Building Code of Australia

Australian Standards: AS2118.1, 1995, Automatic Fire Sprinkler Systems.

Australian Rainfall & Runoff - A Guide to Flood Estimation, Institution of Engineers, Australia, Barton, ACT, 1997

Freeze and Cherry (1979) Freeze, R. A., and Cherry, J. A. 1979. Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.