Soil Management Plan

Visy Pulp & Paper Tumut Mill

Issued By: HSE Manager
Issued Date 21 April 2023
Document no. PLANS-VPP-TUM-HSE-005-4
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VISY
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1.0 Introduction

1.1 Background

This plan describes the soil management at the Tumut Pulp and Paper mill. The Project Approval conditions issued for the Stage 2 expansion in 2007 required that the plan be compiled to detail measures to mitigate and manage adverse impacts on soil in areas affected by effluent irrigation associated with the project, including the existing plan.

The Soil Management Plan addresses the management processes required to satisfy the Project Approval and Development Consent Conditions relevant to the irrigation of effluent on the Visy site.

1.2 Overview of Assessments

Detailed assessments and calculations on water use within the mill, wastewater production and options for irrigation were undertaken for the Environmental Impact Statement (EIS) in 1998. The initial proposal was for irrigation of 1087ML/yr over the dedicated irrigation areas. During the ongoing design of the mill and associated infrastructure a number of modifications to the development occurred particularly relating to water and wastewater management. Further studies were undertaken and a revision of the water balance and irrigation system required the submission of a Statement of Environmental Effects (SOEE), which was approved by authorities in June 2000. The primary changes involved the reduction of water usage in the mill by increasing evaporation capacity, which resulted in the reduction of freshwater required from 2550ML/year to 1147ML/year, and a concurrent reduction in treated effluent produced for irrigation to 430ML/year from 1087ML/year.

Treated effluent is irrigated onto land owned by Visy on the property Gadara Park, Figure 1. An extensive surface water and groundwater bore network is established and regular monitoring and reporting of results has been undertaken since irrigation commenced. This has included the Development consent condition requirement for an interpreted groundwater report by a suitably qualified person to be supplied to the NSW Office of Water (formally the Department of Land and Water Conservation) initially and then annually following a specific request from the department. This report is included with the annual Environment Compliance and Monitoring Report as detailed in Section 7.

An independent evaluation of the existing irrigation operations and Winter Storage Dam was undertaken by Charles Sturt University for the Environment Assessment in 2006. The evaluation was based on historical operation and environmental monitoring data collected since 2001 and was designed to assess performance of the system to date and as a means of improving monitoring and management techniques to ensure the system is sustainable long into the future.

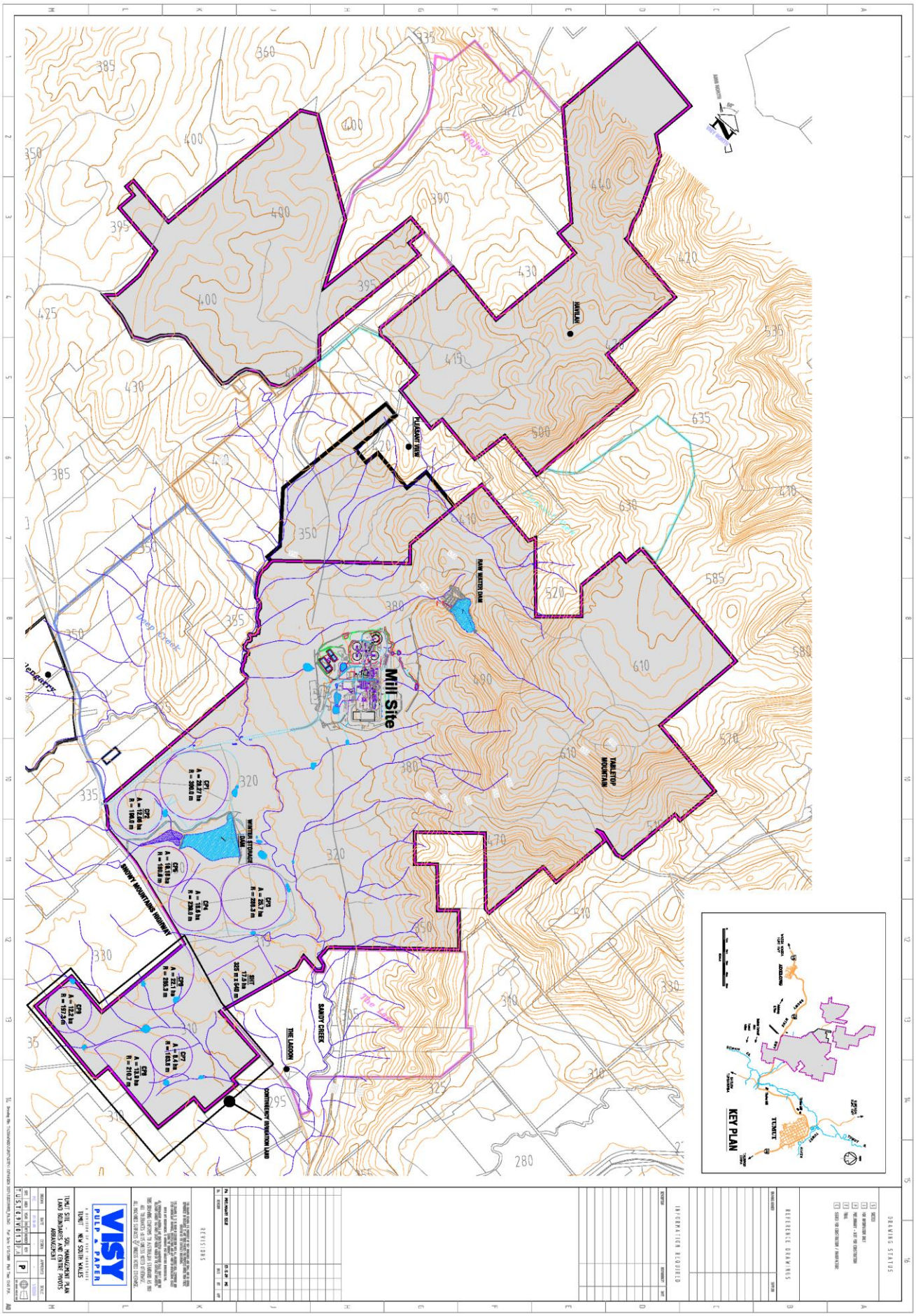

Figure 1.0 Visy land boundaries and irrigation area

Sixteen new piezometers were installed as part of this review to monitor groundwater dynamics under the irrigation areas. The study found that existing area of wastewater reuse paddocks is sufficient to match the current production for the wastewater treatment plant under dry, average and wet climate scenarios. However for a prolonged wet scenario it was determined that it may be necessary to discharge water from the Winter Storage Dam to Sandy Creek to match wastewater production with the irrigation system as provided for in the current approvals.

1.3 Environmental Management System

The Soil Management Plan is a component of the site's Environmental Management System, certified to ISO 14,001:2015. The Environmental Management System consisting of the Operation Environmental Management Plans, operational and environment procedures, and detailed monitoring and auditing program, aims to maintain compliance with Environmental regulations and achieve best-practice standards through a system of continual improvement, as represented in the diagram below. The EMS is integrated with the site's Safety and Quality management systems which are both certified to the relevant standards (i.e. ISO 9,001:2015, ISO 45001:2018), Figure 2.

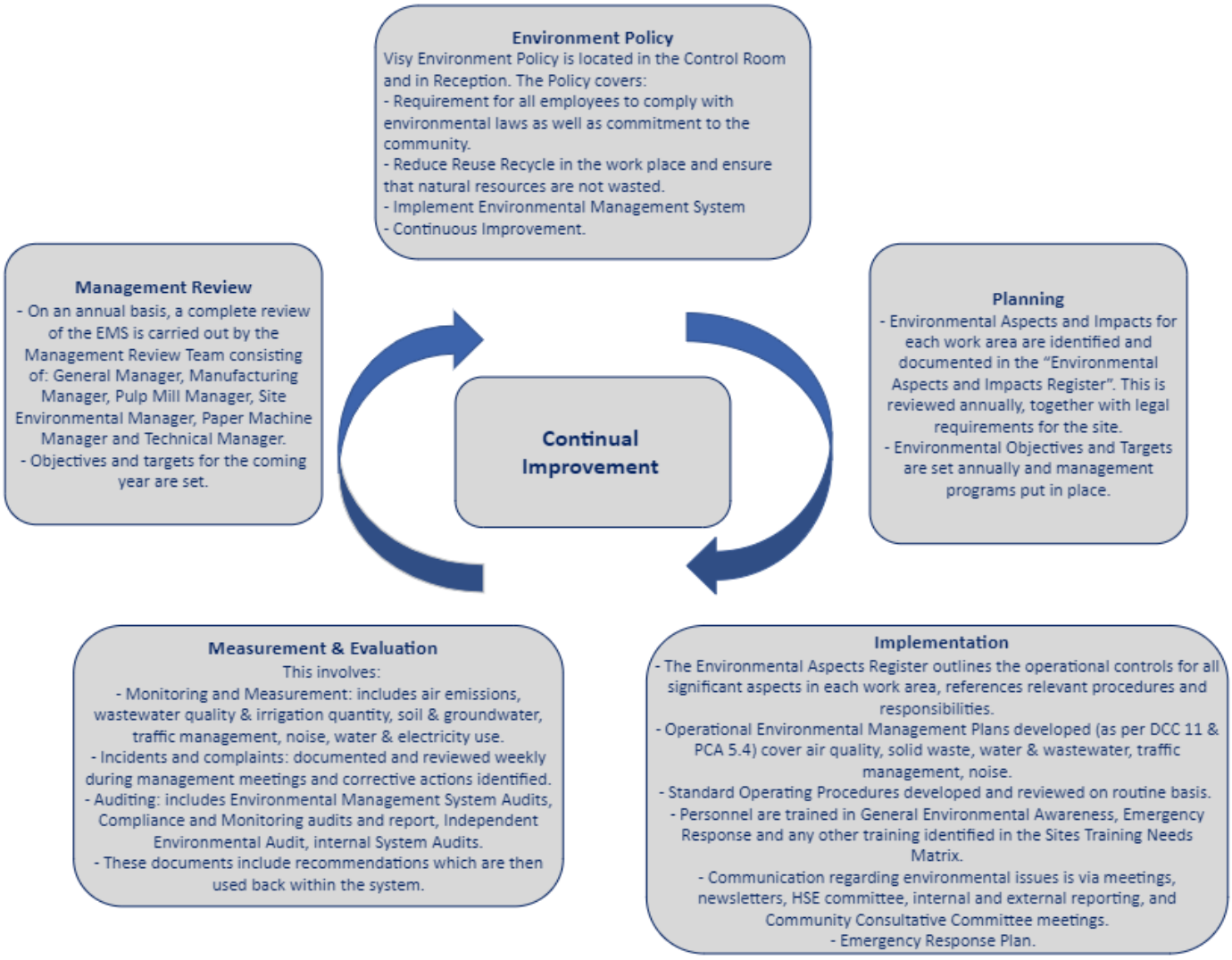

Figure 2.0 Overview of site Environmental Management System (EMS) Continual Improvement

2.0 Legal Requirements

The development approval for the Visy Mill Development was granted under the *Environment Planning and Assessment Act 1979*. Approval of the initial Development (Stage 1) was granted under section 91AB (2) of the Act. Approval was granted subject to meeting the Development Consent Conditions under approval S96/00598. The subsequent Visy Tumut Mill Expansion Development was granted under Part 3A. This approval was granted subject to meeting the Concept and Project Approval Conditions under approval 06_0159.

The Protection of the Environment Operations Act 1997, is the key piece of environmental protection legislation administered by the EPA to authorise the carrying out of scheduled activities at Visy Tumut. Under this legislation Visy are issued with an Environment Protection Licence (Licence number 10232) to operate subject to satisfying the various conditions of this Licence that include air and water emission limits, waste receival and disposal and requirements for monitoring and reporting.

The statutory requirements for soil management which apply to the Tumut site are:

- Documents as listed under Condition 1 of Development Consent Conditions for the initial development(S96/00598 Development Consent Conditions);
- Additional documents as listed under Condition 2 of Development Consent Conditions for the modified development(S96/00598 DCC_ MOD -45-5-2003-1);
- Environment Protection Licence (Licence No. 10232);
- Documents as listed under Condition 1.1 of Project Approval Conditions for the Expansion (06_0159 PA);
- Documents as listed under Condition 1.1 Concept Approval Conditions for the Expansion (06_0159 CA);
- Statement of Commitment Stage 2 (April 2007);
- Documents as listed under Condition 1.1 Modification Approval for the Expansion (06_0159 Mod 1);
- Water Access Licence 40AL405643 & 40AL405644 (formally 40AL40336), under the Murrumbidgee Water Sharing Plan.

Regulations concerning use and releases to surface water, groundwater or land, relevant to this site are contained within the following legislation and standards:

- *Environmental Planning and Assessment Amendment Act* 2012;
- Protection of the Environment Operations Act (Clean Air) Regulation (amended 2002);
- Protection of the Environment Operations (General) Regulation 1998;
- *Water Management Act, 2000*; (this and below are related to extraction of water from Tumut River);
- Murrumbidgee River, Water Sharing Plan, 2004;
- *Water Act*, 1912, Part V – (Approval to construct existing groundwater monitoring bore network);
- Environmental Guidelines for the Utilisation of Treated Effluent by Irrigation (DEC, 2004);
- *Water Act*, 1912 - Approval to construct groundwater bores. Approval no. 40BL191497.

3.0 Objectives

The objectives and performance outcomes for Soil Management are described below, Table 1.0.

Table 1.0 Objectives and performance outcomes for soil management

Objectives	Performance Outcomes
• To comply with all statutory requirements. • To minimise adverse impacts on soil and the environment. • To undertake soil monitoring in accordance with EPL, development consent and project approval conditions. • To ensure long term sustainability of wastewater re-use scheme.	• Conduct soil surveys to identify soil types and properties within the irrigation area. • Ongoing monitoring for assessing soil health. • Establishment of benchmarks for the implementation of soil amelioration measures. • Establish methodologies for soil improvement. • The results and analysis of soil monitoring is reviewed and compared to historical levels to assess any adverse trends developing. • All results, analysis and interpretation are periodically reviewed and included in the Annual Environmental Compliance and Monitoring Report.

4.0 Soil Issues, Management Safeguards and Controls

4.1 Identification of soil types and properties within the irrigation area

Several soil surveys have been conducted within the irrigation area since the commencement of irrigation. The following surveys have been undertaken:

- 1997 van de Graaff & Associates Pty Ltd;
- 2003 DM McMahon Pty Ltd;
- 2005 John Rasic Pty Ltd; and
- 2006 John Rasic Pty Ltd

The initial survey which was undertaken as part of the EIS for the Stage 1 development prior to any irrigation occurring was undertaken by van de Graaff in 1997. The survey identified one main soil type within the irrigation area, being:

- Well to imperfectly drained Red and Yellow Podzolic Soils Catena on igneous and metamorphic parent rocks; deep soils with limited under-drainage, suitable for irrigation.

McMahon in 2003 undertook a soil investigation that included an Electromagnetic (EM) survey and soil coring to delineate soil types within the irrigation area. The 110 hectare irrigation area was surveyed with 31 soil cores to ground truth the EM survey. The irrigation area was delineated into 2 main soil types with that would require different irrigation management owing to differing soil depths, drainage properties and available soil water.

In 2005 and 2006 Rasic undertook a free survey of the irrigation area as part of the Environmental Assessment (EA) for the Stage 2 development. A free soil survey is one in which the sampling sites are irregularly dispersed across the land according to the client's request or surveyor's judgment and/or both. Rasic identified two main soil types within the irrigation area being:

- Well drained Red & Yellow Podzolic soils (highly suited to irrigation)
- Imperfectly drained Red & Yellow Podzolic Soils (with Pseudogley)

4.2 Monitoring regime for assessing soil health

The soil monitoring program is conducted in accordance with the Visy Pulp and Paper EPA licence 10232 and to provide information for ongoing farm management. The licence stipulates monitoring of topsoil annually and subsoil every three years. At Visy topsoil monitoring is carried out yearly, usually in October and subsoil monitoring every three years. This monitoring forms an integral part of crop nutrient budgeting and management.

In addition to the test parameters stipulated in the licence, being pH, Cations, Aggregate stability, Organic carbon, Salinity, Chloride, Nitrogen, Phosphorus and Metals, many other nutrients and metals are tested as part of the monitoring program. Additional nutrients are tested to aid the farm manager in decision making and nutrient budgeting for upcoming crops.

4.2.1 Soil monitoring sites

There are seven soil monitoring sites at Visy, Figure 3. These seven soil monitoring sites are split into three sample regions:

- West of the Winter Storage Dam;
- East and south of the Winter Storage Dam; and
- South-East corner.

4.2.1.1 West of the Winter Storage

There are three soil monitoring sites in this region. There are two located in Centre Pivot 1 (SMS1, SMS2), and one under Centre Pivot 2 (SMS3).

4.2.1.2 East and South of the Winter Storage

There are three soil monitoring sites in this region. There is one soil monitoring site located under Centre Pivots 3, 4 and 5 respectively. SMS4 is in Centre Pivot 3, SMS5 is in Centre Pivot 4 and SMS6 is in Centre Pivot 5.

4.2.1.3 South-East Corner

The only soil monitoring site in this region is SMS7 located in the Soft Hose Traveller paddock along the eastern boundary of the Gadara Park property.

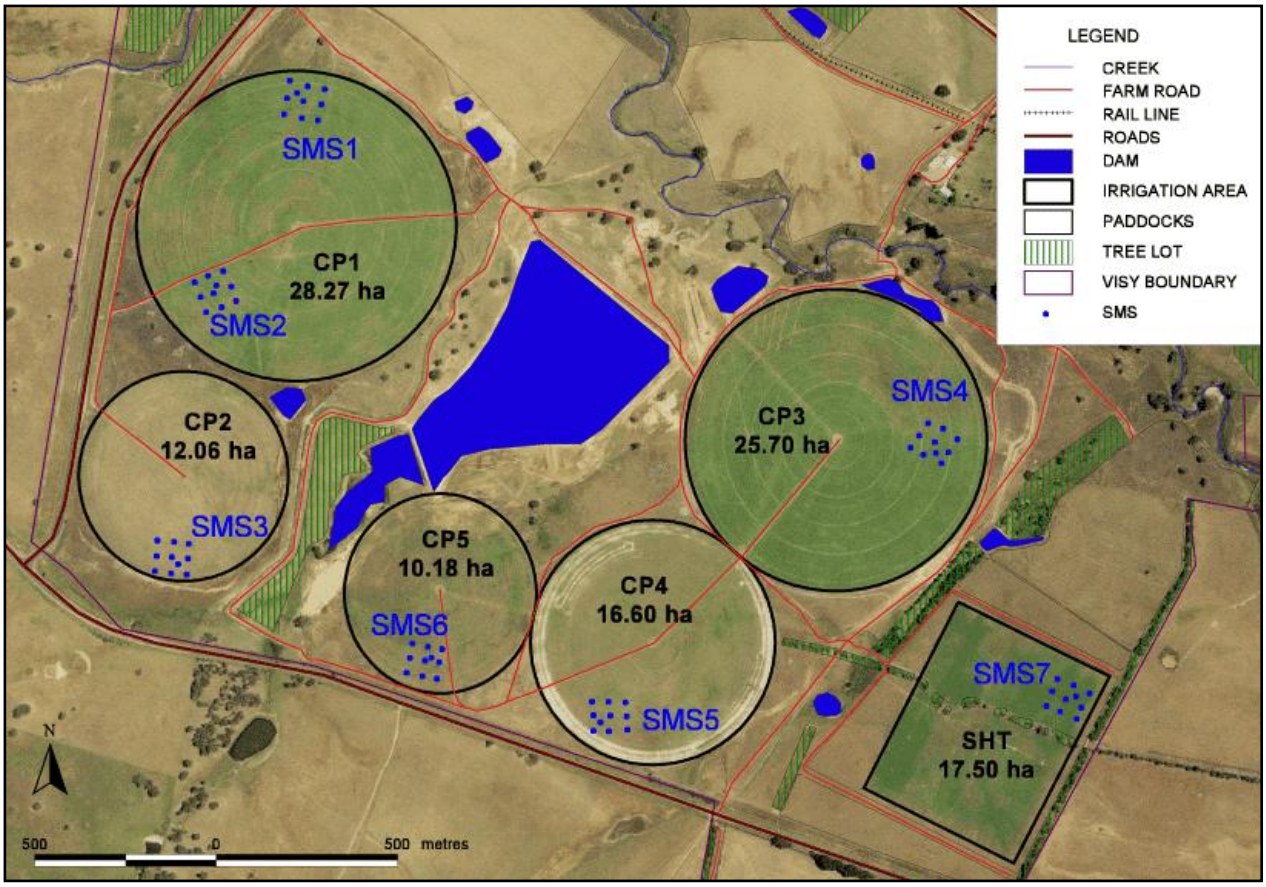

Figure 3.0 Soil Monitoring Sites

4.3 Methodology

Currently there is one soil monitoring site (SMS) per 15.7ha of irrigation area. Recommended soil sampling locations are to be distributed at one per 2 to 20ha, depending on the geological complexity of the site, *Environmental guidelines: Use of effluent by Irrigation (DEC 2004). T*he soil monitoring sites were established in 2000 and have been navigated to using Global Positioning System (GPS) since 2003.

From a monitoring perspective, the soil monitoring sites are an accurate gauge of temporal changes in soil parameters at each location. Cluster sampling is regarded as being the most appropriate procedure for estimating the nutrient status of pastures, Friesen and Blair (1984). This sampling method enables more reasonable estimates to be made of the temporal variations in soil tests.

Both surface and sub-surface samples are taken at each site. Approximately 40 topsoil samples are collected for compositing within each soil monitoring site. Ten subsoil samples are composited for analysis within each soil monitoring site.

4.3.1 Electromagnetic Surveying

Effluent irrigation guidelines recommend that an electromagnetic survey be used to identify soil sampling sites (DEC 2004). An electromagnetic survey was carried out in 2001 and again in 2003. Ground truthing of the electromagnetic survey was undertaken with soil cores in 2003 and in addition soil pits were also investigated in the irrigation areas in 2005.

The EM-38 survey measures the apparent electrical conductivity of the soil profile to a depth of 1.5m, which is the effective root-zone of most irrigated crops.

The main purpose of the ElectroMagnetic (EM)-38 survey is to aid in the identification of different soil types that may influence soil analysis and crop performance so that management can be tailored to soil type.

The EM-38 survey demonstrated a basic correlation between EM-38 readings and soil types. Low EM-38 readings were measured in the high elevation areas, characterised by a deep well drained soil with a substrate of coarse fragments and decomposed rock. High EM-38 readings were measured in the low lying areas of the paddocks, characterised by poorly drained alluvium overlying clay subsoil's.

The EM-38 survey and soil monitoring sites are provided below in Figure 4.

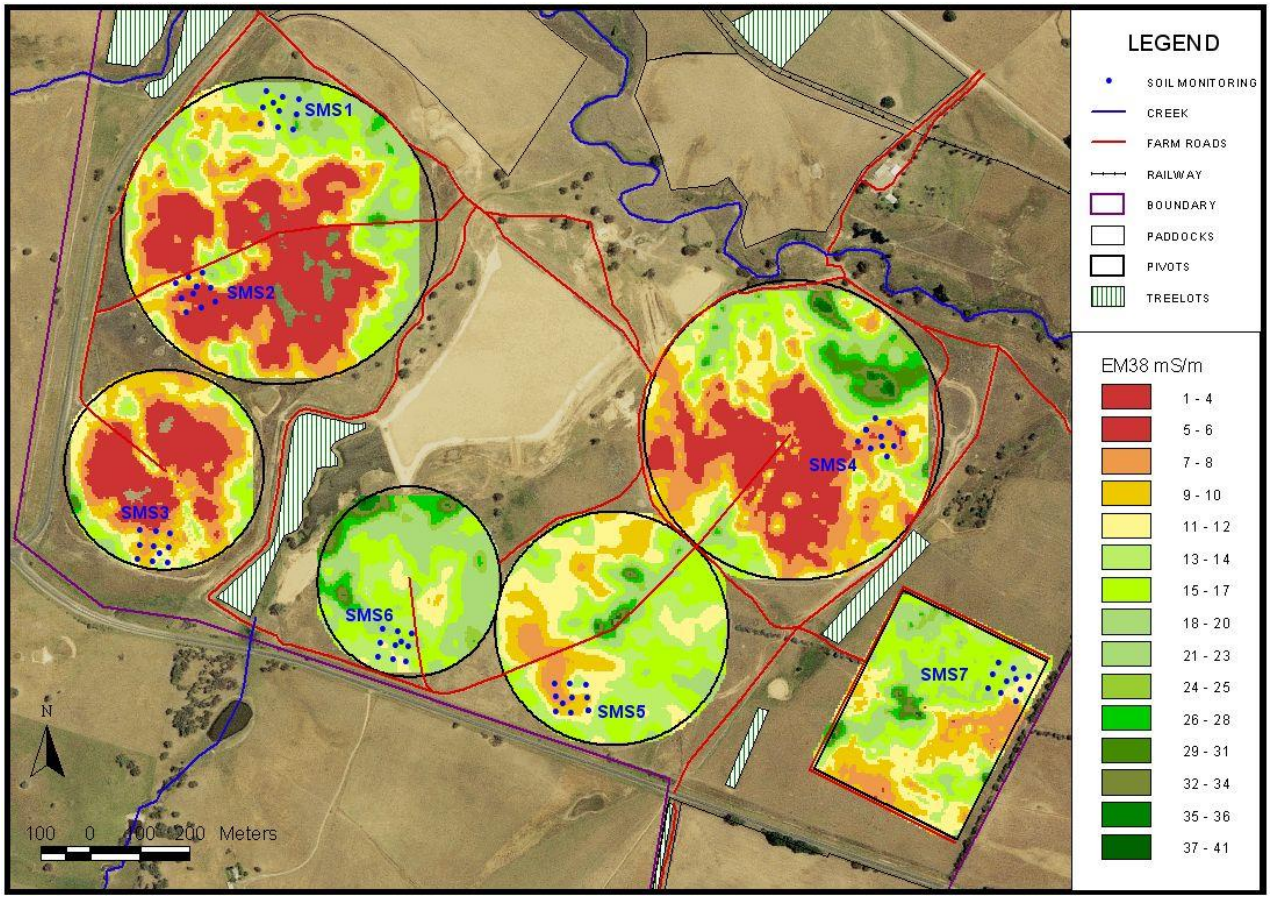

Figure 4.0 Location of soil monitoring sites in relations to EM-38 survey

4.4 Nutrient budgets

An annual review of irrigation and crop management at Visy includes the preparation of a 15 year nutrient budget that fulfils the requirements of the NSWEPA Load Based Licensing Scheme. The 15 year nutrient budget is reviewed and updated each year by an agronomist. The outcomes from the review are included in the annual Environmental Monitoring and Compliance Report submitted to the Department of Planning and Environment.

During the yearly review, farm performance is evaluated in conjunction with water availability and a plan of upcoming activities is produced. This plan includes selected crops to be grown, nutrient budgeting and grazing management.

Soil sampling is undertaken at designated sites selected to be representative of soil conditions under irrigation. Soil samples are taken yearly adhering to strict soil sampling protocol for topsoil, and 3 yearly for sub-soil. Soil samples are reviewed in relation to overall soil health and fertiliser requirement.

Where fertiliser application is required it is applied either at seeding by a mechanical ground spreader, or via the Centre pivots (fertigation) during the crop growth cycle.

4.5 Salinity

Salinity of the soil and groundwater, monitored regularly, shows some fluctuation from autumn to spring. This is apparent when comparing with background data. To determine if the application of wastewater is being detrimental to the irrigation area, tests results are reviewed by the Land management consultant on an annual basis. The monitoring regime is detailed in Section 6. This review is included in the annual report on Monitoring of Gadara Park.

As part of the Environment Assessment (EA) a detailed review was undertaken by Charles Sturt University to assess the cumulative short and long term impacts of the existing and then proposed expanded wastewater irrigation scheme on soils, groundwater levels and quality, and surface water flows in the area. The assessment was conducted with the ultimate aim of incorporating management techniques to ensure the long term sustainability of the design and operation of the entire irrigation system. The review found that there was no soil salinity threat under any of the paddocks studied and that the Electrical conductivity (ECe) values represent soil salinity conditions that are suitable for even salinity sensitive crops.

The potential spatial impact of wastewater irrigation on groundwater levels and salinity were studied using surface-groundwater interaction modelling. In addition a water balance assessment was conducted for the wastewater irrigation system, and nutrient, organics, salts and metals loadings were examined based on the average quality of the existing treated wastewater (from 2001-2006 monitoring records). This data was used as it was expected the then proposed additional wastewater generated by the expanded mill would be of similar quality. The average salinity of the treated wastewater was 0.34 dS/cm (217 mg/L) which equates to average monthly salt loadings on 97 kg/ha. In comparison low salinity irrigation water would have an average monthly salt loading of 186 kg/ha, (DEC 2004). Therefore salinity loading of the treated wastewater would not have any adverse impacts on soil and crop health.

Wastewater generated from the Visy mill operations is considered low strength effluent of very high quality. Due to the high quality no adverse impacts are anticipated on the local environment. Nevertheless the following strategies recommended by the Charles Sturt University review will be incorporated into irrigation management to ensure the long term sustainability of the system to:

- Reduce soil salinity threats and to promote better crop health:
    - Legumes should be considered as an integral part of any cropping pattern, which may include lucerne, oats, rye grass, forage wheat, triticale, barley, maize, forage sorghum, cowpeas, millet, and sugar beet;

- Maintain crop biodiversity:
    - The cropping pattern based on 1, 2, 3 and 4 years of lucerne rotation should be adopted under different paddocks;
- Provide subsurface drainage typically under low-lying parts of the existing as well as the new areas of the wastewater irrigation system.

4.6 Implementation of soil amelioration measures

There are certain conditions that would trigger the need for soil amelioration. These conditions would include soil chemical and physical factors. Soil chemical factors include; acidity, sodicity, nutrient deficiency/imbalance, and salinity.

Soil physical factors include; water logging, compaction (structural), erosion, and organic component. The amelioration measures associated with each of these is detailed below.

4.6.1 Chemical

Acidity
Once top soil pH falls below 5.5 $CaCl_2$, liming will be considered to counter soil acidity. The pH should be maintained at between 5.5 and 6.5 for optimal plant growth.

Sodicity
If topsoil sodicity levels rise to be consistently above 6% Exchangeable Sodium Percentage (ESP) then the application of gypsum will be considered to increase calcium content to aggregate clay particles and decrease relative sodium levels.

Nutrient deficiency
In the case of nutrient deficiency or imbalance detected in the course of the bi-annual monitoring, fertiliser will be applied as required after consultation with an agronomist or consultant.

Salinity
If salinity levels in the topsoil rise to above 1,000 µS/cm corrective action will be taken that may include, deep ripping, application of gypsum or irrigation review.

4.6.2 Physical

Water logging
If persistent water logging is observed in the irrigation area and irrigation scheduling is not the cause, then amelioration action may be undertaken. This would include deep ripping within and upslope of the affected area as outlined in Section 4.4.4 of this document.

Compaction and structural decline
As with water logging, deep ripping would be considered if compaction and structural decline is observed within the irrigation area. Owing to the conservation tillage techniques used and the low traffic load on the soil, compaction is unlikely to occur.

Organic component

If the organic component in the soil is in decline, amelioration measures such as the application of compost or the growing of a green manure crop will be considered. The organic carbon content in the soil at Gadara Park has increased from an average of 2% to 2.4% in the last ten years due to conservation tillage practices and the planting of perennial crops such as lucerne.

4.7 Methodologies for soil improvement

Many methodologies for soil improvement are employed at Gadara Park. Conservation tillage, liming, crop rotations and deep ripping have played a major role in increasing soil quality.

4.7.1 Conservation tillage

A "Conservation tillage" programme has been adopted on Visy farmland. Conservation tillage is an umbrella term that looks beyond "soil preparation" in the narrow sense. Its focus is on the broader concept of conservation agriculture, since this embraces not only the seedbed preparation but also nutrient content of soils, their structure and biological status. Such factors are important determinants of agricultural productivity as a result of farm management and land husbandry practices.

By definition, Conservation tillage consists of any reduced tillage system that leaves 30% or more of crop residue on the soil surface after planting, the method used on Gadara Park is direct seeding. This is a process of planting directly into crop residue, leaving the soil undisturbed from harvest to harvest. Only the seed zone is prepared by a coulter or disk, which cuts through the crop residue, to place the seed in a narrow furrow. Weed control is made by herbicides, the type and timing of herbicide application depends on weed pressure and climate conditions. Uniformly distributed residue shields the soil surface from rainfall impact, important in considering the Gadara soils, thus reducing the tearing and washing away of soil particles.

At the end of each rotation, crops are harvested leaving crop stubble to a height of 20-30mm for, easy application of soil amendments/fertiliser, a quick re-growth between cuts and to allow for the promotion of a thick swath for ground cover to encourage micro-bacterial activity. Weeds are controlled by crop rotation and the application of appropriate herbicides where warranted.

Pasture stands have been selected on the basis that, legume clovers will provide organic nitrogen to the grasses, and therefore, only prescription quantities of inorganic super-phosphate fertiliser in the form of sulphate needs to be applied to the clovers. Plant tissue analysis is undertaken regularly to ascertain plant health, nutrient status and feed quality. Soil samples are taken yearly to determine plant nutrient requirements.

4.7.2 Liming program

The Soil Amendment Trial (SAT), for evaluating Visy Mill by-products as soil ameliorants, was completed in 2006 after the compilation and review of four years of soil testing, hay and silage analysis, animal tissue testing and by-product analysis.

The results show a marked increase in topsoil pH, after being measured as highly acidic pre-trial. Increased agricultural production has been a result of the correction in soil acidity, with improved nutrient availability and a greater variety of crops able to be grown.

Soil heavy metal levels have shown no significant increasing trend since the baseline testing was undertaken in 2001. Hay and silage analysis show heavy metals are not bio-accumulating in the plant tissue. Animal tissue testing indicates there are no food safety concerns, or any other concerns related to the heavy metals of interest.

Up until June 30th 2005 the criteria for the application of by-products was the NSW EPA Environmental Guidelines Use and Disposal of Bio solids Products. As of the 1st of July 2005 the EPA developed new draft guidelines in the "Land Protection Proposal" under the NSW Residue Waste Regulation. On the 1st of December 2005 amendments to the Protection of the Environment Operations (Waste) Regulation came into effect. This Regulation currently prohibits the use of by-products until a specific exemption is granted by the NSW Environment Protection Authority (EPA).

A general prohibition is in place on the application of Visy mill by-products to land until the EPA, in consultation with DPI (NSW Department of Primary Industries), exempt certain products for use as fertilisers or soil conditioners. Visy currently are in the process of seeking an exemption to the prohibition.

Although land application has ceased, the by-products monitoring has continued to determine its suitability for landfill disposal and to assess the products consistency if land application was to resume.

4.7.3 Crop rotations

The aim for the farm is to have a set but flexible rotation in place for each farming block or centre pivot. Having set rotations allows the manager to plan future crops and subsequent paddock preparation and management. The establishment of a high protein crop and high water usage crop such as lucerne is a goal of the rotation but up to two weed clean up crops have to be sown before lucerne establishment will be attempted.

Rotation of crops is staggered across the farming blocks to maintain a balanced feed ratio. The rotation includes perennial and annual crops.

Wheat can be substituted for another winter crop with the opportunity for a summer crop in between once weeds are under control.

4.7.4 Deep ripping

Certain areas under Centre Pivot 3 and Centre pivot 4 where perched water tables exist and water logging occur, result from the presence of an impervious shallow hard pan, the soil investigations undertaken in 2005 – 2006 revealed.

The deep ripping program recommended in the Soil Survey Report in Appendix F of the Environmental Assessment 2007 has been tailored for the different soil types at Gadara Park. The amelioration program as recommended for each of the soil types found within the irrigation area is as follows:

Unit 1

- Surface preparation to a minimum depth of 15 cm;
- Shallow ripping and mixing to a depth of 35-40 cm, using ~20-25 cm wide wings, inclined up to 30 degrees to the horizontal;

- Spacing between ripping lines should be ~ 10 m;
- Slight disking of clods (if necessary);
- Remark: If above steps prove to be insufficient, repeat amelioration procedure as appropriate, and combine it with subsoil and contour trenching.
- Subsoiling and mixing to a depth of 80 cm, using ~ 30 cm wide wings, inclined at 30 degrees to the horizontal; and
- Contour trenching using trench digger, ditch witch, backhoe, or similar implement. Trenches should be 1.2 m deep, 20 cm + wide, and spaced as indicated on the map. If hard rock is hit stop trenching.

Unit 2

- Surface preparation to a minimum depth of 20-25 cm across whole area;
- Shallow contour ripping and mixing to a depth of 50 cm using 40 cm wide wings, inclined at 40 degrees to the horizontal (first pass). Spacing between ripping lines should be ~ 10 m;
- Disking of clods (if necessary);
- Subsoiling and mixing to a depth of 90 cm, using 40 cm wide wings, inclined at 30 degrees to the horizontal (second pass);
- This will require D9 or equivalent;
- Slight disking of clods and/or re-cultivation; and
- Contour trenching using trench digger, ditch witch, backhoe, or similar implement. Trenches should be 1.2 m deep, 20 cm + wide, and spaced ~ 5 m apart, and trenches ~ 20 m apart.

Unit 3

- The very first step is contour trenching using trench digger, ditch witch, backhoe, or similar implement. Trenches should be 1.5 m deep, 25 cm + wide, and spaced as indicated on the map. If hard rock is hit stop trenching;
- Surface preparation to a minimum depth of 20-25 cm across whole area;
- Shallow cross-ripping using double tine ripper (ideally triple tine) to a depth of > 45 cm, using > 30 cm wide wings, inclined at 40 degrees to the horizontal. Spacing between ripping tines: 60-75 cm;
- Disking of clods (if necessary);
- Contour subsoiling and mixing to a depth of > 90 cm, using a single tine ripper with wings that are 40 cm+ wide, and inclined at ~ 40 degrees to the horizontal. Spacing: 5 m apart. This will require a D9 or equivalent;
- Slight disking of clods and/or re-cultivation;
- Remark: If initial amelioration proves to be insufficient, proceed with additional contour subsoiling and trenching; and
- Subsoiling lines should be spaced ~ 5 m apart, and trenches ~ 15 m apart.

Irrigation after deep ripping

Whilst nursing the existing cover crop is essential to prevent soil collapse on wetting, so too is the management of irrigation water. Initially irrigate the soils to a maximum depth of only 20 cm, and then again after several hours of drying period (depending on prevailing weather conditions) to a depth of 40 cm. Keep going this way unless the soil profile is wetted up to full subsoiling depth specified. However, it is of

paramount importance to irrigate in increments of 20-25 cm depth only, with several hours drying period between irrigations. Frequent irrigation at lower application rates will minimise slaking of the topsoil and subsidence of the subsoil.

Deep ripping was undertaken in these areas and this has resulted in reduced water logging, improved soil permeability and improved root penetration. These improvements have enabled the establishment of high value crops such as Lucerne, important for irrigation practises because of its deep penetrating roots and high water uptake.

4.7.5 Irrigation and crop management

Ongoing monitoring and review of the farm management in terms of nutrient levels, soil structure, crop production and water usage is carried out. This process is used in managing irrigation and crops by forecasting water and nutrient budgets for the coming season.

Irrigation is aimed to match crop demand and by irrigating smaller amounts on a daily basis the risk of surface runoff or through drainage occurring is greatly minimised, therefore reducing any environmental impacts. Runoff is monitored by a visual inspection of the irrigation areas while through drainage can be assessed by reviewing the real time soil moisture probes and the piezometers installed in the irrigation areas. Runoff and through drainage can occur when irrigation is scheduled in larger amounts of water at a lesser interval. The centre pivot irrigation system is extremely versatile in the amount of water able to be irrigated by altering the speed of the rotation and droplet size with the use of adjustable nozzles.

Each year the soils in the irrigation area are also sampled and tested in accordance with the site's Environment Protection (EP) licence. Other agricultural parameters are also included in the testing regime. Plant tissue analysis is also used to forecast crop yield and aid nutrient budgeting. The results of soil monitoring are used in the ongoing review of the farm performance and future planning.

An independent evaluation of the irrigation system operation and Winter Storage Dam was undertaken during the Environment Assessment process. The evaluation was based on historical operation and environmental monitoring data collected since 2001. It was designed to assess the performance of the system and to capture any items related to monitoring or management that would ensure the system is sustainable long into the future. The findings of the study are documented in full in the Environmental Assessment.

Current demand based irrigation using both climate and soil based irrigation schedules has yielded a better result for managing salinity in the root zone as well as in the groundwater. Observed paddock wise variations in hydraulic conductivity suggested the need for adjusting irrigation rates on different paddocks to minimise surface runoff. Overall the study found that there is a continual improvement in irrigation operations in particular since climate and soil based irrigation scheduling has been undertaken.

4.8 Training and Responsibilities

4.8.1 Training

The following training measures will be undertaken to ensure provisions of Soil Management Plan are implemented:

- The Farm Manager and farm workers are trained in the requirements of the management safeguards and controls included in Soil Management Plan.

4.8.2 Responsibilities

The key responsibilities for ensuring implementation of the Soil Management plan are as follows:

The *Farm Manager* is responsible for:

- Ensuring the management safeguards and control measures described in the Soil Management Plan are implemented;
- Developing and implementation of annual Farm Management Plan in consultation with the external Agronomist/Land Management Consultant; and
- Routine soil sampling is undertaken in accordance with the Soil Management Plan.

The consulting environmental specialist is responsible for:

- Undertaking monitoring and reporting of the irrigated area including results of soil monitoring;
- Annual review of all data associated with irrigation and any effects it may be having on soil;
- Development of the annual report *Monitoring of Gadara Park*;
- Preparing the 15 year and 5 year rolling nutrient budget and cropping regime for the irrigation area and reporting on these annually in the above report;
- Preparation of the annual Farm management plan in consultation with the Farm manager; and

The *HSE Manager* is responsible for:

- Ensuring that soil monitoring requirements are undertaken in accordance with Soil Management Plan;
- Review of the irrigation and farm performance;
- Inclusion of annual report Monitoring of Gadara Park in the Annual Environmental Compliance and Monitoring Report;
- Reporting of monitoring results in Annual Return;
- Reporting of any incidents that are causing or threatening material harm to the environment to EPA and DPE.

5.0 Criteria and Guidelines

There are no limits specified in the Environment Protection Licence, Development Consent Conditions or Project Approval conditions that apply to soil quality under the irrigation areas. Soil samples that are taken are analysed and comparisons are made against background or previous monitoring results and against a desirable range or level which has been summarised below in Table 2.0. These desirable levels have been obtained from the listed references below.

Table 2.0 Soil Quality Guideline Parameters

Parameter	Units	Desirable Levels		Parameter	Units	Desirable Levels
Aggregate Stability	na	>5[1]		Total Phos.	ppm	>30[5]
Aluminium	ppm	<80,000[2]		CEC	meq/100g	<15[3]
Avail (Bray) Phos.	ppm	>30[3]		Potassium EKP	%	1-5%[3]
EC	$mScm^{-1}$	0.15-0.25[2]		Calcium ECaP	%	65-80%[3]
Sodium ENaP	%	<5[2]		Magnesium EMgP	%	10-15%[3]
Ex. Calcium	ppm	2000-10000[2]		Aluminium EAlP	%	<5%[3]
Ex. Aluminium	ppm	0-9[2]		Ca/Mg Ratio	na	>1[3]
Ex. Magnesium	ppm	240-2000[2]		Arsenic	mg/kg	<20[6]
Ex. Potassium	ppm	390-1000[2]		Cadmium	mg/kg	<2.5[6]
Ex. Sodium	ppm	0-115[2]		Chromium	mg/kg	<100[6]
NO_3 Nitrogen	ppm	30-80[3]		Copper	mg/kg	<50[6]
Organic Carbon	%	<2[4]		Lead	mg/kg	<100[6]
Phosphorous Sorption	$mgkg^{-1}/log10ugL^{-1}$	>30[2]		Mercury	mg/kg	<1[6]
Total Nitrogen	ppm	500-3000[2]		Nickel	mg/kg	<50[6]
pH	1:5-$CaCl_2$:H_2O	5.5-7[2]		Zinc	mg/kg	<200[6]
Chlorides	ppm	<125[2]		Total Kjeldahl Nitrogen	mg/kg	500 - 3000[2]
P Buffer Index		>30[2]		Total Phosphorus	mg/kg	>30[2]
Ca/Mg Ratio		>2[4]				

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6.0 Monitoring

6.1 Soil Quality Monitoring as per Environment Protection Licence

Soil quality monitoring is undertaken in accordance with clause M2.1 at monitoring location Point 13 identified in clause P1.1 of the Environment Protection Licence number 10232.

The pollutants required to be monitored in accordance with M2.1 are summarised below in Table 3.0.

Table 3.0 Soil Quality Monitoring

Pollutant	Units of Measure	Frequency	
		Topsoil (0 -10 cm)	Subsoils (10 – 50 cm)
Aggregate Stability	ppm	Yearly	3 Yearly
Aluminium	ppm	Yearly	3 Yearly
Available Phosphorus	ppm	Yearly	3 Yearly
Conductivity	mS/cm	Yearly	3 Yearly
Exchangeable Aluminium	ppm	Yearly	3 Yearly
Exchangeable Calcium	ppm	Yearly	3 Yearly
Exchangeable Magnesium	ppm	Yearly	3 Yearly
Exchangeable Potassium	ppm	Yearly	3 Yearly
Exchangeable Sodium	ppm	Yearly	3 Yearly
Exchangeable Sodium Percentage	%	Yearly	3 Yearly
Nitrate	ppm	Yearly	3 Yearly
Total Nitrogen	ppm	Yearly	3 Yearly
Organic Carbon	%	Yearly	3 Yearly
Phosphorus Sorption Capacity	$mgkg^{-1}/log10ugL^{-1}$	Yearly	3 Yearly
pH		Yearly	3 Yearly

Soil samples are taken at each sampling location as shown on figure 3. Sample method at each sampling location is by taking 10 representative samples on a 30 metre by 30 metre grid in accordance with *Special Method 1* as described in the EPL.

6.2 Additional Soil Quality Monitoring

Soil monitoring of additional parameters was undertaken in the past and these are listed below in Table 4.0.

Table 4.0 Soil Quality Monitoring Parameters

Parameter	Units	Parameter	Units
P Buffer Index (PBI)		Ca:Mg ratio	
Available Potassium	ppm	K:Mg ratio	
Available Sulphur – KCl	ppm	EAT (H2O Class)	
DTPA Zinc	ppm	EAT (Low SAR Class)	
DTPA Copper	ppm	EAT (High SAR Class)	
DTPA Iron	ppm	Arsenic	mg/kg
DTPA Manganese	ppm	Cadmium	mg/kg
Boron	ppm	Chromium	mg/kg
Chloride	ppm	Copper	mg/kg
CEC	meq/100gm	Lead	mg/kg
Aluminium	meq/100gm	Mercury	mg/kg
Calcium	meq/100gm	Nickel	mg/kg
Magnesium	meq/100gm	Zinc	mg/kg
Sodium	meq/100gm	Total Kjeldahl Nitrogen	mg/kg
Potassium	meq/100gm	Total Phosphorous	mg/kg

The monitoring of the additional parameters listed above in Table 6.2 was carried out as part of the Soil Amendment Trial (SAT), for evaluating Visy Mill by-products as soil ameliorants.

7.0 Reporting and Review

7.1 Legal reporting requirements

7.1.1 Incident and complaint report

The Shift Supervisor or HSE Manager is informed immediately of any incidents to ensure that appropriate and immediate actions are undertaken to mitigate the issue.

All Incidents are ranked from 1 to 5 in accordance with Visy Incident Classification (refer Table VP9-10-10.4-005-01 in VP9-10-10.4-005 Complaint Response Procedure and VP9-10-10.4-004 Environmental Incident Reporting Procedure, and reported to relevant personnel and agencies in accordance with Visy Reporting Requirements as per VP9-10-10.4-004 Environmental Incident Reporting Procedure and with DCC15, Concept Approval 6.1 and EP licence clause R2.

In accordance with the Visy Environmental Reporting Procedure, all incidents are reported in Noggin, the electronic reporting database system that automatically notifies relevant personnel and senior management and is used for incident review and tracking results of investigations and corrective actions.

7.1.2 Annual Return

An Annual Return in the approved format in accordance with Condition R1 Annual Return Documents in the EP Licence 10232 must be completed and supplied to the NSW EPA. The Annual Return comprises a monitoring and complaints summary along with all non-compliances that have occurred through-out the reporting period.

This Annual Return must include a Statement of Compliance signed by a delegated authority and be submitted to the NSW EPA by registered post within 60 days of the end of the reporting period.

7.1.3 Annual Environmental Compliance and Monitoring Report

An Environmental Compliance and Monitoring report to satisfy Condition 12 of the Development Consent Conditions (Oct 1998) and Condition 6.3 of the Concept Approval Conditions (May 2007) must be submitted to the NSW Department of Planning and Environment (NSW DPE). This report is to provide a summary of all environmental monitoring, the Environmental Complaints register for the preceding 12 month period and an annual review of operational environment management plans, the conditions of consent and other licenses and approvals relating to the operation of the plant as well as comparisons with the EIS (1996) and EA (2007) predictions.

This report is submitted annually to the Department of Planning and Environment, and copies provided to the EPA in accordance with Condition R1.10 of the EP Licence, Snowy Valleys Council, Visy Community Consultative Committee (VCCC) and the Department of Primary Industries – Water (DPI).

7.2 Annual Farm and Environmental Assessment Report

On an annual basis, Visy shall appoint a Land Management consultant to undertake a review of the wastewater re-use and by-product management on Gadara Park. The review shall be included in the annual *Monitoring of Gadara Park Report*. The report shall present a summary and analysis of environmental

monitoring undertaken over the previous 12 months and include a farm management plan for upcoming 12 months.

This report is included in the Annual Environment Compliance and Monitoring Report detailed in Section 7.1.3 and submitted to Department of Planning and Environment (DPE), Environment Protection Authority (EPA), Snowy Valleys Council, Visy Community Consultative Committee (VCCC), and the Department of Primary Industries – Water (DPI) to satisfy Development Consent Condition 66.

7.3 Community Consultation

7.3.1 Visy Community Consultative Committee

The Visy Community Consultative Committee, made up of representatives of council and local community members, meet with Visy Management and Environmental personnel on a regular basis to review and monitor Visy's compliance with conditions of consent in accordance with Development Consent Condition 72 and Concept Approval Condition 4.1.

A review of all environmental monitoring and investigations into community complaints are presented at each meeting. Committee members are provided with the opportunity to raise any specific concerns or issues. Meeting minutes are recorded and distributed to all those present and representatives of EPA and DPE.

7.3.2 Local Community Consultation

Visy Management and Environmental personnel partake in a more informal consultation program with the local community that are most affected by the mill's operations. The consultation program is taken in the form of shutdown notifications, electronic mail, telephone conversations and routine visits to residences. Regular updates on the mill's environmental performance are provided and community members are encouraged to raise issues or concerns.

8.0 Auditing

A program of internal and external audits exists for the site to determine whether the site meets environmental objectives and statutory requirements. The internal and external program is outlined in the VMS (Visy Management System).

8.1 Legal Requirements and External Audits

8.1.1 Annual Audit

An Independent Environmental Audit is to be undertaken in accordance with Condition 71 of Development Consent (1998) and Condition 3.16 of Project Approval Conditions (2007). This audit covers all aspects of monitoring and environmental performance and compliance with Development Consent Conditions (1998), Project Approval Conditions (2007) and predictions in the EIS (1998) and EA (2007).

The audit report is to be submitted to the Department of Planning and Environment, Snowy Valleys Council, and Visy Community Consultative Committee. In addition a copy is supplied to the NSW EPA in accordance with Condition R1.10 of the site EP Licence number 10232.

8.2 Internal Auditing

8.2.1 Internal Environmental Management System and Compliance Audit

An internal EMS and Compliance Audit of the site is undertaken in accordance with Visy Corporate Procedure 1102 – HSE Audit System. The Visy Group Manager Safety and Environment, co-ordinates and implements the audit program which is conducted in accordance with Corporate EMS Audit Protocol.

8.2.2 Complaints Register Audit

A register of all community complaints as required by Development Consent Condition 74 and Concept Approval Condition 4.3 is maintained electronically in the Vault system. The status of all entries are reviewed by the Visy HSE Manager and closed out if all actions have been completed. The complaints register and results of internal Audit Review is included in the quarterly report provided to Visy Community Consultative Committee, DPE, EPA and Snowy Valleys Council in accordance with Development Consent Condition No. 76.

8.3 EMS Audit

Triennial Re-certification and annual Surveillance audits of Visy Pulp and Paper (Tumut) Integrated Management System, which incorporates the quality, environment and safety management systems, are undertaken in accordance with requirements of international standards relating to audit practice such as ISO 19011 by a certified Auditing Organisation. The purpose of the audit is to assess the sites compliance to the principles of the Management System Standards (i.e. ISO 14001, ISO 45001, ISO 9001).

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