# SOIL AND WATER MANAGEMENT PLAN

**Bombala Sawmill Project**
**August 2023**

Dongwha

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# DOCUMENT CONTROL

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| **Title** | Soil and Water Management Plan |
| **Description** | Plan to manage and monitor soil and water at the Bombala Sawmill as required under Condition 20, Schedule 3 of Project Approval MP07_0161 |
| **Created By** | Peter J Ramsay and Associates |
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# EXECUTIVE SUMMARY

This Soil and Water Management Plan (SWMP) was originally prepared by Peter J Ramsay and Associates in 2011 for the expansion of Dongwha Timbers Pty Ltd's (Dongwha's) integrated sawmilling and value-adding facility at Sandy Lane, Bombala, New South Wales. The management plan was developed to satisfy Conditions 20 to 24 of the Project Approval issued by the Department of Planning pursuant to Section 75J of the Environmental Planning and Assessment Act 1979. The SWMP was revised in 2017. This latest revision of the plan has been undertaken by Benbow Environmental to take into account the site changes, past monitoring results and additional limited site investigation undertaken in early 2022. The main purpose of the update is to ensure the soil and water monitoring program reflects changes to the EPL in regard to the soil, surface water and groundwater monitoring requirements. The sediment and erosion control plan has also been revised to apply to the remediation works required at the location of the old treatment plant that has recently been removed.

The site comprises an existing sawmilling and value adding facility on a large rural block which has an area of approximately 37 ha. The site has been used as a sawmilling and value adding facility since 1978, including timber treatment timber using copper chrome arsenate.

The expansion of the site involving upgrading the timber production capacity and improving the efficiency and environmental performance of the processes has been completed. Removal of the old timber treatment plant was completed in early 2022 and remediation of this area is still required.

This management plan describes the existing environmental condition of the site and the strategies that have been implemented at the site. The management strategies have been developed to manage legacy contamination issues and to ensure that impacts to the environment are managed in accordance with industry best practice.

Sediment and erosion control measures including procedural controls, the construction of temporary sedimentation ponds and rock check dams, and installation of sedimentation fencing were implemented during construction works. These measures were implemented prior to the commencement of earthworks and remained in place until the development was fully completed. Construction has been completed. Remediation works is still required for the old treatment plant area and the sediment and erosion control measures have been updated for this purpose only.

In addition, a comprehensive stormwater and wastewater management scheme was developed for the site. The scheme involves the capture of stormwater generated at the site in three purpose designed water storage ponds. Ponds 1 and 2 are constructed in the north-western and northeastern portions of the site respectively and capture stormwater for reuse at the site. In addition, the existing Northern Pond was upgraded and captures runoff solely from the treated timber storage areas for reuse in the treatment plant.

The new ponds were designed to capture surface runoff under average rainfall conditions, as well as during extreme flood events in order to minimise the potential for off-site discharge of water. Notably, the Northern Pond which captures stormwater from the treated timber storage areas, was designed to capture a one-in-one-hundred rainfall event. In addition, the proposed water storages will be able to satisfy the water demands of the treatment plant with only very minimal need for mains water in summer. Stormwater generated off-site to the east of the site is diverted across the site and into the natural watercourse downstream of the site to the west as it is surplus to the plants requirements and will not be contaminated.

A key aspect of the stormwater and wastewater management scheme was the reuse and/or on-site management of all wastewater generated at the site. In particular, the major wastewater stream at the site, which was expected to be condensate from the re-dry kilns/boilers and steamers, was to be treated on site using a purpose designed activated carbon water treatment plant prior to 100% reuse. However, this did not go ahead. Condensate is not generated. With the exception of reuse of condensate, the stormwater and wastewater management scheme is still relevant and only minor changes have been made to this section of the plan.

The legacy environmental issues at the site, included CCA impacted soil and groundwater, and residue stockpiles. This legacy stockpile area has been fully remediated. The stormwater pond in the southern portion of the site known as the Southern Pond, has been remediated and rehabilitated to a natural watercourse. This work was completed in 2018.

A comprehensive range of soil and water monitoring, reporting and contingency procedures have also been developed to ensure that the management procedures continue to be effective in the future, thereby ensuring that environmental impacts are minimised. These have been updated with regard to past monitoring results and additional soil and water investigations undertaken in early 2022.

The soil and water management procedures will ensure that the environmental performance of the facility is consistent with environmental best practice. In addition, the procedures have improved the environmental condition of the site by ensuring that environmental impacts are minimised.

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# LIST OF ABBRIEVIATIONS

| | |
|---|---|
| **CCA** | Copper Chrome Arsenate |
| **DEC** | Department of Environment and Conservation (now EPA) |
| **DO** | Dissolved Oxygen |
| **DWAU** | Dongwha Australia |
| **DWRMMP** | Dust and Wood Residue Management and Monitoring Plan |
| **DPE** | Department of Planning and Environment |
| **EC** | Electrical conductivity |
| **EPA** | Environment Protection Authority |
| **EPL** | Environment Protection Licence |
| **NEPM** | National Environment Protection (Assessment of Site Contamination) Measure |
| **NOW** | New South Wales Office of Water |
| **NSW** | New South Wales |
| **OSD** | On-site detention |
| **PIRMP** | Pollution Incident Response Management Plan |
| **PM10** | Particulate matter of size 10 $\mu$m |
| **RAP** | Remediation Action Plan |
| **SEPP** | State Environmental Planning Policy |
| **SWMP** | Soil and Water Management Plan |
| **TDS** | Total Dissolved Solids |
| **TOC** | Total Organic Carbon |
| **UPSS** | Underground Petroleum Storage System |
| **VOC** | Volatile Organic Compounds |
| **WHS** | Work, Health and Safety |

# 1. INTRODUCTION

The land subject to this Soil and Water Management Plan (SWMP) is located at Dongwha Australia (DWAU) (*formerly Dongwha Timbers & Willmott Timbers*) integrated sawmilling and value-adding facility at 1 Sandy Lane, Bombala, New South Wales ('the site'). The location of the site is shown in Figure 1. A figure showing the site and surrounding land uses is presented in Figure 2.

The SWMP was originally prepared by Peter J Ramsay and Associates in 2011 and updated in 2017. The SWMP has been revised in accordance with Conditions 20 to 24 of Schedule 3 of the Project Approval MP07_0161 (MOD4) based on site changes, monitoring program results and additional soil and water investigations recently undertaken at the site. Table 1-1 summarises the relevant Conditions of the Project Approval (MOD4) for the development and where those items are addressed in this report.

The SWMP describes the existing environmental condition of the site and includes the following components:

- Site water balance;
- Sediment and erosion control plan;
- Stormwater management scheme; and
- Soil and water monitoring program.

Table 1-1: Project Approval MP07_0161 (MOD4) – Schedule 3, Conditions 20 to 24

| Condition | Section of Document Addressing Condition |
|---|---|
| 20. The Proponent shall prepare and implement a Soil and Water Management Plan for the project to the satisfaction of the Secretary. This plan must: | |
| (a) be approved by the Secretary prior to the commencement of any works on site; | TBA |
| (b) be prepared in consultation with Council and EPA (including the Office of Water) | Section 1.1 |
| (c) include: | |
| i. a Site Water Balance; | Section 6 |
| ii. a Sediment and Erosion Control Plan; | Section 7 |
| iii. a Stormwater Management Scheme; | Section 5 |
| iv. a Soil and Water Monitoring Program; | Section 8 |
| | |
| (a) identify and quantify all water uses on site; | Section 6.3.2 |
| (b) include a detailed description of the water management and reuse on site; | Sections 5.1, 5.2 and 5.3 |
| (c) demonstrate 100% reuse of CCA condensate would be achieved in the treatment plant; | Section 5.2 and 6.3.3 |
| (d) quantify the wastewater quality and flows, for each wastewater stream and describe the reuse or disposal method for these wastewater streams; | Section 5.2 |

| Condition | Section of Document Addressing Condition |
|---|---|
| (e) describe the reporting procedures and contingency measures that would be implemented in the event of any issues with the water management and or reuse infrastructure; | Section 5.6 |
| (f) include detailed consideration of all available options to reduce the water use of the project; and | Section 5.3 |
| (g) demonstrate that all reasonable and feasible measures to minimise water use would be implemented. | Section 5.3 |
| 22. The Sediment and Erosion Controls for the project must: | |
| (a) be endorsed by an Accredited Site Auditor; | Not relevant. Previous SECP was endorsed. |
| (b) be consistent with the requirements of Landcom's (2004) Managing Urban Stormwater: Soils and Construction manual; | Section 7 |
| (c) manage activities that could cause soil erosion and generate sediment; | Section 7.1 |
| (d) minimise soil erosion and the potential for the transport of sediment to downstream waters; | Section 7.2 |
| (e) describe the location, function and capacity of erosion and sediment control structures; | Section 7.2 |
| (f) describe the measures to be implemented to maintain these structures overtime; and | Section 7.3 |
| (g) be implemented prior to the commencement of any construction, demolition or remediation and be maintained for as long as necessary to control erosion and sediment on site. | Section 7 |
| 23. The Stormwater Management Scheme must: | |
| (a) be prepared in accordance with the EPA's Managing Urban Stormwater: Council Handbook; | Section 5 |
| (b) include details of: | Section 5.4 |
| i. pre and post development flows; | Section 5.5 |
| ii. water quality; | Section 5.1 |
| iii. the rainwater harvesting and reuse infrastructure to be installed; | |
| iv. the stormwater treatment, drainage and retention infrastructure, ensuring there is sufficient capacity to handle the 4 % AEP, 144 hour rainfall depth storm event; | Sections 5.4 and 5.6 |
| v. the measures to manage flow during a 1% AEP event; and | Section 5.1 |
| vi. the measures to be implemented to monitor and manage the stormwater quality and quantity and maintain the stormwater infrastructure over time. | Section 5.6 |
| 24. The Soil and Water Monitoring Program must: | |
| (a) include detailed data on the existing soil, surface and groundwater quality; | Section 3 |
| (b) identify the potential pollutants from the project; | Section 8.1 |
| (c) identify the soil, surface water, groundwater and wastewater impact assessment criteria; | Section 8.2 |
| (d) describe the monitoring strategy to be implemented, including details of the: | |
| i. monitoring locations; | Section 8.2 |
| ii. sampling frequency; | Section 8.2 |

| Condition | Section of Document Addressing Condition |
|---|---|
| iii. sampling methods; | Section 8.3 |
| (e) include justification for the proposed monitoring strategy; | Section 8 |
| (f) describe how the monitoring results will be assessed and reported; | Section 8.6 |
| (g) outline the contingency measures that would be implemented should monitoring identify any exceedance of the impact assessment criteria; | Section 8.7 and 8.8 |

The SWMP has been revised based on outcomes of the 2021 environmental audit, results of additional sampling and analysis undertaken as part of a 2022 detailed site investigation for the purposes of revising the remediation action plan (RAP). Works to remove the old treatment plant was completed in early 2022. Results of past years of soil, surface water and groundwater monitoring under the current monitoring program have also been reviewed.

This SWMP was originally prepared in 2011 and updated in 2017 by Peter J Ramsay and Associates. Updates to the plan in 2022 have been undertaken by Benbow Environmental based on the above information.

## 1.1 CONSULTATION

In accordance with Condition 20 (b), this plan was revised in consultation with Council, the Environmental Protection Authority (EPA) and the Office of Water. These authorities were provided with a copy of the draft revised SWMP as approved by Dongwha. Feedback from each authority is provided below.

The EPA reviewed the details of the draft SWMP and noted that the soil and water monitoring program reflects the current version of the EPL. The EPA acknowledges that the draft SWMP includes consideration of all assessment requirements relevant to the EPA and therefore, there were no additional assessment requirements requested by the EPA for the final SWMP.

Snowy Monaro Regional Council and the Office of Water did not provide feedback.

# 2. SITE DESCRIPTION

The site is approximately 37 hectares and is located approximately 2 km from the small town of Bombala in the south-east of New South Wales. The site is bound by Delegate Road to the north, Sandy Lane to the east and Wedmore Road to the south. The location of the site is shown in Figure 1. A figure showing the site and surrounding land uses is presented in Figure 2.

The land use at the site is a softwood sawmilling and value-adding processing plant. The mill operations prior to 2011 were contained on the eastern portion of the site. The expanded operations are  on the adjacent western portion of the site and the old mill site. The surrounding land uses is mixed rural comprising grazing, cultivation and plantation forestry.

## 2.1 GEOLOGY AND HYDROGEOLOGY

The Geological Survey of Australia 1:250 000 Bega-Mallacoota Geological Series Map (Sheet SJ/55-5 and part of Sheet SJ/55-8) indicates that the site is located on Tertiary Age fluvial sands, grits and lacustrine clays, apart from the northern portion of the site which is located on late Silurian Aged Bukalong Suite Granite, which comprises biotite granite and adamellite. The soil at the site comprises various sands, silts and clay consistent with river and lake sediments.

The results of a 2011 groundwater investigation previously undertaken at the site indicates that the depth to groundwater varies between approximately 3 m and 9.7 m. This is consistent with the results of the previous investigations undertaken at the site by Coffey Geosciences Pty Ltd (Coffey) between July 2002 and September 2003. The groundwater is inferred to be flowing in both northerly and southerly directions from the ridge where the existing copper chrome arsenate (CCA) treatment facility is located. This groundwater flow regime is consistent with the surface topography.

## 2.2 SURFACE DRAINAGE AND HYDROLOGY

Stormwater run-off from the site is separated into two catchments. Stormwater from the northern portion of the site naturally drains into Parsonage Creek, which is located approximately 120 m to the north of the site. Stormwater from the southern portion of the site naturally collects in a drainage line that ultimately flows into Saucy Creek, which is located approximately 650 m west of the site.

Under the existing hydrogeological regime stormwater from the southern portion of the mill site drains into a large pond, which is known as the Southern Pond. Surface water run-off from the northern portion of the existing mill site is collected in a pond known as the Northern pond.

# 3. ENVIRONMENTAL CONDITION OF THE SITE

## 3.1 PREVIOUS ENVIRONMENTAL ASSESSMENTS

A number of previous environmental assessments have been undertaken at the site. These include:

- Groundwater Monitoring January 2003 Prime Pine Treatment Facility, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 14 March 2003;
- Groundwater Monitoring October 2002 Prime Pine Treatment Facility, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 18 December 2002;
- Environmental Site Assessment, Prime Pine Treatment Facility – Sandy Lane, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 1 November 2001;
- Supplementary Environmental Site Assessment Prime Pine Treatment Facility, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 31 July 2002;
- Limited Environmental Site Assessment, Dongwha Forests Pty Ltd Treatment Facility, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 22 September 2003;
- Final Compliance Audit Report, Prime Pine Pty Limited, Sandy Lane, Bombala, NSW, prepared by Environment Protection Authority, January 2003;
- NSW Environmental Protection Authority, Annual Return for EPL 11205 – Dongwha Timbers, Bombala, prepared by Coffey Geosciences Pty Ltd, 1 June 2004;
- NSW Department of Environment and Conservation, Annual Return for Environmental Protection Licence No.11205 – Dongwha Timbers Pty Ltd, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 1 June 2005;
- NSW Department of Environment and Conservation, Annual Return for Environmental Protection Licence No.11205 – Dongwha Timbers Pty Ltd, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 14 June 2006;
- NSW Department of Environment and Conservation, Annual Return for Environmental Protection Licence No.11205 – Dongwha Timbers Pty Ltd, Bombala NSW, prepared by Coffey Geosciences Pty Ltd, 5 June 2007; and
- Results of Surface Water Monitoring, Integrated Sawmilling and Value Adding Facility, Sandy Lane, Bombala, New South Wales, prepared by Peter J Ramsay & Associates, 28 July 2009.

The results of the previous investigations identified elevated arsenic concentrations above the relevant health-based guidelines for an industrial land use in the near surface soil in the vicinity of the CCA treatment area in the central portion of the site. The contaminant concentrations across the remaining areas of the site were low and below the guidelines applicable for an industrial land use. In addition, groundwater monitoring performed at the site on an annual basis since 2002 identified elevated arsenic, chromium (VI), chromium (III) and copper concentrations in the groundwater monitoring wells located in the vicinity of the CCA treatment area. The groundwater monitoring results show that the arsenic, chromium and copper impacted groundwater was migrating from the central portion of the site toward both the north and the south. The chromium (VI) contamination appeared to be localised to the general vicinity of the CCA treatment area in the central portion of the site. The chromium (VI) concentrations had generally shown a decrease in concentration overtime, although elevated levels were measured during the July 2006 monitoring episode. The contaminant trends in the groundwater overtime were considered to indicate that the contamination is likely to have been caused by historical leakages of CCA from the treatment area.

The analytical results for the down-gradient monitoring wells indicated that the plume had reached the northern boundary of the site at levels above the guideline values for the protection of aquatic ecosystems, however, it is noted that these guidelines apply at the point of discharge into the nearest receiving environment. It was also noted that chromium (VI) was not detected in the down-gradient wells, which indicates that the chromium (VI) was being reduced in the natural environment to the less toxic chromium (III).

The results of surface water monitoring performed on a quarterly basis from the Northern Pond showed that variably elevated arsenic, chromium and copper concentrations above the guidelines for the protection of aquatic ecosystems were present in all of the surface samples. Chromium (VI) was also detected on several occasions in the sedimentation pond, which proceeds the Northern Pond.

During the May 2009 surface water monitoring episode performed by Peter J Ramsay & Associates, surface water samples were retrieved from four locations in the Southern Pond, three locations in the Northern Pond, and one sample of steamer/kiln condensate. All of the surface water samples were impacted by CCA contamination. The presence of CCA in the Northern and Southern Ponds was attributed to surface water runoff from existing areas of CCA contamination.

The steamer/kiln condensate, which ultimately is discharged into the Southern Pond, was characterised by elevated total dissolved solids (TDS) and organic carbon concentrations, and a slightly acidic pH. The steamer/kiln condensate also contains elevated arsenic, chromium and copper concentrations, however, this is not due to CCA contamination but is instead attributed to corrosion of the boiler. This boiler will be decommissioned and subsequently reinstalled for the redry boiler during the redevelopment of the site. Therefore, the steamer/kiln condensate generated post-development will not be impacted by arsenic, chromium and copper. The surface water from the Southern Pond was also characterised by a high organic carbon content, which was attributed to the inflow of organic laden steamer/kiln condensate and surface water runoff from the stockpiles of wood chips. The Southern Pond was also characterised by high iron, ammonia and methane concentrations, which are a function of the strongly reducing conditions in the pond. Apart from elevated CCA concentrations, the northern pond was indicated to be uncontaminated with organic carbon.

## 3.2 2011 Soil and Groundwater Sampling Program

Peter J Ramsay & Associates performed a soil and groundwater sampling and analytical program at the site between July and August 2011. The objective of the soil and groundwater assessment was to verify the previous soil assessment results and delineate the areas of significant contamination.

The soil sampling program involved sampling from 24 grid-based sample locations in the vicinity of the existing treatment plant and treated timber storage area. The soil sampling locations are shown in Figure 3 and 4. In addition, sampling was undertaken from 25 targeted sampling locations in the vicinity of the treatment plant and storage areas, former waste storage area and in the vicinity of the existing underground petroleum storage systems (UPSSs).

The 6roundwayter investigation involved the installation of seven (7) groundwater monitoring wells, and sampling of the 10 existing and 7 newly installed wells using low-flow minimum drawdown techniques in accordance with OEH requirements. This was to determine the magnitude and extent of the impacted groundwater at the site. The location of the groundwater monitoring wells are shown on Figures 3 and 4.

The results of the 2011 soil and groundwater sampling and analytical program are outlined in the following sections.

### 3.2.1 Soil

The analytical results for the soil samples identified elevated arsenic concentrations in the near surface soil in the vicinity of the existing CCA treatment plant, and in the treated timber storage yard, above the health investigation level (HIL) for a commercial/industrial land use (HIL F). Significant arsenic contamination was also identified at approximately 2 m depth in the vicinity of the sump adjacent to the former treated timber fixation slab.

Elevated total petroleum hydrocarbon (TPH) (C15-C28) aromatic concentrations were measured above the HIL for this analyte in the near surface samples retrieved from the vicinity of the existing diesel UPSSs. This is likely to be due to the near surface spillage of diesel fuel. There was no evidence of hydrocarbon leakages from the diesel UPSSs themselves.

Arsenic, chromium (III), chromium (VI) and copper were measured at concentrations above the ecological investigation levels (EILs) but below the HILs in the near surface soil at a number of the sample locations. However, this would only be significant should the soil be utilised as a growing medium for plants. Since the impacted areas will be sealed for the proposed development, the arsenic, chromium and copper concentrations in the soil above the EILs would not be significant for the proposed re-development of the site.

In view of the elevated arsenic concentrations in the vicinity of the existing CCA treatment plant, sump and in the treated timber storage yard, above the HIL F, remediation is considered necessary for the proposed ongoing commercial/industrial use of the site. In addition, the petroleum hydrocarbon impacted soil in the vicinity of the diesel UPSSs should be remediated. The originally proposed extent of soil remediation at the site is shown in Figure 5. (Note: Areas of remediation have been revised based on recent studies, refer to Section 3.3 for details)

Based on the results of the soil sampling program, approximately 310 $m^3$ of arsenic contaminated soil located in the vicinity of the existing CCA treatment plant and sump is necessary. Approximately 50 $m^3$ is proposed to be remediated in each of the treated timber storage yard and in the vicinity of the diesel UPSSs. A remediation action plan (RAP) is currently being prepared for the remediation of the contaminated soil at the site.

### 3.2.2 Groundwater

The results of the groundwater monitoring undertaken from the existing and newly installed groundwater monitoring wells at the site indicate that the groundwater in the vicinity of the existing treatment plant is contaminated with chromium (VI), arsenic and manganese. In particular, the concentrations of these analytes are above the guideline values for the protection of aquatic ecosystems (which apply at the point of groundwater discharge into the receiving water environment) and the Australian drinking water guidelines.

Arsenic was also detected in one down-gradient well at a concentration of 0.007 mg/L, marginally above the criterion for the protection of aquatic ecosystems of 0.013 mg/L. Elevated manganese concentrations above the Australian drinking water criterion were also identified in the groundwater in the vicinity of the Southern Pond. The chromium and manganese concentrations in the groundwater elsewhere at the site were either very low or not detected.

Cobalt, copper, nickel and zinc were identified in the majority of the wells installed at the site at concentrations above guideline values for the protection of aquatic ecosystems. The nickel concentrations are also variably above the Australian drinking water guidelines. The presence of these analytes in the majority of the wells at similar concentrations indicates that these analytes are naturally occurring.

Beryllium and mercury were measured in only one well each, above the guideline values for aquatic ecosystems. Lead and mercury were also measured above the guideline values for drinking water. The beryllium concentration is only marginally above the guideline value for this analyte and is not considered to be significant. The elevated lead and mercury concentrations are anomalous as they were only measured in one well each and mercury and lead were not measured in significant quantities in the soil at the site. Further groundwater monitoring would be necessary to determine the significance of these results.

Nitrate was also measured at concentrations above the criteria for the protection of aquatic ecosystems and the Australian drinking water criterion in the wells located in the former waste disposal area and the well located in the vicinity of the former UPSSs. Petroleum hydrocarbon impacts were not identified in the groundwater at these locations. These nitrate concentrations are within natural background ranges and given the absence of significant soil contamination at both locations, the elevated nitrate is considered to be naturally occurring.

Overall the results of the groundwater monitoring demonstrate that the groundwater in the vicinity of the existing treatment plant is polluted with chromium (VI), manganese and arsenic. The groundwater is also characterised by naturally elevated cobalt, copper, nickel, zinc and nitrate concentrations. The chromium, manganese and arsenic pollution has not migrated to the down-gradient wells, which are located approximately 60 m down-gradient of the treatment plant and therefore has not migrated offsite. This suggests that the extent of the plume has contracted since Coffey's groundwater monitoring was performed between 2002 and 2006.

In view of the inferred extent of the groundwater pollution, it is considered unlikely that aquatic ecosystems would be impacted by the impacted groundwater. However, the use of the groundwater as a drinking water resource at the site would be impacted. In view of this, groundwater remediation is recommended to restore the groundwater to natural background concentrations to the extent practicable. The remediation of groundwater should therefore be considered in the RAP that is currently being prepared for the site.

## 3.3 2022 Soil Investigation

The initial RAP and SWMP as prepared by PJR&A in 2011, identified five areas requiring soil remediation. This included three locations within the former CCA treatment area and storage yard having elevated CCA levels, an area with elevated TRH levels and an area containing a disused diesel UST, slated for removal. The five areas were defined as Area A, B & C (containing elevated CCA), Area D (elevated TRH) and Area E (the UST). Due to the passage of time and that site works had disturbed surface soils in these locations (including the removal of the UST), a limited site investigation was conducted to determine the current extent of soil contamination within these areas. Sampling occurred on the 22nd and 23rd March 2022 within areas A, B and C. Sampling points totalling fourteen, were determined by grid spacing to detect a hotspot . These are shown in Figure 11.

During the investigation, BE learned from site personnel that earlier site works included the installation of a large subsurface impermeable membrane which captures stormwater and potential fugitive CCA drips from treated timbers stored externally. The extent of the covering and precise location of Areas D and E were not able to be verified with the potential existing that the membrane may cover some or all of Area D and E. As a result these two locations could not be investigated at the time. It is recommended further investigation be made to determine the membrane's precise boundaries, so soils from Area D and E can be potentially located and sampled (if possible).

Sampling of soils obtained from the floor and walls of the excavated space were conducted following the removal of the USTs as per legislative requirements. Laboratory analysis revealed samples contained contaminant concentrations below relevant commercial/industrial criteria.. Approximately 80m$^3$ of potentially contaminated soil was removed from where the removed USTs were once housed. Laboratory analysis of these soils were found to be greater than relevant commercial/industrial land-use standards and thus was deemed unsuitable for on-site reuse. Identified contaminated material was treated on-site and subsequently deemed suitable for re-use on-site following further analysis.

Contaminant levels were below the Site Assessment Criteria in Areas A and C and slightly elevated in a portion of Area B where CCA solution was historically stored in an aboveground storage tank (AST). Perched water was also encountered beneath the former tank at a depth of approx. 1.0 m. It is assumed this water would contain elevated CCA levels.

# 4. UPGRADED FACILITY

The facility prior to the upgrade which included milling operations; processing, refinement and treatment to produce value-added softwood timber products, has been upgraded to increase the timber production capacity and to also improve the efficiency and environmental performance of the processes. The expanded mill comprises a primary sawing plant, timber dry mill, processing and treatment facilities and associated site infrastructure. A site plan showing the redeveloped site is shown in Figure 6.

The project utilises some components of the old mill, with others being decommissioned and replaced with new items. In particular, the old timber treatment plant has been decommissioned and a new treatment plant is now in operation.

The water storage known as the Northern Pond has been upgraded and new water storages also constructed (Ponds 1 and 2). The Southern Pond has been remediated and the area has been restored to its natural state as a drainage line which ultimately feeds into Pond 2.

The new treatment plant has been constructed on the eastern portion of the site, prior to the decommissioning of the old treatment plant. The works to remove the old treatment plant were completed in early 2022. The soil and groundwater remediation is scheduled to be undertaken following the revision and approval of the RAP.

As part of the redevelopment works, the legacy woodchips stockpiles that were located in the south-eastern corner of the site have been removed from site. A summary of the scheduling for the soil and water management strategies outlined in this management plan is provided in Table 4-1.

Table 4-1: Summary of Scheduling for Soil and Groundwater Management Strategies

| Management Measure | Implementation Timeframe | Section of Report Containing Further Detail |
|---|---|---|
| Soil Remediation | Removal of the old treatment plant completed in early 2022. Remediation to be completed following the approval of the revised RAP | Refer to Remidation Action Plan |
| Groundwater Remediation | Removal of the old treatment plant completed in early 2022. Remediation to be completed following the approval of the revised RAP. | Refer to Remediation Action Plan |
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# 5. STORMWATER AND WASTEWATER MANAGEMENT

Beca AMEC Limited and Tasman Engineering in consultation with Tasco, Fifth Estate and Peter J Ramsay & Associates has prepared a comprehensive stormwater and wastewater management system for the site. The stormwater management scheme has been prepared in accordance with OEH's Managing Urban Stormwater: Council Handbook.

The key objectives of the stormwater and wastewater management system designed for the site are to:

- Provide sufficient stormwater retention capacity to retain a 4%, average annual probability (AEP), 144 hour rainfall event;
- Minimise and manage off-site discharge as far as practicable, including in the event of a 1% AEP rainfall event; and
- Minimise mains water consumption and maximise the potential for water to be reused at the plant.

The stormwater and wastewater management system is shown in Figure 7 and is described following.

## 5.1 Stormwater Management

The stormwater retention infrastructure installed at the site is summarised in Table 5-1 Stormwater is managed by capturing all of the stormwater generated at the site in three ponds known as the Northern Pond, Pond 1 and Pond 2. The Northern Pond and Pond 2 are used as the main water storages for 'contaminated' and 'uncontaminated' water respectively. In particular, the Northern Pond captures stormwater from the areas of the site used to treat and store treated timber, and the Pond 2 captures water from elsewhere on the site. The catchment areas for each of the ponds are shown in Figure 8.

Ponds 1 is located down-stream of the Northern Pond. This is operated as a dry pond. That is, Pond 1 captures water from its own surface water catchment but the water captured is immediately transferred to Pond 2 for storage. Therefore, Pond 1 offers additional storage capacity in the event of an extreme flood event in order to minimise the potential for off-site discharge.

Table 5-1: Summary of Water Storages Constructed at the site

| Storage | Maximum Capacity | Working Capacity | Footprint | Catchment Area | Basis for Design | Facilities Within Catchment Area |
|---|---|---|---|---|---|---|
| Northern Pond | 11,774 $m^3$ | Negligible | 61 m x 95 m | 49 ha | Capture average rainfall plus a 1% AEP, 72 hour rainfall event. | Treatment plant, treated timber storage areas |
| Pond 1 | 1,441 $m^3$ | Negligible | 16 m x 69 m | 3.4 ha | Capture a 4% AEP, 144 hour rainfall event. | Offices, carpark, roadways. |
| Pond 2 | 24,000 $m^3$ | 16,000 $m^3$ | 180 m x 70 m | 18.3 ha | Capture average rainfall from its own catchment, and from the catchment of Ponds 1, plus a 4% AEP, 144 hour rainfall event from own catchment. | Dry mill, woodchip stockpiles (to be removed post development), finished product storage, green mill, GOS boilers and kilns, materials handling, green storage. |

Ponds 1 and Pond 2, which contain 'uncontaminated' water, have sufficient storage capacity to contain a 4% AEP, 144 hour rainfall event. By comparison, the Northern Pond, which has the potential to capture contaminated stormwater, has sufficient storage capacity to capture a 1 in 100, 72 hour storm event, which is a very rare event (1% chance of the event occurring in any given year).

The water that is generated to the east of the site and naturally flows through the site is considered to be surplus to the plants requirements. In view of this, any stormwater generated off-site to the east is diverted from the site. This is achieved by connecting a sub-surface pipeline to an existing culvert located in Sandy Lane and piping the water across the eastern half of the site where there is the potential for contamination to occur. The water is released at the surface in the natural drainage line in the western half of the site where the catchment is undeveloped and therefore there is negligible potential for contamination to occur.

Should an event greater than a 1 in 100, 72 hour rainfall event occur at the site, there is the potential for off-site discharge to occur from the Northern Pond. In this event, the very significant volume of freshwater runoff is likely to dilute any contaminant concentrations in the runoff. Therefore, there is considered to be a very low risk of off-site impacts occurring during a rare storm event as a result of this dilution effect. In addition, the water balance indicates that the Northern Pond will be dry for a significant time, which means there will be no contamination present in the Northern Pond to be mobilised in an extreme rainfall event.

In order to control the surface water levels in each pond, float switches are installed in each pond. These automatically activate the pumps in order to transfer water from Pond 1 to Pond 2, and transfer water from the Northern Pond and Pond 2 to the treatment plant. The Northern Pond is the primary source of water to the treatment plant. However, when the Northern Pond reaches its minimum level, the pump switches off and the pump in Pond 2 is activated. The system has been designed so that only one pump at a time can pump to the treatment plant. As dust suppression is a major factor on site DWT will utilise the water captured in Pond 2 by pumping directly into the Water Truck. Water will them be spread around site to suppress the dust.

## 5.2 WASTEWATER MANAGEMENT

The following wastewater streams are present at the site:

- Sewerage generated at the site;
- Surplus CCA generated within the treatment plant or during the fixation of the timber on the fixation slab.

The proposed wastewater management measures for the redevelopment of the site are summarised in Table 5-2. Any surplus CCA generated within the treatment plant or during the fixation of timber will be collected in a sump. The residue will be directly pumped back into the CCA make up water tanks. These management strategies will ensure that all waste water streams from the timber milling and treatment are reused at the site.

Table 5-2: Summary of Wastewater Streams and Management Strategies

| Wastewater Source | Volume | Expected Wastewater Quality | Management Strategy |
|---|---|---|---|
| Sewerage | 15.3 $m^3$ /day | Organics, bacterial and faecal contamination | Septic tank and black water dispersion trenches |
| Surplus CCA | Negligible | Heavy metals and ammonia | Capture in sump within treatment plant and recirculate directly into CCA make up water tank. |

It is also noted that water from the Northern Pond, which may contain trace amounts of CCA, is the primary source of water to the treatment plant. Based on the water balance, all of the water that accumulates in the Northern Pond can be reused in the treatment plant.

## 5.3 WATER MINIMISATION STRATEGIES

In order to minimise water usage at the site a number of water reuse strategies have been developed. These include:

- As outlined above, any surplus CCA will be directly reused in the treatment plant;
- Stormwater collected at the site firstly in the Northern Pond and secondly in Pond 2 will be used to feed the treatment plant. The water balance indicates that the storage in the Northern Pond and Pond 2 will be greater than the demand for the treatment plant and therefore there will be no need to use mains water for the treatment plant; and
- Water from Pond 2 will also be used in preference to mains water supply for dust suppression (approximately 16.4 $m^3$ /day).

There is also the potential to use water from Pond 2 as feed water for the boilers (approximately 17.3 $m^3$ /day). The water quality requirements for the boilers to be installed at the site are provided in Table 5-3. Water quality data available for Pond 2 is not suitable to compare to the water quality requirements appropriate for reuse in the boilers. In view of this, the water quality of Pond 2 should be tested for relevant parameters/characteristics and compared to these criteria prior to reuse in the boilers at the site.

Table 5-3: Water Quality Requirements for Boilers

| Characteristic | Unit | Pressure <15 bar | Pressure <25 bar |
|---|---|---|---|
| pH | - | 7 – 9.5 | 7 – 9.5 |
| Total hardness | mg/L (as $CaCO_3$) | 10 | 5 |
| Alkalinity | mg/L (as $CaCO_3$) | 1,000 | 750 |
| Oxygen | mg/L | 0.1 | 0.05 |
| Free Carbon Dioxide | mg/L | 0.2 | 0.2 |
| Iron | mg/L | 0.1 | 0.1 |
| Copper | mg/L | 0.1 | 0.1 |
| Silica | mg/L | 150 | 100 |
| Conductivity | µS/cm | 8,000 | 7,000 |

| Characteristic | Unit | Pressure <15 bar | Pressure <25 bar |
|---|---|---|---|
| TDS | mg/L | 3,500 | 3,000 |
| Oily substances | mg/L | 1 | 1 |
| Aspect | - | Clear, limpid, no persistent foam | |

In view of the water minimisation strategies outlined above, mains water is only be used for potable services, the GOS kilns/boilers (a once only fill of mains water is required as the water is recirculated in the kiln/boiler) and potentially the redry kilns/boilers. It is noted that as outlined above, water from Pond 2 is used in the redry kilns/boilers in preference to mains water provided it is of sufficient quality for that purpose.

## 5.4 PRE AND POST DEVELOPMENT FLOWS

The stormwater management strategies at the site have increased the volume of environmental flows which ultimately flow into Saucy Creek. Water collected up-stream of the site is diverted across the site. The volume of runoff that is generated from the land to the east of the site in an average year amounts to approximately 12,000 $m^3$ /year. Only the stormwater generated at the site is captured and reused.

## 5.5 WATER QUALITY

Water quality has considerably improved at the site post development. In particular, all CCA treated timber is contained within the treatment plant area and surrounding sealed areas. Runoff from these areas is captured in the Northern Pond, which is the primary source of water for the treatment plant. In view of this, CCA contamination does not appear to occur elsewhere at the site. In addition, since the stockpiles of woodchips previously located in the south-western portion of the site have been removed, the water quality in the Southern portion of the site has improved considerably.

In addition, there is the potential for coarse organic fragments to be flushed into the ponds at the site. A coarse filter has been placed at the inlet of each pond to capture this material prior to it flowing into the ponds. The filters are subject to routine maintenance to ensure they operate efficiently and effectively.

## 5.6 ONGOING MONITORING, MAINTENANCE AND REPORTING

The water storages are subject to regular water quality monitoring in accordance with the monitoring program outlined in Section 8. In addition, routine inspections are carried out on a quarterly basis to ensure that all infrastructure is in sound working condition. In addition, daily inspections need to be undertaken following periods of rainfall that generate rainfall (events greater than 10 mm) to ensure that the stormwater management system is in sound working order. The results of the inspections should be documented on an inspection checklist to be prepared by the Site Manager or Environmental Manager.

Any repairs or maintenance will be initiated immediately should an issue be identified. In addition, routine maintenance includes routinely cleaning drains and filters to be undertaken on a quarterly basis. Table 5-4 outlines the reporting and contingency measures that are to be implemented in the event that issues are identified with the water management or reuse infrastructure.

Table 5-4: Reporting and Contingency Measures for Water Management Issues

| Potential Issue | Response |
|---|---|
| Emergency release from Pond 2 during events greater than a 4% AEP, 144 hour rainfall event. | Activate the PIRMP. Notify down-gradient landholder and EPA immediately. Provide emergency water supply to replace water usually taken from neighbouring stock dam. Test the stock dam water to confirm there is no off-site impact. Provide written report to landholder and EPA on the results of the testing. Notify landholder that they can commence using the dam if no issue has arisen. In the event of an issue, develop a rectification strategy in consultation with EPA. |
| Overflow from Northern Pond during an event greater than a 1% AEP. | Activate the PIRMP. Cease pumping water from Pond 1 into Pond 2 immediately (automated response). Notify EPA and downstream landholders. |
| Pump failure | An emergency pump is located onsite, it will be relocated to temporarily replace the failed pump. The failed pump will be repaired/replaced as required. |
| Water quality exceedance during routine monitoring | Refer to Section 8 |

# 6. SITE WATER BALANCE

A site water balance was previously prepared by Peter J Ramsay and Associates in order to:

- Quantify all water sources and water uses on the site;
- Demonstrate that of the CCA condensate will be reused in the treatment plant and that water reuse at the site will be maximised;
- Quantify all wastewater flows; and
- Demonstrate that there is sufficient capacity in the proposed stormwater ponds to contain a 4% AEP, 144 hour rainfall event and manage flows during a 1% AEP.

The following site changes have occurred since the writing of the original site water balance:

- Condensate from the re-dry kilns is not generated and an activated carbon treatment system was not installed.
- An impermeable membrane was installed under the external treated timber storage area to capture stormwater and divert this to underground tanks and finally into the Northern Pond. Details of this system are needed to inform the update of the site water balance.

The site water balance figure (Figure 7) has been revised accordingly.

## 6.1 METHODOLOGY

A time series analysis water balance methodology as outlined in the NSW Department of Land and Water Conservation The Constructed Wetlands Manual, 1998, has been adopted. The volume in each water storage has been calculated on a monthly basis for several years of operation so that the long-term performance of the storages can be assessed. The monthly storage in each water storage is added to the water balance for the subsequent months to give cumulative storage.

For the purpose of the water balance, the site has been divided into four separate catchment areas based on the topography and future land use of the site. These are shown in Figure 8 and are:

- Area 1 – north-eastern and central-northern portions of the site, which drains into Pond 1 ;
- Area 2 – western portion of the site, which drains into Pond 2 ;
- Area 3 – south-eastern portion of the site, which also drains into Pond 2; and
- Area 4 – north-eastern portion of the site occupied by the treatment plant and treated timber storage areas, which drains into the existing Northern Pond.

The volume of water captured in each of the ponds during average rainfall conditions and also a 4% AEP, 144 hour rainfall depth event has been calculated. These rainfall conditions are simulated both during construction and post-redevelopment.

The water balance has been developed based on the proposed stormwater management scheme. In particular, Pond 2 collects average rainfall from its own catchment (Areas 2 and 3) and plus from the catchment of Ponds 1, plus a 4% AEP 144 hour rainfall depth event. Any stormwater that accumulates in Pond 1 is pumped into Pond 2 so that it is kept dry. This ensures that Pond 1 has sufficient capacity to capture the 4% AEP, 144 hour rainfall depth event. The Northern Pond, which has the potential to capture contamination stormwater, have sufficient storage capacity to capture a 1 in 100, 72 hour storm event.

The results of the water balance have also been used to calculate a 'working capacity' for Pond 2 and the Northern Pond, which is the volume that should not be exceeded in an average year. By keeping the volume in these ponds below the working capacity volume ensures there is sufficient room in these Ponds to capture a high rainfall event as specified by Condition 23 (b) iv. of the Project Approval of 7 September 2010. In particular. Pond 2 and the Northern Pond has capacity to capture the 4% AEP, 144 hour rainfall depth event and 1 in 100, 72 hour storm event respectively.

For the water balance, the 4% AEP, 144 hour rainfall depth event is conservatively simulated to occur when the ponds are at capacity from an average rainfall event, which would normally occur in July. For an average year, only the rainfall that falls in the winter months is considered in the water balance as runoff typically only occurs during periods when rainfall exceeds evaporation (i.e. winter or spring) when the soil has a high moisture content due to winter rainfall.

The following water balance methodology was used to calculate the storage capacity required to accommodate average rainfall conditions and a 4% AEP, 144 hour rainfall depth event for each of the ponds. The water balance for the site is determined by the following equation:

*Storage = Inputs – Outputs (Equation 1)*

Inputs of water to the site include:

- Rainfall directly into the ponds;
- Runoff from both on-site and off-site areas; and
- Discharge of waste steamer condensate.

Outputs of water from the site include:

- Evaporation; and
- Usage at the site including in the treatment plant

Substituting each of the inputs and outputs above into Equation 1 gives the following equation, which is calculated on a monthly basis for each Pond:

*Storage = [Rainfall (direct) + Runoff] – [Evaporation + usage] (Equation 2)*

A description of each of the inputs and outputs variables in the water balance Equation 2 are discussed below.

## 6.2 INPUTS

### 6.2.1 Rainfall and Runoff

Monthly rainfall data was sourced from the Bureau of Meteorology for the Therry Street, Bombala meteorological station, which is located approximately 3 km north-east of the site. This station was chosen as it is the closest meteorological station to the site with an extensive dataset that is considered most likely to be representative of the long-term rainfall conditions at the site. Monthly rainfall data for Therry Street, Bombala is available from 1885 to 2011.

The magnitude of a 4% AEP, 144 hour rainfall depth event was taken from data from the Cooma weather station, which is outlined in Managing Urban Stormwater, Soils and Construction, Volume

1, March 2004. The Cooma weather station is located approximately 75 km north of the site but within a similar climatic zone. The 4% AEP, 144 hour rainfall depth event represents a rainfall event that as a 4% chance of occurring in any given year. This equates to approximately 40 mm over a 6 day period.

The volume of rainfall that falls on the site and generates runoff that flows into each of the ponds is determined by the following equation:

*Rainfall x Area x Runoff Ratio (Equation 3)*

The runoff ratio in Equation 3 represents the proportion of rainfall that actually ends up as runoff that enters the ponds, rather than infiltrating into the ground for example. The site has been segregated into separate areas depending on their varying runoff characteristics. These include unsealed areas (bare ground or grass), sealed areas (asphalt, concrete or stabilised crushed rock), woodchip stockpiles and the ponds themselves.

Any rainfall that falls directly onto the ponds is obviously captured in the dam. Therefore, the runoff ratio for the ponds is 100%. Conversely, based on our observations during high rainfall events, in view of the high organic content and porosity of the woodchip stockpiles, the stockpiles are likely to absorb the majority of rainfall that falls directly on them. Therefore, the runoff ratio from the stockpiles has been assumed to be approximately 10%. It is noted that the stockpiles have been removed post-development, which will increase the runoff that is generated from this portion of the site. The treatment plant is fully sealed and covered in a roof. Therefore, runoff from this area is negligible. Runoff ratios of 58% and 84% have been adopted for unsealed areas and sealed areas respectively. The runoff ratios for the unsealed and sealed portions of the site have been determined based on runoff ratios summarised for different soil types and land uses as outlined in Soil Conservation Service, Hydrology-Section 4, National Engineering Handbook (prepared by Victor Mockus) Hydrology Branch, SCS, U.S. Department of Agriculture, Washington, D.C. 1972.

## 6.3 OUTPUTS

### 6.3.1 Evaporation

Water loss will predominantly occur from the ponds as a result of evaporation. Evaporation will also occur from the soil surface, however, it is not necessary to consider evaporation loss from the soil surface as the runoff ratio outlined above takes into account the effects of evaporation from the soil surface, amongst other variables.

The nearest meteorological station that measures evaporation is Orbost, which is located approximately 110 km south-west of the site. Class A pan evaporation is an overestimate of actual evaporation due to the effect of heating of the metal pan that is used for the measurements. Class A pan evaporation can be converted to actual evaporation from a surface water body using the following equation:

*Evaporation = Class A Pan Evaporation x pan coefficient (Equation 5)*

Pan coefficients typically range between 0.8 to 0.9. A pan coefficient of 0.8 indicates that only 80% of the measured Class A Pan Evaporation will end up being actual evaporation, whereas a coefficient of 0.9 indicates that 90% will end up being actual evaporation. That is, the higher the coefficient, the greater the estimate of actual evaporation. We have conservatively used a pan coefficient of 0.8 as this would result on a lower amount of water loss than a higher coefficient.

### 6.3.2 Water Usage at the Plant

Water usage at the plant was provided by Dongwha and is provided in Appendix A. This has been adopted in the water balance for the period October 2011 until January 2012 when the water usage is anticipated by Dongwha to increase to 50% of the maximum capacity, which occured in 2014. Dongwha's predicted water usage is based on predicted timber volumes that will require treatment. The annual water usage in the treatment plant has been converted to daily water usage based on a 235 days of operation per year. In addition, condensate generation from the redry kilns/boilers is based on 336 days/year of operation.

There is the potential that the water from Pond 2 is also be used to feed the redry kilns and boilers. In particular, these boilers have a daily water demand of approximately 17.3 m3 /day. The water balance does not take this into account as the potential to use stormwater from Pond 2 in the boilers depends on the ultimate water quality in the Southern Pond post development.

## 6.4 RESULTS AND DISCUSSION

The results of the water balance are shown in Appendix B. In addition, Figure 9 shows the predicted water levels in Pond 2 and the Northern Pond overtime based on the results of the water balance. The results indicate that Pond 1 only fills in June and July under average rainfall conditions. The water that is be captured in Pond1 is immediately and automatically pumped to the Pond 2, which has been designed to have sufficient capacity to accept the water from Pond 1 in addition to water from its own catchment area.

Pond 2 commences filling in June each year and has sufficient capacity to provide water to the treatment plant until February when the pond is likely to dry out. The maximum level in the pond in an average year is approximately 16,000 $m^3$. Following a 4% AEP, 144 hour rainfall event, the capacity would increase to approximately 23,000 $m^3$. In view of this, Pond 2 has a capacity of 24,000 $m^3$, which includes 0.5m freeboard.

The water balance also indicates that the Northern Pond is predominantly dry, apart from between June and August when winter rainfall is captured in the pond. This water is rapidly used in the treatment plant. The maximum volume predicted to be present in the Northern Pond following a 4% AEP, 144 hour rainfall event is approximately 2 000 $m^3$. Keeping the Northern Pond predominantly dry minimises the potential for contaminated water to overflow from the pond in an extreme rainfall event and ensure the pond has sufficient capacity to capture a 1% AEP, 72 hour rainfall event.

# 7. SEDIMENT AND EROSION CONTROL PLAN

Due to the sensitive nature of the area of disturbance, a comprehensive Sediment and Erosion Control Plan (SECP) was developed for construction works in order to:

- Manage activities that could cause soil erosion and generate sediment; and
- Minimise soil erosion and the potential for the transport of sediment to downstream waters.

The objective of the erosion and sediment control plan was to minimise the impact of construction activities on erosion and the sedimentation of the land, water watercourses and water bodies. The sediment and erosion controls were implemented prior to the commencement of any earthworks at the site (including construction, demolition and/or remediation). In addition, these controls will remain in place until the development works have been fully completed. The development works have been completed. The only remaining work is remediation of the old treatment area. The area requiring remediation is limited to approximately 24 m x 15 m area that can be accessed via the existing heavy vehicle entrance from Sandy Lane. Therefore a revised sediment and erosion control plan is provided. This needs to be supported by a Remediation Action Plan (RAP) that addresses key procedural controls and management strategies for the remediation works.

The sediment and erosion controls for the remediation works have been developed in accordance with Managing Urban Stormwater, Soils and Construction, Volume 1, March 2004.

In addition to sediment and erosion, the RAP would also include environmental control systems, environmental planning and controls, incident management and emergency response, soil and water management, noise and vibration management, flora and fauna management, resource and waste management, traffic control, dust and air quality, indigenous heritage, ground vibration and air blast, fire precautions and community liaison.

## 7.1 POTENTIAL EROSION IMPACTS

The remediation works will result in areas of land disturbance and may result in alteration of the existing surface water flow. Potential impacts may include:

- Increased runoff volumes and velocities from land disturbance and the introduction of impervious surfaces;
- Increased movement of sediments resulting in an increased pollutant load entering the natural water system; and
- Decline in water quality and degradation of local amenities through increased and potential for transfer of sediment and dust to nearby watercourses

## 7.2 SEDIMENT AND EROSION CONTROLS

### 7.2.1 Procedural Controls

In order to minimise erosion and the generation of sediment laden runoff, the following general procedures are to be implemented prior to the commencement of the remediation works:

- Implementation of a RAP to be prepared by the remediation contractor;

- Install all sediment and erosion controls specified in this SECP and the RAP to ensure that they operate as intended by implementing and monitoring and reporting program, as described in Section 7.3;
- Prioritise works at areas with a high potential for erosion to occur;
- Minimise areas of disturbance to workable sizes; and
- Restrict vehicle and pedestrian access where possible.

In addition, during the works all bare soil surfaces should be watered, particularly in dry conditions to reduce wind erosion, and rehabilitation should be performed quickly once works in a particular area have been completed.

The procedures are to be implemented by the relevant remediation contractor. The Principal, Dongwha, will also perform independent routine checks to ensure that the procedures are being implemented.

### 7.2.2 Barrier Fencing

Barrier fences are used to define work areas and to minimise unnecessary disturbance of vegetated or developed lands. They are used to restrict access to any areas that do not need to be disturbed and are used on an as-needs basis. A barrier fence is recommended to be installed to fence the area of remediation for the duration of the works.

### 7.2.3 Sediment Fencing

Sediment fencing is to be utilised extensively at various locations at the site during the remediation works. These include:

- Along earthen roads to prevent sediment migration off the active road surface;
- Around temporary stockpiles of soil generated as a results of the construction works; and
- On the downward side of any fill batters to ensure that any sediment is contained.

### 7.2.4 Stabilised Entrance to Area of Remediation

Entrance to the site would be via the existing sealed heavy vehicle entrance on Sandy Lane. The entrance to the area of remediation would need to have a stabilised entrance and exit point. This must be installed and maintained at the ingress/egress location prior to the commencement of any work. Single sized 40mm or larger aggregate placed 150mm deep and extending from the street kerb/road shoulder to the land is recommended to be provided as a minimum.

### 7.2.5 Temporary Sediment Ponds and Rock Check Dams

Temporary sediment ponds are not required for the remediation works. Existing ponds would be used to capture any stormwater flows during the works.

### 7.2.6 Slope Stabilisation

In order to minimise erosion from occurring, any earth banks will be stabilised with suitable vegetation cover or geotextile. Grass will be sewn using a fast-growing seed mix. Should seed germination be delayed, for example by low rainfall conditions, watering and/or hydro-mulching will be performed.

### 7.2.7 Temporary Stockpiles

Temporary stockpiles may need to be stored on site during remediation. Stockpiles would need to be generally managed as follows:

- Stockpiles are to be located on an impermeable base.
- Stockpiles should be located at least 2 metres away from existing vegetation, waterbodies, roads and other hazard areas.
- The side slopes of the stockpiles should be maintained at 2:1.
- Stabilise the surface of the stockpile using measures such as dampening with water or cover using LPDE plastic rolls.
- Maintain stockpiles to a height of no more than 2 metres.
- LPDE plastic rolls are plastic covers that can be applied to cover stockpiles as weather proofing and protection from erosion.

## 7.3 Monitoring and Reporting

### 7.3.1 Monitoring and Maintenance Requirements

The monitoring will involve systematically walking around the remediation area of the site and recording the condition of each erosion or sediment control measures. Maintenance requirements will be noted and initiated following the monitoring. Particular attention will be paid to inspecting areas where vehicles enter and leave the site, all installed erosion and sediment control measures, and off-site discharge points. Checklists to be utilised during the development works are included in the RAP.

The monitoring will be performed by the site manager at the following frequency:

- Each day during periods of rainfall that generate runoff (considered to be events greater than 10 mm); and
- Weekly during dry periods.

Any repairs or maintenance will be initiated immediately should an issue be identified. In addition, maintenance will include routinely cleaning drains, sediment fencing, ponds and filters. The frequency of cleaning will vary depending on the site conditions and climate. The site manager will specify when routine maintenance is necessary based on the results of the routine monitoring.

### 7.3.2 Responsibilities and Reporting

The remediation contractor will be responsible for ensuring that monitoring is undertaken and providing the completed checklist to the project manager for their information.

# 8. SOIL AND WATER MONITORING PROGRAM

A soil and water monitoring program has been implemented in order to monitor the performance of the facility and confirm that environmental impacts do not occur. This program has been revised based on past monitoring results and additional soil and water investigations and includes soil, groundwater and surface water monitoring.

## 8.1 POTENTIAL CONTAMINATION SOURCES AND CONTAMINANTS OF CONCERN

The following potential sources of contamination are present at the site:

- CCA treatment plant;
- Treated timber storage yard;
- Northern Pond which captures stormwater from the treated timber storage yard; and
- AGST for the storage of fuel.

The CCA treatment plant is covered with a roof, fully sealed and bunded and therefore the potential for contamination to occur beneath the treatment plant is considered to be low. In addition, the treated timber storage area (where the treated timber is stored following fixation) has been designed with an impermeable pavement and first flush stormwater collection system to minimise contamination. That is, there is a low potential for contamination to occur within the treated timber storage area. Although the treatment plant is bunded, there is some potential for soil contamination to occur on the unsealed area beyond the treatment plant. This area has been modified to include a membrane that captures stormwater and drains this into underground tanks and then to the Northern Pond. Monitoring of the soil will therefore be undertaken on the unsealed surface for the contaminants associated with the CCA which are arsenic, copper, chromium (total), chromium III and chromium (VI).

The AGST is bunded and therefore there is very low risk of contamination to occur. In view of this, there is considered to be no need for soil monitoring in this area. Routine inspections to verify the integrity of the bunding are undertaken to ensure that contamination does not occur.

In view of the groundwater contamination identified in the vicinity of the old treatment plant, ongoing groundwater monitoring has been undertaken at the site. The contaminants of concern in the groundwater include arsenic, copper, chromium (total), chromium (VI), total organic carbon (TOC) and ammonia. The measurement of TOC and ammonia, as well as other water quality indicators such as TDS, DO, EC, pH and redox are to identify any impacts associated with leakages from the surface water storages. Cobalt, nickel and zinc are not contaminants of concern in the groundwater as they are not present in the soil and are indicated to be naturally occurring in the groundwater. Therefore, they are not analysed for.

The water that accumulates in Ponds 1 and 2 is largely uncontaminated, apart from trace amounts of organics. The organic concentrations in the Ponds is reduced by filters installed on the inlet to the ponds and only retaining woodchips in controlled areas. These ponds have been monitored for indicators or organic contamination including TOC, lignin/tanins, ammonia and nitrate, as well as arsenic, chromium and copper.

## 8.2 MONITORING LOCATIONS AND FREQUENCY

It is noted that the original SWMP informed the monitoring requirements under the EPL. The monitoring requirements have changed since the preparation of this monitoring program and additional soil and water investigations undertaken in early 2022 have been reviewed to revise this program.

**Soil**

Soil sampling has been undertaken since 2011 in the vicinity of the proposed new CCA treatment facility and in the CCA timber storage areas on a biannual basis post development. This was to verify that soil impacts are not occurring in the treatment and post-treatment storage areas, although it is noted that the new design of the plant minimises the potential for soil contamination to occur. The revised monitoring locations are shown in Figure 10. The revised monitoring program is summarised in Table 8-4.

A summary of results for 2019-2021 is provided in Table 8-1. All results are under the HIL-F criteria.

Table 8-1: Summary of soil monitoring results

| POINT | Pollutant | HIL-F | Measured concentrations (from laboratory analysis) mg/kg | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Feb 2019 | Jul 2019 | Feb 2020 | Aug 2020 | Feb 2021 | Jul 2021 |
| 1 | Arsenic | 500 | 48 | 210 | 3.3 | 6.1 | 26.0 | 210 |
| | Chromium (total) | 60,000 | 60 | 160 | 38 | 5.8 | 190 | 190 |
| | Chromium (VI) | 500 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Copper (total) | 5000 | 97 | 210 | <5 | <5 | 69 | 650 |
| 2 | Arsenic | 500 | 25 | 70 | 100 | 28 | 7.4 | 3.9 |
| | Chromium (total) | 60,000 | 140 | 200 | 200 | 46 | 9.2 | 190 |
| | Chromium (VI) | 500 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Copper (total) | 5000 | 39 | 91 | 94 | 31 | ≤5 | <5 |
| 3 | Arsenic | 500 | 78 | 46 | 49 | 48 | 230 | 110 |
| | Chromium (total) | 60,000 | 92 | 42 | 46 | 60 | 200 | 200 |
| | Chromium (VI) | 500 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Copper (total) | 5000 | 64 | 91 | 94 | 46 | 160 | 110 |
| 4 | Arsenic | 500 | 63 | 73 | 34 | 82 | 130 | 170 |
| | Chromium (total) | 60,000 | 68 | 130 | 21 | 120 | 170 | 200 |
| | Chromium (VI) | 500 | <1 | <1 | <1 | <1 | <1 | <1 |
| | Copper (total) | 5000 | 42 | 70 | 40 | 55 | 110 | 120 |

A review of the past soil monitoring results was undertaken and found exceedances of the HIL-F criteria for arsenic at POINT 1 on three occasions – July 2012 (540 mg/kg), January 2014 (810 mg/kg) and April 2014 (1100 mg/kg). It is noted that three rounds of soil sampling were undertaken in 2014. Sampling undertaken in October 2014 found arsenic concentrations at POINT 1 to be <2 mg/kg, and the following round of monitoring in January 2015, the levels were <10 mg/kg.

Since the exceedance in April 2014, all results have been well below the HIL-F criteria.

It is noted that the HIL-F criteria has since been replaced with HIL-D criteria for commercial/industrial use in the NEPM. HIL-D criteria appears to be less stringent as follows:

Arsenic: 3000 mg/kg
Chromium (VI): 3,600 mg/kg and
Copper: 240,000 mg/kg

**Groundwater**

Groundwater monitoring has been undertaken since 2011 on an annual basis from groundwater monitoring wells located at the site. Four of the original monitoring wells have been removed and additional monitoring wells have been installed since the original program was written. The current locations of the groundwater monitoring wells are shown in Figure 10. The revised monitoring program is summarised in Table 8-4.

A review of the past monitoring results and SWMP found that the original program included biannual groundwater monitoring at certain points, however since April 2012, groundwater monitoring has been undertaken annually. Four of the original monitoring points were removed around this time. The EPL was varied on 8 May 2014 (Notice 1517907) to introduce additional pollutants to be tested at ten (10) wells, connected with the completed expansion and reconfiguration of the premises. This established the current program for groundwater monitoring at the site.

There are no concentration limits within the project approval or EPL. The SWMP includes adopted assessment criteria for both ecosystem protection (which apply at the point of groundwater discharge to the nearest receiving environment) and for drinking water supply. The most relevant are the ecosystem protection values which are shown in the table below as “trigger values” and are indicators only.

A summary of groundwater monitoring results for 2019-2021 is provided in Table 8-1.

Table 8-2: Summary of groundwater monitoring results

| POINT | Sample Date | Pollutant concentrations (mg/L unless otherwise stated) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arsenic | Chromium (Total) | Chromium (VI) | Copper (total) | Copper (dissolved) | Iron | Zinc | TOC | TDS | DO (ppm) | EC (µS) | pH (pH units) |
| Trigger value | | 0.013 | 0.0033 | 0.001 | 0.0014 | - | - | - | - | - | - | - | 6.5-8.0 |
| 10 | Jul 2019 | <0.001 | 0.001 | <0.005 | 0.002 | <0.001 | 0.22 | 0.01 | <5 | 200 | 2.1 | 597 | 5.94 |
| | Aug 2020 | 0.002 | <0.001 | <0.005 | <0.001 | <0.001 | 0.07 | 0.005 | 5 | 220 | 2.54 | 639 | 6.32 |
| | Jul 2021 | 0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.05 | 0.011 | <5 | 210 | 3.66 | 517.20 | 6.48 |
| 11 | Jul 2019 | 0.003 | 0.006 | <0.005 | 0.013 | 0.001 | 4.5 | 0.032 | <5 | 270 | 2.35 | 1450 | 5.82 |
| | Aug 2020 | 0.028 | 0.027 | <0.05 | 0.38 | <0.01 | 7.5 | 0.62 | 160 | 1500 | 2.71 | 1297 | 6.08 |
| | Jul 2021 | 0.16 | 0.026 | <0.005 | 0.09 | <0.01 | 52 | 0.3 | 150 | 590 | 2.95 | 1435 | 6.4 |
| 12 | Jul 2019 | <0.001 | <0.001 | <0.005 | <0.001 | <0.001 | <0.05 | 0.017 | <5 | 100 | 2.29 | 2136 | 5.08 |
| | Aug 2020 | 0.001 | 0.002 | <0.005 | 0.002 | <0.001 | 0.7 | 0.024 | <5 | 98 | 2.61 | 1760 | 5.64 |
| | Jul 2021 | <0.001 | <0.001 | <0.005 | 0.001 | <0.001 | 0.1 | 0.019 | <5 | 120 | 1.96 | 2086 | 5.94 |
| 13 | Jul 2019 | 0.073 | 0.08 | <0.005 | 0.074 | 0.004 | 3.7 | 0.11 | <5 | 100 | 1.99 | 548 | 4.98 |
| | Aug 2020 | 0.18 | 0.17 | <0.005 | 0.11 | 0.002 | 14 | 0.17 | 6.3 | 52 | 2.68 | 513 | 5.49 |
| | Jul 2021 | 0.14 | 0.14 | <0.005 | 0.12 | 0.007 | 11 | 0.15 | <5 | 87 | 2.39 | 470.6 | 6.08 |
| 14 | Jul 2019 | - | - | - | - | - | - | - | - | - | - | - | - |
| | Aug 2020 | - | - | - | - | - | - | - | - | - | - | - | - |
| | Jul 2021 | - | - | - | - | - | - | - | - | - | - | - | - |
| 15 | Jul 2019 | 0.074 | 0.17 | <0.005 | 0.15 | 0.003 | 87.0 | 0.13 | 5.9 | 240 | 1.7 | 842 | 5.63 |
| | Aug 2020 | 0.013 | 0.018 | 0.005 | 0.013 | 0.005 | 5.4 | 0.012 | 13 | 200 | 2.36 | 799 | 5.90 |
| | Jul 2021 | 0.037 | 0.052 | <0.005 | 0.045 | 0.004 | 27.0 | 0.058 | <5 | 220 | 2.91 | 775.60 | 6.03 |
| 16 | Jul 2019 | 0.001 | 0.002 | <0.005 | 0.002 | 0.002 | 1.7 | 0.086 | <5 | 360 | 2.4 | 1235 | 5.74 |
| | Aug 2020 | 0.003 | 0.003 | <0.005 | 0.002 | <0.001 | 12 | 0.11 | 14 | 470 | 2.31 | 1113 | 6.09 |
| | Jul 2021 | 0.045 | 0.006 | <0.005 | 0.009 | 0.003 | 14 | 0.18 | <5 | 270 | 2.25 | 928.00 | 6.22 |
| 17 | Jul 2019 | 0.013 | 0.026 | <0.005 | 0.016 | 0.001 | 8.8 | 0.036 | <5 | 160 | 2.74 | 968 | 5.84 |
| | Aug 2020 | 0.004 | 0.005 | <0.005 | 0.005 | 0.002 | 1.8 | 0.037 | 9.6 | 150 | 3.16 | 1224 | 5.9 |
| | Jul 2021 | 0.004 | 0.002 | <0.005 | 0.002 | 0.001 | 1 | 0.035 | <5 | 120 | 2.84 | 1365 | 6.16 |

| POINT | Sample Date | Pollutant concentrations (mg/L unless otherwise stated) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arsenic | Chromium (Total) | Chromium (VI) | Copper (total) | Copper (dissolved) | Iron | Zinc | TOC | TDS | DO (ppm) | EC (μS) | pH (pH units) |
| 18 | Jul 2019 | <0.001 | <0.001 | <0.005 | 0.002 | 0.002 | 3.6 | 0.14 | 8.1 | 580 | 1.92 | 860 | 5.71 |
| | Aug 2020 | 0.011 | 0.001 | <0.005 | 0.001 | <0.001 | 42 | 0.17 | 19 | 740 | 2.17 | 810 | 5.63 |
| | Jul 2021 | 0.03 | 0.007 | <0.005 | 0.009 | 0.008 | 11 | 0.3 | <5 | 400 | 2.04 | 837.2 | 5.79 |
| 19 | Jul 2019 | 0.003 | 0.027 | <0.005 | 0.009 | <0.001 | 19 | 0.036 | <5 | 170 | 2.95 | 399 | 5.34 |
| | Aug 2020 | <0.001 | 0.003 | <0.005 | <0.001 | <0.001 | 1.4 | <0.005 | 12 | 160 | 3.73 | 431 | 6.08 |
| | Jul 2021 | 0.001 | 0.002 | <0.005 | <0.001 | <0.001 | 0.35 | 0.008 | <5 | 190 | 2.86 | 590.3 | 6.11 |

Notes: EC: Electrical conductivity

DO: Dissolved Oxygen

TOC: Total organic carbon

TDS: Total dissolved solids

**Surface Water**

Surface water samples have been retrieved on a biannual basis since 2011 from each of the water storage bodies. The locations of the surface water monitoring points are shown in Figure 10 and the monitoring program is summarised in Table 8-4.

A review of the past monitoring results found that from the first round of sampling in July 2012 until April 2014, only monitoring point 9 was sampled. In 2011, the EPL contained five sample points for surface water. The EPL was varied on 8 May 2014 (Notice 1517907) to modify the position of monitoring points and introduce additional monitoring requirements connected with the completed expansion and reconfiguration of the premises. Water monitoring at three locations (points 5, 6 and 7) was included. This established the current program for water monitoring at the site. It is noted that since the EPL was varied to modify the surface water monitoring program, the SWMP has not been revised.  This warrants revision of the SWMP.

There are no concentration limits within the project approval or EPL. The 2011 and 2017 SWMP included adopted assessment criteria from relevant default guideline values in the Australian and New Zealand Environment and Conservation Council (ANZECC) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality Guidelines* (2000) as trigger values. Revised criteria “trigger levels” have been established from the Australian and New Zealand Guidelines for Fresh and Marine Waters (ANZG, 2018) or the ANZECC Guidelines 2000 where trigger values are not provided by the 2018 guidelines. The criteria parameters relevant to the site are “slightly-moderately disturbed systems” and the conservative 95% protection value for freshwater has been selected.

A summary of results for 2019-2021 is provided in Table 8-1.

Table 8-3: Summary of surface water monitoring results

| POINT | Sample Date | Pollutant concentrations (mg/L unless otherwise stated) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arsenic | Chromium (Total) | Chromium (VI) | Copper (total) | Hardness (as $CaCO_3$) | Total Organic Carbon | Dissolved Oxygen (ppm) | Electrical Conductivity (μS) | pH (pH units) | Redox Potential (mV) |
| Trigger value | | 0.013 | 0.0033 | 0.001 | 0.0014 | - | - | - | - | 6.5-8.0 | - |
| 5 SWE-1 Pond 1 | Feb 2019 | 0.096 | 0.032 | <0.005 | 0.059 | 34 | 58 | 1.22 | 576 | 7.96 | 138 |
| | Jul 2019 | 0.037 | 0.011 | <0.05 | 0.02 | 57 | 62 | 7.03 | 102.6 | 7.12 | 101.4 |
| | Feb 2020 | 0.028 | 0.015 | <0.005 | 0.019 | 33 | 100 | 0.54 | 261 | 7.3 | 149 |
| | Aug 2020 | 0.1 | 0.074 | <0.1 | 0.13 | 66 | 20 | 1.29 | 114.4 | 6.09 | 119.1 |
| | Feb 2021 | 0.057 | 0.019 | <0.005 | 0.028 | 53 | 90 | 4.06 | 162.6 | 7.52 | 52.1 |
| | Jul 2021 | 0.2 | 0.11 | <0.005 | 0.32 | 180 | 400 | 1.15 | 136.9 | 6.54 | 132.4 |
| 6 SWE-2 Pond 2 | Feb 2019 | 0.013 | 0.006 | <0.01 | 0.007 | 110 | 83 | 0.84 | 465 | 7.52 | 134 |
| | Jul 2019 | 0.015 | 0.1 | <0.05 | 0.010 | 110 | 40 | 6.78 | 268.9 | 7.03 | 84.8 |
| | Feb 2020 | 0.013 | 0.006 | <0.005 | 0.007 | 140 | 53 | 3.86 | 657 | 7.97 | 81.1 |
| | Aug 2020 | 0.026 | 0.017 | <0.05 | 0.030 | 110 | 120 | 2.66 | 447.8 | 7.22 | 108.9 |
| | Feb 2021 | 0.022 | 0.011 | <0.005 | 0.012 | 120 | 68 | 3.32 | 399.3 | 7.61 | 21.7 |
| | Jul 2021 | 0.037 | 0.036 | <0.005 | 0.044 | 110 | <5 | 1.91 | 355.0 | 7.18 | 173.9 |
| 7 SWE-3 Northern Pond | Feb 2019 | 0.15 | 0.02 | <0.05 | 0.021 | 140 | 23 | 8.31 | 904 | 7.4 | 107 |
| | Jul 2019 | 0.048 | 0.07 | <0.005 | 0.039 | 130 | 22 | 10.52 | 491.1 | 7.74 | 87.3 |
| | Feb 2020 | 0.32 | 0.07 | <0.005 | 0.13 | 180 | 28 | 6.85 | 146 | 7.65 | 102.8 |
| | Aug 2020 | 0.29 | 0.27 | 0.029 | 0.18 | 110 | 22 | 6.54 | 360.5 | 7.57 | 107.8 |
| | Feb 2021 | 0.31 | 0.02 | <0.005 | 0.022 | 190 | 19 | 4.49 | 82 | 7.92 | 35.8 |
| | Jul 2021 | 0.24 | 0.18 | <0.005 | 0.15 | 87 | <5 | 4.36 | 278.6 | 7.27 | 151.5 |

The current ongoing environmental monitoring program now proposed is summarised in the table below.

Table 8-4: Ongoing Environmental Monitoring Program

| Location Number | Location Description | Monitoring Frequency | Analytical Program |
|---|---|---|---|
| ***Soil*** | | | |
| SE-1 – SE-4 | Refer to Figure 10 | Biannual | Arsenic, copper, chromium (total), chromium (VI) |
| ***Surface Water*** | | | |
| SWE-1 | Pond 1 | Biannual | Arsenic, copper, chromium (total), chromium (VI), TOC, pH, DO, EC, redox and hardness |
| SWE-2 | Pond 2 | Biannual | Arsenic, copper, chromium (total), chromium (VI), TOC, pH, DO, EC, redox and hardness |
| SWE-3 | Northern Pond | Biannual | Arsenic, copper, chromium (total), chromium (VI), TOC, pH, DO, EC, redox and hardness |
| ***Groundwater*** | | | |
| MWE-1 to MWE-10 | Refer to Figure 10 | Biannual | Arsenic, copper (total), copper (dissolved), chromium (total), chromium (VI), zinc, iron, TOC, TDS, pH, DO, EC. |

Note: EC = Electrical Conductivity DO = Dissolved Oxygen TDS = Total Dissolved Solids TOC = Total Organic Carbon

## 8.3 MONITORING PROCEDURES

**Soil**

Soil samples will be retrieved in accordance with Australian Standard 4482.1-2005: Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil – Part 1: Non-volatile and Semi-volatile Compounds, 2 November 2005, Standards Australia.

**Groundwater**

The groundwater monitoring wells must be sampled in accordance with DEC's Guidelines for the Assessment and Management of Groundwater Contamination, March 2007 (DECC 2007), or any subsequent superseding document. In particular, 'low flow' purging techniques should be used. Care must be taken to ensure that drawdown in the monitoring well does not exceed 0.1 m during 'low flow' purging. In addition, water samples for heavy metal analysis should be field filtered to 0.1 µm prior to acid preservation. These procedures are necessary to ensure that the groundwater samples are not affected by high suspended solids, which can result in false positives, particularly for heavy metals. Groundwater standing water levels should be recorded at the time of sampling and be related to the Australian Height Datum.

**Surface Water**

Surface water samples should be collected in accordance with EPA's Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales, January 2022 (EPA, 2022), or any subsequent superseding document. In addition, surface water samples should be taken from 0.1 m below the water surface to avoid the influence of near surface evaporation. Samples to be analysed for heavy metals should be filtered to 0.1 µm prior to acid preservation.

## 8.4 ANALYTICAL PROGRAM

The analytical program for the soil, groundwater and surface water samples is outlined in Table 8-4. In addition, the following procedures should be implemented:

- Laboratory detection limits should be set below the relevant guideline levels; and
- Samples must be analysed by a National Association of Testing Authorities (NATA) accredited laboratory using NATA accredited methods

## 8.5 QUALITY ASSURANCE PROCEDURES

Quality assurance procedures should be implemented in accordance with the National Environment Protection (Assessment of Site Contamination) Measure (NEPM). In particular:

- Rinsate and tip blanks should be collected for each day of sampling. The rinsate blank should be analysed for the contaminants of concern;
- A split duplicate sample should be collected and analysed by a secondary laboratory for the contaminants of concern at a rate of 5% of the total number of primary samples analysed;
- A blind replicate sample should be collected and analysed by the primary laboratory for the contaminants of concern at a rate of 5% of the total number of primary samples analysed;
- Chain of custody documentation should be completed and accompany the samples to the laboratories; and
- Internal QA/QC procedures should be conducted by the laboratories, including method blanks, matrix spikes and sample duplicates in accordance with their NATA registration.

## 8.6 REPORTING REQUIREMENTS

A review of the water monitoring data should be performed immediately after each round of water quality monitoring by a suitably qualified environmental consultant. Any significant changes in contaminant levels should be checked and the implications considered by the consultant. Water quality data should be compared to the results of previous monitoring episodes and the relevant water quality guidelines.

A brief report should be prepared following each monitoring episode. This should include a comparison of soils data to the HIL F and/or HIL-D criteria and the groundwater and surface water data to the guideline values specified in ANZG, 2018 or ANZECC 2000 and the Australian Drinking Water Guidelines for the relevant environmental values of ecosystem protection and drinking water.

An annual report monitoring report should be prepared at the end of each year. The annual monitoring report should include a review of the results of the monitoring and quality control data, and provide conclusions and recommendations for the site. NATA endorsed laboratory reports, chain of custody documentation and well purge sheets should also be included.

## 8.7 Monitoring Assessment Criteria and Management Responses

The criteria to be adopted for the soil, groundwater and surface water sample are summarised in Table 8-5. The rationale for the selection of the criteria is discussed following.

**Soil**

The NEPM Health Investigation Level's for a commercial/industrial land use (HIL F) is used as screening criteria. However, following the capping of the area for remediation, the HIL-D criteria which is less stringent can then be adopted. Should these criteria be exceeded, then further investigation will be undertaken to determine the significance of the contamination and the most appropriate remedial response. This is in accordance with the NEPM. Should significant contamination be identified that would impact on the ongoing use of the site for a commercial/industrial land use, remediation may need to be undertaken. The efficacy of the existing environmental management procedures should also be reviewed and improved where necessary.

**Groundwater**

Groundwater assessment criteria have been adopted for both ecosystem protection (which apply at the point of groundwater discharge to the nearest receiving environment) and for drinking water supply. The management responses outlined in Table 8-6 should be adopted when the contaminant concentrations in the groundwater are identified above the assessment criteria outlined Table 8-5.

**Surface Water**

Trigger values for the surface water samples are provided for the contaminants of concern at the site in Table 8-5. The trigger values have been set to primarily ensure that no off-site impacts occur, and also to ensure that the waste water treatment systems are operating optimally. It is noted that there are no guideline values available for TOC nor lignins/tanins. These contaminants are an issue when they are present in concentrations that cause the water to become discoloured or odorous. In view of this, aesthetic observations are to be used as the indicator of unacceptable TOC and lignin/tannin concentrations.

Table 8-5: Soil, Groundwater and Surface Water Assessment Criteria

| Potential Contaminant | Adopted Assessment Criteria | | | | |
|---|---|---|---|---|---|
| | Soil[1] (mg/kg) | | Groundwater (mg/L) | | Surface Water (mg/L) |
| | HIL-F | HIL-D | Ecosystem Protection[2] | Drinking Water[3] | |
| Arsenic | 500 | 3,000 | 0.013 (a) | 0.007 | 0.013 (a) |
| Beryllium | - | | 0.2 (b) | - | |
| Chromium (III) | 60,000 | 60,000 | 0.0033 (b) | - | 0.0033 (b) |
| Chromium (VI) | 500 | 3,600 | 0.001 | 0.05 | 0.001 |
| Copper | 5,000 | 240,000 | 0.0014 | 2.0 | 0.0014 |
| Lead | - | - | 0.0034 | 0.010 | |

| | | | | | |
|---|---|---|---|---|---|
| Manganese | - | - | 1.9 (b) | 0.5 | |
| Mercury | - | - | 0.011 | 0.020 | |
| pH | - | - | 6.5 - 8.0 | - | 6.5 - 8.0 |
| TOC | - | - | - | - | - |
| Lignins/tanins | - | - | - | - | - |
| Ammonia (as N) | - | - | 0.90 | 0.4 | 0.90 |
| Iron | - | - | - | 0.3 | - |
| Nitrate (as N) | - | - | 0.159 | 0.050 | 0.159 |
| Aesthetic considerations | - | - | The water should not have an objectionable odour or colour | | |

1 NEPM HILs for a commercial industrial land use (HIL F) is now updated to (HIL-D). For the purposes of soil monitoring, HIL-F criteria will be used until the area is capped.

2 ANZG, 2018 or ANZECC 2000 criteria for freshwater ecosystems, 95% level of protection.

3 Australian Drinking Water Guidelines, 2004. This is provided for comparison purposes only.

(a) ANZECC 95% trigger value for arsenic as arsenic V.

(b) ANZECC 2000 low or moderate reliability trigger value adopted in the absence of ANZECC 95% trigger values

Table 8-6: Responses to Groundwater and Surface Water Assessment Criteria Exceedances

| Sample Numbers | Sample Locations | Applicable Analytes[1] | Response |
|---|---|---|---|
| ***Groundwater*** | | | |

Table 8-6: Responses to Groundwater and Surface Water Assessment Criteria Exceedances

| Sample Numbers | Sample Locations | Applicable Analytes[1] | Response |
|---|---|---|---|
| MWE-4, MWE-5 and MWE-6 | Vicinity of old treatment plant (to be remediated) | Arsenic, beryllium, chromium, copper, lead, manganese, mercury, TOC, lignins/tanins ammonia, iron and nitrate. | Contaminant concentrations are expected to decrease or remain stable with time.<br>• In the event of a significant increase (increase by more than five times between episodes), reanalyse the sample or resample to confirm the result. If result is confirmed, a suitably qualified hydrogeologist should be engaged to investigate the source of the contamination and develop the most appropriate response.<br>• In the event that a long-term increasing trend is identified (over 3 or more monitoring episodes), a suitably qualified hydrogeologist should be engaged to investigate the source of the contamination and develop the most appropriate response. |
| Other wells | - | Arsenic, beryllium, chromium, copper, lead, manganese, mercury, TOC, lignins/tanins ammonia, iron and nitrate. | Contaminant concentrations should remain below guideline values or within natural background levels.<br>• In the event of an increase to above guideline or natural background levels, or if a long-term increasing trend is identified (over 3 or more monitoring episodes), reanalyse the sample or resample to confirm the result. If the result is confirmed, a suitably qualified hydrogeologist should be engaged to investigate the source of the contamination and most appropriate response. |
| ***Surface water*** | | | |

Table 8-6: Responses to Groundwater and Surface Water Assessment Criteria Exceedances

| Sample Numbers | Sample Locations | Applicable Analytes[1] | Response |
|---|---|---|---|
| SWE-1 and SWE-2 | Ponds 1 and 2 | Arsenic, chromium, copper, TOC and lignins/ tanins. | • If arsenic, chromium and copper are measured above guideline values, reanalyse the sample or resample to confirm the result. If the result is confirmed, investigate source of contamination as a matter of priority.<br>• If TOC and/or lignins show an increasing trend with time (over 3 or more monitoring episodes) or if the water is observed to have an 'organic', 'rotting' or 'rotten egg' odour, investigate the source of contamination as a matter or priority. Check filters at inlet to Ponds and ensure there are no wood residues in the catchment areas. |
| SWE-3 | Northern Pond | Arsenic, chromium and copper. | Some low level CCA contamination expected.<br>• Investigate cause of any chromium (VI) exceedances (i.e. spillage). Keep water levels in ponds low to prevent over flow during potential storm events. |

Notes: 1 Analytes for which a response should be considered.

## 8.8 Care and Maintenance

Each of the groundwater monitoring wells should be inspected regularly, routinely maintained and repaired as necessary. Where monitoring wells are destroyed, replacement monitoring wells will be installed at the nearest practicable location as a matter of priority.

The sealed surfaces of the CCA treatment plant and the bund associated with the AGST should be regularly inspected. Where cracks or damage is identified they should be repaired as a matter of priority. In addition, any pits or drains that come in contact with CCA should be regularly inspected and repaired as necessary.

# 9. REFERENCES

ANZECC and ARMCANZ 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, October 2000.

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Standards Australia 2005, Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds, AS4482.1-2005, Standards Australia.

# FIGURES

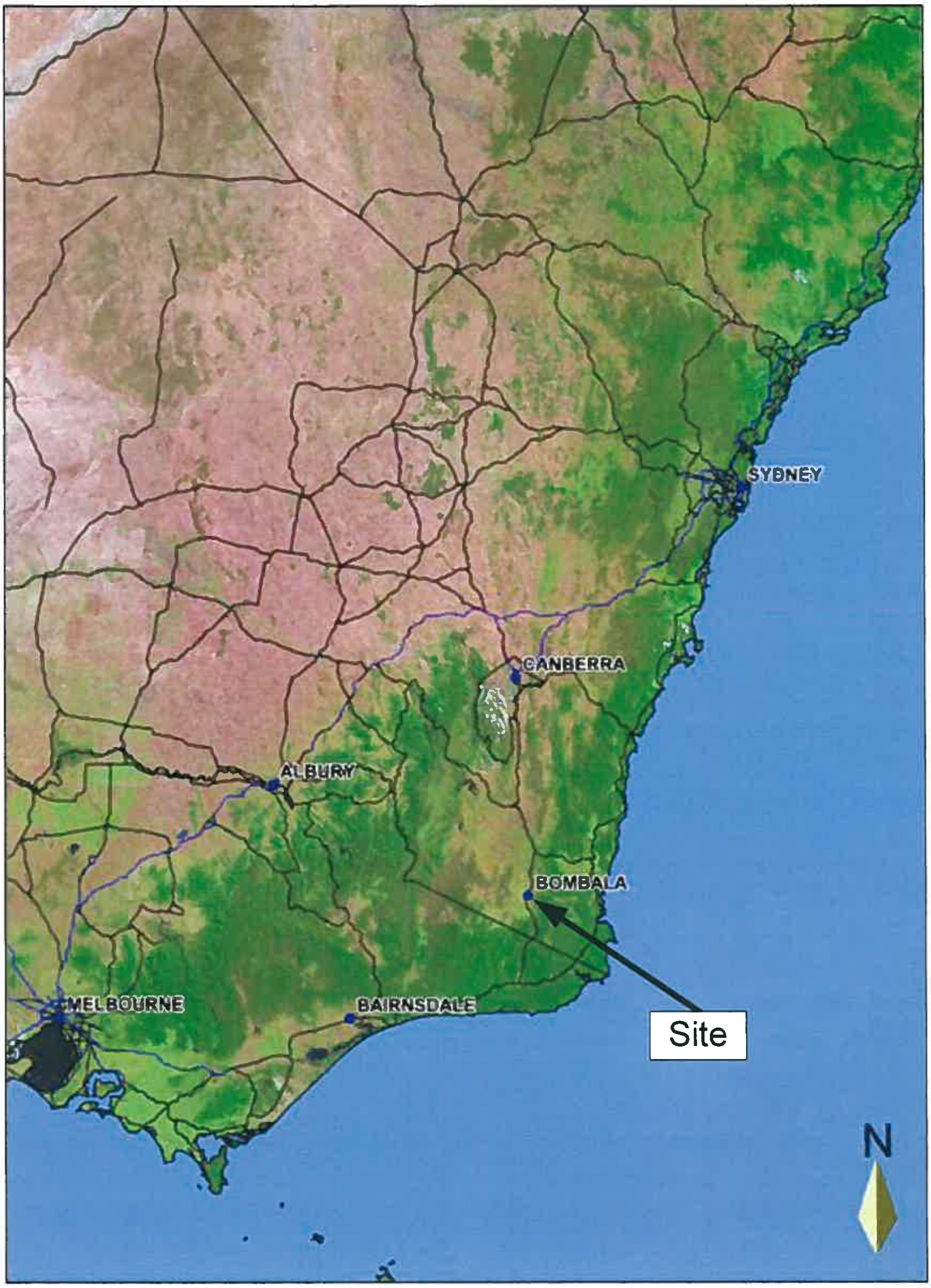


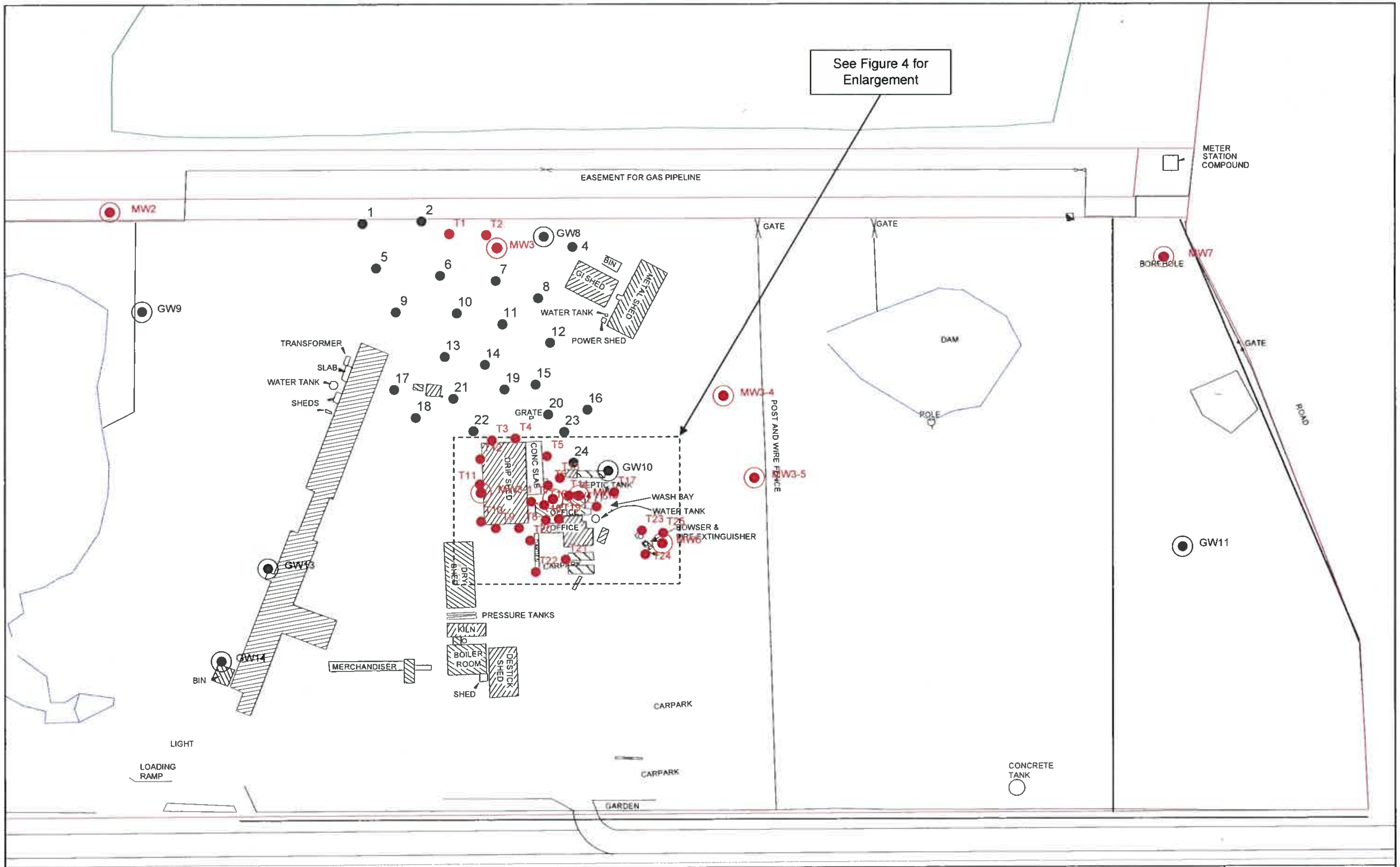

Figure 1: Locality Map

0 125 km
Approximate Scale

1 Sandy Lane, Bombala,
New South Wales

PETER J RAMSAY
& ASSOCIATES


**Figure 2: Site and surrounding land uses**




| Figure 3: Site Plan Showing Soil Sample and Groundwater Monitoring Well Locations | LEGEND | | | |
|---|---|---|---|---|
| 0 — 75 m<br>Approximate Scale | 17 | Grid Based Borehole Number and Location | | Approximate Location of UPSS |
| | T3 | Targeted Borehole Number and Location | | Fuel Bowser |
| | GW1 | Groundwater Monitoring Well Number and Location | | Approximate Location of Demountable Office |
| 1 Sandy Lane, Bombala, New South Wales | MW1 | Groundwater Monitoring Well Number and Location (Coffey 2002) | | |
| | *Source: Base Plan Derived from CAD File Provided by Client* | | | |

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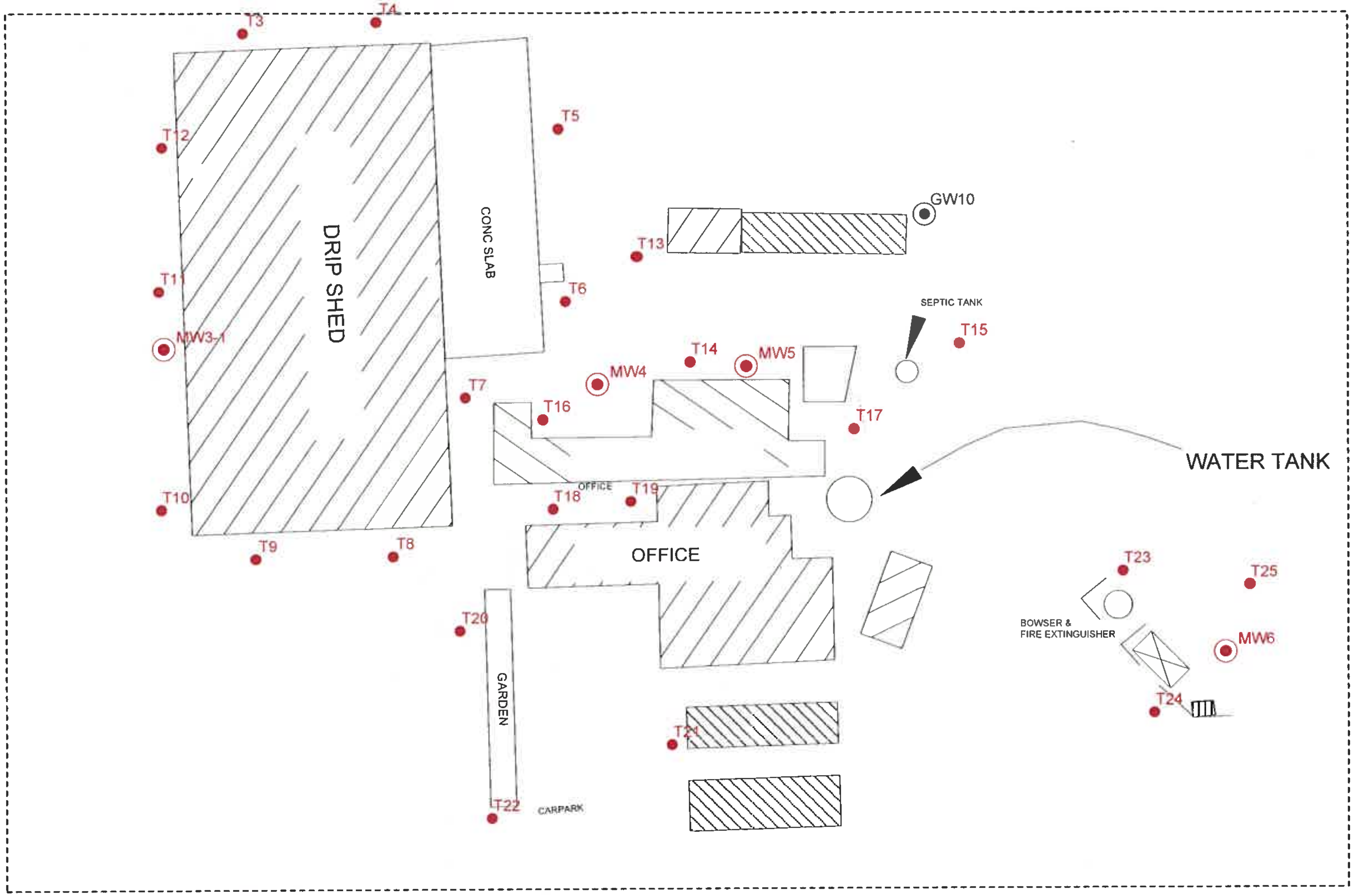


Figure 4: Site Plan Showing Soil Sample and Groundwater Monitoring Well Locations in the Vicinity of the Treatment Plant

0 — 15 m

Approximate Scale

1 Sandy Lane, Bombala,
New South Wales

LEGEND

| | |
|---|---|
| 17 | Grid Based Borehole Number and Location |
| T3 | Targeted Borehole Number and Location |
| GW1 | Groundwater Monitoring Well Number and Location |
| MW1 | Groundwater Monitoring Well Number and Location (Coffey 2002) |
| | Approximate Location of UPSS |
| | Fuel Bowser |
| | Approximate Location of Demountable Office |

*Source: Base Plan Derived from CAD File Provided by Client*

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& ASSOCIATES

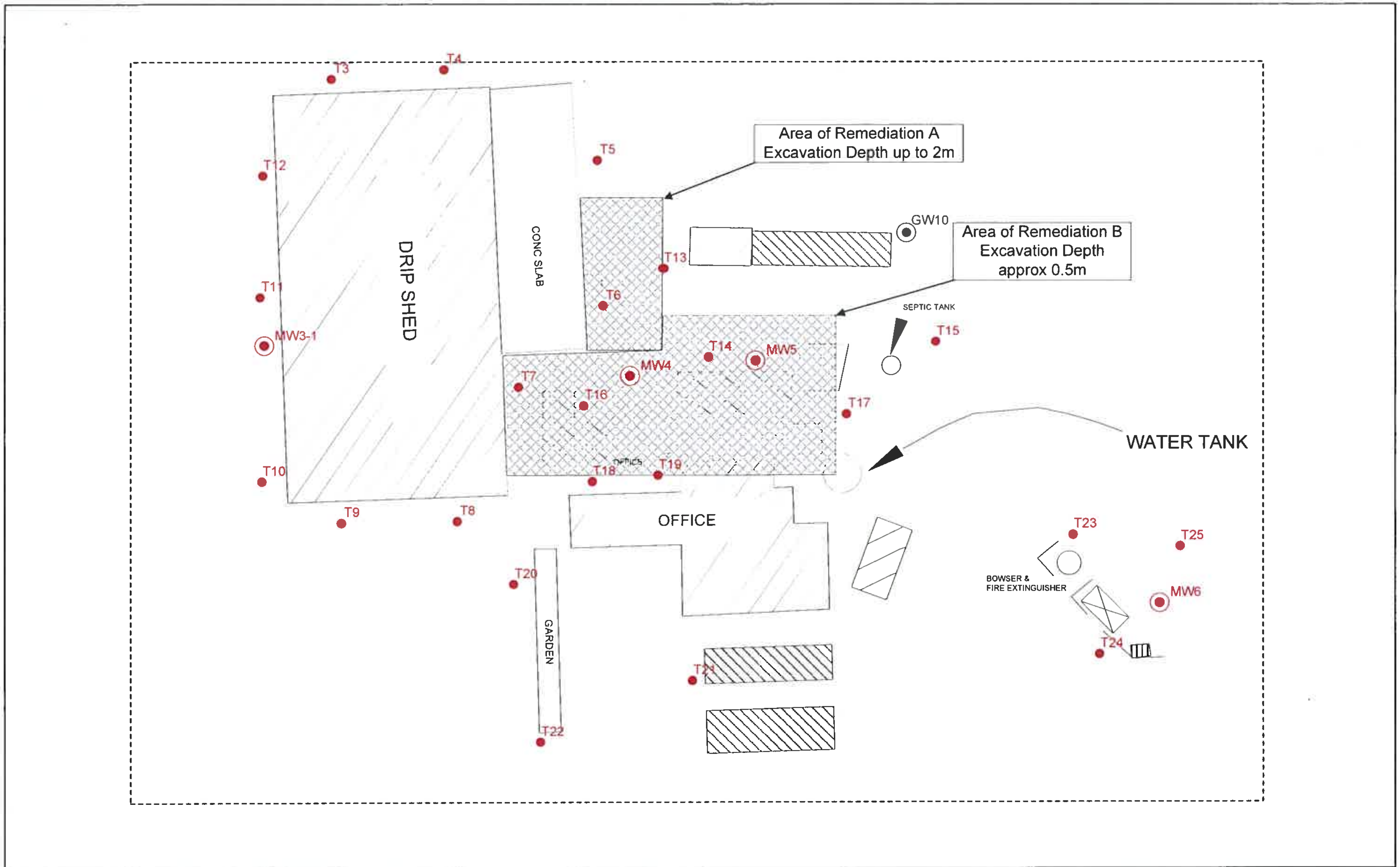


Figure 5: Proposed Extent of Soil Remediation in the Vicinity of the Treatment Plant

0 15 m

Approximate Scale

1 Sandy Lane, Bombala, New South Wales

LEGEND

| | |
|---|---|
| 17 | Grid Based Borehole Number and Location |
| T3 | Targeted Borehole Number and Location |
| GW1 | Groundwater Monitoring Well Number and Location |
| MW1 | Groundwater Monitoring Well Number and Location (Coffey 2002) |
| | Approximate Location of UPSS |
| | Fuel Bowser |
| | Approximate Location of Demountable Office |

*Source: Base Plan Derived from CAD File Provided by Client*

N

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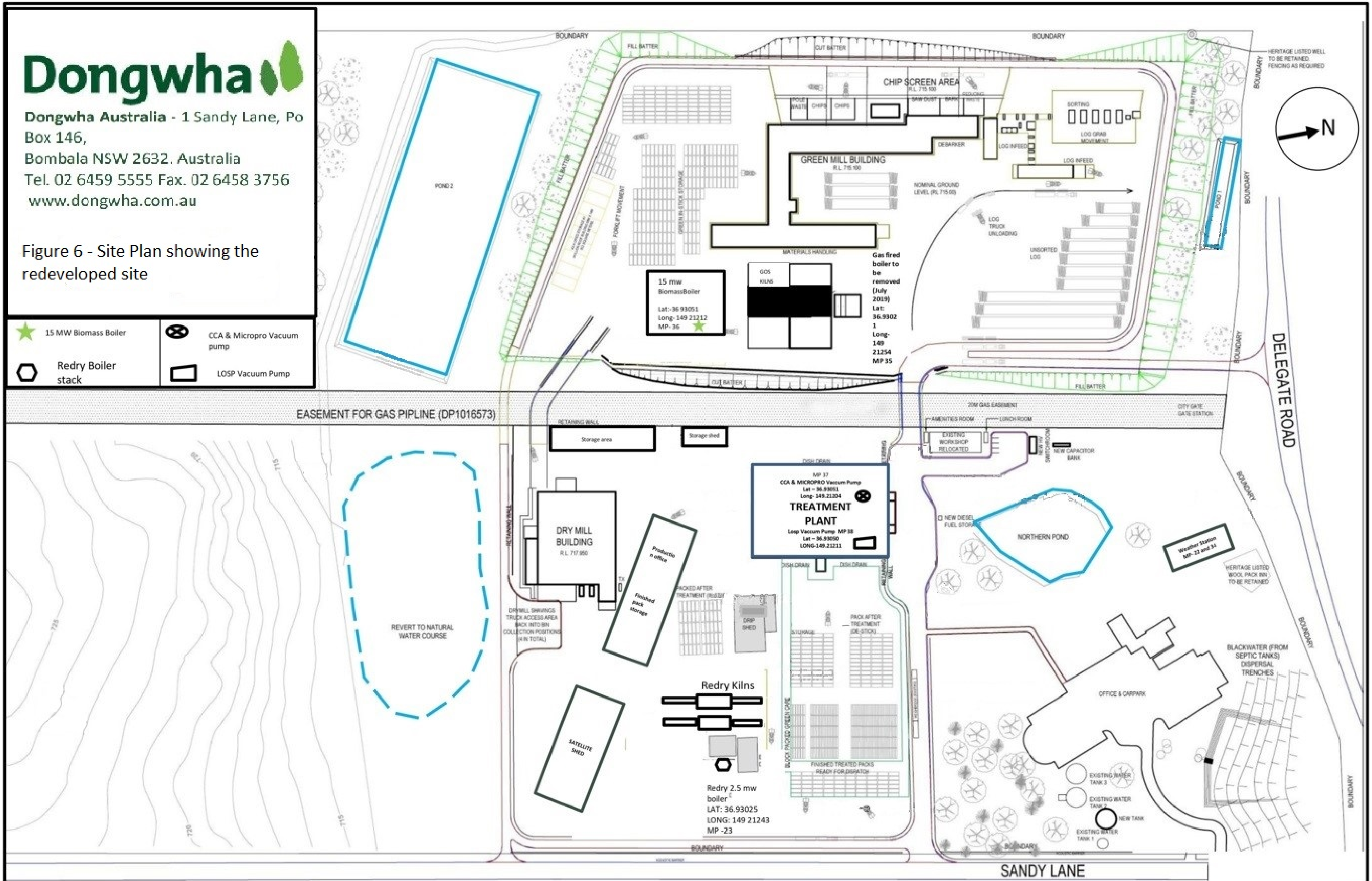


Figure 6 - Site Plan showing the redeveloped site

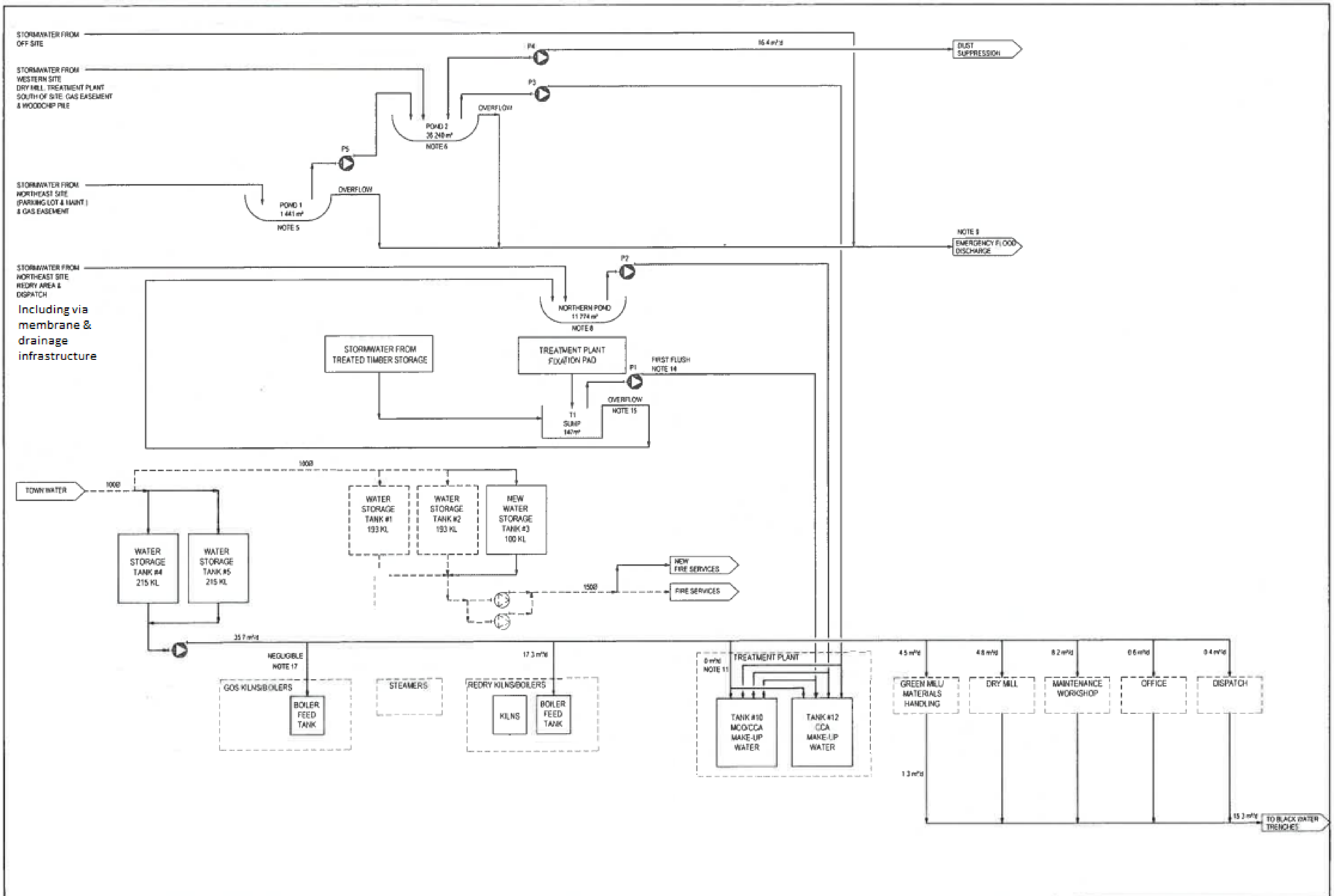


Figure 7: Proposed Water Management System

1 Sandy Lane, Bombala, New South Wales

Updated by Benbow Environmental 15/08/2022

*Source: Beca AMEC Limited*

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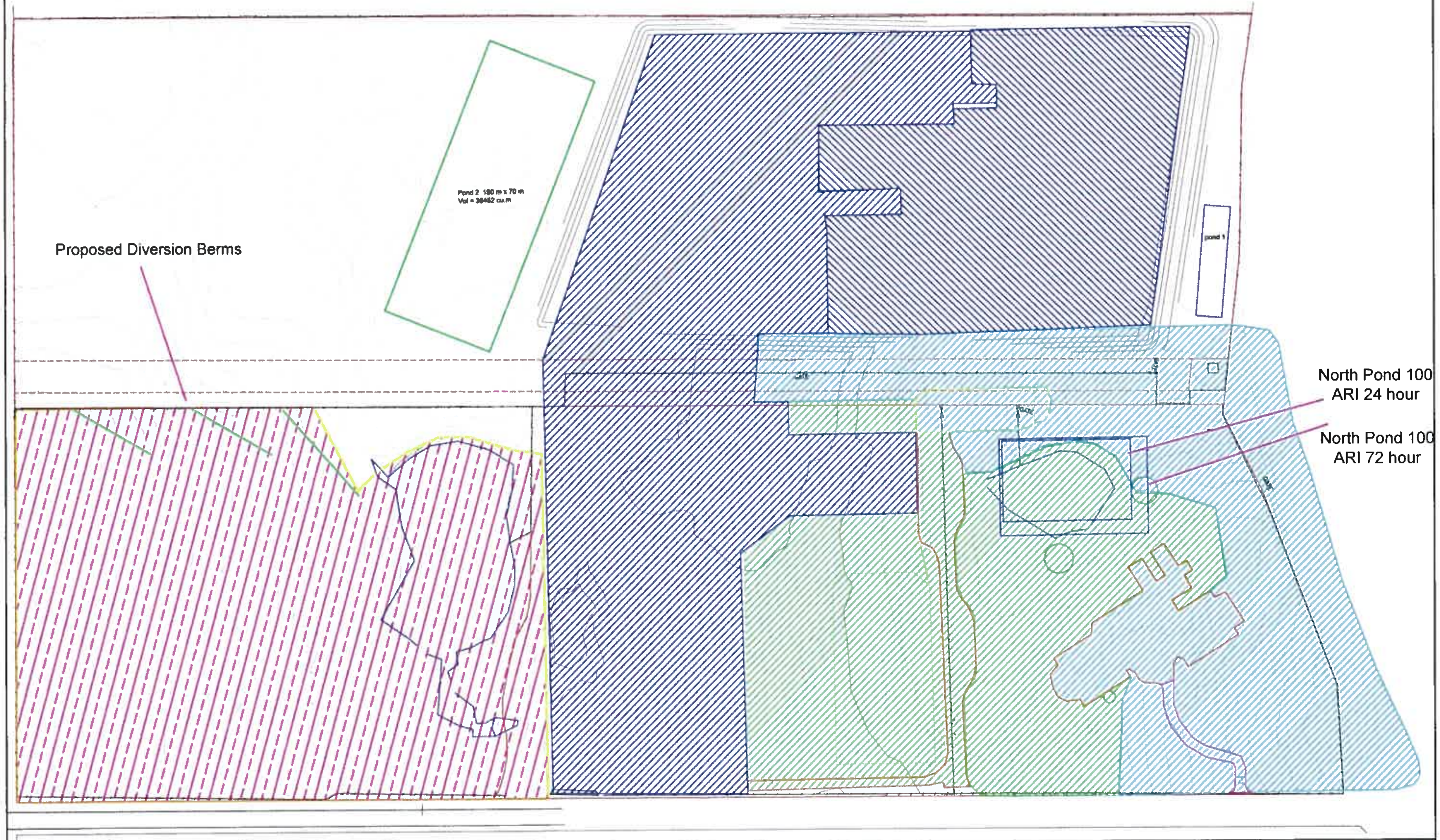


Figure 8: Proposed Surface Water Catchment Areas

0 120 m

Approximate Scale

1 Sandy Lane, Bombala, New South Wales

LEGEND

North Pond Catchment

Pond 2 Catchment

Pond 1 Catchment

Southern Pond Catchment

*Source: Tasman Engineering*

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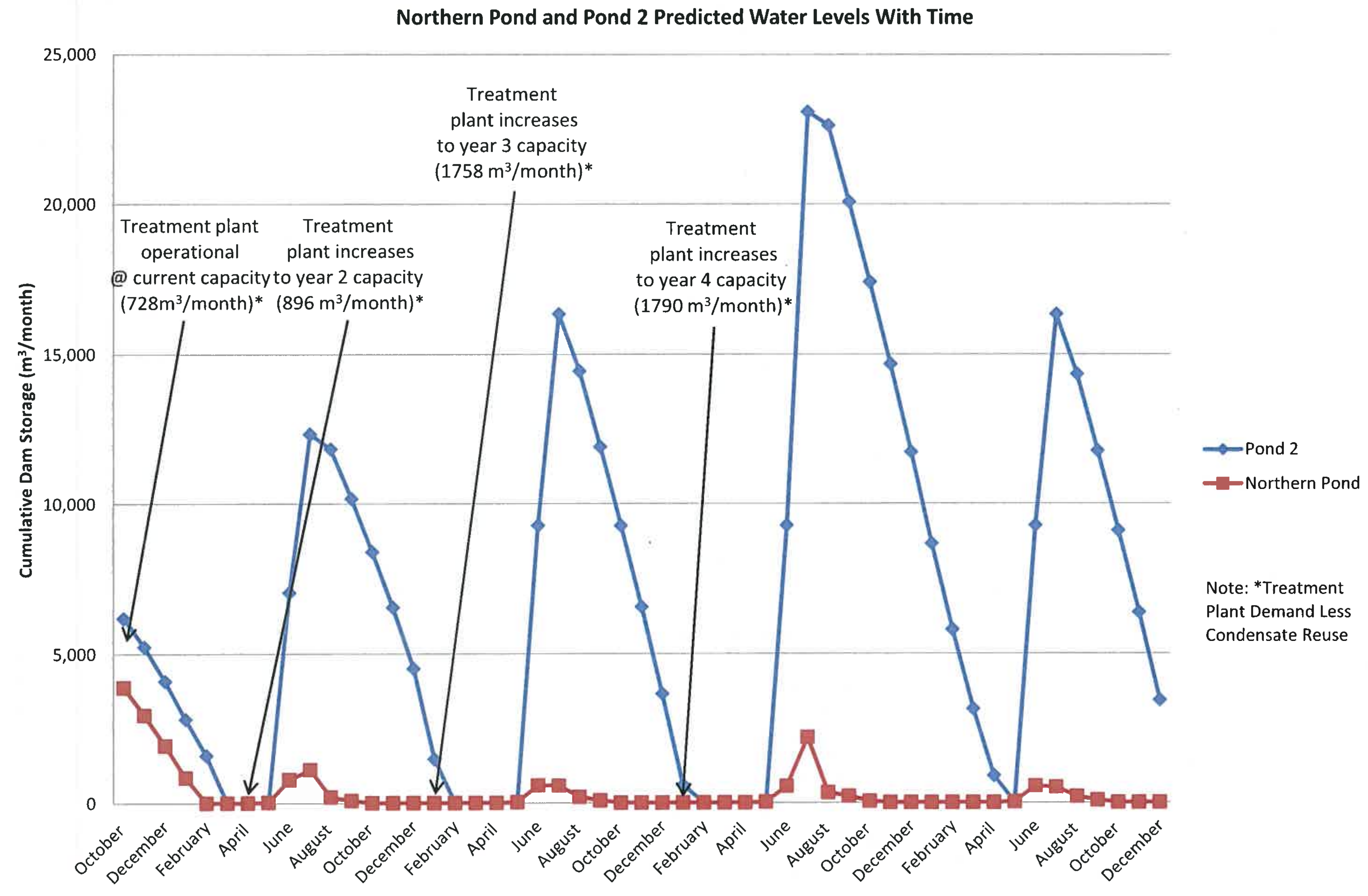


Figure 9: Predicted Water Levels in the Northern Pond and Pond 2

1 Sandy Lane, Bombala, New South Wales

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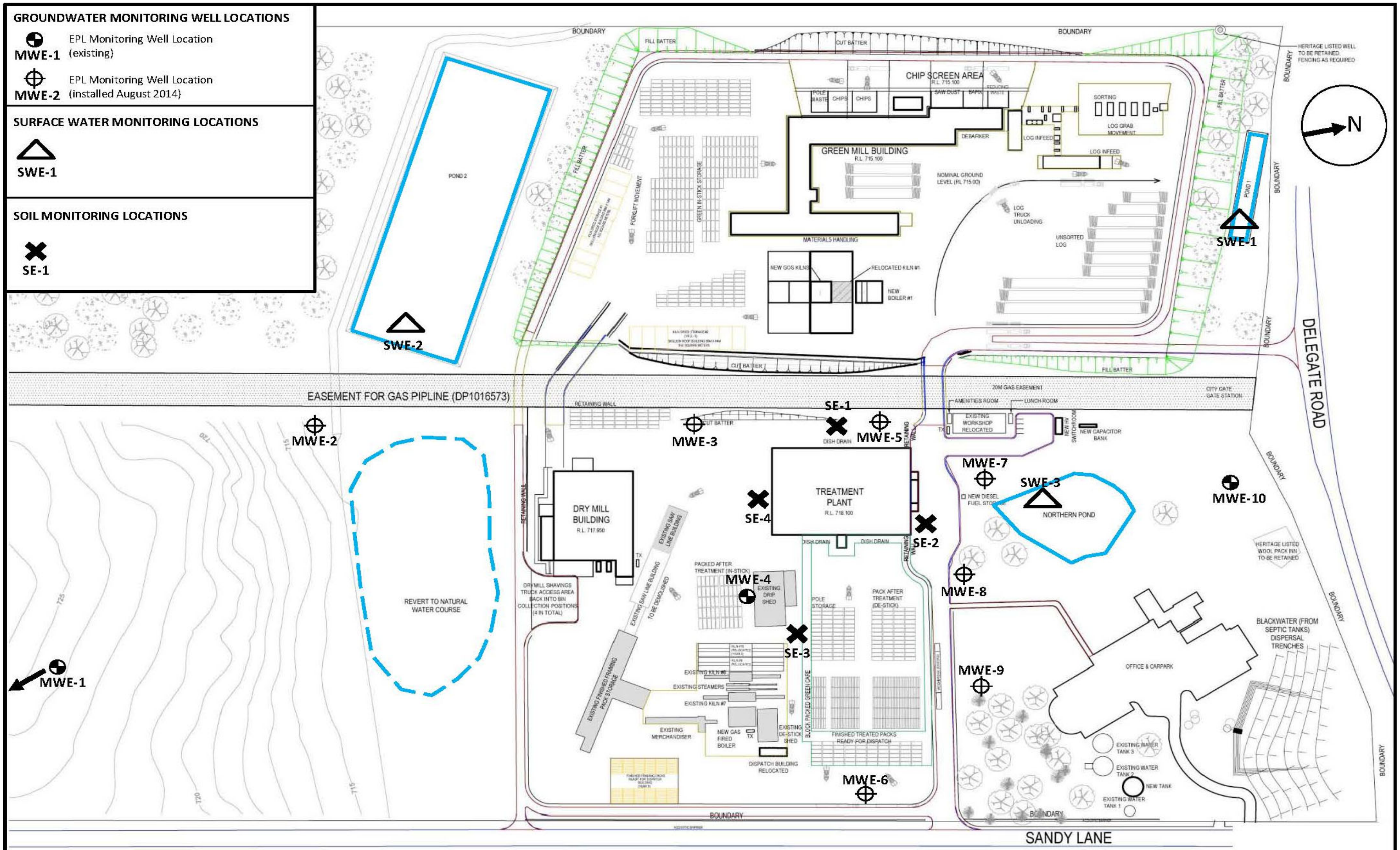


| **VANTAGE ENVIRONMENTAL MANAGEMENT** | **Figure 1: EPL MONITORING POINT LOCATION PLAN, 1 Sandy Lane, Bombala NSW** | |
|---|---|---|
| | **Project:** EPL 11205 – Bombala Treatment Facility | **Project ID:** AL07-002 |
| | **Client:** Dongwha Timbers Pty Ltd | **Date:** 22 August 2014 |
| | **Drawn by:** SP Checked by: TH | **Scale:** 1:1000 @ A4 size |

**Figure 10:** Soil, Groundwater and Surface Water Monitoring Locations

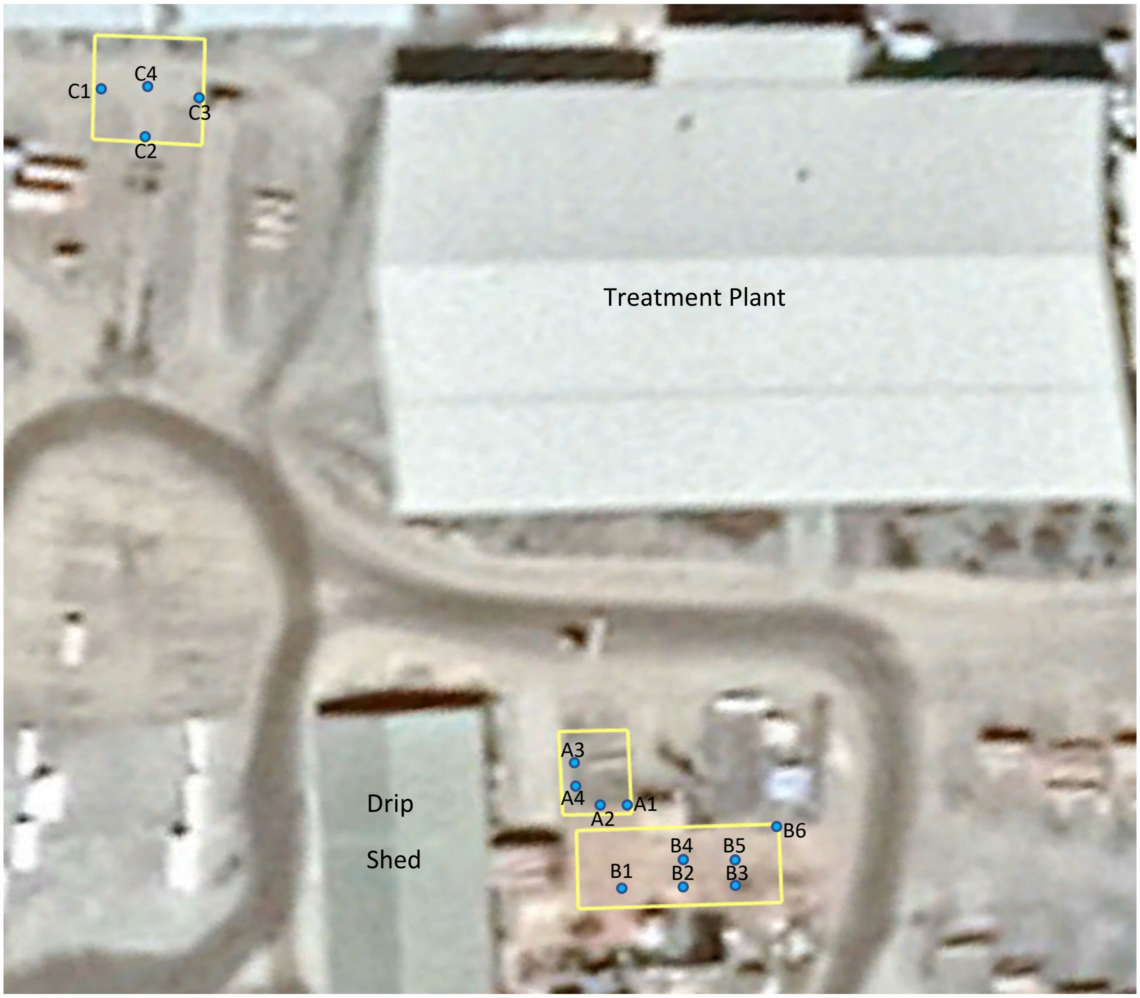


**Figure 11:** Soil Sample Locations for 2022 Soil and Groundwater Investigation

# APPENDICES

# Appendix A: Estimated Water Use and Waste Water Generation

## WATER SUMMARY

WILLMOTT - NAMU PROJECT - PHASE 2
Project No. 2531501
08-Jul-09
By : Peter Haintz & Cam Johnston

| WATER REQUIREMENT | | | Peak Flow | Average Yearly Demand | | | | Pressure | Temp. | Quality | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Year 1 | Year 2 | Year 3 | Year 4 | | | | |
| | | | (L/hr) | (1000L/yr) | (1000L/yr) | (1000L/yr) | (1000L/yr) | (Bar) | (°C) | | |
| Process Water | | | | | | | | | | | |
| Green Mill | | | 403 | 709 | 709 | 709 | 709 | 1 to 2 | 5 to 25 | | Per Veisto e-mail dated 02/07/09 |
| Materials Handling | | | 0 | 0 | 0 | 0 | 0 | | | | |
| Dry Mill | | | 0 | 0 | 0 | 0 | 0 | | | | |
| Treatment Plant | | | 7,697 | 25,165 | 30,735 | 37,127 | 39,473 | 3 | Ambient | | *Per Osmose E-mail 03/07/09* |
| *Palings* | *100* | *l/m3* | | *419* | *539* | *677* | *677* | | | | *L/m3 per Osmose e-mail dated 26/05/09* |
| *Sleepers* | *300* | *l/m3* | | *4,260* | *5,479* | *6,875* | *9,221* | | | | *L/m3 per Osmose e-mail dated 26/05/09* |
| *Sapwood (Structural Sawn & Appearance)* | *300* | *l/m3* | | *9,372* | *12,065* | *15,152* | *15,152* | | | | *L/m3 per Osmose e-mail dated 26/05/09* |
| *Decking* | *250* | *l/m3* | | *5,370* | *6,909* | *8,680* | *8,680* | | | | *L/m3 per Osmose e-mail dated 26/05/09* |
| *Rounds* | *320* | *l/m3* | | *5,744* | *5,744* | *5,744* | *5,744* | | | | *L/m3 per Osmose e-mail dated 26/05/09* |
| *Appearance* | *250* | *l/m3* | | *Included* | *Included* | *Included* | *Included* | | | | *Included in Sapwood* |
| GOS Boilers | | | 4,000 | 5,441 | 7,003 | 8,796 | 11,990 | | | | |
| *GOS Kilns steam loss (Preheat)-Single Track* | *50* | *m3/charge* | *2,000* | *2,721* | *4,283* | *6,076* | *9,270* | | | | *2,000 l/hr x 2 hrs/charge x Kiln Production / 50m3/charge per Mahild meeting 10/06/09. Charges based on production rate less 100m3 production noted below* |
| *GOS Kilns steam loss (Preheat)-Double Track* | *100* | *m3/charge* | *4,000* | *2,720* | *2,720* | *2,720* | *2,720* | | | | *4,000 l/hr x 2 hrs/charge x Kiln Production / 100m3/charge per Mahild meeting 10/06/09 & Telecon 03/07/09. Estimate double track usage = 1 charge/day = 34,000m3/year* |
| *Blowdown - Hot Water* | | | *0* | *0* | *0* | *0* | *0* | | | | *No Blowdown on Hot Water Boilers* |
| Redry Boilers | | | 3,943 | 11,637 | 13,686 | 16,035 | 17,990 | | | | |
| *Steamers steam loss* | *250* | *L/m3* | *2,500* | *8,038* | *9,054* | *10,217* | *12,172* | | | | *L/m3 per Osmose e-mail dated 25/06/09. Qty steam = Qty condensate & Steam evaporation = wood moisture volume. Peak per Osmose E-mail 25/6/09* |
| *Redry Kilns steam loss (No Preheat)* | | | *0* | *0* | *0* | *0* | *0* | | | | |
| *Blowdown - Steam* | *15%* | | *1,443* | *3,599* | *4,632* | *5,819* | *5,819* | | | | *Blowdown as a % of circ. flow per Mahild meeting 10/06/09. 1 MW boiler = 1.2 t/hr steam flow & 1t steam = 1m3 water per mahild telecon 03/07/09. 10,000m3 per MW peak & 50% MW for average per Mahild meeting 10/06/09* |
| Sawshop | | | 0 | 0 | 0 | 0 | 0 | | | | Assumed Negligible per R. Rowling/P. Herde E-mail 03/07/09 |
| Potable Services | 50 | L/day/man/shift | 438 | 2,737 | 2,799 | 3,490 | 4,092 | | | | Peak based on 50L/person/day x max. # people/shift. **TO BE CONFIRMED BY VANLEEEUWEN.** |
| *Log Yard* | *235* | *shifts/yr* | | *24* | *24* | *35* | *35* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Green Mill* | *235* | *shifts/yr* | | *153* | *153* | *153* | *153* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Materials Handling* | *235* | *shifts/yr* | | *Included* | *Included* | *Included* | *Included* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Kilns/Boilers* | *1008* | *shifts/yr* | | *252* | *302* | *353* | *403* | | | | *48 weeks/yr & 7 days/wk & 3 shift* |
| *Dry Mill* | *1008* | *shifts/yr* | | *1,109* | *1,109* | *1,109* | *1,613* | | | | *48 weeks/yr & 7 days/wk & 3 shift* |
| *Stenner* | *235* | *shifts/yr* | | *35* | *35* | *35* | *35* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Sticking/De-Sticking (Green Mill)* | *235* | *shifts/yr* | | *0* | *0* | *129* | *129* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Treatment Plant* | *235* | *shifts/yr* | | *1,000* | *1,000* | *1,500* | *1,500* | *6* | *Ambient* | | *Per Osmose E-mail 03/07/09* |
| *Dispatch* | *235* | *shifts/yr* | | *47* | *59* | *59* | *82* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| *Administration* | *235* | *shifts/yr* | | *118* | *118* | *118* | *141* | | | | *47 weeks/yr & 5 days/wk & 1 shift* |
| Fire Services | 23 | l/s | 83,333 | 0 | 0 | 0 | 0 | | | | 20 l/s for buildings >5,000 m2 and fill 500 m3 tank in 6 hours per VanLeeuwen E-mail dated 03/07/09 |
| Miscellaneous | | | 100 | 6,000 | 6,000 | 6,000 | 6,000 | | | | |
| *Wash Bay* | | | 0 | 0 | 0 | 0 | 0 | | | | Assumed Negligible |
| *Dust Suppression* | | | 100 | *6,000* | *6,000* | *6,000* | *6,000* | | | | E-mail from Peter Herde dated 29/07/08 multipied by 2 for twice the area. |
| **SUBTOTAL WATER REQUIREMENT** | | | | **51,689** | **60,932** | **72,158** | **80,254** | | | | |
| Contingency | 20% | | | 10,338 | 12,186 | 14,432 | 16,051 | | | | |
| **TOTAL WATER REQUIREMENT** | | | | **62,026** | **73,119** | **86,589** | **96,304** | | | | |
| **LESS RECYCLE WATER** | | | | **25,165** | **30,735** | **35,108** | **35,342** | | | | Minimum of available and acceptable for Treatment Plant reuse |
| Available Recycle Water | | | | 33,911 | 34,469 | 35,108 | 35,342 | | | | |
| *Stormwater* | | | | *31,395* | *31,395* | *31,395* | *31,395* | | | | *Rainfall per P. Haintz e-mail dated 29 July 2009* |
| *Average Rainfall* | *644* | *mm/yr* | | | | | | | | | ***TO BE CONFIRMED BY VANLEEEUWEN.*** |
| *Developed Site Area* | *130000* | *m2* | | | | | | | | | ***TO BE CONFIRMED BY VANLEEEUWEN.*** |
| *Collection Efficiency* | *50%* | | | | | | | | | | ***TO BE CONFIRMED BY VANLEEEUWEN.*** |
| *Evaporation Losses* | *25%* | | | | | | | | | | ***TO BE CONFIRMED BY VANLEEEUWEN.*** |
| *Recycled Steamer Condensate* | *Minimum of below* | | | *2,516* | *3,074* | *3,713* | *3,947* | | | | *Lesser of available from Steamer and acceptable by Treatment* |
| *Available Steamer Condensate* | | | | *8,038* | *9,054* | *10,217* | *12,172* | | | | *Steamer loss* |
| *Max Acceptable in Treatment Plant* | 10% | | | *2,516* | *3,074* | *3,713* | *3,947* | | | | *Portion of Treatment Water that can be dirty Steamer Water* |
| **NET WATER REQUIREMENT** | | | | **36,861** | **42,383** | **51,481** | **60,962** | | | | |
| **PEAK WATER REQUIREMENT** | | | | | | | | | | | |
| **Flow From Storage To Site** | | | | | | | | | | | |
| Peak Process Flow From Storage | 20% | | 19,372 | | | | | | | | Sum of peak flows except Potable and Fire |
| Peak Potable Flow From Storage | 20% | | 525 | | | | | | | | |
| Peak Fire Flow From Storage | 20% | | 100,000 | | | | | | | | |
| **Flow From Town Water To Storage** | 20% | | **100,000** | | | | | | | | |

# WATER SUMMARY

WILLMOTT - NAMU PROJECT - PHASE 2
Project No. 2531501 08-Jul-09

By : Peter Haintz & Cam Johnston

| WASTE WATER | | | Peak Flow (L/hr) | Average Yearly Demand | | | | Pressure (Bar) | Temp. (°C) | Quality | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Year 1 (1000L/yr) | Year 2 (1000L/yr) | Year 3 (1000L/yr) | Year 4 (1000L/yr) | | | | |
| **Sanitary Sewer** | **50** | **L/day/man/shif** | **438** | **2,737** | **2,799** | **3,490** | **4,092** | | | | **From Potable Water above** |
| *Log Yard* | *235* | *shifts/yr* | | *24* | *24* | *35* | *35* | | | | *From Potable Water above* |
| *Green Mill* | *235* | *shifts/yr* | | *153* | *153* | *153* | *153* | | | | *From Potable Water above* |
| *Materials Handling* | *235* | *shifts/yr* | | *Included* | *Included* | *Included* | *Included* | | | | *From Potable Water above* |
| *Kilns/Boilers* | *1008* | *shifts/yr* | | *252* | *302* | *353* | *403* | | | | *From Potable Water above* |
| *Dry Mill* | *1008* | *shifts/yr* | | *1,109* | *1,109* | *1,109* | *1,613* | | | | *From Potable Water above* |
| *Stenner* | *235* | *shifts/yr* | | *35* | *35* | *35* | *35* | | | | *From Potable Water above* |
| *Sticking/De-Sticking (Green Mill)* | *235* | *shifts/yr* | | *0* | *0* | *129* | *129* | | | | *From Potable Water above* |
| *Treatment Plant* | *235* | *shifts/yr* | | *1,000* | *1,000* | *1,500* | *1,500* | *6* | *Ambient* | | *From Potable Water above* |
| *Dispatch* | *235* | *shifts/yr* | | *47* | *59* | *59* | *82* | | | | *From Potable Water above* |
| *Administration* | *235* | *shifts/yr* | | *118* | *118* | *118* | *141* | | | | *From Potable Water above* |
| | | | | | | | | | | | |
| **Process Water** | | | **3,943** | **9,121** | **10,612** | **12,323** | **14,043** | | | | |
| Redry Boilers | | | 3,943 | 9,121 | 10,612 | 12,323 | 14,043 | | | | |
| *Steamers steam loss* | *250* | *L/m3* | *2,500* | *5,521* | *5,980* | *6,504* | *8,224* | | | | *Steamer Steam loss less recycled steam loss* |
| *Blowdown - Steam* | *15%* | | *1,443* | *3,599* | *4,632* | *5,819* | *5,819* | | | | *From Boier blowdown above* |
| | | | | | | | | | | | |
| **Site Run-off - Assuming Recycle** | | | **100** | **8,747** | **3,733** | **0** | **0** | | | | ***Excess storm water above recycle requirement. Storm water - (Recycled water - Steamer recycle)*** |
| **Site Run-off - Assuming No Recycle** *Stormwater* | | | **100** | **37,395** | **37,395** | **37,395** | **37,395** | | | | |
| *Average Rainfall* | | | | 31,395 | 31,395 | 31,395 | 31,395 | | | | From Stormwater above |
| | *644* | *mm/yr* | | | | | | | | | ***From Stormwater above*** |
| *Developed Site Area* | *130000* | *m2* | | | | | | | | | ***From Stormwater above*** |
| *Collection Efficiency* | *50%* | *0 days/yr* | | | | | | | | | ***From Stormwater above*** |
| *Evaporation Losses* | *25%* | *0 days/yr* | | | | | | | | | ***From Stormwater above*** |
| *Wash Bay* | | | 0 | 0 | 0 | 0 | 0 | | | | From Wash Bay above |
| *Dust Suppression* | | | 100 | *6,000* | *6,000* | *6,000* | *6,000* | | | | From Dust Suppression above |
| | | | | | | | | | | | |

# Appendix B: Water Balance Results

**Table R1  Water Balance for Pond 1**

| | | 2011 | | | 2012 - Construction and Average Rainfall | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Terms** | **Units** | **October** | **November** | **December** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** |
| **Inputs** | | | | | | | | | | | | | | | | |
| Rainfall (Average) (Therry Street, Bombala) | mm/month | 55.3 | 63.7 | 64.0 | 63.4 | 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| Direct Rainfall (Pond 1) | $m^3$/month | 61 | 70 | 71 | 70 | 65 | 66 | 49 | 48 | 65 | 51 | 44 | 49 | 61 | 70 | 71 |
| Runoff (Remainder of Site)* | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,167 | 915 | 0 | 0 | 0 | 0 | 0 |
| **Outputs** | | | | | | | | | | | | | | | | |
| Evaporation (Average) (Orbost, 2010) | mm/month | 105 | 123 | 143 | 155 | 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| Direct Evaporation (Pond 1) | $m^3$/month | 93 | 109 | 126 | 137 | 114 | 96 | 64 | 44 | 34 | 38 | 57 | 72 | 93 | 109 | 126 |
| Water Transfer to Southern Pond | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1,198 | 928 | 0 | 0 | 0 | 0 | 0 |
| **Cumulative Dam Storage** | $m^3$ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**Fixed Terms**

| Areas | Area ($m^2$) | | Runoff Ratios (% x $10^{-2}$) |
|---|---|---|---|
| -Total Area 1 | 34,000 | 1,104 | 1 |
| -Pond 1 | 34,000 | | 0.58 |
| -Remainder of Area 1 (during construction) | 5,430 | | 0.84 |
| -Remainder of Area 1 (sealed post development) | 28,570 | | 0.58 |
| -Remainder of Area 1 (unsealed post development) | | | |

**Notes**

* In an average year, runoff from site only occurs when rainfall exceeds evaporation (typically only winter).

**2013 - Full Production and Average Rainfall**

| March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|
| 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 66 | 49 | 48 | 65 | 51 | 44 | 49 | 61 | 70 | 71 |
| 0 | 0 | 0 | 1,251 | 981 | 0 | 0 | 0 | 0 | 0 |
| 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 96 | 64 | 44 | 34 | 38 | 57 | 72 | 93 | 109 | 126 |
| 0 | 0 | 4 | 1,282 | 993 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

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**2014 - Full Production and 4% AEP, 144 Hour Rainfall Event**

| ebruary | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 86.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 65 | 66 | 49 | 48 | 65 | 95 | 44 | 49 | 61 | 70 | 71 |
| 0 | 0 | 0 | 0 | 1,251 | 1,826 | 0 | 0 | 0 | 0 | 0 |
| 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 114 | 96 | 64 | 44 | 34 | 38 | 57 | 72 | 93 | 109 | 126 |
| 0 | 0 | 0 | 4 | 1,282 | 1,883 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**2015 - Full Production and Average Rainfall**

**y March April May June July August September October November December**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 66 | 49 | 48 | 65 | 51 | 44 | 49 | 61 | 70 | 71 |
| 0 | 0 | 0 | 1,251 | 981 | 0 | 0 | 0 | 0 | 0 |
| 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 96 | 64 | 44 | 34 | 38 | 57 | 72 | 93 | 109 | 126 |
| 0 | 0 | 4 | 1,282 | 993 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Table R2 Water Balance for Pond 2**

| | | 2011 | | | 2012 - Construction and Average Rainfall | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Terms** | **Units** | **October** | **November** | **December** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** |
| **Inputs** | | | | | | | | | | | | | | | | |
| Rainfall (Average) (Therry Street, Bombala) | mm/month | 55.3 | 63.7 | 64.0 | 63.4 | 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| Direct Rainfall (Pond 2) | $m^3$/month | 697 | 803 | 806 | 799 | 737 | 748 | 563 | 551 | 746 | 585 | 504 | 559 | 697 | 803 | 806 |
| Runoff (South of Southern Pond)* | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 450 | 353 | 0 | 0 | 0 | 0 | 0 |
| Runoff (Remainder of Catchment)* | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5,321 | 4,170 | 0 | 0 | 0 | 0 | 0 |
| Transfer from Pond 1 | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 1,198 | 928 | 0 | 0 | 0 | 0 | 0 |
| **Outputs** | | | | | | | | | | | | | | | | |
| Evaporation (Average) (Orbost, 2010) | mm/month | 105 | 123 | 143 | 155 | 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| Direct Evaporation (Southern Wetland/Pond 2) | $m^3$/month | 1,062 | 1,240 | 1,437 | 1,562 | 1,298 | 1,094 | 726 | 500 | 393 | 437 | 656 | 816 | 1,062 | 1,240 | 1,437 |
| Water Usage (Remainder of Treatment Plant) | $m^3$/month | 0 | 0 | 0 | 0 | 144 | 728 | 896 | 896 | 0 | 0 | 53 | 896 | 896 | 896 | 896 |
| Water Usage (General Site Dust Suppression) | $m^3$/month | 515 | 515 | 515 | 515 | 515 | 515 | 294 | 0 | 294 | 294 | 294 | 515 | 515 | 515 | 515 |
| Water Usage (Construction) | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Cumulative Dam Storage** | $m^3$ | 6,179 | 5,227 | 4,081 | 2,803 | 1,582 | 0 | 0 | 0 | 7,028 | 12,332 | 11,833 | 10,165 | 8,388 | 6,540 | 4,498 |

New treatment plant commences operation at 50% capacity

Woodchip stockpiles still in place, removed by Jan 2013

**Fixed Terms**

| **Areas** | **Area ($m^2$)** | **Runoff Ratios (% x $10^{-2}$)** |
|---|---|---|
| -Total Area 2 + Area 3 (during construction) | 183,000 | - |
| -Total Area 2 + 3 (post development) | 183,000 | - |
| -Pond 2 | 12,600 | 1 |
| -South of Southern Pond (woodchip during construction) | 76,000 | 0.1 |
| -South of Southern Pond (no woodchip post development) | 76,000 | 0.58 |
| -Remainder of Catchment (during construction) | 107,000 | 0.58 |

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| | | |
|---|---|---|
| -Remainder of Catchment (post development) | 107,000 | 0.84 |

**Notes**

* In an average year, runoff from site only occurs when rainfall exceeds evaporation (typically only winter).

**2013 - Full Production and Average Rainfall**

| March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|
| 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 748 | 563 | 551 | 746 | 585 | 504 | 559 | 697 | 803 | 806 |
| 0 | 0 | 0 | 2,610 | 2,045 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 5,321 | 4,170 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 4 | 1,282 | 993 | 0 | 0 | 0 | 0 | 0 |
| 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 1,094 | 726 | 500 | 393 | 437 | 656 | 816 | 1,062 | 1,240 | 1,437 |
| 1,758 | 1,758 | 1,758 | 0 | 0 | 1,453 | 1,758 | 1,758 | 1,758 | 1,758 |
| 515 | 294 | 0 | 294 | 294 | 294 | 515 | 515 | 515 | 515 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 9,271 | 16,333 | 14,434 | 11,904 | 9,266 | 6,555 | 3,651 |

**2014 - Full Production and 4% AEP, 144 Hour Rainfall Event**

| ebruary | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 86.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 737 | 748 | 563 | 551 | 746 | 1,089 | 504 | 559 | 697 | 803 | 806 |
| 0 | 0 | 0 | 0 | 2,610 | 3,809 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 5,321 | 7,766 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 4 | 1,282 | 1,883 | 0 | 0 | 0 | 0 | 0 |
| 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 1,298 | 1,094 | 726 | 500 | 393 | 437 | 656 | 816 | 1,062 | 1,240 | 1,437 |
| 1,790 | 491 | 1,790 | 1,790 | 0 | 0 | 0 | 1,790 | 1,790 | 1,790 | 1,790 |
| 515 | 515 | 294 | 0 | 294 | 294 | 294 | 515 | 515 | 515 | 515 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 9,271 | 23,085 | 22,639 | 20,077 | 17,406 | 14,664 | 11,728 |

**2015 - Full Production and Average Rainfall**

| March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|
| 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 748 | 563 | 551 | 746 | 585 | 504 | 559 | 697 | 803 | 806 |
| 0 | 0 | 0 | 2,610 | 2,045 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 5,321 | 4,170 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 4 | 1,282 | 993 | 0 | 0 | 0 | 0 | 0 |
| 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 1,094 | 726 | 500 | 393 | 437 | 656 | 816 | 1,062 | 1,240 | 1,437 |
| 1,790 | 1,790 | 1,790 | 0 | 0 | 1,549 | 1,790 | 1,790 | 1,790 | 1,790 |
| 515 | 294 | 0 | 294 | 294 | 294 | 515 | 515 | 515 | 515 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3,143 | 897 | 0 | 9,271 | 16,333 | 14,338 | 11,776 | 9,106 | 6,363 | 3,427 |

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**Table R3 Water Balance for Northern Pond**

| | | 2011 | | | 2012 - Construction and Average Rainfall | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable Terms** | **Units** | **October** | **November** | **December** | **January** | **February** | **March** | **April** | **May** | **June** | **July** | **August** | **September** | **October** | **November** | **December** |
| **Inputs** | | | | | | | | | | | | | | | | |
| Rainfall (Average) (Therry Street, Bombala) | mm/month | 55.3 | 63.7 | 64.0 | 63.4 | 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| Direct Rainfall (Northern Pond) | $m^3$/month | 320 | 369 | 371 | 367 | 339 | 344 | 259 | 253 | 343 | 269 | 232 | 257 | 320 | 369 | 371 |
| Runoff (Remainder of Site)* | $m^3$/month | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,483 | 1,163 | 0 | 0 | 0 | 0 | 0 |
| **Outputs** | | | | | | | | | | | | | | | | |
| Evaporation (Average) (Orbost, 2010) | mm/month | 105 | 123 | 143 | 155 | 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| Direct Evaporation (Northern Pond) | $m^3$/month | 489 | 570 | 661 | 719 | 597 | 503 | 334 | 230 | 181 | 201 | 302 | 376 | 489 | 570 | 661 |
| Water Usage (Treatment Plant) | $m^3$/month | 728 | 728 | 728 | 728 | 584 | 0 | 0 | 0 | 896 | 896 | 843 | 0 | 0 | 0 | 0 |
| **Cumulative Dam Storage** | m3 | 3,869 | 2,940 | 1,922 | 842 | 0 | 0 | 0 | 23 | 773 | 1,107 | 194 | 76 | 0 | 0 | 0 |

New treatment plant commences operation at 50% capacity

**Fixed Terms**

| Areas | Area ($m^2$) | Runoff Ratios (% x $10^{-2}$) |
|---|---|---|
| -Total Area 4 Area | 49000 | - |
| -Northern Pond | 5795 | 1 |
| -Remainder of Area 4 (during construction) | 43205 | 0.58 |
| -Remainder of Area 4 (post development) | 43205 | 0.84 |

**Notes**

* In an average year, runoff from site only occurs when rainfall exceeds evaporation (typically only winter).

**2013 - Full Production and Average Rainfall**

| y | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| | 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| | 344 | 259 | 253 | 343 | 269 | 232 | 257 | 320 | 369 | 371 |
| | 0 | 0 | 0 | 2,148 | 1,684 | 0 | 0 | 0 | 0 | 0 |
| | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| | 503 | 334 | 230 | 181 | 201 | 302 | 376 | 489 | 570 | 661 |
| | 0 | 0 | 0 | 1,758 | 1,758 | 305 | 0 | 0 | 0 | 0 |
| | 0 | 0 | 23 | 576 | 570 | 195 | 76 | 0 | 0 | 0 |

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**2014 - Full Production and 4% AEP, 144 Hour Rainfall Event**

| February | March | April | May | June | July | August | September | October | November | December |
|---|---|---|---|---|---|---|---|---|---|---|
| 58.5 | 59.4 | 44.7 | 43.7 | 59.2 | 86.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 339 | 344 | 259 | 253 | 343 | 501 | 232 | 257 | 320 | 369 | 371 |
| 0 | 0 | 0 | 0 | 2,148 | 3,136 | 0 | 0 | 0 | 0 | 0 |
| 129 | 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 597 | 503 | 334 | 230 | 181 | 201 | 302 | 376 | 489 | 570 | 661 |
| 0 | 0 | 0 | 0 | 1,790 | 1,790 | 1,790 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 23 | 544 | 2,189 | 329 | 211 | 43 | 0 | 0 |

**2015 - Full Production and Average Rainfall**

| y March | April | May | June | | July | August | September | October | November December |
|---|---|---|---|---|---|---|---|---|---|
| 59.4 | 44.7 | 43.7 | 59.2 | 46.4 | 40.0 | 44.4 | 55.3 | 63.7 | 64.0 |
| 344 | 259 | 253 | 343 | 269 | 232 | 257 | 320 | 369 | 371 |
| 0 | 0 | 0 | 2,148 | 1,684 | 0 | 0 | 0 | 0 | 0 |
| 109 | 72 | 50 | 39 | 43 | 65 | 81 | 105 | 123 | 143 |
| 503 | 334 | 230 | 181 | 201 | 302 | 376 | 489 | 570 | 661 |
| 0 | 0 | 0 | 1,790 | 1,790 | 241 | 0 | 0 | 0 | 0 |
| 0 | 0 | 23 | 544 | 506 | 195 | 76 | 0 | 0 | 0 |

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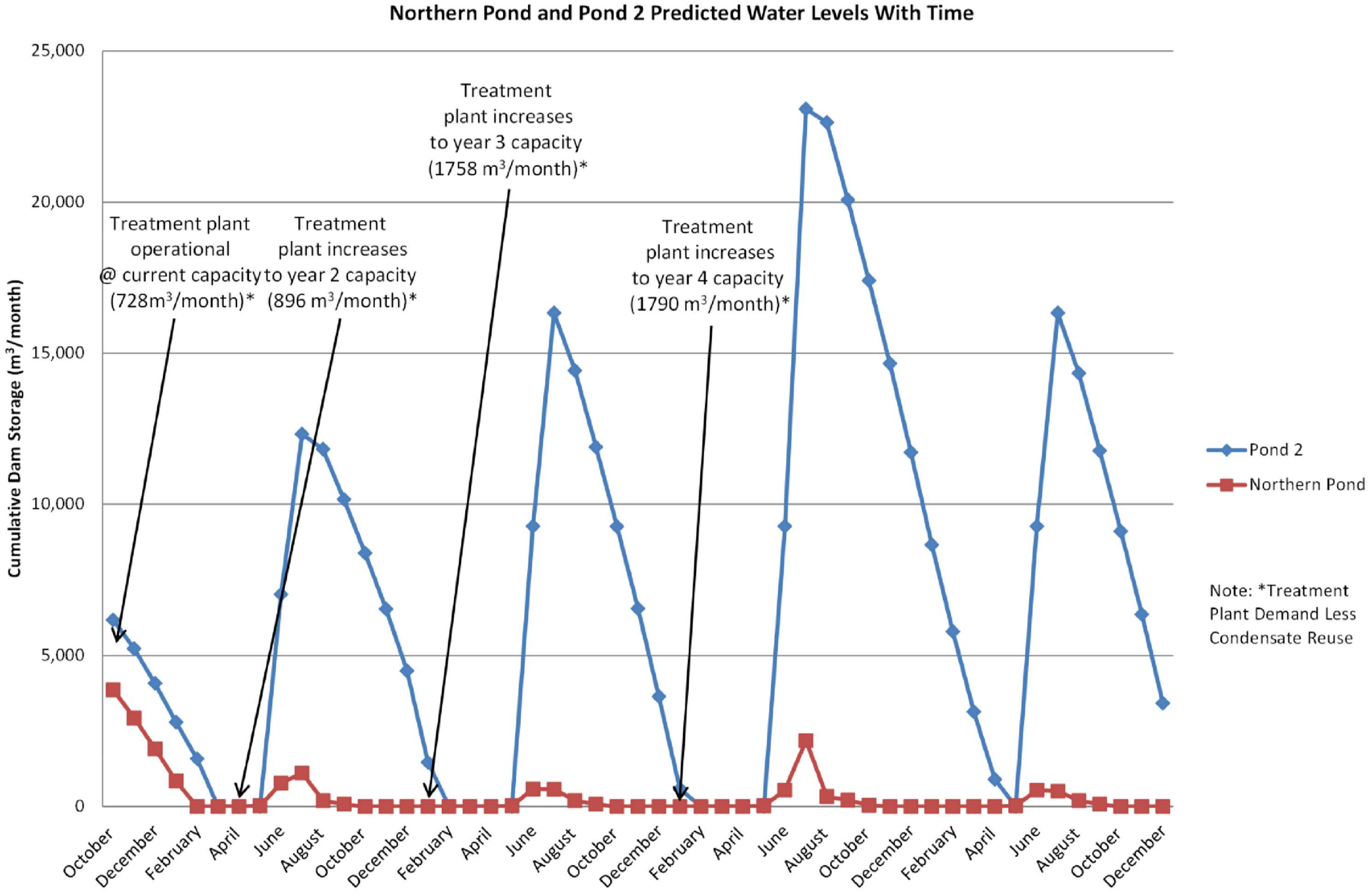


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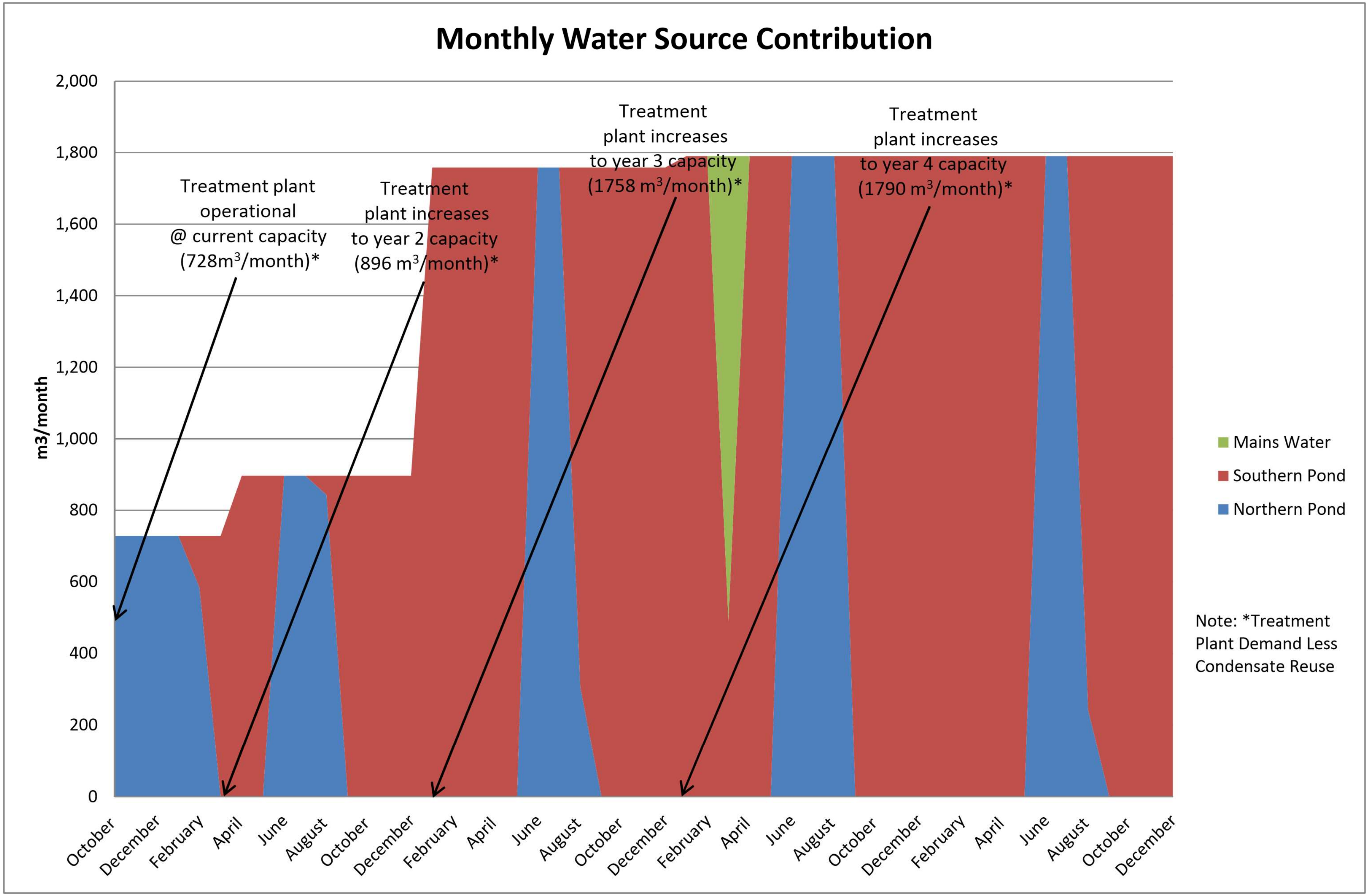

Monthly Water Source Contribution
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
m3/month
Treatment plant operational @ current capacity (728m3/month)*
Treatment plant increases to year 2 capacity (896 m3/month)*
Treatment plant increases to year 3 capacity (1758 m3/month)*
Treatment plant increases to year 4 capacity (1790 m3/month)*
October
December
February
April
June
August
October
December
February
April
June
August
October
December
February
April
June
August
October
December
February
April
June
August
October
December
Mains Water
Southern Pond
Northern Pond
Note: *Treatment Plant Demand Less Condensate Reuse