Planning Proposal

Proposed amendment to The Hills LEP 2012

Land at Part Lot 10 DP 593517, Red Gables Road, Box Hill

Prepared by:

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1	Client Review	RD	SG	27.05.2015
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Approval for Issue

Name	Signature	Date
Rob Dwyer		14.08.15

Executive Summary

In urban areas of Australia the most common form of sewage collection, treatment and disposal is the use of gravity feed sewers coupled with sewage pump stations linked to an offsite sewage treatment plant. This traditional method utilises technology that is not without environmental impacts.

The Box Hill North Urban Release Area will eventually contain 4,100 dwellings and local town centre and will be serviced by a pressure sewer network (a well-established alternative to gravity sewer) linked to a water recycling facility known as the local water centre (LWC). Sustainable management of water is at the heart of the operations of the LWC planned for the site subject of this Planning Proposal. The water recycling facility will treat sewage and generate recycled water for use in the community. The pressurised sewerage system will collect sewage in a closed system in so far as rainwater, groundwater and stormwater cannot flow into the system. There are no wet weather flow peaks to the system and therefore no overflow events discharging into the environment. Significantly, this minimisation and predictability of flow allows for technically advanced treatment technology (membrane bioreactor) to be appropriately sized and therefore cost effective and for the footprint of the associated water recycling facility to be minimised. Hence the environmental benefits of the LWC are significant.

To enable the establishment of the water recycling facility a suitably zoned site is required and hence this Planning Proposal provides justification to rezone Part Lot 10 DP 593517 from R3 Medium Density Residential to SP2 Infrastructure (Sewerage System). When approved, the Planning Proposal will enable the construction and operation of a water recycling facility, as defined under The Hills LEP 2012, to occur.

It is considered that this Planning Proposal is generally consistent with the provisions of all relevant local and State government strategic plans and strategies and detailed investigations of site constraints demonstrate that the land is relatively free of major physical constraints.

The suitability of the site for the proposed water recycling facility taking into account the site's regional context and environmental, economic and social opportunities and constraints has been addressed and the resultant development of the site will result in significant environmental benefits particularly in relation to sustainable management of water. In addition the water recycling facility is architecturally designed as a community asset providing benefits to the local community.

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1.0 Introduction

RPS acts on behalf of Flow Systems Operations Pty Ltd, a wholly owned subsidiary of Flow Systems Pty Ltd (Flow), in preparing this Planning Proposal for rezoning of land at Red Gables Road, Box Hill.

The Planning Proposal has been prepared in accordance with Section 55 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the relevant Department of Planning and Environment (DP&E) Guidelines, including *A Guide to Preparing Local Environmental Plans* and *A Guide to Preparing Planning Proposals.*

The site is within the local government area (LGA) of The Hills Shire. The address of the site is 153 Boundary Road, Box Hill (Part Lot 10 DP 593517) as shown in **Figure 1**. The site is the subject of an agreement between the developer of the Box Hill North Urban Release Area (Celestino Pty Ltd) and the current land owner for purchase. Flow has a commercial agreement with Celestino Pty Ltd to secure appropriate approvals for the construction and operation of a water recycling facility on the site.

The site is located within the Box Hill North Urban Release Area. This Area was the subject of a comprehensive Planning Proposal process which commenced in 2013 and included detailed investigations of site constraints demonstrating that the land is relatively free of major physical constraints. The Planning Proposal for the Box Hill North Urban Release Area demonstrated a holistic and integrated approach taking into account the area's regional context and environmental, economic and social opportunities and identified significant benefits for North-West Sydney and its future residents. Development within the Box Hill North Urban Release Area will deliver a range of densities, lot sizes and dwelling types and create a diverse community that is demographically balanced. The variety of housing forms will provide opportunities to respond to changing life cycle, lifestyle and work requirements over time, enabling people to age in place. It will also provide for an accessible town centre, and a connected open space and pedestrian network. On February 20 2015, via publication on the NSW Government Gazette website, a variety of land use zones (Local Centre, Residential (General, Low, Medium and High), Environmental Living, Public Recreation and Transition) were applied to the Box Hill North Urban Release Area.

As part of the above process the site subject of this Planning Proposal was rezoned to R3 Medium Density Residential. This Planning Proposal provides justification to commencing rezoning of part of the land from R3 Medium Density Residential to SP2 Infrastructure (Sewerage System) under *The Hills Local Environmental Plan 2012* (The Hills LEP 2012). Sustainable management of water is at the heart of the operations of the water recycling facility planned for the site subject of this Planning Proposal and this is highly consistent with the holistic and integrated approach adopted for the Box Hill North Urban Release Area. When approved, the Planning Proposal will enable Flow to utilise the provisions of *State Environmental Planning Policy (Infrastructure) 2007* (ISEPP) thus allowing the construction and operation of a water recycling facility, as defined under The Hills LEP 2012, to occur under Part 5 of the EP&A Act. Under the current provisions of The Hills LEP 2012 water recycling facilities are a type of sewerage system as defined and are not permitted within the R3 Medium Density Residential zone.

On 8th October 2013 Council resolved to forward the Box Hill North Planning Proposal to the DP&E and to include development standards as described in the Council officer report. The report recommended the use of a prescribed zone such as SP2 Infrastructure to enable permissibility of sewerage systems under the ISEPP once locations within the Box Hill North Urban Release Area were determined. Therefore this Planning Proposal is consistent with the Council recommendation and resolution from the 8th October 2013.

This Planning Proposal will require updating once Council resolve to support the rezoning subject of this Planning Proposal and once a "gateway" determination is provided by DP&E.

It should be noted that the site is the subject of a development application for subdivision of Lot 10 DP 593517 (DA 1634/2015/ZB) to enable the creation of a separate lot for the purpose of a water recycling facility.

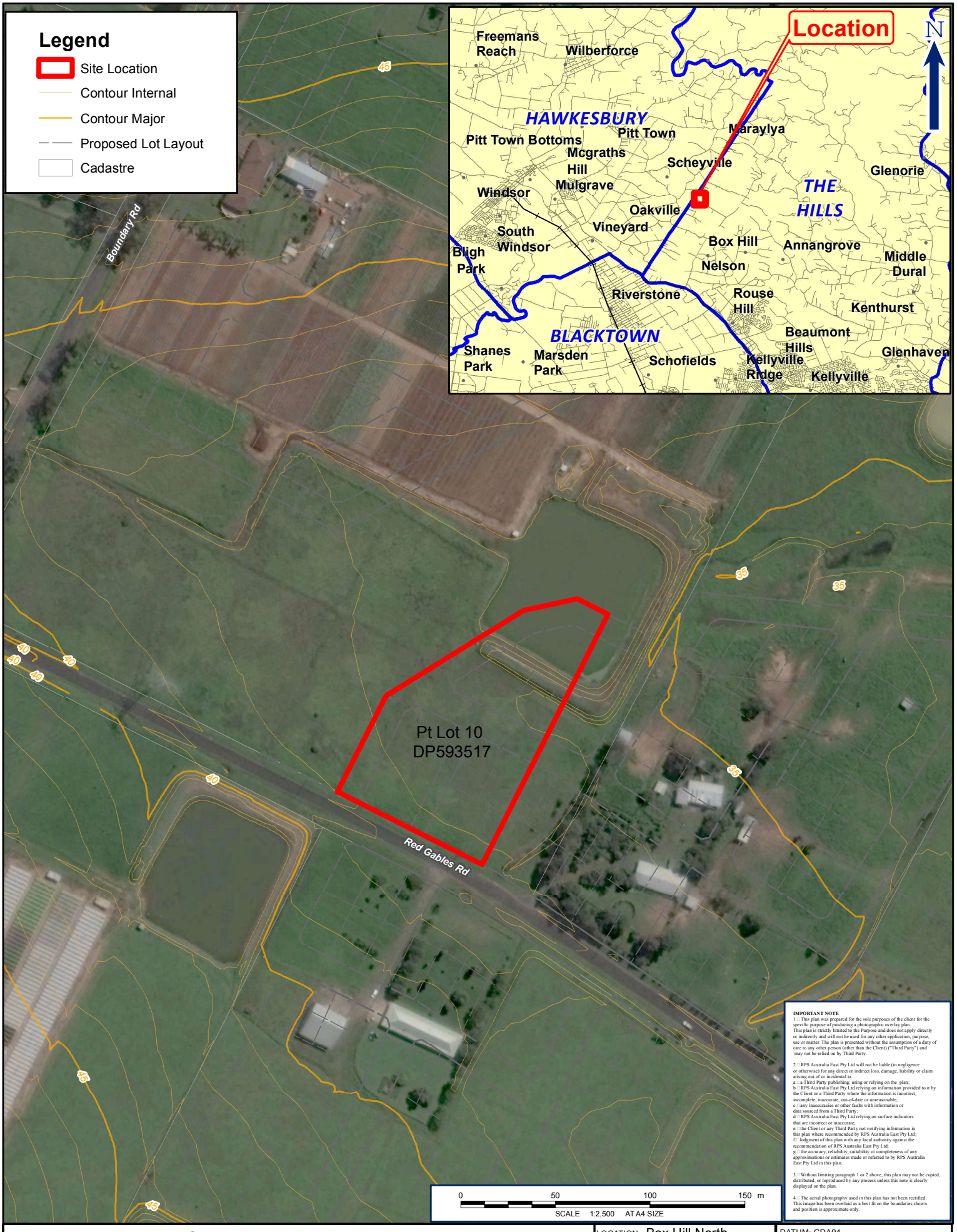

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Figure 1: Locality and Site Location Map

LOCATION: Box Hill North	DATUM: GDA94 PROJECTION: MGA Zone 56
JOB NO.: **PR127067** PURPOSE: Planning Proposal Technician: Natalie.Wood Date: 15/05/2015	Data Sources: RPS

CLIENT: Flow Systems

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2.0 Part 1 and Part 2 – Objectives, Intended Outcomes and Explanation of Provisions

Under the current provisions of The Hills LEP 2012 the site is zoned R3 Medium Density Residential and water recycling facilities, which is a type of sewerage system as defined, is not permitted within the R3 Medium Density Residential zone. The R3 Medium Density Residential zone is not a "prescribed zone" as defined in the ISEPP and hence construction and operation of a water recycling facility on the site as defined under The Hills LEP 2012 cannot currently occur under Part 5 of the EP&A Act. Rezoning to SP2 Infrastructure (Sewerage System) will permit development by Flow (as a holder of a WICA licence) without development consent. It is noted that sites owned and operated by other operators (eg Sydney Water) within The Hills LGA and beyond for the purpose of sewage treatment are zoned SP2 Infrastructure (Sewerage System). This zoning allows current operators to utilise the provisions of ISEPP, via it being a prescribed zone under the ISEPP, thus allowing many of the essential activities to occur under Part 5 of the EP&A Act.

Hence the Planning Proposal aims to amend The Hills LEP 2012 pursuant to Section 55 of the EP&A Act. The amendment will remove the R3 Medium Density Residential zone as it relates to Part Lot 10 DP 593517, refer to **Figure 1**, and will replace it with a SP2 Infrastructure (Sewerage System) zone.

As mentioned above sewerage System is a definition adopted by The Hills LEP 2012 and means any of the following:

- Bio-solids treatment facility;
- Sewage reticulation system;
- Sewage treatment plant;
- Water recycling facility;
- A building or place that is a combination of any of the things referred to above.

Therefore the Planning Proposal will require amendment to the Land Zoning Map (LZN_005) within The Hills LEP 2012. The minor nature of the amendment does not necessitate other changes to The Hills LEP 2012, such as Lot Size Map, Height of Buildings Map, Floor space ratio map and the like.

A suggested map illustrating the proposed zoning layer is contained in Part 4 of the Planning Proposal.

Figure 2 is a plan showing the location of the site in the context of the current zonings across the Box Hill North Urban Release Area.

An extract from the Land Use Table of the SP2 Infrastructure zone within The Hills LEP 2012 is provided below.

Zone SP2 Infrastructure

1 Objectives of zone

- To provide for infrastructure and related uses.
- To prevent development that is not compatible with or that may detract from the provision of infrastructure.

2 Permitted without consent

- Roads

3 Permitted with consent

The purpose shown on the Land Zoning Map, including any development that is ordinarily incidental or ancillary to development for that purpose

4 Prohibited

Any development not specified in item 2 or 3

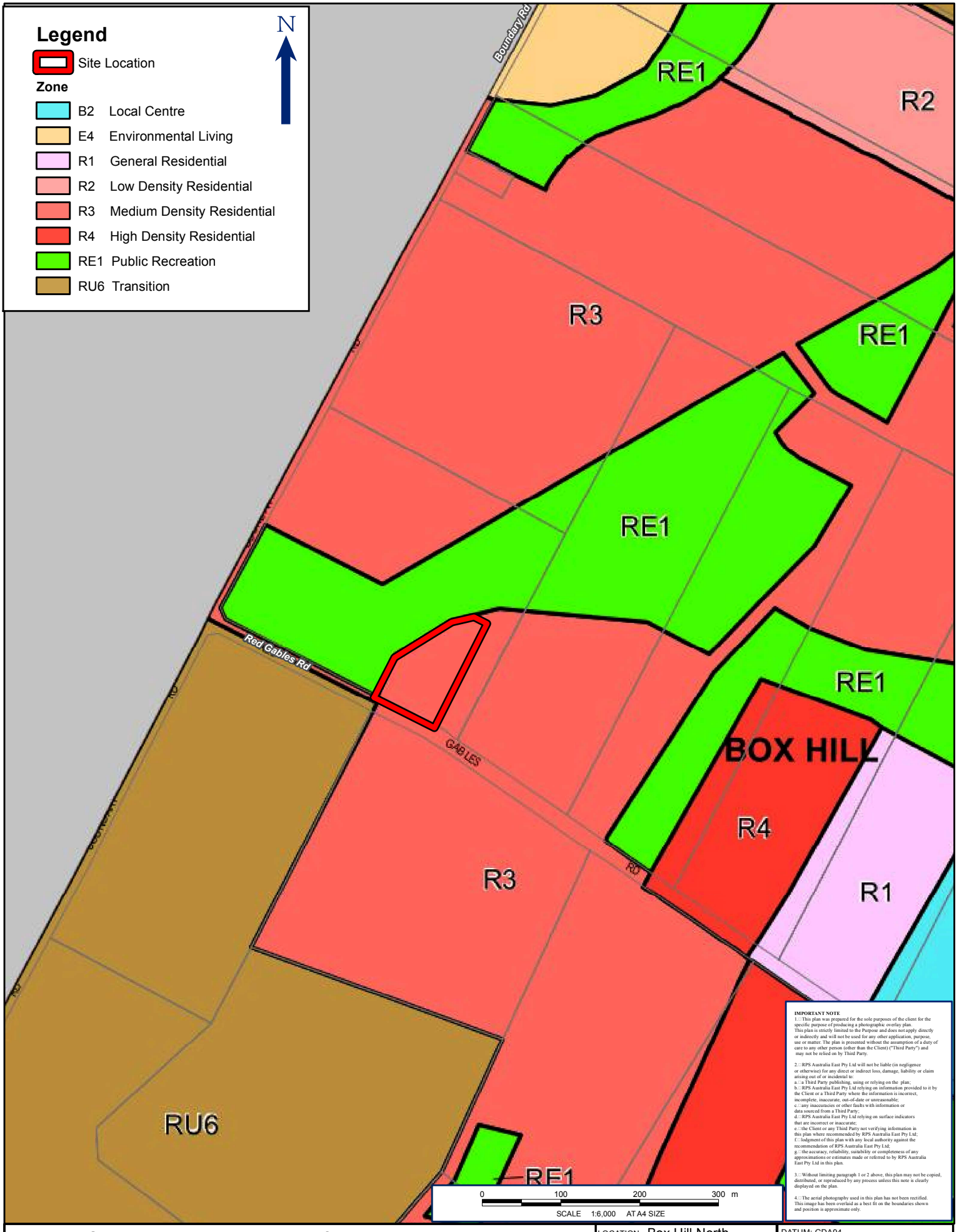

Figure 2: Current Zoning Plan - Extract from The Hills LEP 2012

LOCATION: Box Hill North	DATUM: GDA94 PROJECTION: MGA Zone 56
JOB NO.: **PR127067** PURPOSE: Planning Proposal Technician: Natalie.Wood Date: 15/05/2015	Data Sources: RPS

CLIENT: Flow Systems

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Path: J:\JOBS\127k\127067 Box Hill North\10 - Drafting\Arcgis Map Documents\Planning\127067 Figure 2 Zoning A A4.mxd

3.0 Part 3 – Justification for the Planning Proposal

In accordance with the Department of Planning *A Guide to Preparing Local Environmental Plans* and *A Guide to Preparing Planning Proposals,* this section provides a response to the following issues:

- Section A: Need for the Planning Proposal;
- Section B: Relationship to strategic planning frameworks;
- Section C: Environmental, social and economic impact; and
- Section D: State and Commonwealth interests.

3.1 Section A – Need for the Planning Proposal

Strategic Overview

The NSW Government introduced the *Water Industry Competition Act 2006* (WICA) as part of its strategy for a sustainable water future to harness the innovation and investment potential of the private sector in the water and wastewater industries. WICA established a licensing regime for new entrants to the industry to ensure the continued protection of public health, consumers and the environment. The private sector is now encouraged to develop and operate water management schemes and the licensing system is governed by the NSW Independent Pricing and Regulatory Tribunal (IPART).

Sustainable management of water is at the heart of the operations of the water recycling facility planned for the site subject of this Planning Proposal. The water recycling facility will be delivered, operated and maintained by Flow under regulations set out by WICA and governed by IPART.

In urban areas of Australia the most common form of sewage collection, treatment and disposal is the use of gravity feed sewers coupled with sewage pump stations linked to an offsite sewage treatment plant. This traditional method utilises technology that is not without environmental impacts. Rainwater, groundwater and stormwater can enter such systems potentially leading to discharge overflow events with utility operators often needing to apply for discharge licences to manage flows into the environment. Leaks and groundwater infiltration are common problems with gravity feed systems and large, traditional wastewater treatment plants often emit high levels of odorous gases. The design of traditional sewage collection treatment and disposal systems usually includes deep sewage networks, pumping stations, storage and treatment facilities that are considerable in size.

In comparison, the Box Hill North Urban Release Area will be serviced by a pressure sewer network (a well-established alternative to gravity sewer) linked to a water recycling facility known as the local water centre (LWC). The water recycling facility will treat sewage and generate recycled water for use in the community. The pressurised sewerage system proposed is closed in so far as rainwater, groundwater and stormwater cannot flow into the system and there are no wet weather overflow events discharging into the environment. Significantly, this minimisation and predictability of flow allows for technically advanced treatment technology (membrane bioreactor) to be appropriately sized and therefore cost effective and for the footprint of the associated water recycling facility to be minimised, The pressure sewage network, pumping stations and LWC will be considerably smaller (six to eight times smaller) than a traditional centralised gravity fed network. The network of pipes is designed to have the same life expectancy as a typical domestic building, which is 50 years.

Residents of the Box Hill North Urban Release Area will have a dual water supply – drinking water from Sydney Water, and a recycled water supply for flushing toilets, outdoor irrigation and to use in washing machines from Flow. In addition to its environmental benefits, the dual water supply will make the community

highly water efficient, creating a more secure water supply, extending the life of water infrastructure to the existing community and reducing the increase in demand for potable water supplies. Recycled water reaches the natural environment from the watering of gardens and water used outdoors. Much of the outdoor water use in the community will be to establish new gardens. Subject to Council agreement recycled water could be used for irrigating public spaces, such as sporting fields and parks. This will contribute to the maintenance and upkeep of these public facilities. Overall Flow's intention is to irrigate with no negative environmental impact and make a significant contribution to sustainability. Irrigation will be guided by Flows' licence conditions, the Australian Guidelines for Water Recycling and other national and state guidelines.

A concept plan of the Box Hill LWC, sited on the subject site, is contained in **Appendix 1**.

The land is not currently within a prescribed zone as defined in the ISEPP. Rezoning to SP2 Infrastructure (Sewerage System) will permit development by Flow (as a holder of a WICA licence) without development consent. It is noted that sites owned and operated by Sydney Water within The Hills LGA and beyond for the purpose of sewage treatment are zoned SP2 Infrastructure (Sewerage System). This zoning allows Sydney Water to utilise the provisions of ISEPP, via it being a prescribed zone under the ISEPP, thus allowing many of the essential activities to occur under Part 5 of the EP&A Act.

Hence the constructor and operator of the water recycling facility on the site subject of this Planning Proposal should be afforded the equivalent provisions as the established public sector operators and hence a SP2 Infrastructure (Sewerage System) zone should be applied to the site.

Environmental assessments for the site have been prepared and will be used for the review of environmental factors (REF) for the Box Hill LWC. Assessments from the REF and relevant to the Planning Proposal are referred to and included within this Planning Proposal.

Is the Planning Proposal a result of any strategic study or report?

The land subject to this Planning Proposal is not a result of any specific study or report. However the site and the Box Hill North Urban Release Area was the subject of a comprehensive Planning Proposal process which commenced in 2013 and resulted in the rezoning of land on February 20 2015, via publication on the NSW Government Gazette website. The site was rezoned to R3 Medium Density Residential in accordance with the Planning Proposal thus allowing uses permitted in that zone. Water recycling facilities which are a type of sewerage system as defined are not permitted within the R3 Medium Density Residential zone.

Is the Planning Proposal the best means of achieving the objectives or intended outcomes or is there a better way?

The current zoning of the subject site does not permit water recycling facilities. Amending the zoning of the subject site via this Planning Proposal is the most appropriate way to achieve the outcome of establishing a water recycling facility on the site with the ability to utilise the provisions of ISEPP and allowing the construction and operation to occur under Part 5 of the EP&A Act.

A sub-optimal means of achieving permissibility of the water recycling facility on the site would be the inclusion of sewerage systems and water recycling facilities as permitted uses in the R3 Medium Density Residential zone. If this was to occur construction and operation of the LWC would be under Part 4 of the EP&A Act which would place the proposal at odds with the zoning provisions afforded to public sector operators.

3.2 Section B – Relationship to Strategic Planning Framework

Is the Planning Proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy (including the Sydney Metropolitan Strategy and exhibited draft strategies?

Metropolitan Plan for Sydney 2036

The Metropolitan Plan predicts that Sydney will grow to a population of approximately 6 million people by 2036. To accommodate this growth, it is anticipated that there will be a need for an additional 770,000 dwellings, 10 million square metres of commercial floor space and 5 million square metres of additional retail floor space. Approximately 760,000 more jobs are targeted to be created in this period.

The primary objective of the Metropolitan Plan for Sydney is to ensure that there is an adequate supply of land to enable the delivery of residential development to accommodate the forecast population growth. The strategy seeks to encourage the provision of housing near jobs, transport and services, to improve housing affordability, upgrade the quality of new development and encourage urban renewal. The Metropolitan Plan provides updated subregional housing targets and a new timeframe to 2036. For the North-West, the new dwelling target is 169,000 new dwellings. Of the 169,000 new dwellings, 83,000 are anticipated to be accommodated in new release areas (Growth Centres and other Greenfield releases in the subregion). The recently rezoned Box Hill North Urban Release Area will deliver 4,100 new dwellings within close proximity to a town centre and supporting services and facilities and will go some way in contributing to the balance of dwellings to be accommodated within the subregion.

The Planning Proposal and subsequent construction and operation of the Box Hill LWC will provide an environmentally superior alternative to the traditional sewage treatment plant usually required to service new residential developments. As opposed to traditional sewage treatment plants off-site impacts of the proposed Box Hill LWC are limited and because it is scalable it allows supply to increase in line with the anticipated residential development of Box Hill North and the volume of waste to be treated. The Box Hill LWC will also make a significant contribution to sustainability through the provision of recycled water back to the new residential areas. Accordingly it is considered that the Planning Proposal is not inconsistent with the Metropolitan Plan for Sydney 2036.

Metropolitan Strategy – City of Cities: A Plan for Sydney's Future

The NSW Government's Metropolitan Strategy - City of Cities: A Plan for Sydney's Future (Metropolitan Strategy) outlined the strategic direction for the Sydney region over the next 25 years and included actions specific to the North West Growth Centre. The Metropolitan Strategy outlined five aims to achieve a more sustainable city which include:

- Enhance liveability,
- Strengthen economic competitiveness,
- Ensure fairness,
- Protect the environment, and
- Improve governance.

The Metropolitan Strategy anticipated that Sydney's population would grow by 1.1 million people from a population of 4.2 million to 5.3 million by 2031. This population growth would require the following:

- 640,000 new homes;
- 500,000 more jobs over the next 25 to 30 years;

- 7,500 hectares of extra industrial land if current trends continue;
- 6.8 million square metres of additional commercial floor space; and
- 3.7 million square metres of additional retail space.

Whilst the Planning Proposal will reduce land available for development within the R3 Medium Density Residential zone by approximately 1 hectare (or approximately 15 dwellings) its overall contribution to sustainability should be noted by:

- The provision of recycled water back to the new residential areas; and
- The removal of the need for discharge to local waterways, or more expensively to pipe sewage to an existing sewage treatment plant for treatment and disposal, which may also require an amplification/upgrade of the existing receiving treatment plant.

Accordingly it is considered that the Planning Proposal is not inconsistent with the Metropolitan Strategy. It is also anticipated that the loss of potentially 15 dwellings in this location can be "re-gained" in later stages of the Box Hill Urban Release Area.

Draft North West Subregional Strategy

Subregional strategies have been adopted to translate objectives of the Metropolitan Strategy and State Plan to the local level. The draft North West Subregional Strategy prepared in December 2007 is the subregional strategy relevant to precinct planning for the Precincts and aims to guide land use planning until 2031. The Draft Subregional Strategy is currently under review.

The Hills LGA has a population of 170,000 people (2011) and covers an area of 400 km². Population growth in recent years has been among the highest in the Sydney Region. This has been influenced by major land release focussed around Kellyville and Rouse Hill. Housing in the subregion is mainly low density detached dwellings. Employment within the LGA is focussed at Castle Hill, Annangrove, Dural, North Rocks, Northmead, Rouse Hill, Winston Hills and Kellyville as well as Norwest, Marsden Park and Box Hill.

It is considered that the Planning Proposal will not be inconsistent with the Draft Strategy as it will contribute to the delivery of essential services for up to 4,100 new dwellings.

Is the Planning Proposal consistent with the local council's Community Strategic Plan, or other local strategic plan?

Draft Local Strategy – New Strategic Direction for Baulkham Hills Shire

The Draft Local Strategy was adopted by Council on 10 June 2008. This land use planning document aims to guide planning up to 2031 and reflects the five key themes of the Hills 2026 Community Strategic Direction: Looking Towards the Future:

- Resilient local leadership;
- Vibrant communities;
- Balanced urban growth;
- Protected environment; and
- Modern local economy.

The Planning Proposal is consistent with Draft Local Strategy – New Strategic Direction for Baulkham Hills Shire as it will contribute to the delivery of essential services for up to 4,100 new dwellings. Furthermore the

resultant LWC will make a significant contribution to sustainability through the provision of recycled water back to the planned residential areas of Box Hill North.

Is the Planning Proposal consistent with applicable state environmental planning policies?

There are two State Environmental Planning Policies (SEPP) that are relevant to the Planning Proposal and an assessment of the criteria of the relevant SEPP's against the Planning Proposal is provided in **Table 1**.

Table 1 Relevant State Environmental Planning Policies

SEPP	Relevance	Consistency and Implications
SEPP 55	This SEPP applies to land across NSW and states that land must not be developed if it is unsuitable for a proposed use because of contamination.	A Preliminary Site Investigation was prepared by JBS Environmental as part of the Planning Proposal for the Box Hill North Urban Release Area. Based on the results of the investigations there is potential for subsurface contamination to be present on the site as a result of previous site usage (i.e. agriculture). Based on the site observations and agriculturally related site activities, it is considered that the potential for widespread contamination across the site is low.
SEPP Infrastructure 2007 (ISEPP)	Provides a consistent approach for infrastructure and the provision of services across NSW, and to support greater efficiency in the location of infrastructure and service facilities.	The planning proposal aims to rezone land for infrastructure purposes. This will result in lands being available for use under the SEPP.

Is the Planning Proposal consistent with applicable Ministerial Directions (s117 directions)?

The Minister for Planning, under section 117(2) of the EP&A Act, issues directions that relevant planning authorities such as local councils must follow when preparing Planning Proposals for new LEPs. **Table 2** contains a response to each of the relevant directions in relation to the Planning Proposal.

Table 2 Listing of Section 117 Directions

Ministerial Direction	Aim of Direction	Consistency and Implications
3.1 Residential Zones	The objectives of this direction area: ▪ To encourage a variety and choice of housing types to provide for existing and future housing needs, ▪ To make efficient use of existing infrastructure and services and ensure that new housing has appropriate access to infrastructure and services, and ▪ To minimise the impact of residential development on the environment and resource lands.	Not inconsistent. Whilst the Planning Proposal will reduce land available for development within the R3 Medium Density Residential zone by approximately 1 hectare (approx. 15 dwellings) it is considered that it is not inconsistent with this Direction. The overall contribution to sustainability by the future LWC, which will be established as a result of the Planning Proposal, should be noted. The Planning Proposal and LWC will result in the provision of recycled water back to the new residential areas and remove the need for discharge to local waterways, or more expensively to pipe sewage to an existing STP.

Ministerial Direction		Aim of Direction	Consistency and Implications
3.4	Integrating Land Use and Transport	The objective of this direction is to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts achieve the following planning objectives: ▪ Improving access to housing, jobs and services by walking, cycling and public transport, and ▪ increasing the choice of available transport and reducing dependence on cars, and ▪ Reducing travel demand including the number of trips generated by development and ▪ the distances travelled, especially by car, and ▪ Supporting the efficient and viable operation of public transport services	Not inconsistent. The built form of the resultant development will be detailed in a manner that is sympathetic to its location on the margin of a future residential area and is to be treated as a community asset.
4.4	Planning for Bushfire Protection	The objectives of this direction are: ▪ To protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire prone areas, and ▪ To encourage sound management of bush fire prone areas.	Not inconsistent. A preliminary assessment carried out by an Accredited Bushfire Practitioner from RPS reviewed the site conditions and concluded that compliance with *Planning for Bushfire Protection 2006* can be achieved or practically implemented without change to the proposed layout or construction methodology.
7.1	Implementation of Metropolitan Plan for Sydney 2036	The objective of this direction is to give legal effect to the vision, transport and land use strategy, policies, outcomes and actions contained in the Metropolitan Plan for Sydney 2036.	Not inconsistent. The Planning Proposal is not inconsistent with the vision, transport and land use strategy, polices, outcomes and actions contained in the Metropolitan Plan for Sydney 2036.

3.3 Section C – Environmental, social & economic impact

Environmental assessments for the site have been prepared and will be used for the review of environmental factors (REF) for the Box Hill LWC. Relevant assessments from the REF are referred to and included within this Planning Proposal.

Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

No. The site has been the subject of rural farming and grazing and hence contains grass vegetation and dam only. The study area remains rural and still operates as part of a garden market plot.

The site was subject of a comprehensive Planning Proposal process which commenced in 2013 and resulted in the rezoning of the Box Hill North Urban Release Area in February 2015. The process included a number of ecological assessments. Drawing from the results of the reports and assessment, the ecological value of the LWC site is considered low given that no existing remnant vegetation persists on site, habitat features are highly restricted, no threatened flora and/or fauna were detected and no Endangered Ecological Communities were detected. Thus, it is unlikely that a significant impact will arise from the Planning Proposal.

Are there any other likely environmental effects as a result of the Planning Proposal and how are they proposed to be managed?

Key aspects of the Local Water Centre that will be permitted as a result of the Planning Proposal

Flow will construct and operate the water recycling facility at the site.

The Box Hill LWC will utilise sewage from the Box Hill North Urban Release Area to produce high quality water. The sewage will be treated through a multi-stage process of screening, anaerobic and aerobic processing, chemical treatment, membrane filtration, (collectively known as membrane bioreactor), ultraviolet disinfection and chlorination. The recycled water will be plumbed into houses for non-potable uses such as toilet flushing, washing machines, irrigation and car washing, thus reducing potable water demand. The facility will operate 24 hours, 7 days per week, housed in a low-scale, single building within an open space setting. An architectural drawing of the development as it would appear once constructed is provided in **Appendix 1**.

The Box Hill LWC will provide an alternative to the traditional sewage treatment plant usually required to service new residential developments. Off-site impacts of the Box Hill LWC will be limited and because it is scalable it allows supply to increase in line with the anticipated residential development of the Box Hill North Urban Release Area and the volume of waste to be treated. The Box Hill LWC will also make a significant contribution to sustainability through the provision of recycled water back to the new residential areas.

Stormwater, Flooding and Drainage

A Stormwater Concept Plan for the site has been prepared and is contained in **Appendix 2**. The Stormwater Concept Plan incorporates a range of water sensitive and industry best practice management measures with the endeavour of further improving surface water quality onsite whilst harnessing the synergy of providing water quality treatment, flow retention and passive irrigation. The Stormwater Concept Plan has been compiled in accordance with the *Landcom Managing Urban Stormwater – Soils and Construction* (the Blue Book) and will ensure adequate treatment of runoff from both construction and ongoing operations of the Box Hill LWC.

Aboriginal Archaeology

A Heritage Due Diligence Assessment Report has been prepared and is contained in **Appendix 3**. The Due Diligence Report considered the available environmental and archaeological information for the area, the land condition (including visual inspection by a qualified archaeologist), as well as the nature of the proposed activities resulting from the Planning Proposal. The Report states that no Aboriginal objects or places have been identified within the study area and as such an Aboriginal Impact Permit is not required for construction works to proceed.

European Heritage

There are no non-Aboriginal heritage items located within the area to be disturbed. A search of the State Heritage Inventory database on 19 January 2015 identified four items in the Box Hill North locality which are listed on the State Heritage Inventory. Both the local and state historic items were located over 4km away from the site. The Planning Proposal and resultant development is unlikely to affect identified heritage listed items in the broader vicinity.

Noise

A Noise Impact Assessment for the establishment of the Box Hill LWC has been prepared and is contained in **Appendix 4**. Operational noise associated with the equipment within the Box Hill LWC has been

assessed against noise criteria set out in the NSW Environmental Protection Authority (EPA) *NSW Industrial Noise Policy* (INP). Noise monitoring to determine ambient noise has been carried and enabled the establishment of Project Specific Noise Criteria for daytime and night time operations of the LWC. The noise monitoring and modelling used the $L_{Aeq,15min}$ criteria which is a common measure of environmental noise and road traffic noise. Criterion established were L_{Aeq} 41 dBA for day time and L_{Aeq} 41 dBA for night time. Under abnormal operating conditions involving the use of a back-up generator the INP allows for a positive adjustment of 5 dB to the criterion stated above.

Predicted noise levels from the proposed blowers and compressors room, recycled water pumps and potable water pumps indicate compliance with all criteria on all occasions at the closest identified noise sensitive receptors provided that a number of minor modifications to the building construction / treatment are implemented. The results of the modelling of the typical operation of the Box Hill LWC with recommended mitigation measures in place are presented in graphical form as a contour map in **Figure 3**. The results of the modelling of the Box Hill LWC under abnormal operating conditions involving the use of a back-up generator but with recommended mitigation measures in place are presented in graphical form as a contour map in **Figure 4**. With appropriate mitigation the predicted noise levels from the plant comply with all criteria on all occasions at the nearest existing and future residential receivers provided that specific acoustic treatment for the Box Hill LWC is implemented during the Box Hill LWC's construction and operation.

Figure 3 Noise Modelling – Normal Operation Without Back-Up Generator

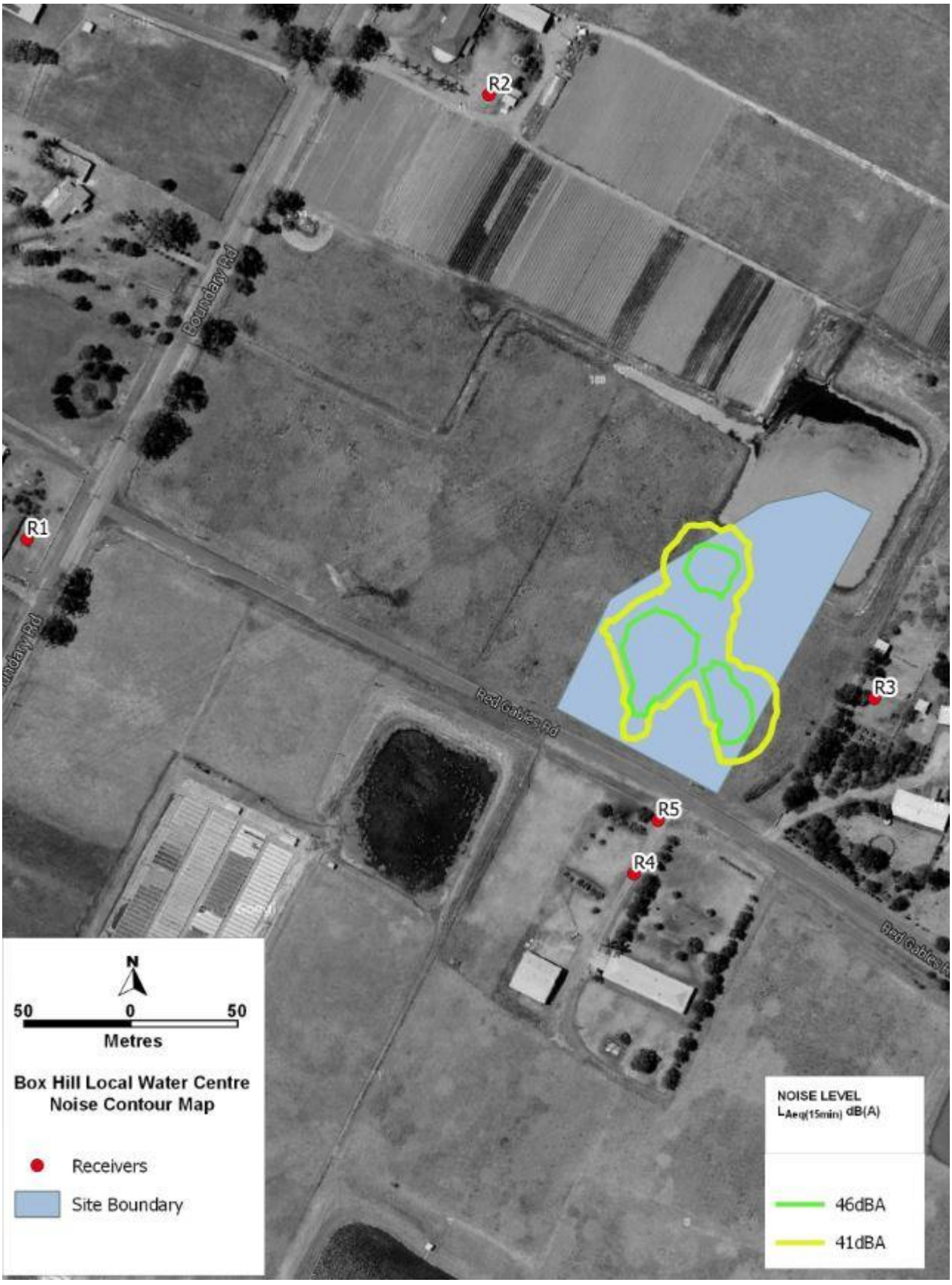
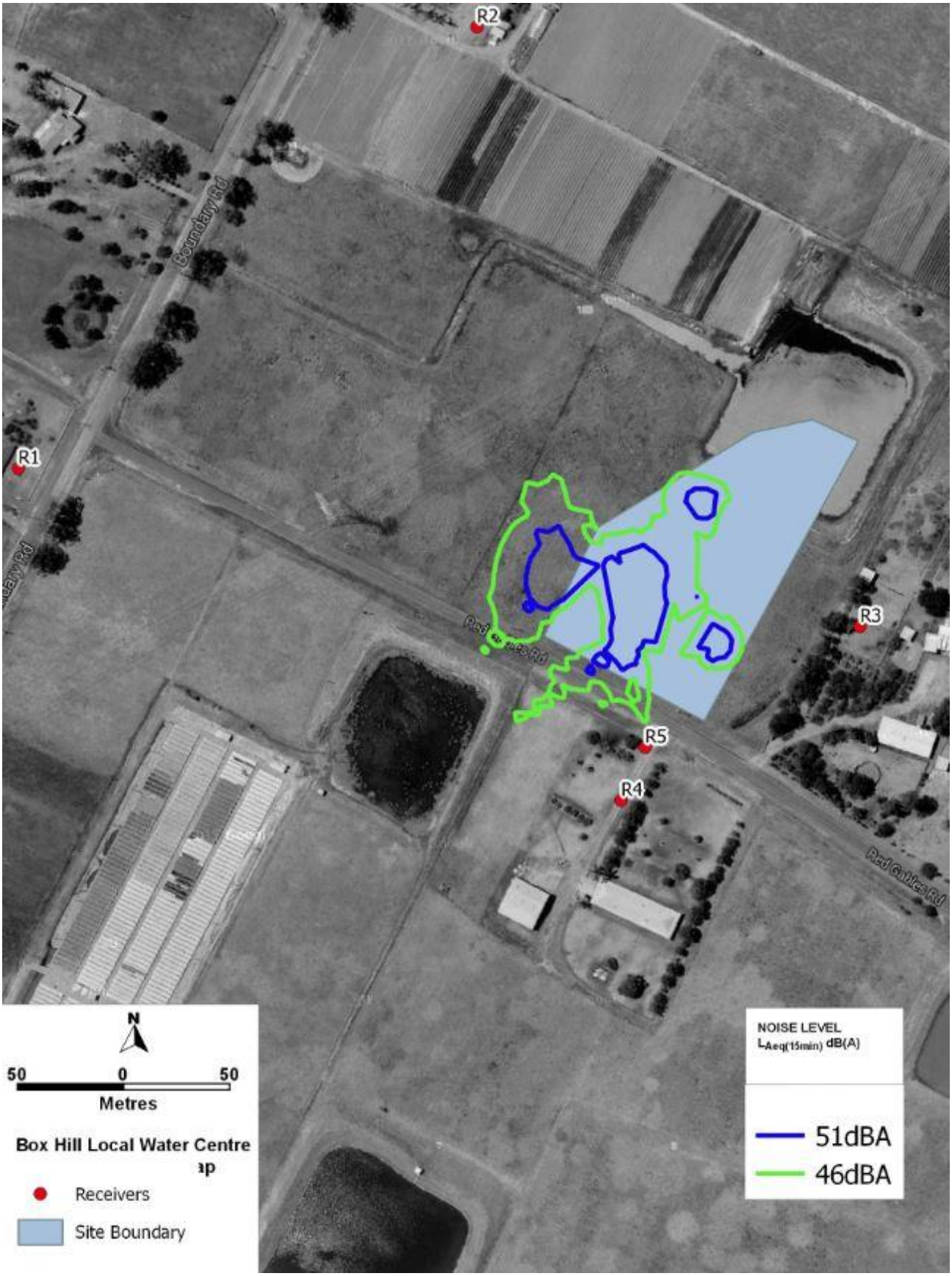


Figure 4 Noise Modelling – Abnormal Operation with back-up generator



Odour and Air Quality

An Odour Impact Assessment having due consideration for the NSW Environmental Protection Authority guidelines has been carried out as part of the assessment of the Box Hill LWC and is contained in **Appendix 5**. The odour impacts for the fully operational plant were assessed and modelling output is illustrated in **Figure 5**. Results from the dispersion modelling indicated that predicted odour concentrations from the proposed facility would comply with the most stringent assessment criterion of 2 OU (99th percentile) at all sensitive receivers outside the Box Hill LWC boundary.

Figure 5 Odour Modelling – Predicted 99th percentile odour concentration (OU)

Bushfire

The site is clear of tree vegetation. Lands surrounding the site are actively managed rural properties, with no vegetation threat to the site (no vegetation within a 140m buffer of the site). A preliminary assessment carried out by an Accredited Bushfire Practitioner from RPS reviewed the site conditions and the proposed development layout of the Box Hill LWC and concluded that compliance with *Planning for Bushfire Protection*

2006 can be achieved or practically implemented without change to the proposed layout or construction methodology.

Access and Traffic

The site is located immediately north of Red Gables Road. Vehicle movements during construction will mostly consist of the floating of earthmoving equipment and concrete agitator trucks delivering concrete during scheduled pours. Concrete truck movements will occur at various stages throughout the construction period and will peak at around five concrete trucks per day at the peak of the construction. In addition, there will be an average of two truck movements per day for the delivery of other plant, materials and equipment.

Once the facility is fully operational, truck movements will be limited to deliveries and is estimated at 4-6 trucks per month. Operator(s) will visit the site 2-3 times per week in standard utilities or passenger vehicles.

Has the Planning Proposal adequately addressed any social and economic effects?

Visual Assessment

The Red Gables Road verge landscape comprises of established lawn, grass vegetation, road signs and overhead power lines. The Box Hill LWC site is a grassed landscape. The visual quality of both of these landscapes is considered to be low.

Visual impacts will be short ones. Potential short term construction impacts include the presence of mobile plant machinery, warning / flashing lights, barriers, signage and construction machinery, minor stripping of soil and the occurrence of temporary stockpiles during excavation and filling and presence of temporary environmental management devices such as silt fences and perimeter fencing.

The design of the Box Hill LWC, as illustrated in **Appendix 1**, although housing an industrial type of activity is nevertheless detailed in a manner that is sympathetic to its location on the margin of a future residential area. Architectural finishes and treatments range from concrete and glass with aluminium trim to colour bond steel for roofs and tanks, to provide a robust look to the facility but with architectural detail to integrate the facility into a residential neighbourhood. The facility is intended to present as a community asset.

The Box Hill LWC will include a combination of hard and soft landscaping features to provide an effective screening of the development from future residential development.

Social and Economic Effects

Two residences are located approximately 75 – 80 metres from the eastern boundary of the subject site.

Construction of the Box Hill LWC is likely to take approximately twelve months. There will be minor short term constructional impacts on existing local residents including the presence of machinery and associated traffic movements, and the minor visual impacts of these. These impacts will be for a short period of time and will not create any long term socio-economic issues. Based upon the land use zones applying to land surrounding the site future dwellings contained within the R3 Medium Density Residential zone will be located to the east and the south of the site. To the north and west is land zoned RE 1 Public Recreation. The indicative layout plan for Box Hill North Urban Release Area contains a highly inter-connected street, residential block and open space network that will accommodate the siting of the Box Hill LWC without compromising the overall urban structure.

It is considered that there will be no significant socio-economic impacts other than the positive impact of enabling an identified growth area to be adequately serviced by the necessary sewer infrastructure.

3.4 Section D – State and Commonwealth Interests

What are the views of State and Commonwealth public authorities consulted in accordance with the gateway determination?

No advice has formally been sought from government agencies or public authorities in relation to the Planning Proposal. However it is anticipated that post "gateway" determination, Council will consult with public authorities to seek their views.

Is there adequate public infrastructure for the Planning Proposal?

The site is currently serviced with electricityand telecommunications. The need, or not, for upgrades to the networks of each of these services are currently being discussed by Flow, Celestino Pty Ltd and the respective service providers. It is anticipated that any required upgrades to services would be made as part of the overall development of the Box Hill North Urban Release Area.

4.0 Part 4 – Mapping

4.1 Current maps within The Hills LEP 2012

The following maps within The Hills LEP 2012 apply to Part Lot 10 DP 593517:

- Land Zoning Map LZN_005 – showing the site zoned as R3 Medium Density Residential;
- Height of Buildings Map HOB_005 – showing the site has a maximum building height of 10.0 metres;
- Urban Release Area Map CL2_005 – showing the site is within an Urban Release Area as defined by Part 6 of The Hills LEP 2012;
- Floor Space Ratio Map FSR_005 – the map is silent on an FSR for the site; and
- Lots Size Map LSZ_005 – showing the site has a minimum lot size of 450 m2.

4.2 Proposed LEP mapping amendment

The Planning Proposal will remove the R3 Medium Density Residential zone as it relates to Part Lot 10 DP 593517 and will replace it with a SP2 Infrastructure (Sewerage System) zone as illustrated in **Figure 6**. Therefore the Planning Proposal will require amendment to the Land Zoning Map (LZN_005) within The Hills LEP 2012.

Having regard for the design of the LWC which is detailed in a manner to integrate into a residential neighbourhood the Planning Proposal does not necessitate other changes to The Hills LEP 2012, such as Height of Buildings Map, Urban Release Area Map, Floor Space Ratio Map and Lot Size Map.

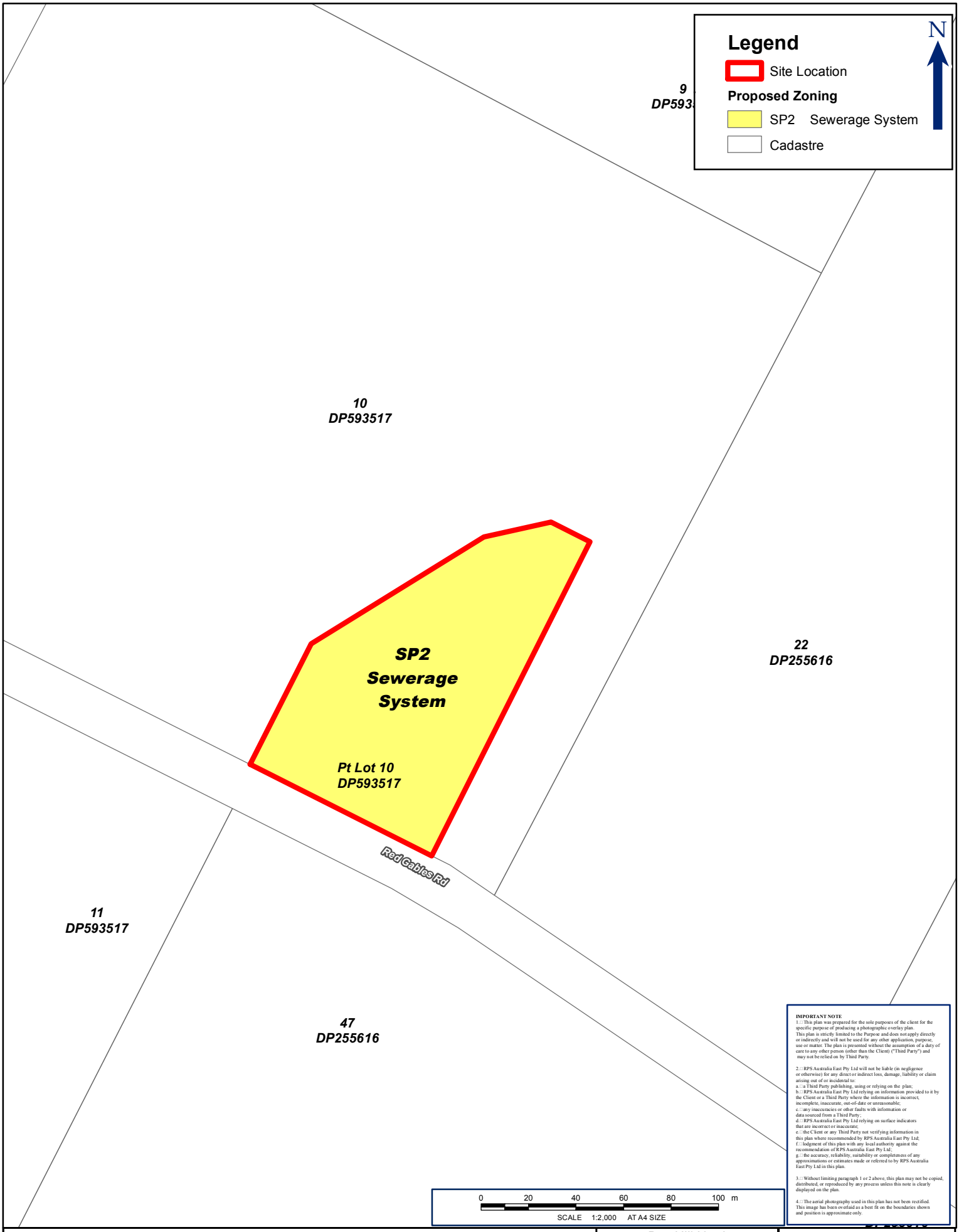


Figure 6: Proposed Land Zoning Map

LOCATION: Box Hill North	DATUM: GDA94 PROJECTION: MGA Zone 56
JOB NO.: **PR127067** PURPOSE: Planning Proposal Technician: jeremy.hill Date: 25/05/2015	Data Sources: RPS

CLIENT: Flow Systems

RPS AUSTRALIA EAST PTY LTD (ABN 44 140 292 762)
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4940 4200 F: 02 4961 6794 www.rpsgroup.com.au

RPS

Path: J:\JOBS\127k\127067 Box Hill North\10 - Drafting\Arcgis Map Documents\Planning\127067 Figure 6 Proposed Zoning A A4.mxd

5.0 Part 5 - Community Consultation

Prior to the lodgement of the Planning Proposal with The Hills Shire Council, representatives from Flow, Celestino Pty Ltd and RPS met with members from Council's Forward Planning Department on Friday 10 July 2015.

Post "gateway" determination the Planning Proposal will be placed on public exhibition. The Planning Proposal is considered to be a low impact proposal (subject to DP&E concurrence) and therefore it is suggested that the Proposal would be exhibited for a minimum 14 day period.

To engage the local community it is likely the following would be undertaken during public exhibition:

- Notice in the local newspaper;
- Exhibition material and relevant consultation documents to be made available at Council's Administration Building and libraries;
- Consultation documents made available on Council's website; and
- Letters, advising of the proposed rezoning and how to submit comments, will be sent to adjoining landowners and other stakeholders that Council deem relevant to the matter.

At the close of the consultation process, Council officers will consider all submissions received and present a report to Council for their endorsement before proceeding to finalise the Planning Proposal.

The consultation process as outlined above does not prevent any additional consultation measures that may be determined appropriate as part of the "gateway" determination process.

6.0 Conclusion

Under the current provisions of The Hills LEP 2012 water recycling facilities are a type of sewerage system and are not permitted within the R3 Medium Density Residential zone.

This Planning Proposal provides justification to rezone Part Lot 10 DP 593517 from R3 Medium Density Residential to SP2 Infrastructure (Sewerage System). When approved, the Planning Proposal will enable the construction and operation of a water recycling facility, as defined under The Hills LEP 2012, to occur.

Numerous environmental assessments of the site have been prepared and indicate that it is unlikely that a significant impact will arise from the Planning Proposal or the resultant development of the Box Hill LWC.

Whilst the Planning Proposal will reduce land available for development within the R3 Medium Density Residential zone by approximately 1 hectare (approximately 15 dwellings) it is considered that the Planning Proposal is not inconsistent with the objectives and actions of the Sydney Metropolitan Strategy, other NSW sub-regional strategies, or local strategies. The LWC will be delivered, operated and maintained by Flow and will make a significant contribution to sustainability through the provision of recycled water back to the planned residential areas of the recently zoned Box Hill North Urban Release Area.

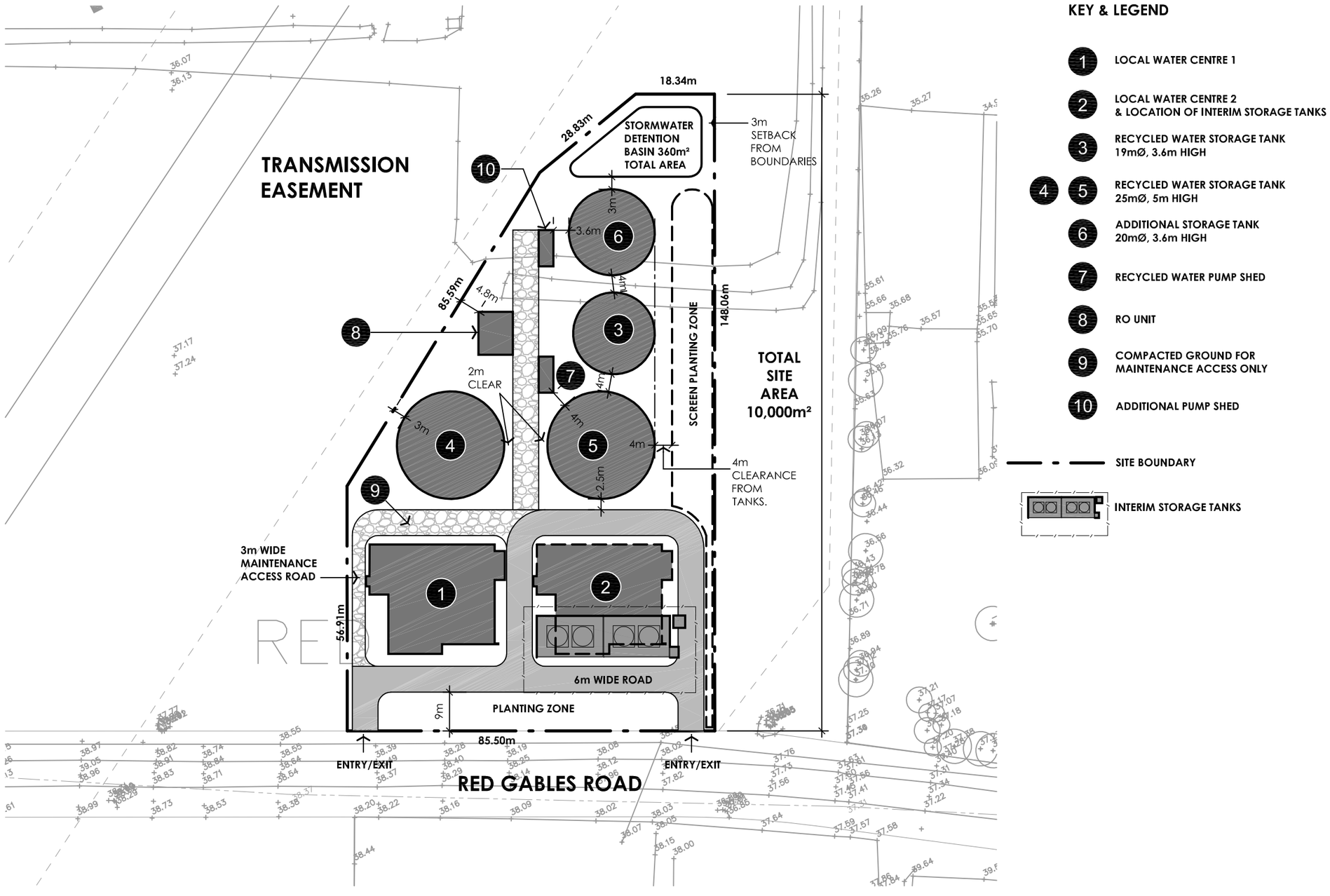
As a result of the Planning Proposal residents of the Box Hill North Urban Release Area will have a dual water supply – drinking water from Sydney Water and a recycled water supply for flushing toilets, use in washing machines and for outdoor irrigation from Flow. Recycled water will also be used to for irrigating public spaces, such as sporting fields and parks and will contribute to the maintenance and upkeep of these public facilities. The pressure sewer network and LWC is a closed system and impacts associated with traditional gravity fed systems such as leaks, groundwater infiltration and overflow discharges are very unlikely.

In addition to its environmental benefits, the dual water supply will make the community highly water efficient, creating a more secure water supply, extending the life of water infrastructure to the existing community and reducing the increase in demand for potable water supplies.

The strategic merit of the Planning Proposal has been demonstrated and hence warrants initial Council resolution of support and a positive “gateway” determination by DP&E. This Planning Proposal will require updating once Council resolve to support the Planning Proposal and once a “gateway” determination is provided by the DP&E.

Appendix 1

Concept Plan of the Box Hill LWC



PERMEATE PARTNERS
E: info@permeate.com.au
P : 1300 799 155
F : 1300 799 005
W: www@permeate.com.au

1:1 SHEET PRINT SCALE

NOT FOR CONSTRUCTION

NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
6	17.03.15	VC	AC	**	ISSUED FOR COMMENT
5	16.03.15	VC	AC	**	ISSUED FOR COMMENT
4	19.12.14	VC	AC	**	ISSUED FOR COMMENT

CLIENT: flow systems

NAME:	BOX HILL NORTH	TITLE:	SITE PLAN	
PROJECT:	LOCAL WATER CENTRE	SCALE	PERMEATE PROJECT # C14121	PERMEATE DRAWING # C14121-100
Design: AJC	Date: 17-Mar-15	Drafting: MDP	Date: 17-Mar-15	
SHEET A3	CLIENT PROJECT # TBA		CLIENT DRAWING # TBA	

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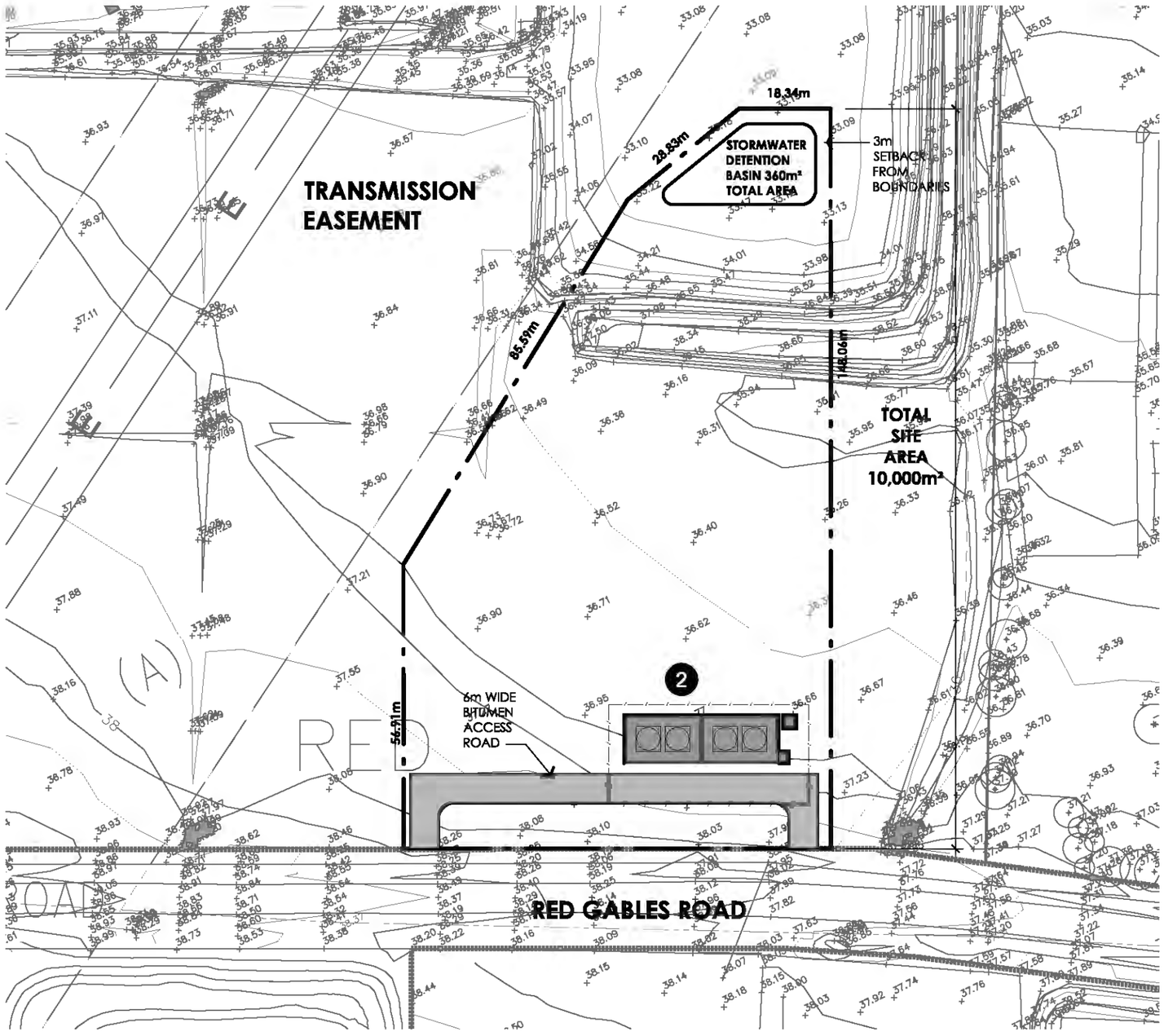

STAGE 1 WORKS

2 INTERIM STORAGE TANKS

STORMWATER DETENTION BASIN

NOT FOR CONSTRUCTION

NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
2	17.03.15	VC	AC	**	ISSUED FOR REVIEW
1	23.12.14	GO	AC	**	ISSUED FOR REVIEW

1:1 SHEET PRINT SCALE

PERMEATE PARTNERS
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P : 1300 799 155
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W: www@permeate.com.au

CLIENT: flow systems

NAME:	BOX HILL NORTH			TITLE:	STAGE 1 PLAN
PROJECT:	LOCAL WATER CENTRE			SCALE	PERMEATE PROJECT # C14121 / PERMEATE DRAWING # C14121-111
Design	Date	Drafting	Date		
AJC	18-Mar-15	MDP	18-Mar-15	SHEET A3	CLIENT PROJECT # TBA / CLIENT DRAWING # TBA

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PERSPECTIVE 1 - PROPOSED

NOT TO SCALE

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P : 1300 799 155
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W: www@permeate.com.au

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NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
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2	19.12.14	VC	AC	**	ISSUED FOR COMMENT
1	18.12.14	VC	AC	**	ISSUED FOR COMMENT

CLIENT
flow systems

NAME:	BOX HILL NORTH			
PROJECT:	LOCAL WATER CENTRE			
Design	Date	Drafting	Date	
AJC	24-Mar-15	MDP	24-Mar-15	

TITLE: **PERSPECTIVE 1**

SCALE	PERMEATE PROJECT # C14121	PERMEATE DRAWING # C14121-501
SHEET A3	CLIENT PROJECT # TBA	CLIENT DRAWING # TBA

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PERSPECTIVE 2 - PROPOSED

NOT TO SCALE

PERMEATE PARTNERS
E: Info@permeate.com.au
P : 1300 799 155
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W: www@permeate.com.au

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NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
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2	19.12.14	VC	AC	**	ISSUED FOR COMMENT
1	18.12.14	VC	AC	**	ISSUED FOR COMMENT

CLIENT
flow systems

NAME:	BOX HILL NORTH			TITLE:	PERSPECTIVE 2
PROJECT:	LOCAL WATER CENTRE			SCALE	PERMEATE PROJECT # C14121 / PERMEATE DRAWING # C14121-S02
Design	Date	Drafting	Date	SHEET A3	CLIENT PROJECT # TBA / CLIENT DRAWING # TBA
AJC	24-Mar-15	MDP	24-Mar-15		

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PERSPECTIVE 3 – PROPOSED

NOT TO SCALE

PERMEATE PARTNERS

E: Info@permeate.com.au
P : 1300 799 155
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W: www@permeate.com.au

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NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
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2	19.12.14	VC	AC	**	ISSUED FOR COMMENT
1	18.12.14	VC	AC	**	ISSUED FOR COMMENT

CLIENT

flow systems

NAME:	BOX HILL NORTH			
PROJECT:	LOCAL WATER CENTRE			
Design	Date	Drafting	Date	
AJC	24-Mar-15	MDP	24-Mar-15	

TITLE:	PERSPECTIVE 3	
SCALE	PERMEATE PROJECT # C14121	PERMEATE DRAWING # C14121-503
SHEET A3	CLIENT PROJECT # TBA	CLIENT DRAWING # TBA

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- **PERSPECTIVE 4** – PROPOSED

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F : 1300 799 005

W: www@permeate.com.au

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NO.	DATE	DRAFTER	DESIGN	MGMT	DESCRIPTION
2	24.03.15	VC	AC	**	ISSUED FOR COMMENT
1	19.12.14	VC	AC	**	ISSUED FOR COMMENT

CLIENT

flow systems

NAME:	BOX HILL NORTH			TITLE:	PERSPECTIVE 4
PROJECT:	LOCAL WATER CENTRE			SCALE	PERMEATE PROJECT # C14121 / PERMEATE DRAWING # C14121-504
Design	Date	Drafting	Date		
AJC	24-Mar-15	MDP	24-Mar-15	SHEET A3	CLIENT PROJECT # TBA / CLIENT DRAWING # TBA

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Appendix 2

Stormwater Concept Plan

NORTHROP

Level 1, 215 Pacific Highway Charlestown NSW 2290
PO Box 180 Charlestown NSW 2290
T (02) 4943 1777 F (02) 4943 1577
E newcastle@northrop.com.au

NL140529_B01 [Revision C]

11th August 2015

RPS Australia Asia Pacific Pty Ltd
Mr Robert Dwyer
241 Denison Street
Broadmeadow NSW 2292

Dear Robert,

Re: Box Hill North Local Water Centre – Concept Stormwater Management Strategy

Northrop Consulting Engineers have been engaged by RPS Australia Asia Pacific Pty Ltd to provide the concept stormwater management strategy for the proposed Box Hill North Local Water Centre (LWC), to be utilised for the Box Hill North Residential Precinct.

This letter should be read in conjunction with the attached Concept Plans NL140529/CSK1-CSK2.

Site Appreciation

The Box Hill North LWC is to be located on a portion Lot 10 DP 593517, herein known as "the site". It is anticipated the lot will be subdivided in the future to accommodate the LWC in a separate allotment. Furthermore, it is understood that general filling of the lot will be undertaken as part of the subdivision works, including filling in of the existing farm dam to the north of the site. Refer to J. Wyndham Prince subdivision plans for lot regrading details. We also understand Red Gables Road will be upgraded with kerb and gutter capable of conveying the 1% AEP peak flow from the upstream catchment.

The proposed allotments will be 1ha and, at full capacity, will have the following features;

- The LWC buildings occupies an area of approximately 1400m^2;
- The external hardstand occupies an area of approximately 2000m^2;
- The external plant and equipment (e.g., tanks) occupies an area of approximately 1800m^2;
- Significant areas for soft landscaping have been provided in and around the facility; and
- The site is proposed to have permanent vehicle access from the existing Red Gables Road.

A schematic of the site is shown overleaf in Figure 1.

Prepared	AK	11/08/2015
Reviewed	AB	11/08/2015

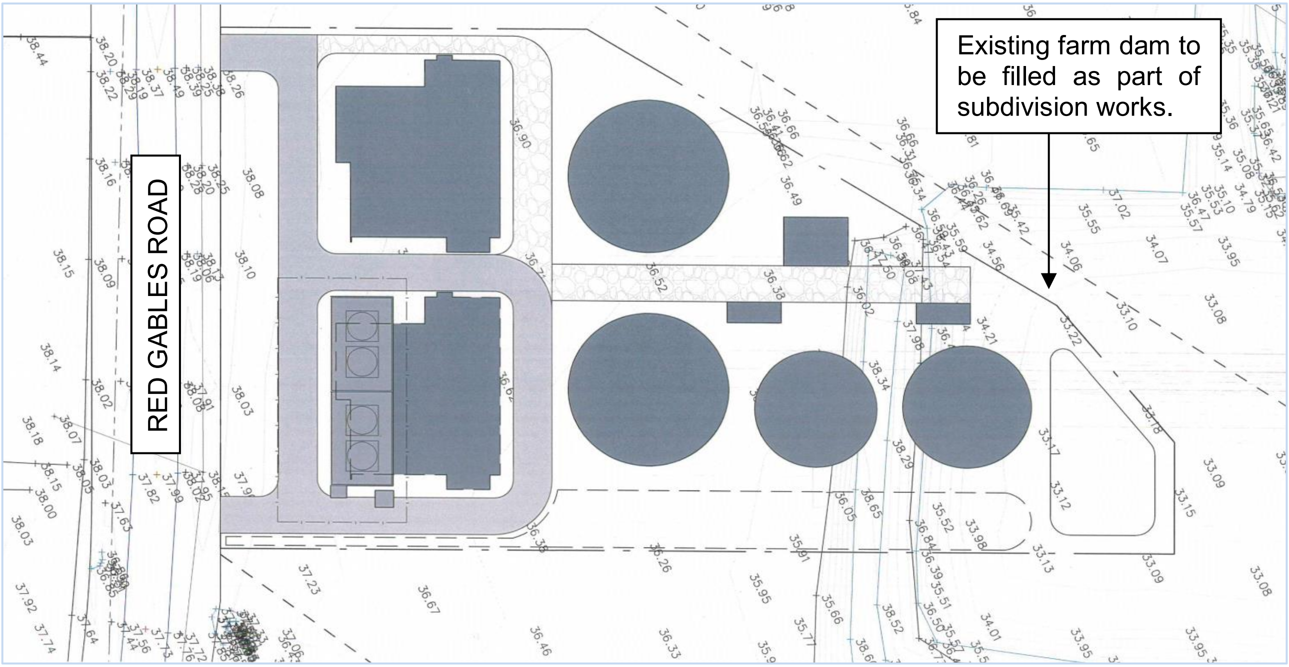


Figure 1 – Site Schematic

In line with the *"Box Hill North Precinct Water Cycle & Flood Management Strategy Report"*, compiled by J. Wyndham Prince (Ref# 9720Rpt1D, July 2013); the site is located within the Cataract Creek Catchment. The stormwater analysis undertaken by J. Wyndham Prince considered the allotment as residential zoning, which was delegated a percentage impervious of 80% in accordance with The Hills Shire Council Design Guidelines Subdivision and Development.

It is noted that whilst the site does not conform to the land use associated with the residential zoning, the runoff regime from the proposed site is considered to be less than that produced from an equivalent residential development. Table 1 below depicts a comparison of the pervious and impervious development percentages.

	Impervious Area	Pervious Area
Residential Zoning	80%	20%
Water Recycling Plant	55%	45%

Table 1 – Residential Zoning Site Comparison

As seen above in Table 1, the proposed development is compliant with, albeit much lower than, the anticipated runoff regime of the residential zoning which is the basis of the regional stormwater management modelling/design.

Construction Phase Soil and Water Management

As part of the Stormwater Management investigation, a Concept Sediment and Erosion Control Plan, attached drawing NL140529/CSK1, has been compiled in accordance with Landcom Managing Urban Stormwater – Soils and Construction (the Blue Book). A range of control measures to eliminate, limit or mitigate impacts from construction activities have been proposed. Some of these control measures include:

- Implementation of a mulch bund up slope of the proposed disturbance areas;
- Coir logs within the proposed drainage channel;
- Sediment fences downslope of all disturbed areas and material stockpile areas;
- Re-vegetation of disturbed areas post construction.

Stormwater Management – Water Quantity and Quality

The proposed stormwater management strategy for the Box Hill North land release area, outlined in the *“Box Hill North Precinct Water Cycle & Flood Management Strategy Report”* (compiled by J. Wyndham Prince), incorporates a regional stormwater management system comprising water quantity (detention) as well as water quality treatment. The proposed regional system provides quantity and quality treatment for all proposed upstream developed land areas, including the North Box Hill LWC site, through a range of measures including;

- Proprietary Gross Pollutant Traps at trunk stormwater discharge points;
- Twenty proposed Bio-retention raingardens; and
- Six proposed detention basins.

These regional stormwater management measures are proposed to be adequately sized to treat the stormwater runoff for water quantity and quality. As such, no formal quantitative treatment should be required from the Box Hill North LWC site. We reiterate that the runoff expected from the Box Hill North LWC is considerably less than that assumed in the regional modelling for residential lands.

Notwithstanding this, a Concept Stormwater Management Plan has been prepared to further manage stormwater runoff from the LWC. This concept plan incorporates a range of water sensitive and industry best practice management measures with the endeavour of further improving water quality onsite whilst harnessing the synergy of providing water quality treatment, flow retention and passive irrigation. No onsite detention is required or proposed for the LWC, although the proposed site management strategy will provide additional flow retention over and above that required. The proposed Concept Stormwater Management Plan can be seen in the attached drawing NL140529/CSK2.

Furthermore, vehicle loading areas or areas where potential spillage could occur will be isolated and additional treatment measures will be employed. For example: the inclusion of physical bunds in hazard areas; the inclusion of spill containment and storage systems; as well as developing operational procedures to control handling and minimise the likelihood for spillage whilst also managing spill response. Such systems will be incorporated in to the detailed design to reflect the sites handling and operational procedures.

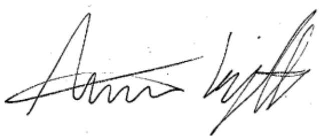
Conclusions

The proposed Concept Stormwater Management Strategy for the site has been prepared in line with the overarching stormwater management strategy for the Box Hill North Residential Precinct and industry best practice.

The Sediment and Erosion Control Plan and Concept Stormwater Management Plan provide adequate treatment of runoff from both construction and ongoing operations for the proposed Box Hill North Local Water Centre.

I trust the above meets your requirements, however, if you would like to discuss further then please do not hesitate to contact the undersigned on 4943 1777.

Yours sincerely,



Aaron Knight
Civil Engineer
BE (Civil Hons 1)

ATTACHMENT A – ENGINEERING DRAWINGS

PROVIDE STABILISED SITE ACCESS FROM RED GABLES ROAD. REFER TO SEDIMENT & EROSION CONTROL NOTES.

SEDIMENT & EROSION CONTROL NOTES

1. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH RELEVANT ORDINANCES AND REGULATIONS; NOTE IN PARTICULAR THE REQUIREMENTS OF LANDCOMS MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION' (THE 'BLUE BOOK')
2. INSTALL SEDIMENT PROTECTION FILTERS ON ALL NEW AND EXISTING STORMWATER INLET PITS IN ACCORDANCE WITH EITHER THE MESH AND GRAVEL INLET FILTER DETAIL SD6-11 OR THE GEOTEXTILE INLET FILTER DETAIL SD6-12 OF THE 'BLUE BOOK'.
3. ESTABLISH ALL REQUIRED SEDIMENT FENCES IN ACCORDANCE WITH DETAIL SD6-8 OF THE 'BLUE BOOK'
4. INSTALL SEDIMENT FENCING AROUND INDIVIDUAL BUILDING ZONES/AREAS AS REQUIRED AND AS DIRECTED BY THE SUPERINTENDENT.
5. ALL TRENCHES INCLUDING ALL SERVICE TRENCHES AND SWALE EXCAVATION SHALL BE SIDE-CAST TO THE HIGH SIDE AND CLOSED AT THE END OF EACH DAYS WORK.
6. THE CONTRACTOR SHALL ENSURE THAT ALL VEGETATION (TREE, SHRUB & GROUND COVER) WHICH IS TO BE RETAINED SHALL BE PROTECTED DURING THE DURATION OF CONSTRUCTION. REFER ARCHITECTS PLANS FOR TREES TO BE KEPT.
7. ALL VEGETATION TO BE REMOVED SHALL BE MULCHED ONSITE AND SPREAD/STOCKPILED AS DIRECTED BY THE SUPERINTENDENT.
8. STRIP TOPSOIL IN AREAS DESIGNATED FOR STRIPPING AND STOCKPILE FOR RE-USE AS REQUIRED. ANY SURPLUS MATERIAL SHALL BE REMOVED FROM SITE AND DISPOSED OF IN ACCORDANCE WITH EPA GUIDELINES
9. CONSTRUCT AND MAINTAIN ALL MATERIAL STOCKPILES IN ACCORDANCE WITH DETAIL SD4-1 OF THE 'BLUE BOOK' (INCLUDING CUT-OFF SWALES TO THE HIGH SIDE AND SEDIMENT FENCES TO THE LOW SIDE).
10. ENSURE STOCKPILES DO NOT EXCEED 2.0m HIGH. PROVIDE WIND AND RAIN EROSION PROTECTION AS REQUIRED IN ACCORDANCE WITH THE 'BLUE BOOK'.
11. PROVIDE WATER TRUCKS OR SPRINKLER DEVICES DURING CONSTRUCTION AS REQUIRED TO SUPPRESS DUST.
12. ONCE CUT/FILL OPERATIONS HAVE BEEN FINALIZED ALL DISTURBED AREAS THAT ARE NOT BEING WORKED ON SHALL BE RE-VEGETATED AS SOON AS IS PRACTICAL.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A DETAILED WRITTEN RECORD OF ALL EROSION & SEDIMENT CONTROLS ON-SITE DURING THE CONSTRUCTION PERIOD. THIS RECORD SHALL BE UPDATED ON A DAILY BASIS & SHALL CONTAIN DETAILS ON THE CONDITION OF CONTROLS AND ANY/ ALL MAINTENANCE, CLEANING & BREACHES. THIS RECORD SHALL BE KEPT ON-SITE AT ALL TIMES AND SHALL BE MADE AVAILABLE FOR INSPECTION BY THE PRINCIPAL CERTIFYING AUTHORITY AND THE SUPERINTENDENT DURING NORMAL WORKING HOURS

PROVIDE SEDIMENT EROSION CONTROL FENCE

VERIFIER: A.BROWN
JOB MANAGER: A.BROWN
DESIGNED: A.KNIGHT
DRAWN: A.KNIGHT

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	AK	AB	AK	21.01
B	RE-ISSUED_SITE LAYOUT AMENDED	AK	AB	AK	10.04
C	RE-ISSUED_SITE LAYOUT AMENDED	AK	AB	AK	11.08

CLIENT: RPS

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PROJECT: BOX HILL NORTH LOCAL WATER CENTRE BOX HILL NSW 2765

DRAWING TITLE: CONCEPT SEDIMENT & EROSION CONTROL PLAN

JOB NUMBER: NL140529
DRAWING NUMBER: CSK1
REVISION: C
DRAWING SHEET SIZE = A1

DENOTES PROPOSED DIRECTION OF FALL IN FINISHED SURFACE

REFER TO SUBDIVISION PLANS PREPARED BY J.WYNDHAM PRINCE FOR LOT REGRADING

RED GABLES ROAD

RL 38.40

RL 38.40

38.30

FFL = 38.40

PAD RL = 38.25

PAD RL = 38.30

RL 38.20

RL 38.20

38.20

FFL = 38.20

PAD RL = 38.15

PAD RL = 38.20

PAD RL = 38.25

38.10

38.00

RL 38.00

RL 37.95

RL 38.25

CONNECT TO FUTURE STORMWATER DRAINAGE FOR RED GABLES ROAD. PROVIDE PIT AND PIT AS REQUIRED TO CONNECT INTO EXISTING.

INTERIM SEWER SERVICING TANKS RL=38.20

PROVIDE SWALE TO CONVEY RUNOFF TO LAWFUL POINT OF DISCHARGE.

DRAWN: A.KNIGHT
DESIGNED: A.KNIGHT
JOB MANAGER: A.BROWN
VERIFIER: A.BROWN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	AK	AB	AK	21.01
B	RE-ISSUED_SITE LAYOUT AMENDED	AK	AB	AK	10.04
C	RE-ISSUED_SITE LAYOUT AMENDED	AK	AB	AK	11.08

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PROJECT: BOX HILL NORTH LOCAL WATER CENTRE BOX HILL NSW 2765

DRAWING TITLE: CONCEPT STORMWATER MANAGEMENT PLAN

JOB NUMBER: NL140529

DRAWING NUMBER: CSK2

REVISION: C

DRAWING SHEET SIZE = A1

Appendix 3

Heritage Due Diligence Assessment

Heritage Due Diligence Assessment

Box Hill North Local Water Centre

Visual Inspection Date: 05 December 2014

Prepared by:

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IMPORTANT NOTE

We have prepared this report for the sole purposes of Appian Group (**Client**) for the specific purpose of only for which it is supplied (**Purpose**). This report is strictly limited to the purpose and the facts and matters stated in it; it does not apply directly or indirectly and will not be used for any other application, purpose, use or matter.

In preparing this report we have made certain assumptions. We have assumed that all information and documents provided to us by the Client or as a result of a specific request or enquiry were complete, accurate and up-to-date. Where we have obtained information from a government register or database, we have assumed that the information is accurate. Where an assumption has been made, we have not made any independent investigations with respect to the matters the subject of that assumption. We are not aware of any reason why any of the assumptions are incorrect.

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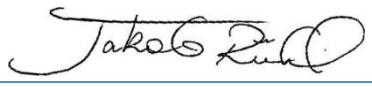
Document Status

Version	Purpose of Document	Orig	Review	Review Date
Draft	Draft for client comment	J. Madden	J.Ruhl	10 December 2014
Final	Final report for client	J. Madden	J.Ruhl	12 December 2014

Approval for Issue

Name	Signature	Date
J.Ruhl		12 December 2014

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Executive Summary

RPS Australia East was engaged by Flow Systems Pty Ltd (the proponent) to prepare an Aboriginal Cultural Heritage Due Diligence Assessment Report for the installation of a Local Water Centre (LWC) (the study area) within the Box Hill North Precinct. The study area is located within The Hills Shire Local Government Area and is approximately 39 kilometres north west of the Sydney CBD.

The proposed activity involves the construction of:

- Two 2.5 mega litre tanks, one 1.2 mega litre tank and associated pumping stations with the site having space for a future reverse osmosis plant.
- The construction of two operational buildings covering an area of approximately 1,200m².
- The construction of hardstand areas for vehicles, a service driveway and concrete hardstand to Red Gables Road.
- External lighting and a closed circuit television (CCTV) system for external areas.
- A small detention pond to treat surface water flows resulting from the proposed works.
- Landscaped gardens and walkways between the proposed facilities.

This assessment has been undertaken in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects* (DECCW 2010) which requires reasonable and practicable steps be taken to: identify whether or not Aboriginal objects are, or are likely to be, present in an area; determine whether or not their activities are likely to harm Aboriginal objects (if present); and determine if an Aboriginal Heritage Impact Permit is required (DECCW 2010:2).

This assessment has found that the study area has been subject to moderate and high levels of modern disturbance including soil cutting, benching and mounding for the construction of rural irrigation and water systems and market gardening. No Aboriginal objects or areas of potential archaeological deposits were identified during this assessment. The study area has been identified as having low Aboriginal heritage sensitivity.

This Aboriginal cultural heritage due diligence assessment has confirmed that, no Aboriginal sites or areas likely to have archaeological material will be impacted upon by the proposed works. This assessment has found that further Aboriginal heritage assessment, in the form of an Aboriginal Heritage Impact Permit (AHIP), is not required for the proposed works.

The following recommendations are made in relation to the proposed activity:

Recommendation 1

The proponent may proceed with the proposed LWC works within the study area, with caution.

Recommendation 2

All relevant personnel should be made aware of their statutory obligations for heritage under the *National Parks and Wildlife Act* 1974 and the *Heritage Act* 1977, which may be implemented as a heritage induction prior to the commencement of the proposed activity.

Recommendation 3

This due diligence assessment must be kept by the proponent so that it can be presented, if needed, as a defence from prosecution under s86(2) of the *National Parks and Wildlife Act* 1974.

Recommendation 4

If unrecorded Aboriginal objects are located in the study area in the course of the proposed works, then all works in the immediate area must cease and the area cordoned off. OEH must be notified by ringing the Enviroline 131 555 so that the site can be adequately assessed and managed.

Recommendation 5

In the unlikely event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH must be contacted by ringing the Enviroline 131 555. An OEH officer will determine if the remains are Aboriginal or not; and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.

Terms, Definitions, and Abbreviations

Abbreviation/ Term	Meaning
Aboriginal Object	"any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises NSW, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains" (DECCW 2010:18).
Aboriginal Place	"a place declared under s.84 of the NPW Act that, in the opinion of the Minister, is or was of special significance to Aboriginal culture" (DECCW 2010:18). Aboriginal places have been gazetted by the minister.
Aboriginal Culturally Modified Tree	"means a tree that, before or concurrent with (or both) the occupation of the area in which the tree is located by persons of non-Aboriginal extraction, has been scarred, carved or modified by an Aboriginal person by: (a) the deliberate removal, by traditional methods, of bark or wood from the tree, or (b) the deliberate modification, by traditional methods, of the wood of the tree" NPW Regulation 80B (3). Culturally Modified trees are sometimes referred to as scarred trees
Activity	A project, development, or work (this term is used in its ordinary meaning and is not restricted to an activity as defined by Part 5 EP&A Act 1979).
AHIMS	Aboriginal Heritage Information Management System
AHIP	Aboriginal Heritage Impact Permit
DECCW	Department of Environment, Climate Change and Water (is now the Office of Environment and Heritage – OEH)
Disturbed Land	"Land is disturbed if it has been the subject of a human activity that has changed the land's surface, being changes that remain clear and observable." (DECCW 2010:18).
Due Diligence	"taking reasonable and practical steps to determine whether a person's actions will harm an Aboriginal object and, if so, what measures can be taken to avoid that harm" (DECCW 2010:18)
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW)*
GDA	Geodetic Datum Australia
Harm	"destroy, deface, damage an object, move an object from the land on which it is situated, cause or permit an object to be harmed." (DECCW 2010:18)
LGA	Local Government Area
NPWS	National Parks and Wildlife Service
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NPW Regulation	*National Parks and Wildlife Regulation 2009* (NSW)
OEH	Office of Environment and Heritage (formerly DECCW)
PAD	Potential Archaeological Deposit
Study area	Study area is the area subject to the desktop study in this report

1.0 Introduction

RPS Australia East was engaged by Flow Systems Pty Ltd (the proponent) to prepare an Aboriginal Cultural Heritage Due Diligence Assessment Report for the installation of a Local Water Centre (LWC) (the study area) within the Box Hill North Precinct. This report been prepared to assess potential impacts upon Aboriginal heritage in regards to the construction of the LWC. The LWC will facilitate the Box Hill North Urban Release residential development, within The Hills Shire Council local government area (LGA). The facility will be will be constructed, operated and maintained by Flow Systems.

The purpose of a due diligence assessment is to demonstrate that reasonable and practicable measures have been taken to prevent harm to Aboriginal objects and/or places. The purpose of this report is to identify whether the study area possesses or has the potential to possess Aboriginal heritage sites, places, objects and/or values, in accordance with the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010) (Due Diligence Code).

This report has outlined the relevant environmental and archaeological context, including landforms, landscape features and disturbances, legislative context and the nature of the proposed activity. This information has been considered in formulating an impact assessment, conclusions and recommendations.

1.1 The Study Area

This assessment has been prepared for the proposed location of the LWC (the study area). The study area is located within Lot 10 DP 593517 along Red Gables Road within the Box Hill North residential subdivision, Box Hill, and is approximately 1 hectare (Figure 1).

The study area is located within The Hills Shire Local Government Area and is approximately 39 kilometres north west of the Sydney CBD and approximately 7.5 kilometres north east of the Windsor CBD. The study area is situated within the Deerubbin Local Aboriginal Land Council boundaries (DLALC).

1.2 Scope of Works

This due diligence assessment assesses the scope of works for the proposed location of the LWC as identified in the Gateway Determination for the planning proposal (PP_2013_THILL_015_00), (NSW Planning Operations & Regional Delivery 29 November 2013).

The LWC is a water recycling facility that refines raw sewage and reticulates the refined water resource back into the local Box Hill North residential precinct water source. RPS East understand that the construction of the LWC will involve the following:

- The construction of two 2.5 mega litre tanks and an associated pumping station for the storage of recycled water.
- The construction of one 1.2 mega litre tank and associated pump shed for the storage of drinking water.

The tanks and associated pumping sheds will be installed on a gradual basis as the development expands. The site will also have space for a future reverse osmosis plant.

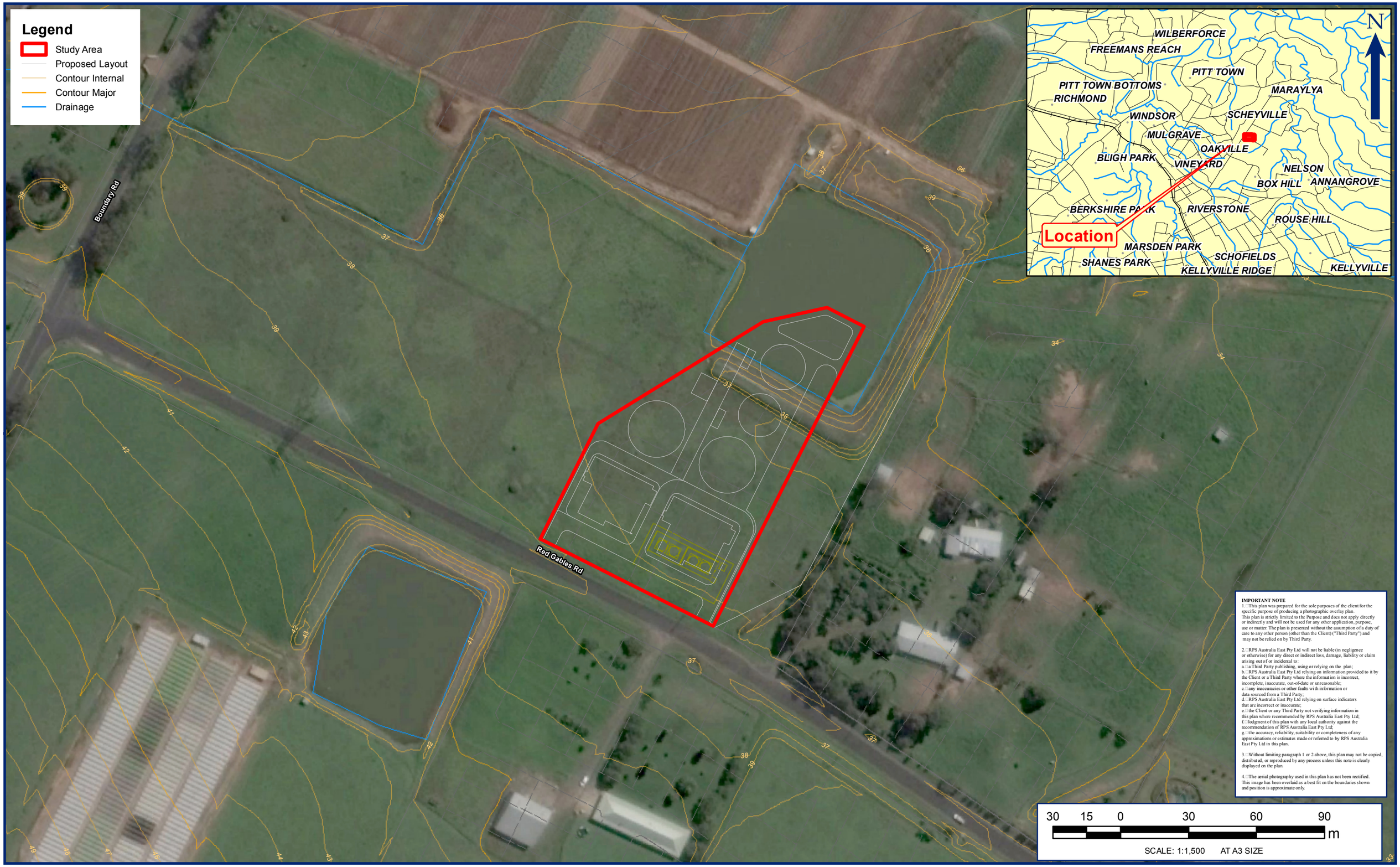
- The construction of two operational buildings covering an area of approximately 1,600m². The two operational buildings will store equipment and instrumentation for operation of the treatment process. Solar panels will be installed on the roofs on the two main operational buildings.
- The construction of hardstand areas for vehicles. A service driveway and concrete hardstand is located on the western side of the two main operational buildings that will link to Red Gables Road.

- External lighting will be installed to the external areas of the main operational facility buildings which is configured with movement sensors and light sensors to provide additional deterrent against vandalism and graffiti.
- A closed circuit television (CCTV) system for external areas will be installed for security purposes.
- The construction of a small detention pond to treat surface water flows resulting from the proposed works.
- Areas for soft landscaping have been provided to complement the architecture of the main operational facility buildings and surrounding residential area.

The installation of the LWC will involve the excavation and benching of natural A1 topsoil profiles. The proposed works will disturb the ground surface and as such, a due diligence assessment is required under the Due Diligence Code (DECCW 2010: 11-12).

1.3 Authorship and Acknowledgements

This report was prepared by RPS Heritage Consultant Joshua Madden. The report was reviewed by RPS Senior Heritage Consultant Jakob Ruhl. All mapping was undertaken by RPS Draftsperson Natalie Wood.



TITLE : **FIGURE 1: LOCATION OF STUDY AREA**

LOCATION : **BOX HILL NORTH**

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **14/04/2015**

PURPOSE: **HERITAGE**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: J:\JOBS\126k\126988 Box Hill North\10 - Drafting\Arcgis Map Documents\Planning\126988 Figure 1 Heritage A A3 20150414.mxd

CLIENT: **FLOW SYSTEMS**

JOB REF: **PR126988**

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2.0 Legislative Context

The following overview of the legal framework is provided solely for information purposes for the client, it should not be interpreted as legal advice. RPS will not be liable for any actions taken by any person, body or group as a result of this general overview, and recommend that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the summary below.

Although there are a number of Acts protecting and managing cultural heritage in New South Wales (Appendix 1); the primary ones which apply to this report include:

- *National Parks & Wildlife Act 1974.*
- *National Parks & Wildlife Regulation 2009.*

In brief, the *National Parks & Wildlife Act 1974* protects Aboriginal heritage (places, sites and objects) within NSW; the National Parks and Wildlife Regulation 2009 provides a framework for undertaking activities and exercising due diligence.

2.1 *National Parks & Wildlife Act 1974*

The *National Parks & Wildlife Act 1974* (NPW Act) protects Aboriginal heritage (places, sites and objects) within NSW. Protection of Aboriginal heritage is outlined in section 86 of the Act, as follows:

- "A person must not harm or desecrate an object that the person knows is an Aboriginal object" s86(1).
- "A person must not harm an Aboriginal object" s86(2).
- "A person must not harm or desecrate an Aboriginal place" s86(4).

Penalties apply for harming an Aboriginal object or place. The penalty for knowingly harming an Aboriginal object (s86[1]) and/or an Aboriginal place (s86[4]) is up to $550,000 for an individual and/or imprisonment for 2 years; and in the case of a corporation the penalty is up to $1.1 million. The penalty for a strict liability offence (s86[2]) is up to $110,000 for an individual and $200,000 for a corporation.

Harm under the NPW Act is defined as any act that; destroys defaces or damages the object, moves the object from the land on which it has been situated, causes or permits the object to be harmed. However, it is a defence from prosecution if the proponent can demonstrate 1) that harm was authorised under an Aboriginal Heritage Impact Permit (AHIP) (and the permit was properly followed), or 2) that the proponent exercised due diligence in respect to Aboriginal heritage.

The **'due diligence' defence** (s87[2]), states that if a person or company has exercised due diligence to ascertain that no Aboriginal object was likely to be harmed as a result of the activities proposed for the study area (subject area of the proposed activity, referred herein as the study area); then liability from prosecution under the NPW Act will be removed or mitigated if it later transpires that an Aboriginal object was harmed.

Notification of Aboriginal Objects

Under section 89A of the NPW Act Aboriginal objects (and sites) must be reported to the Director-General (now Chief Executive) of OEH within a reasonable time (unless it has previously been recorded and submitted to AHIMS). Penalties of $11,000 for an individual and $22,000 for a corporation may apply for each object not reported.

2.2 *National Parks and Wildlife Regulation 2009*

The *National Parks and Wildlife Regulation 2009* (NPW Regulation) provides a framework for undertaking activities and exercising due diligence in respect to Aboriginal heritage. The NPW Regulation 2009 outlines the recognised due diligence codes of practice which are relevant to this report, but it also outlines procedures for AHIP applications and Aboriginal Cultural Heritage Consultation Requirements (ACHCRs); amongst other regulatory processes.

2.3 Due Diligence and Codes of Practice

The aims of a due diligence assessments are to:

- Assist in avoiding unintended harm to Aboriginal objects.
- Provide certainty to land managers and developers about appropriate measures for them to take.
- Encourage a precautionary approach.
- Provide a defence against prosecution if the process is followed.
- Result in more effective conservation outcomes for Aboriginal cultural heritage.

One of the advantages of the due diligence provisions are that they provide a simplified process of investigating the Aboriginal archaeological context of an area to determine if an AHIP is required.

Under the section 80A NPW Regulation a number of due diligence codes are recognised.

This report has been written to meet the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (2010) (Due Diligence Code).

2.3.1 *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales* (DECCW 2010)

This publication sets out a minimum benchmark for acceptable due diligence investigations to be followed. The purpose of the code is set out reasonable and practical steps in order to:

(1) Identify whether or not Aboriginal objects (and places) are, or are likely to be, present in an area.

(2) Determine whether or not their activities are likely to harm Aboriginal objects (if present).

(3) Determine whether an AHIP application is required. (DECCW 2010:2)

Investigations under the code include the following:

- A search of the AHIMS to identify if there are previously recorded Aboriginal objects or places in the study area.
- Identification of landscape features including, land within 200 metres of water, dune systems, ridge tops, headlands, land immediately above or below cliff faces and/or rock shelters/caves.
- Desktop assessment including a review of previous archaeological and heritage studies and any other relevant material.
- Visual inspection of the study area to identify if there are Aboriginal objects present.
- Assessment as to whether an AHIP is required.

This report has complied with the requirements of the code listed above. Other requirements under the code are outlined below.

Aboriginal consultation is not required for an investigation under the Due Diligence Code (DECCW 2010:3). However, if the due diligence investigation shows that the activities proposed for the area are likely to harm objects or likely objects within the landscape, then an Aboriginal Heritage Impact Permit will be required with full consultation.

A record of the due diligence procedure followed must be kept to ensure it can be used as a defence from prosecution (DECCW 2010:15).

Following a due diligence assessment (where an AHIP application was not required), an activity must proceed with caution. If any Aboriginal objects are identified during the activity, then works should cease in that area and OEH notified (DECCW 2010:13). The due diligence defence does not authorise continuing harm.

3.0 Environmental Context

The purpose of reviewing the relevant environmental information is to assist in identifying whether Aboriginal objects or places are present within the study area. The environmental context forms part of the desktop assessment required under the Due Diligence Code (DECCW 2010:12-13).

3.1 Geology and Soils

Soil profile and depth impact upon the preservation and integrity of any cultural materials that may have been deposited by past Aboriginal peoples. The depth of soils impacts upon the likelihood of uncovering Aboriginal objects and the likelihood of the original deposition of these objects. The soil profile can inform on the type of erosion and soil movement of an area, providing a basis for the likelihood of Aboriginal cultural material movement and depositional context. Understanding the geology and rock formations of an area is important as past Aboriginal peoples utilised sandstone outcroppings to grind edges of stone tools and objects. The presence of sandstone may therefore result in the uncovering of grinding grooves.

The study area is located along the Cumberland Plain, which is low-lying and characterised by a gently undulating landscape within the Sydney Basin (Clark and Jones 1991). The Cumberland Plain is a Sydney bio-region that has been extensively cleared and disturbed through farming and urban development activities.

The study area is underlain by the Middle Triassic Wianamatta Group (MTWG). This geological unit is overlain by the Ashfield Shale lithology which is made up of undifferentiated dark grey to black claystone-siltstone and fine sandstone-siltstone laminate (Clark and Jones 1991).

The dominant soil landscape of the Box Hill area is the Blacktown soil landscape, which underlies the study area. The residual Blacktown soil landscape is characterised by shallow to moderately deep (<100cm) red and brown podzolic soils on crests, upper slopes and well drained areas, and deep yellow Podzolic soils and soloths on lower slopes and in areas of poor drainage (Chapman & Murphy, 1989:30). The Blacktown soil landscape is generally associated with gently undulating rises. The soils are primarily poorly drained with very little erosional activity with minor sheet and gully erosion in zones stripped of vegetation.

The Blacktown soil landscape is a residual shallow to moderately deep soil with slight erosional activity. This soil landscape indicates that archaeological features and/or artefacts could have changed or moved from their original depositional context. This is more likely in areas that have been cleared and farmed.

3.2 Topography and Hydrology

The study area is situated along the northern fringes of the Cumberland Plain. The Cumberland Plain is a gently undulating landform, stretching from the Nepean/Hawkesbury Rivers in the west, to Glenorie in the north, to Thirlmere in the south. The Cumberland Plain covers an area of approximately 275,000 hectares and is the most highly urbanised environment in the western Sydney Basin bioregion. The area comprises fertile soils, contrasting with the rugged sandstone plateaux surrounding it, and has been utilised extensively for agriculture use since European settlement in 1788 (NPWS, 2002:1).

The natural landscape of the Blacktown soil landscape is gently undulating with broad and rounded crests and ridges with convex upper slopes grading into concave lower slopes (Chapman & Murphy, 1989:30). The surrounding local relief is between 10 and 30 metres with slope gradients generally less than 10 per cent. . Agricultural dams, ponds and drainage lines are located within close proximity and within the boundary of the study area.

A tributary of Cataract Creek runs directly north of the study area with McKenzies Creek located approximately 1.5 kilometres west of the study area. Agricultural dams, ponds and drainage lines are located within close proximity with a dam located within the north eastern portion of the study area.

The location of freshwater resources is important for land utilisation by past Aboriginal peoples. In order to utilise an area freshwater for drinking and as a source of food is required. The study area is situated approximately 3 kilometres north of First Ponds Creek, 5.5 kilometres north west of Second Ponds Creek and approximately 6 kilometres east of confluence of South Creek and the Hawkesbury River. As such, whilst the local area could have been utilised by past Aboriginal peoples, there are nearby major freshwater resources which would have been of greater importance for utilisation and habitation purposes then the current location.

3.3 Flora and Fauna

The purpose of this section is to provide an indication of the types of flora and fauna resources that may have been available to Aboriginal people in the past. It is based on broad scale vegetation mapping for New South Wales (Keith 2006) and does not replace more detailed studies undertaken for the study area.

The dominant ecological community prior to European contact was the now-endangered Cumberland Plain Woodland group. Along the creeklines and rivers throughout the northern reaches of the Cumberland Plain, Alluvial woodlands dominated (NPWS, 2002:10).

The Alluvial Woodland is an endangered ecological community of open woodland with Eucalypts up to 30 metres tall with scattered shrubs. The dominant tree species include Cabbage Gum, Forest Red Gum and Swamp Oak. Other vegetation species include White Sally, Coast Myall, Grey Myrtle with an under storey of Kangaroo grass and Weeping Meadow Grass.

Dominant species occurring within the wider Cumberland Plain woodland and throughout the Box Hill area were the grey box, Forest red gum, spotted gum and thin-leaved stringybark. The dominant understorey comprised Blackthorn with grasses such as kangaroo grass, weeping meadow grass and herbs such as kidney weed, blue trumpet.

With the exception of small pockets of remnant vegetation, the local area has largely been cleared of native Cumberland Plain Woodland species. The small lot semi-rural setting of the study area has resulted in widespread vegetation clearance and intensive land use for market gardening.

The fauna of the nearby Cumberland lowlands, at the time of contact, is well documented and includes many species still present within the wider Sydney region today. The various species would have included kangaroo, wallaby, wombat, echidna, bandicoots, flying fox, emus, quolls, various native rats and mice, snakes, frogs and lizards. The bones of these animals have been recovered from Aboriginal sites in the Sydney region suggesting that they were sources of food (Attenbrow 2002:70-76), although the hides, bones and teeth of some of the larger mammals may have been used for Aboriginal clothing, ornamentation, or other implements.

3.4 Synthesis of Environmental Context

The Cumberland Plain was an area with ample food sources in the form of, freshwater, fish and game, with areas considerable distances from permanent freshwater courses identified as having lower levels of habitation due to a lack of freshwater resources. The environmental context identifies that the study area is located a considerable distance from significant freshwater resources and, as such, it is likely that the study area was not an area of intense occupation. This is evident when taking into consideration the OEH

Aboriginal Heritage Information Management System (AHIMS) and the results of previous archaeological and heritage assessments.

4.0 Heritage Context

The purpose of reviewing the relevant heritage information is to assist in identifying whether Aboriginal objects or places are present within the study area. The heritage context forms part of the desktop assessment required under the Due Diligence Code (DECCW 2010:12-13).

4.1 Aboriginal Heritage Information Management System (AHIMS)

A search of the Aboriginal Heritage Information Management System (AHIMS) was undertaken on 5 December 2014 (AHIMS Client Service ID: 157047), the coordinates searched for the study area were GDA Zone 56, Eastings 302000 to 310000and Northings 6272900 to 6280900. The AHIMS search revealed that there are 111 previously recorded Aboriginal sites within these coordinates (Figure 2).

The search revealed that no Aboriginal objects or places were present in the study area.

Table 1 AHIMS search results

Site type	Frequency	Per cent
Art	2	2
Grinding Groove	2	2
Open Campsite (Isolated Finds, Artefact Scatters)	58	52
Potential Archaeological Deposits (PADs)	31	28
Shelter with Art	4	3.5
Shelter with Art and Deposit	4	3.5
Shelter with Deposit	7	6
Shelter with Deposit and Grinding Groove/Rock Engraving	3	3
Total	**111**	**100%**

The AHIMS search and relevant regional archaeological assessments indicate that there is a concentration of open camps sites which include artefact scatters, isolated finds and PADs within the wider geographical region. The AHIMS search identified that the closest previously recorded and registered Aboriginal site and/or PAD is located approximately one kilometre from the current study area (Figure 2).

4.2 Aboriginal Ethno-History

Aboriginal tribal boundaries within Australia have been reconstructed based on surviving linguistic evidence and ethno-historic data are therefore only approximations. Social interaction, tribal boundaries and linguistic evidence may not always correlate and it is likely boundaries and interaction levels varied and fluctuated over time. The language spoken within the Box Hill area and across the Cumberland Plain is known as Darug, a term first used in 1900 by anthropologist R.H Mattews (RPS, 2012). The Darug language group is thought to have extended from Appin in the south to the Hawkesbury River in the north and west as far as Penrith and Windsor (Attenbrow 2010:32-34).

The original inhabitants of the Cumberland Plain would have been among the first Aboriginal people to experience the effects of physical and social dislocation as a result of European settlement. The effects of European colonisation on local the Aboriginal populations included loss of access to traditional lands and resources, inter-tribal conflict, starvation, the breakdown of traditional cultural practices. Further, large scale loss of life through disease and epidemics, like that of the 1789 smallpox epidemic, severely affected the Aboriginal peoples and the traditional way of life.

Legend

- Study Area
- Drainage
- Cadastre
- Proposed Lot Layout

AHIIMS

- Artefact Scatter
- Artefact Scatter with PAD
- Artefact Site (Number unspecified)
- Grinding Groove
- Grinding Groove, Shelter with Deposit
- Isolated Find
- PAD
- Rock Engraving
- Rock Engraving ,Shelter with Deposit
- Shelter with Art
- Shelter with Art, Deposit
- Shelter with Deposit
- Not an Aboriginal Site

N

Warning:
While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

760 380 0 760 1,520 2,280 m

SCALE: 1:34,276 AT A3 SIZE

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airb... GIS User Community

TITLE : **FIGURE 2: STUDY AREA WITH AHIMS**

LOCATION : **BOX HILL NORTH**

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **10/12/2014**

PURPOSE: **HERITAGE**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: J:\JOBS\125k\125114 Box Hill North\10 - Drafting\Arcgis Map Documents\Arch\125114-2 Figure 2 A A3 20141208.mxd

CLIENT: **FLOW SYSTEMS**

JOB REF: **PR125114-2**

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4.3 Archaeological and Heritage Overview

A review of previous archaeological and heritage reports has been undertaken to inform this due diligence assessment.

Kelleher Nightingale Consulting Pty Ltd. July 2013, Box Hill North Planning Proposal: Aboriginal Heritage Assessment

In 2013 Kelleher Nightingale Consulting Pty Ltd (KNC) undertook an Aboriginal heritage assessment of the proposed Box Hill North residential precinct. The assessment was undertaken to inform the proposed subdivision of the Aboriginal heritage and potential constraints. The 2013 KNC assessment included the current study area. KNC identified the current study area as heavily disturbed and therefore having low archaeological potential.

As part of the assessment a pedestrian survey of the area was undertaken between 20 May and 23 May 2013. The survey identified four previously un-recorded Aboriginal sites within the study area:

- Box Hill North 1 (BHN 1) – AHIMS 45-5-4297, identified as a grinding groove.
- Box Hill North 2 (BHN 2) – AHIMS 45-5-4298, identified as an artefact scatter.
- Box Hill North 3 (BHN 3) – AHIMS 45-5-4299, identified as an artefact scatter.
- Box Hill North 4 (BHN 4) – AHIMS 45-5-4300, identified as an isolated find.

The assessment identified that BHN 1 and BHN 4 would be located within a proposed open space corridor and would not be impacted upon by the proposed sub-division works. The assessment identified that BHN 2 and 3 would be partially impacted on by the proposed works.

The assessment recommended that site BHN 1 be conserved. The assessment also recommended that sites BHN 2–4 be subject to further assessment and that an AHIP process be undertaken and lodged with the DA application.

AECOM 2012, Box Hill and Box Hill Industrial Precincts, Aboriginal Heritage Assessment: Final Stage 3 Report

In 2010 AECOM were commissioned by the Department of Planning and Infrastructure to undertake an Aboriginal heritage assessment of the Box Hill and Box Hill Industrial Precincts, in relation to the Sydney North West Growth Centre.

The assessment included a five day pedestrian survey of the area. The survey identified 23 of the 27 previously recorded Aboriginal sites and PADs within the study area. It was identified that the four sites/PADs not re-located had been destroyed by the Windsor Road upgrades. The assessment identified 11 previously un-recorded sites within the study which consisted of 9 artefact scatters and two isolated finds. A total of 21 artefacts sites were identified with 19 identified as having ‘some’ significance while the remaining two were identified as having moderate significance. The majority of identified sites were located in association with extant or former creeklines. All sites identified were recorded on the flats or lower slopes associated with freshwater resources. The assessment identified that all identified sites were surface expressions of sub-surface artefact sites.

Aboriginal archaeological sensitivity mapping was undertaken for the precinct. Areas of high, moderate and low potential for intact subsurface deposit were identified and determined based on landform disturbance and other landscape variables (AECOM 2011:64).

The assessment recommended that areas of PAD and zones of high archaeological sensitivity should be subject to further archaeological investigation and test excavation prior to any development impacts. Further works and test excavations would be undertaken in order to identify the likely hood, nature and extent of the PADs and areas of high archaeological sensitivity. The assessment also identified that due diligence assessment, in line with the OEH guidelines, should be undertaken for areas of moderate archaeological sensitivity. In relation to previously recorded Aboriginal sites, the assessment recommended conservation where possible. If sites were to be impacted upon by the proposed development, an AHIP would be required.

Austral Archaeology Pty Ltd, 2009. Box Hill Future Urban Release, Box Hill NSW: Aboriginal archaeological and cultural heritage assessment.

In 2009 Austral Archaeology Pty Ltd undertook an Aboriginal heritage assessment for the Box Hill Urban Release Precinct approximately 1.5 kilometres south of the two study area loci (Austral Archaeology 2009).

A pedestrian survey of the 2009 study area identified twelve Aboriginal sites (BH1–BH12). The sites included seven isolated artefact sites and five artefact scatter sites. The assessment noted that silcrete was the dominant raw material (n=23, or 82%), followed by a smaller frequency of undifferentiated mudstone/FGS (n=5, or 18%). Austral Archaeology also identified 11 Potential Archaeological Deposits (PADs) during the pedestrian survey. The majority of PADs identified during the assessment, were located on flats and lower slopes in close proximity to creek lines.

The assessment recommended that any areas of PAD to be impacted upon by the proposed development should be subject to further archaeological investigations and test excavations, especially the PADs associated with BH1, BH9 and BH10 which were identified as having moderate to high significance. The significance of the majority of the open artefact scatters and isolated finds was considered to be low, with no further assessment recommended.

4.4 Recent Land Use

The current study area and its immediate surrounds have primarily been subject to rural farming and grazing since initial European settlement. Vegetation clearing including the logging of large native trees occurred across the Cumberland Plain to make way for farming, grazing, cropping and market gardens. The study area has remained rural, with the small lot semi-rural subdivision evident today occurring in the twentieth century. The current study area still operates as part of a garden market plot.

4.5 Synthesis of Heritage Context

A review of the AHIMS search result and of previous archaeological investigations in the area indicates a high level of previously recorded Aboriginal sites within the local region. The previous regional Aboriginal heritage assessments of the Cumberland Plain have utilised archaeological artefact distributions, lithic raw material, site typology and site location in order to provide a series of statements on the Aboriginal occupation of the local area.

Previous archaeological investigations and the results of the AHIMS search have identified that open camp sites, expressed as surface scatters and isolated finds, are the most common site type within the vicinity of the study area. Previous investigations have demonstrated that there is a strong relationship between artefact densities and proximity to water sources and landform unit. Previous archaeological studies have identified that elevated landforms along the margins of permanent freshwater resources, were more favourable for repeated and more intensive occupation by past Aboriginal peoples.

The results of previous archaeological assessments within the vicinity of the study area indicate that, there is potential for open camp sites. Potential Aboriginal sites are more likely to be located within close proximity to

freshwater resources along flats and lower slopes. Aboriginal sites and areas of PAD are more likely to be identified within areas of high sensitivity with low levels of disturbance.

5.0 Visual Inspection and Field Results

A visual inspection of the study area was undertaken to establish whether Aboriginal objects were located within the study area or were likely to be present below the ground surface. Further, a visual inspection of the study area aimed to determine potential impacts to Aboriginal objects and design options to avoid impacts. In accordance with the Due Diligence Code, a qualified consultant undertook the visual inspection (DECCW 2010:12-13).

5.1 Visual Inspection

A visual inspection of the study area was conducted on foot by RPS Heritage Consultant Joshua Madden on Tuesday 9 December 2014.

The study area is located within the rural allotment of 153 Boundary Road, Box Hill (Lot 10 DP593517) and is approximately one hectare in size. The study area is fronted by Red Gables Road to the south and surrounded by rural allotment to the west, north and east. The study area is located approximately 100 metres south of a tributary of Cataract Creek.

The study area is located along a natural flat landform unit within the rolling landscape of the Cumberland Plain. The study area is bordered by an artificial drainage channel to the east (Plate 1) and by a dam to the north (Plate 2). The rural allotment has been subject to extensive landform modification with soil grading, cutting and mounding evident along the southern boundary, along the artificial drainage channel and around the dam (Plates 3 and 4). The study area has been subject to moderate to high historical disturbances associated with market gardening, sub-surface irrigation systems and ploughing (Plates 5 and 6).

The visual inspection of the study area found that, due to a high level of ground cover, surface visibility was below ten per cent with exposure also below ten per cent. Areas of exposure were identified along the dam and along areas of soil mounding, grading and ploughing (Plate 7). Soils in exposed sections appeared to be deflated, shallow and highly eroded.

No Aboriginal objects or areas where Aboriginal objects are likely to occur beneath the ground surface were identified during the study area investigation.

5.2 Visual Inspection Summary

The study area visual inspection did not identify any Aboriginal archaeological object and/or sites. The study area is located directly south of a tributary of Cataract Creek, with First Ponds Creek, the closets major freshwater resource, approximately three kilometres to the south. As such, the study area is likely to have been an area of transient occupation with areas of more permanent occupation in the local area likely found closer to major creek lines.

The study area has been subject to high levels of modern disturbances including soil grading, benching and mounding for the construction of rural irrigation and water systems. Extensive farming and market gardening have also been undertaken across the study area removing much of the A1 topsoils. The use of the study area for farming and market gardening has resulted in extensive landform modification. Previous assessment of the study area identified that the area was heavily disturbed and was of low archaeological potential. With consideration of all of these factors, the study area has been assessed as having low archaeological sensitivity.

Plate 1 Drainage Channel along the eastern boundary of the study area with the dam wall in the background.

Plate 2 The study area with the dam in the background.

Plate 3 Soil mounding along the southern boundary of the study area.

Plate 4 Soil cutting, grading and mounding along the drainage channel and the dam in the background.

Plate 5 Irrigation systems at the top of the dam wall.

Plate 6 Plough and market garden furrows with soil mounding in the fore and back grounds.

Plate 7 Example of visibility and exposure throughout the study area.

6.0 Impact Assessment

The purpose of a due diligence assessment is to identify whether Aboriginal objects are present, or are likely to be present, within the study area; to determine whether the proposed activity is likely to harm Aboriginal objects (if present) and to determine whether an AHIP is required.

The proposed activity involves the construction of a LWC which involves the installation of a raw sewage treatment plant. The proposed plant will be constructed in order to refine raw sewage and reticulate the refined water resource back into the Box Hill North residential precinct for non-drinking purposes. The proposed works will include soil grading, benching, cutting and filling/soil capping across the study area.

No Aboriginal objects or areas of potential archaeological deposits were identified during the study area site investigation. This assessment has found that the study area has been subject to moderate and high levels of modern disturbance including soil cutting, benching and mounding for the construction of rural irrigation and water systems and market gardening. The study area has been identified as having low Aboriginal heritage sensitivity.

Within areas of low Aboriginal heritage sensitivity, the potential for impact to Aboriginal heritage is low. As such, this Aboriginal cultural heritage due diligence assessment has confirmed that, no Aboriginal sites or areas likely to have archaeological material will be impacted upon by the proposed works.

7.0 Conclusions and Recommendations

This report has considered the available environmental and archaeological information for the study area, the land condition, as well as the nature of the proposed activity.

The AHIMS results indicate that there are no Aboriginal objects recorded in the study area. The visual inspection noted that the study area had been heavily modified by recent land uses, including soil cutting, benching and mounding. No Aboriginal objects or areas where Aboriginal objects are likely to occur beneath the ground surface were identified during the study area investigation.

No Aboriginal objects or places are located within the study area. This assessment has found that no further Aboriginal cultural heritage assessment is required for the proposed activity.

The following recommendations are made in relation to the proposed activity:

Recommendation 1

The proponent may proceed with the proposed LWC works within the study area, with caution.

Recommendation 2

All relevant personnel should be made aware of their statutory obligations for heritage under the *National Parks and Wildlife Act* 1974 and the *Heritage Act* 1977, which may be implemented as a heritage induction prior to the commencement of the proposed activity.

Recommendation 3

This due diligence assessment must be kept by the proponent so that it can be presented, if needed, as a defence from prosecution under s86(2) of the *National Parks and Wildlife Act* 1974.

Recommendation 4

If unrecorded Aboriginal objects are located in the study area in the course of the proposed works, then all works in the immediate area must cease and the area cordoned off. OEH must be notified by ringing the Enviroline 131 555 so that the site can be adequately assessed and managed.

Recommendation 5

In the unlikely event that skeletal remains are identified, work must cease immediately in the vicinity of the remains and the area must be cordoned off. The proponent must contact the local NSW Police who will make an initial assessment as to whether the remains are part of a crime scene or possible Aboriginal remains. If the remains are thought to be Aboriginal, OEH must be contacted by ringing the Enviroline 131 555. An OEH officer will determine if the remains are Aboriginal or not; and a management plan must be developed in consultation with the relevant Aboriginal stakeholders before works recommence.

8.0 References

AECOM 2012, Box Hill and Box Hill Industrial Precincts, Aboriginal Heritage Assessment: Final Stage 3 Report.

Attenbrow, V. (2010). Sydney's Aboriginal Past: Investigating the Archaeological and Historical Records (edition 2), UNSW Press.

Austral Archaeology Pty Ltd, 2009. Box Hill Future Urban Release, Box Hill NSW: Aboriginal archaeological and cultural heritage assessment.

Chapman, G.A. and Murphy C.L. (1989), *Soil Landscapes of the Sydney 1:100 000 sheet*. Soil Conservation Service of N.S.W., Sydney, pages 30-33.

Clark, N. R. and D. R. Jones (1991). Penrith 1:100 000 geological map sheet, 9030, Department of Minerals and Energy, New South Wales.

DECCW 2010. NPWS Act 1974. *Fact sheet 1*. September 2010

DECCW. 24 April 2009. *Due diligence guidelines for protection of Aboriginal objects in NSW. Accessed Online.*

Kelleher Nightingale Consulting Pty Ltd. July 2013, Box Hill North Planning Proposal: Aboriginal Heritage Assessment.

Keith, D. (2006). Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales and the ACT. Sydney, Department of Environment and Conservation NSW.

Navin Officer, 1992. *Assessment of Aboriginal Archaeological Resource: Sandon Point, Wollongong, NSW.* Report to GHD Pty Ltd

NSW National Parks and Wildlife Service (2002). National Biodiversity Audit – Biodiversity Strategy Case Study: Cumberland Plain subregion - Sydney Basin Bioregion, NSW

NSW National Parks and Wildlife Service (2004). *Endangered Ecological Community Information: Cumberland Plain Woodland*, retrieved on 09 November 2014 from http://www.environment.nsw.gov.au/resources/nature/EECinfoCumberlandPlainWoodland.pdf

Appendix 1

Legislative Requirements

Summary of Statutory Controls

The following overview of the legal framework is provided solely for information purposes for the client, it should not be interpreted as legal advice. RPS will not be liable for any actions taken by any person, body or group as a result of this general overview, and recommend that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the summary below.

COMMONWEALTH

Aboriginal & Torres Strait Islander Heritage Protection Act 1984 (ATSIHIP Act)

The purpose of this Act is to preserve and protect all heritage places of particular significance to Aboriginal and Torres Strait Islander people. This Act applies to all sites and objects across Australia and in Australian waters (s4).

It would appear that the intention of this Act is to provide national baseline protection for Aboriginal places and objects where State legislation is absent. It is not to exclude or limit State laws (s7(1)). Should State legislation cover a matter already covered in the Commonwealth legislation, and a person contravenes that matter, that person may be prosecuted under either Act, but not both (s7(3)).

The Act provides for the preservation and protection of all Aboriginal objects and places from injury and/or desecration. A place is construed to be injured or desecrated if it is not treated consistently with the manner of Aboriginal tradition or is or likely to be adversely affected (s3).

Australian Heritage Commission Act 1975

The *Australian Heritage Commission Act (1975)* established the Australian Heritage Commission which assesses places to be included in the National Estate and maintains a register of those places. Places maintained in the register are those which are significant in terms of their association with particular community or social groups and they may be included for social, cultural or spiritual reasons. The Act does not include specific protective clauses.

The *Australian Heritage Council Act 2003,* together with the *Environment Protection & Biodiversity Conservation Act 1999,* includes a National Heritage List of places of National heritage significance, maintains a Commonwealth Heritage List of heritage places owned or managed by the Commonwealth and ongoing management of the Register of the National Estate.

STATE

It is incumbent on any land manager to adhere to state legislative requirements that protect Aboriginal Cultural heritage. The relevant legislation is NSW includes but is not limited to the summary below.

National Parks and Wildlife Act 1974 (NPW Act)

The NPW Act provides statutory protection for all Aboriginal heritage, places and objects (not being a handicraft made for sale), with penalties levied for breaches of the Act. This legislation is overseen by the Office of Environment and Heritage (OEH), and specifically the Chief Executive (formerly the Director-General) of OEH. Part 6 of this Act is the relevant part concerned with Aboriginal objects and places, with Section 86 and Section 90 being the most pertinent. In 2010, this Act was substantially amended, particularly with respect to Aboriginal cultural heritage requirements. Relevant sections include:

Section 86

This section now lists four major offences:

(4) A person must not harm an object that the person knows is an Aboriginal object;

(5) A person must not harm and Aboriginal object;

(6) For the purposes of s86, "circumstances of aggravation" include:

  (a) The offence being committed during the course of a commercial activity; or

  (b) That the offence was the second or subsequent offence committed by the person;

(7) A person must not harm or desecrate an Aboriginal place.

Offences under s86 (2) and (4) are now strict liability offences, i.e., knowledge that the object or place harmed was an Aboriginal object or place needs to be proven. Penalties for all offences under Part 6 of this Act have also been substantially increased, depending on the nature and severity of the offence.

Section 87

This section now provides defences to the offences of s86. These offences chiefly consist of having an appropriate Aboriginal Heritage Impact Permit (AHIP), not contravening the conditions of the AHIP or demonstrating that due diligence was exercised prior to the alleged offence.

Section 87A & 87B

These sections provide exemptions from the operation of s86; Section 87A for authorities such as the Rural Fire Service, State Emergency Services and officers of the National Parks & Wildlife Service in the performance of their duties, and s87B for Aboriginal people performing traditional activities.

Section 89A

If a person knows of the location of an Aboriginal object or place that has not been previously registered and does not advise the Director-General (now Chief Executive) of that object or place within a reasonable period of time, then that person is guilty of an offence under this Section of the Act.

Section 90

This section authorises the Director-General (now Chief Executive) to issue and AHIP.

Section 90A-90R

These sections govern the requirements relating to applying for an AHIP. In addition to the amendments to the Act, OEH have issued three new policy documents clarifying OEH's requirements with regards to Aboriginal archaeological investigations: *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010, Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW and Code of Practice for Archaeological Investigations in NSW*. The Consultation Requirements formalise the consultation with Aboriginal community groups into four main stages, and includes details regarding the parties required to be consulted, advertisements inviting Aboriginal community groups to participate in the consultation process, requirements regarding the provision of methodologies, draft and final reports to the Aboriginal stakeholders and timetables for the four stages. The Due Diligence Code of Practice sets out the minimum requirements for investigation, with particular regard as to whether an AHIP is required. The Code of Practice for Archaeological Investigation sets out the minimum requirements for archaeological investigation of Aboriginal sites.

Aboriginal Heritage Impact Permits (AHIP)

OEH encourages consultation with relevant Aboriginal stakeholders for all Aboriginal Heritage Assessments. However, if an Aboriginal Heritage Impact Permit (AHIP) is required for an Aboriginal site, then specific OEH guidelines are triggered for Aboriginal consultation.

Aboriginal Cultural Heritage Consultation Requirements for Proponents

In 2010, the Aboriginal Cultural Heritage Consultation Requirements for Proponents (ACHCRs) were issued by OEH (12 April 2010). These consultation requirements replace the previously issued Interim Community Consultation Requirements (ICCR) for Applicants (Dec 2004). These guidelines apply to all AHIP applications prepared after 12th April 2010; for projects commenced prior to 12th April 2010, transitional arrangements have been stipulated in a supporting document, Questions and Answers 2: Transitional Arrangements.

The ACHCRs 2010 include a four stage Aboriginal consultation process and stipulate specific timeframes for each state. Stage 1 requires that Aboriginal people who hold cultural information are identified, notified and invited to register an expression of interest in the assessment. Stage 1 includes the identification of Aboriginal people who may have an interest in the study area and hold information relevant to determining the cultural significance of Aboriginal objects or places. This identification process should draw on reasonable sources of information including: the relevant OEH EPRG regional office, the relevant Local Aboriginal Land Council(s), the Registrar of Aboriginal Owners, Aboriginal Land Rights Act (1983), the Native Title Tribunal, Native Title Services Corporation Limited, the relevant local council(s), and the relevant catchment management authority. The identification process should also include an advertisement placed in a local newspaper circulating in the general location of the study area. Aboriginal organisations and/or individuals identified should be notified of the project and invited to register an expression of interest (EoI) for Aboriginal consultation. Once a list of Aboriginal stakeholders has been compiled from the EoI's, they need to be consulted in accordance with ACHCR's Stages 2, 3 and 4.

Environmental Planning & Assessment Act 1979 (EP&A Act)

This Act regulates a system of environmental planning and assessment for New South Wales. Land use planning requires that environmental impacts are considered, including the impact on cultural heritage and specifically Aboriginal heritage. Within the EP&A Act, Parts 3, 4 and 5 relate to Aboriginal heritage.

Part 3 regulates the preparation of planning policies and plans. Part 4 governs the manner in which consent authorities determine development applications and outlines those that require an environmental impact statement. Part 5 regulates government agencies that act as determining authorities for activities conducted by that agency or by authority from the agency. The National Parks & Wildlife Service is a Part 5 authority under the EP&A Act.

In brief, the NPW Act provides protection for Aboriginal objects or places, while the EP&A Act ensures that Aboriginal cultural heritage is properly assessed in land use planning and development.

Heritage Act 1977

This Act protects the natural and cultural history of NSW with emphasis on non-indigenous cultural heritage through protection provisions and the establishment of a Heritage Council. Although Aboriginal heritage sites and objects are primarily protected by the *National Parks & Wildlife Act* 1974, if an Aboriginal site, object or place is of great significance, it may be protected by a heritage order issued by the Minister subject to advice by the Heritage Council.

Other legislation of relevance to Aboriginal cultural heritage in NSW includes the *NSW Local Government Act* 1993. Local planning instruments also contain provisions relating to indigenous heritage and development conditions of consent.

Appendix 2

AHIMS

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : PR125114

Client Service ID : 157047

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-2839	WBH2	AGD	56	302678	6273805	Open site	Valid	Artefact : 7		102500
	Contact	**Recorders**	Michael Therin,Therin Archaeological Consulting					**Permits**	1844	
45-5-2840	WBH3	AGD	56	302571	6273876	Open site	Valid	Artefact : -		102500
	Contact	**Recorders**						**Permits**	1844	
45-5-2846	WBH1	AGD	56	302763	6273731	Open site	Valid	Artefact : 2		102500
	Contact	**Recorders**	Michael Therin,Therin Archaeological Consulting					**Permits**		
45-5-2838	WBH9	AGD	56	302531	6273753	Open site	Valid	Artefact : -		102500
	Contact	**Recorders**	Michael Therin					**Permits**		
45-5-2869	WMB3 (1005-4 scatter)	AGD	56	304776	6272997	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Michael Therin,Archaeological & Heritage Management Solutions Pty Ltd (AHMS),M					**Permits**	2152	
45-5-2870	WMB4	AGD	56	303944	6273302	Open site	Valid	Artefact : -		102500
	Contact	**Recorders**	Michael Therin					**Permits**	2152	
45-5-2871	WMB5	AGD	56	302865	6273502	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Michael Therin					**Permits**	2152	
45-5-4069	PAD 1008-6	GDA	56	305748	6273142	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-3973	BH AS1	GDA	56	304986	6275850	Open site	Valid	Artefact : 2		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3974	BH AS2	GDA	56	304899	6275499	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3975	BH AS3	GDA	56	304623	6275815	Open site	Valid	Artefact : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3976	BH AS4	GDA	56	304533	6275887	Open site	Valid	Artefact : 7		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3977	BH AS5	GDA	56	304329	6276034	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3978	BH AS6	GDA	56	304766	6274475	Open site	Valid	Artefact : 11		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3979	BH AS7	GDA	56	303998	6274578	Open site	Valid	Artefact : 5		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3980	BH AS8	GDA	56	304258	6274645	Open site	Valid	Artefact : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Enviros ciences),Andrew McLaren					**Permits**		
45-5-3981	BH AS9	GDA	56	303998	6274578	Open site	Valid	Artefact : 5		

Report generated by AHIMS Web Service on 05/12/2014 for Joshua Madden for the following area at Datum :GDA, Zone : 56, Eastings : 302000 - 310000, Northings : 6272900 - 6280900 with a Buffer of 0 meters. Additional Info : Aboriginal due diligence archaeological assessment. Number of Aboriginal sites and Aboriginal objects found is 111

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : PR125114

Client Service ID : 157047

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	AECOM Australia Pty Ltd (previously HLA-Enviros	ciences),Andrew McLaren				Permits		
45-5-4063	Isolated Object 1001-5	GDA	56	302618	6273190	Open site	Valid	Artefact : 1		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4064	PAD 1002-6	GDA	56	302281	6272973	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4068	PAD 1007-6	GDA	56	305632	6273022	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4070	PAD 1009-6	GDA	56	305373	6273465	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4071	PAD 1010-6	GDA	56	305042	6273737	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4072	PAD 1011-6	GDA	56	304763	6273851	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4073	PAD 1012-6	GDA	56	304928	6274108	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4074	Isolated Object 1013-5	GDA	56	305372	6275062	Open site	Valid	Artefact : 1		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4075	PAD 1014-6	GDA	56	306411	6273463	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4076	Isolated Object 1015-5	GDA	56	306068	6275778	Open site	Valid	Artefact : 1		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		
45-5-4077	PAD 1016-6	GDA	56	304431	6276442	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William					Permits		

Report generated by AHIMS Web Service on 05/12/2014 for Joshua Madden for the following area at Datum :GDA, Zone : 56, Eastings : 302000 - 310000, Northings : 6272900 - 6280900 with a Buffer of 0 meters. Additional Info : Aboriginal due diligence archaeological assessment. Number of Aboriginal sites and Aboriginal objects found is 111

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-4078	PAD 1017-6	GDA	56	304572	6276389	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4088	Artefact Scatter PAD 1027-46	GDA	56	305740	6273441	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4089	Artefact Scatter 1028-4	GDA	56	304618	6274961	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4090	Artefact Scatter PAD 1029-46	GDA	56	304787	6275060	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4091	Isolated Object 1032-5	GDA	56	303256	6274204	Open site	Valid	Artefact : -		102500
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4092	Isolated Object 1034-5	GDA	56	305305	6273437	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-4094	Isolated Object 1036-5	GDA	56	305297	6275030	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Alan William:					**Permits**		
45-5-2526	LL-OS-1	AGD	56	302590	6273510	Open site	Valid	Artefact : -	Open Camp Site	102500
	Contact	**Recorders**	Mrs.Robynne Mills					**Permits**		
45-5-0811	RH 5;Rouse Hill;RH/SP5;	AGD	56	308300	6273220	Open site	Valid	Artefact : -	Open Camp Site	98281
	Contact	**Recorders**	Laura-Jane Smith,Miss.Lisa Smith					**Permits**		
45-5-0976	Rouse Hill__pad 2 second pond creek;	AGD	56	307590	6272840	Open site	Valid	Artefact : -	Open Camp Site	98281
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**	627	
45-5-0967	RH/SP6;Rouse Hill;	AGD	56	308160	6272950	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	2524,98281,102968
	Contact	**Recorders**	Doctor.Jo McDonald					**Permits**		
45-5-0616	Long Neck_Ck.2	AGD	56	304150	6279530	Open site	Valid	Artefact : -	Open Camp Site	1815
	Contact	**Recorders**	Ms.Bronwyn Conyers,Mr.Stephen King					**Permits**		
45-5-0634	Longneck Creek 3	AGD	56	304120	6279230	Open site	Valid	Artefact : -	Open Camp Site	1815
	Contact	**Recorders**	Ms.Bronwyn Conyers					**Permits**		
45-5-0639	LN1	AGD	56	304200	6280050	Open site	Valid	Artefact : -	Open Camp Site	1380,1815
	Contact	**Recorders**	Laura-Jane Smith					**Permits**		
45-5-0640	LN2	AGD	56	304220	6280410	Open site	Valid	Artefact : -	Open Camp Site	1380,1815
	Contact	**Recorders**	Laura-Jane Smith					**Permits**		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-0644	LN6	AGD	56	303630	6279950	Open site	Valid	Artefact : -	Open Camp Site	1380,1815
	Contact	**Recorders**	Laura-Jane Smith					**Permits**		
45-5-0645	LN7	AGD	56	303490	6279730	Open site	Valid	Artefact : -	Open Camp Site	1380,1815
	Contact	**Recorders**	Laura-Jane Smith					**Permits**		
45-5-0217	Cattai Creek Y-Junction Shelter	AGD	56	307000	6276900	Closed site	Valid	Artefact : -	Shelter with Deposit	362
	Contact	**Recorders**	ASRSYS					**Permits**		
45-5-0218	Cattai Creek Blue Gum Creek	AGD	56	308300	6276900	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	362
	Contact	**Recorders**	ASRSYS					**Permits**		
45-5-0219	Annangrove Ross Place	AGD	56	308400	6273300	Open site	Not a Site	Art (Pigment or Engraved) : -	Not an Aboriginal Site	362
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**		
45-5-0220	Blue Gum Creek;Annangrove;	AGD	56	309237	6274507	Open site	Valid	Art (Pigment or Engraved) : -	Rock Engraving	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0230	Cattai Creek Nelson	AGD	56	307700	6276900	Closed site	Valid	Artefact : -	Shelter with Deposit	362
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**		
45-5-0167	Annangrove	AGD	56	308800	6273200	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Deposit	362
	Contact	**Recorders**	Ms.Laila Haglund					**Permits**		
45-5-0168	Annangrove;	AGD	56	308989	6273131	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0173	Nelson;	AGD	56	308052	6274301	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0176	Herne Trig;Nelson;	AGD	56	309131	6275237	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0178	Herne Trig;Nelson;	AGD	56	308396	6275406	Closed site	Valid	Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0180	Nelson;	AGD	56	307647	6276306	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-0183	Curtis Trig;O'Hara's Creek;	AGD	56	309606	6279088	Closed site	Valid	Artefact : -, Grinding Groove : -	Axe Grinding Groove,Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0184	Curtis Trig Cattai Creek Wrecked Car Shelter	AGD	56	308200	6277900	Closed site	Valid	Artefact : -	Shelter with Deposit	362
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0185	Curtis Trig;Cattai Creek;	AGD	56	308073	6277960	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Rock Engraving,Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0186	Curtis Trig;Cattai Creek;	AGD	56	307888	6278048	Closed site	Valid	Artefact : -	Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0187	Junction Shelter Cataract Ck	AGD	56	306900	6279000	Closed site	Valid	Artefact : -	Shelter with Deposit	362
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0188	Maralya	AGD	56	307500	6279000	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Deposit	362
	Contact	**Recorders**	ASRSYS					**Permits**		
45-5-0189	Maralya;	AGD	56	307213	6279864	Closed site	Valid	Art (Pigment or Engraved) : -	Shelter with Art	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0190	Curtis Trig;O'Hara's Creek;	AGD	56	309136	6279719	Open site	Valid	Grinding Groove : -	Axe Grinding Groove	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0191	Maralya;	AGD	56	308493	6279889	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Deposit	
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0192	Maralya White Hands Shelter	AGD	56	308400	6280300	Closed site	Valid	Artefact : -, Art (Pigment or Engraved) : -	Shelter with Art,Shelter with Deposit	362
	Contact	**Recorders**	Mr.R Taplin					**Permits**		
45-5-0763	RH 1 Rouse Hill RH/SP 1	AGD	56	307560	6272750	Open site	Valid	Artefact : -	Open Camp Site	1715,98281,98747
	Contact	**Recorders**	Elizabeth Rich,Laura-Jane Smith					**Permits**	406,506	
45-5-0617	Longneck Ck.1	AGD	56	304190	6279600	Open site	Valid	Artefact : -	Open Camp Site	1815
	Contact	**Recorders**	Ms.Bronwyn Conyers,Mr.Stephen King					**Permits**		

Report generated by AHIMS Web Service on 05/12/2014 for Joshua Madden for the following area at Datum :GDA, Zone : 56, Eastings : 302000 - 310000, Northings : 6272900 - 6280900 with a Buffer of 0 meters. Additional Info : Aboriginal due diligence archaeological assessment. Number of Aboriginal sites and Aboriginal objects found is 111

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-4297	Box Hill North 1 (BHN 1)	GDA	56	306633	6278314	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Mark Rawson,Kelleher Nightingale Consulting Pty Ltd					**Permits**		
45-5-4298	Box Hill North 2 (BHN 2)	GDA	56	306599	6278205	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Mark Rawson,Kelleher Nightingale Consulting Pty Ltd					**Permits**		
45-5-4299	Box Hill North 3 (BHN 3)	GDA	56	305061	6276893	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Kelleher Nightingale Consulting Pty Ltd					**Permits**		
45-5-4300	Box Hill North 4 (BHN 4)	GDA	56	305777	6276713	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Mr.Mark Rawson,Kelleher Nightingale Consulting Pty Ltd					**Permits**		
45-5-4129	BH IA1	GDA	56	304403	6275972	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	South East Archaeology,Andrew McLaren					**Permits**		
45-5-4130	BHIA2	GDA	56	304925	6275323	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences),Andrew McLaren					**Permits**		
45-5-4479	RV 22	GDA	56	303330	6273577	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Alan Williams					**Permits**		
45-5-4480	RV 21	GDA	56	303479	6273820	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Alan Williams					**Permits**		
45-5-4481	RV 18	GDA	56	302786	6274266	Open site	Valid	Artefact : -		
	Contact	**Recorders**	Mr.Alan Williams					**Permits**		
45-5-4483	A 4	GDA	56	303394	6273290	Open site	Valid	Artefact : -, Potential Archaeological Deposit (PAD) : -		
	Contact	**Recorders**	Mr.Alan Williams					**Permits**		
45-5-3168	Boundary Road Reserve 1	AGD	56	306167	6278939	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	ERM Australia Pty Ltd- Sydney CBD					**Permits**		
45-5-3169	Boundary Road Reserve 2	AGD	56	306060	6278831	Open site	Valid	Artefact : 1		
	Contact T Russell	**Recorders**	ERM Australia Pty Ltd- Sydney CBD					**Permits**		
45-5-3170	Boundary Road Reserve 3	AGD	56	305907	6278753	Open site	Valid	Artefact : 2		
	Contact T Russell	**Recorders**	ERM Australia Pty Ltd- Sydney CBD					**Permits**		
45-5-3831	BH PAD 2	GDA	56	304509	6275362	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3832	BH PAD 3 (1033-6)	GDA	56	303961	6273982	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832

Report generated by AHIMS Web Service on 05/12/2014 for Joshua Madden for the following area at Datum :GDA, Zone : 56, Eastings : 302000 - 310000, Northings : 6272900 - 6280900 with a Buffer of 0 meters. Additional Info : Aboriginal due diligence archaeological assessment. Number of Aboriginal sites and Aboriginal objects found is 111

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Evan Raper,M					**Permits**		
45-5-3833	BH PAD 4	GDA	56	303941	6273580	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3834	BH PAD 5	GDA	56	304440	6275674	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3835	BH PAD 6	GDA	56	303519	6274378	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3836	BH PAD 7 (1030-6)	GDA	56	304451	6274791	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Evan Raper,M					**Permits**		
45-5-3837	BH PAD 8 (1031-6)	GDA	56	304451	6274399	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Evan Raper,M					**Permits**		
45-5-3838	BH PAD 9	GDA	56	303926	6274503	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3839	BH PAD 10	GDA	56	303617	6274156	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Evan Raper,M					**Permits**		
45-5-3840	BH PAD 11	GDA	56	304373	6274471	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3818	BH 1 & BH 1 PAD	GDA	56	304911	6275760	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : -		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3819	BH 2	GDA	56	304772	6275661	Open site	Valid	Artefact : 1		101832
	Contact	**Recorders**	Mr.Evan Raper					**Permits**		
45-5-3820	BH 3	GDA	56	304827	6275661	Open site	Valid	Artefact : 1		101832

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SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3821	BH 4	GDA	56	303366	6274026	Open site	Valid	Artefact : 2		101832,102500
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3822	BH 5	GDA	56	304486	6274804	Open site	Valid	Potential Archaeological Deposit (PAD) : -, Artefact : 1		101832
	Contact	Recorders	Archaeological & Heritage Management Solutions Pty Ltd (AHMS),Mr.Evan Raper,M					Permits		
45-5-3823	BH 6	GDA	56	304265	6274625	Open site	Valid	Artefact : 1		101832,102500
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3824	BH 7	GDA	56	304219	6274615	Open site	Valid	Artefact : 1		101832
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3825	BH 8	GDA	56	304098	6274575	Open site	Valid	Artefact : 1		101832
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3826	BH 9	GDA	56	303985	6274560	Open site	Valid	Artefact : 1		101832
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3827	BH 10	GDA	56	303996	6274573	Open site	Valid	Artefact : 1		101832
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3828	BH 11	GDA	56	303920	6275034	Open site	Valid	Artefact : 1		101832,102500
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3829	BH 12	GDA	56	303674	6273778	Open site	Valid	Artefact : 1		101832,102500
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-3830	BH PAD 1	GDA	56	304440	6275674	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		101832
	Contact	Recorders	Mr.Evan Raper					Permits		
45-5-4391	RH/SP9 SPOP8 correctly registered under 45-5-2603	GDA	56	308009	6273060	Open site	Deleted	Artefact : -, Potential Archaeological Deposit (PAD) : -		102968
	Contact	Recorders	Ms.Michelle Lau					Permits		
45-5-4368	PAD 5 CCOP-5	GDA	56	308940	6272967	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102968
	Contact	Recorders	Bobbie Oakley					Permits		

Report generated by AHIMS Web Service on 05/12/2014 for Joshua Madden for the following area at Datum :GDA, Zone : 56, Eastings : 302000 - 310000, Northings : 6272900 - 6280900 with a Buffer of 0 meters. Additional Info : Aboriginal due diligence archaeological assessment. Number of Aboriginal sites and Aboriginal objects found is 111

AHIMS Web Services (AWS)

Extensive search - Site list report

Purchase Order/Reference : PR125114

Client Service ID : 157047

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
45-5-4369	PAD-6 CCOP6	GDA	56	308538	6273532	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102968
	Contact	**Recorders**	Bobbie Oakley					**Permits**		
45-5-4370	PAD 7 SPOP-7	GDA	56	308376	6273438	Open site	Valid	Potential Archaeological Deposit (PAD) : -		102968
	Contact	**Recorders**	Bobbie Oakley					**Permits**		
45-5-4458	RAA 1	GDA	56	302690	6273895	Open site	Valid	Artefact : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences)					**Permits**		
45-5-4459	RAA 2	GDA	56	302356	6273301	Open site	Valid	Artefact : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences)					**Permits**		
45-5-4460	RAA 4	GDA	56	302151	6274099	Open site	Valid	Artefact : -		
	Contact	**Recorders**	AECOM Australia Pty Ltd (previously HLA-Envirosciences)					**Permits**		

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Appendix 4

Noise Impact Assessment

ACOUSTICS AND AIR

BOX HILL NORTH LOCAL WATER CENTRE

REVIEW OF ENVIRONMENTAL FACTORS (ACOUSTICS)

REPORT NO. 14391
VERSION C

MAY 2015

PREPARED FOR

RPS AUSTRALIA ASIA PACIFIC
241 DENISON STREET
BROADMEADOW NSW 2292

WILKINSON MURRAY

DOCUMENT CONTROL

Version	Status	Date	Prepared By	Reviewed By
A	Final	19 January 2015	George Jenner	John Wassermann
B	Final	22 January 2015	George Jenner /Luke Warren	-
C	Final	26 May 2015	George Jenner	-

Note

All materials specified by Wilkinson Murray Pty Limited have been selected solely on the basis of acoustic performance. Any other properties of these materials, such as fire rating, chemical properties etc. should be checked with the suppliers or other specialised bodies for fitness for a given purpose. The information contained in this document produced by Wilkinson Murray is solely for the use of the client identified on the front page of this report. Our client becomes the owner of this document upon full payment of our **Tax Invoice** for its provision. This document must not be used for any purposes other than those of the document's owner. Wilkinson Murray undertakes no duty to or accepts any responsibility to any third party who may rely upon this document.

Quality Assurance

We are committed to and have implemented AS/NZS ISO 9001:2008 "Quality Management Systems – Requirements". This management system has been externally certified and Licence No. QEC 13457 has been issued.

AAAC

This firm is a member firm of the Association of Australian Acoustical Consultants and the work here reported has been carried out in accordance with the terms of that membership.

Celebrating 50 Years in 2012

Wilkinson Murray is an independent firm established in 1962, originally as Carr & Wilkinson. In 1976 Barry Murray joined founding partner Roger Wilkinson and the firm adopted the name which remains today. From a successful operation in Australia, Wilkinson Murray expanded its reach into Asia by opening a Hong Kong office early in 2006. 2010 saw the introduction of our Queensland office and 2011 the introduction of our Orange office to service a growing client base in these regions. From these offices, Wilkinson Murray services the entire Asia-Pacific region.

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APPENDIX A – Noise Measurement Results

APPENDIX B – Operational Noise Contour

APPENDIX C – Operational Noise Contour with Back-up Generator

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, largely as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

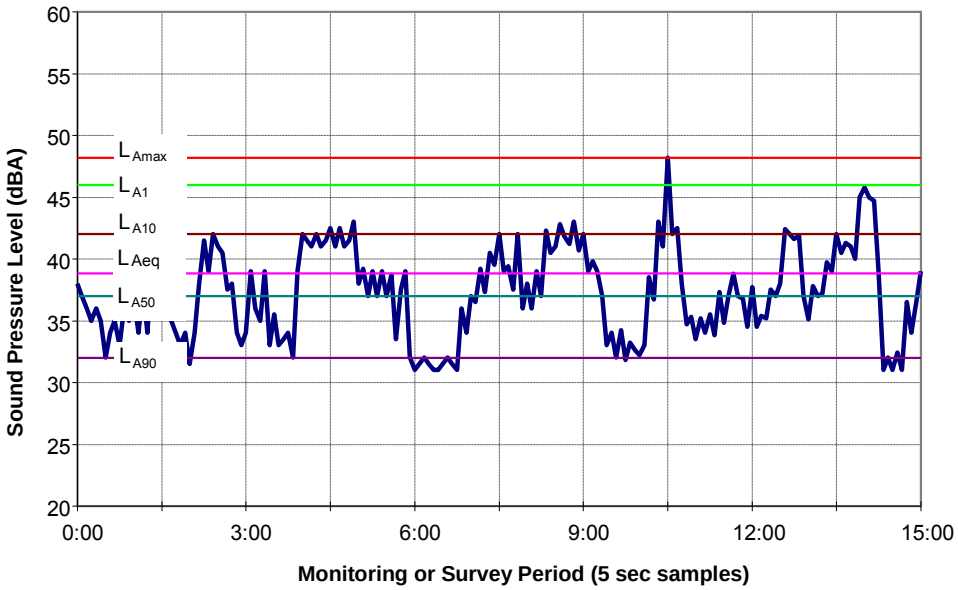
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10th percentile (lowest 10th percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

Wilkinson Murray Pty Limited has been engaged by RPS Australia Asia Pacific on behalf of Flow Systems Pty Ltd to provide an operational noise assessment of the proposed Local Water Centre (LWC) located at Box Hill North. The LWC is to be located on part of Lot 10 DP 593517 (existing) within the Box Hill North Residential Precinct as shown in Figure 2-1.

The noise assessment evaluates potential noise and vibration impacts associated with the construction and operation of the facility in accordance with the Environmental Protection Authority (EPA) *Interim Construction Noise Guideline (ICNG), Road noise Policy (RNP)* and NSW *Industrial Noise Policy (INP)*.

New residential development requires the co-ordinated provision of reticulated water and sewerage services. The provision of a LWC is the best alternative type of water treatment facility because the off-site impacts are limited; and because it is scalable and allows supply to increase in line with the anticipated residential development and the volume of waste to be treated. The Box Hill North North LWC also makes a significant contribution to sustainability through the provision of recycled water back to the residential area.

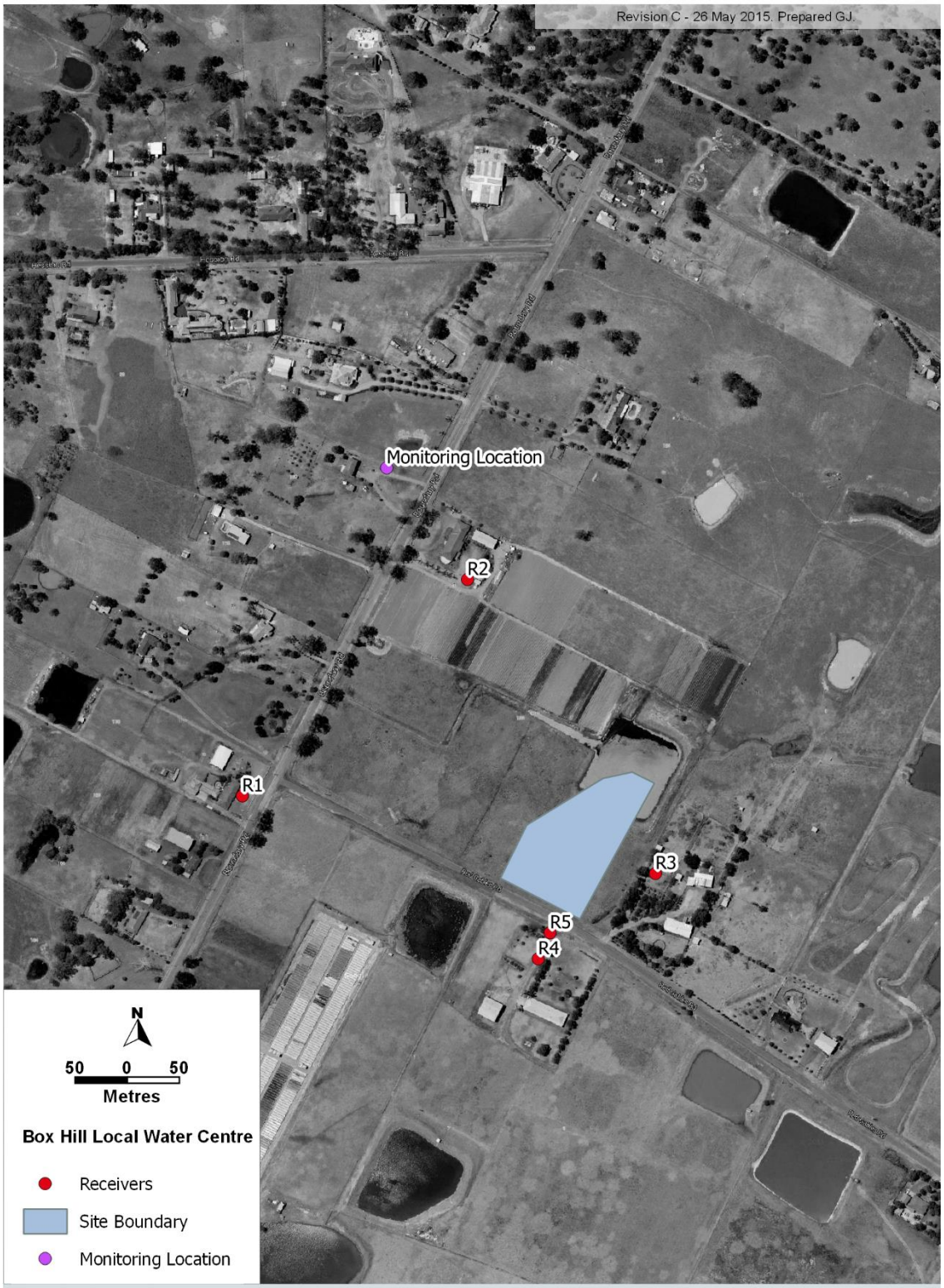
The alternative(s) to the proposed Box Hill North North LWC is to build a traditional local sewage treatment plant with potential discharge to the local waterway, or more expensively to pipe the sewage to an existing sewage treatment plant for treatment and disposal, which would also require an amplification/upgrade of the existing receiving treatment plant. Either alternative would be more expensive, take longer to implement, have greater potential environmental impacts, and fail to achieve sustainability initiatives for water re-use.

2 SITE & PROJECT DESCRIPTION

2.1 Surrounding Land Uses

The proposed location of the site is located at Red Gables Road, Box Hill North. The land surrounding the site will facilitate a new residential community. The existing area is predominantly rural in nature. Existing residential areas or noise catchment areas (NCAs) are currently located approximately 150m to the west, 100m to the east and 285m to the west of the site, and more than 500m to the east of the site. Figure 2-1 shows the subject area, noise monitoring location and the nearest existing and future residential receivers. Locations R1, R2, R3 and R4 represent the nearest existing residential receivers surrounding the site. R3 also represents the closest future residential receiver to the east, and R5 the nearest future residential receiver to the south.

Figure 2-1 Locality Map



Site Location and Sensitive Receivers

2.2 Description of the Proposed Operation Works

The intended LWC will utilise sewage from the future residential area to produce high quality water. The sewage is treated at the LWC to provide recycled water plumbed into houses for non-drinking uses, such as toilet flushing, washing machines, irrigation and car washing, thus reducing drinking water demand. The facility is intended to operate 24 hours, 7 days per week, housed in a low-scale, single level building within an open space setting.

The operation will be on the following basis:

- the facility will operate 24 hours a day, 7 days per week;
- the recycled water, which is transported by pipe system back to customers; and
- any waste water screenings will be collected and disposed of, by way of an authorised waste disposal contractor.

A concept layout for the LWC is shown in Figure 2-2. The proposal will be developed in stages:

1. Interim sewer servicing tanks (ISST) will be constructed and operated first at the east of the site;
2. Western local water centre built and commissioned (Number 1 on Figure)
3. ISST removed
4. Eastern local water centre built and commissioned (Number 2 on Figure).

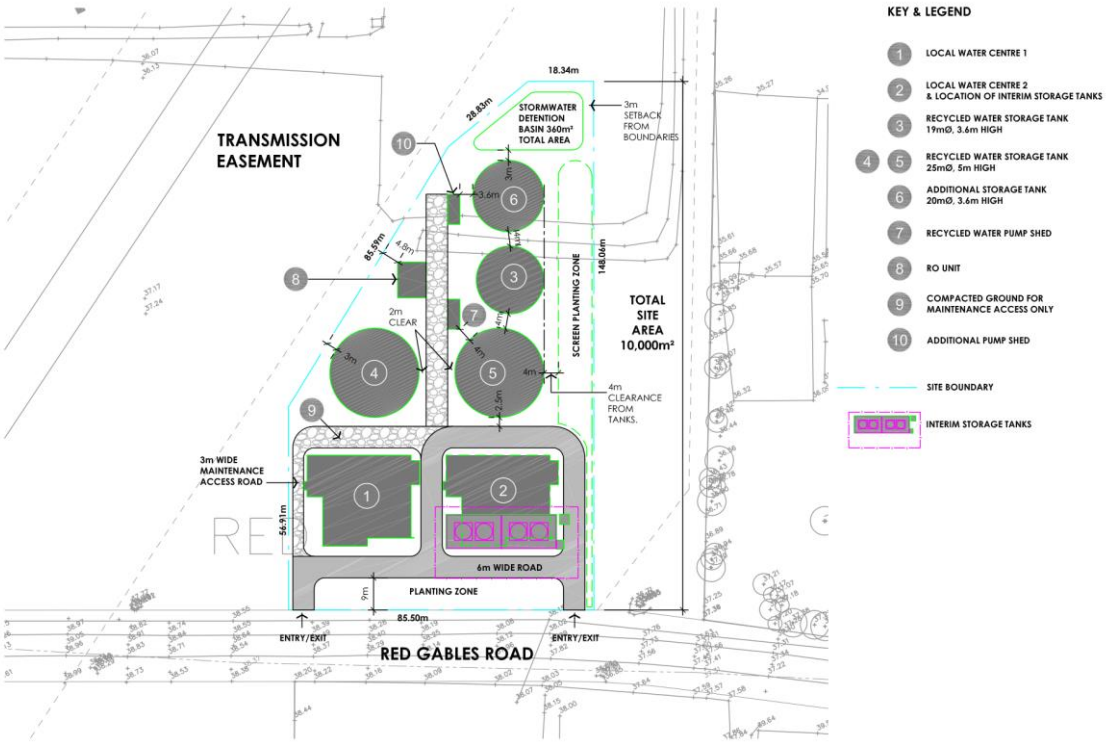
The following describes the LWC and its associated noise sources (equipment):

- Two operations building will house plant and equipment involved in water treatment processes. The buildings are approximately 24m x 10m each and have a skillion roofs ranging from 3.6m to 6.1m height across its width. The building will have a mix of Colorbond and off-form concrete materials in natural and muted grey colours in its facades, and dressed with narrow bands of glass windows to soften the elevations. The eastern elevations will carry a roller door for access to the facility as well as a single door access from operations to delivery area. The western elevation will carry the entry doors to operations and acoustic aluminium louvered doors to blowers and compressors rooms. The roofs will also be of Colorbond material. Air-conditioning units will be used for conditioning the Control room.
- Aligned with the operations buildings, will be the treatment tanks approximately 5m in height. They will be constructed of off-form concrete panels in natural colours. Staircases located at the east and west of the buildings will provide access to the roof of the structure for servicing purposes. Located near the western face of the buildings is a back-up generator, sitting externally to the buildings beneath the access staircases, which will provided power to the facility in the event that primary power supply becomes insufficient. The generators will be surrounded by block walls up to 1m above the height of the generators. The facility buildings will contain plant items including membrane drain pumps, WAS pump, permeate pumps, membrane blowers, process blowers, compressors and WAS dewatering.

- Two drinking water storage tanks are located in the eastern part of the site. A further two tanks to store recycled water are located to the eastern part of the site. Capacity ranges from 1.2 million litres to 2.5million litres each, and will stand approximately 5m high above ground level, and be up to 25m in diameter. The tanks will be constructed of steel and sit in a compacted earth and gravel area.

The tanks will be interconnected with pipes and pumps and the like to each other, and to the treatment plant building. Pumps for drinking water and recycled water tanks are to be housed in sheds of Colorbond material for weather and acoustic screening (Number 7 on Figure 2-2).

Figure 2-2 Site Layout Plan



Once the facility is fully operational, truck movements will be limited to chemical deliveries and is estimated at two to six trucks per month. Operator(s) will visit the site 2-3 times per week in standard utilities or passenger vehicles. An additional six trucks per week will be required to collect the solid waste bins.

2.3 Outline of Construction Works

To enable the operation of the proposal, the construction work on the interim facility (interim flow balance tanks) will commence once the network operators licence is granted which is anticipated for late 2015. The interim facility will be constructed by first clearing and grubbing the site for the facility. The land will be generally contoured to the required bulk earthworks design. A temporary hardstand area will be built for the interim flow balance tanks and temporary access road.

The first Box Hill North LWC will then be constructed once detailed designs are complete and commissioned once a suitable quantity of sewage is available for commissioning of the facility. It is anticipated that construction, equipping and commissioning will take approximately 12 months to complete.

The construction of the first Box Hill North LWC will commence with detailed excavation and installation of under-slab pipework and conduits followed by traditional form, reinforcement and pouring of concrete floors and walls. The concrete tanks will be hydraulically tested and the building finished with architectural finishes. The steel storage tanks will be constructed on concrete ring beam foundations. Spoil from the construction of the Box Hill North LWC is expected to be minimal and will be managed in accordance with a Construction Environmental Management Plan (CEMP) for the proposal. It is likely that all spoil will be used for re-contouring of the land surrounding the building and facilities.

Once the building and tanks are substantially complete, it will be equipped with mechanical, electrical and control equipment including pumps, mixers, inlet screens, odour control unit, membranes, UV disinfection and chemical dosing tanks.

The second Box Hill North LWC will be constructed when demand requires it. This is currently estimated to be 2024.

2.3.1 Construction Hours

The Box Hill North LWC will be constructed during the following hours:

- Monday to Friday 7.00am to 6.00pm; and
- Saturday 8.00am to 1.00pm.

2.3.2 Construction Plant & Equipment

The following plant and equipment would be required to undertake the proposed works:

- Front end loader / Chainsaws / Mulcher;
- Small tipper trucks;
- Rigid and articulated delivery trucks;
- Excavator;
- Concrete trucks;
- Cranes;
- Grader;
- Portable generators;
- Scaffold;
- Elevated work platforms; and
- General construction / building tools.

2.3.3 Construction Traffic

Vehicle movements during construction will mostly consist of the floating of earthmoving equipment and concrete agitator trucks delivering concrete during scheduled pours. Concrete truck movements will occur at various stages throughout the construction period and will peak at around eight concrete trucks per day at the peak of the construction. In addition, there will be an average of two truck movements per day for the delivery of other plant, materials and equipment.

3 EXISTING NOISE ENVIRONMENT

Unattended noise monitoring was conducted at 180 Boundary Road, Box Hill North from 26 November to 4 December 2014. The location and its relation to the site is shown in Figure 2-1.

The noise monitoring equipment used for the unattended measurements consisted of an ARL-NGARA Environmental Noise Logger set to A-Weighted, Fast response continuously monitoring over 100ms sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift occurred.

The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. The L_{A1}, L_{A10} and L_{A90} levels are the levels exceeded for 1%, 10% and 90% of the sample time respectively (See Glossary of Acoustic Terms for further explanations). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional passby of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period. The L_{Aeq} level is the Equivalent Continuous Sound Level and has the same sound energy over the sampling period as the actual noise environment with its fluctuating sound levels. The L_{Aeq} is used for the assessment of operational noise and traffic noise. The L_{A10} is used for the assessment of construction noise.

The detailed measurement results are shown in graphical format in Appendix A.

The measured RBLs are shown in Table 3-1. The RBLs for the standard periods of daytime, evening and night time are presented. The RBL for evening is higher than that for daytime. In such cases the *INP* recommends that the daytime level be used for evening. Therefore, the RBL for all periods is 36dBA.

Table 3-1 Measured Rating Background Noise Levels (dBA)

Location	Day (7am-6pm)	Evening (6pm-10pm)	Night (10pm-7am)
180 Boundary Road	36	38	36

4 CONSTRUCTION ROAD TRAFFIC NOISE ASSESSMENT

4.1 Relevant Road Traffic Noise Criteria

Whilst there are no criteria which relate to temporary changes in traffic noise during construction periods, it is desirable that noise associated with truck deliveries to the site comply with the criteria shown in the NSW *Road Noise Policy (RNP)* published by EPA in March 2011. The main roads affected by heavy vehicle movements will be Boundary Road, considered a sub-arterial road, and Red Gables Road which is a local road. On this basis, the traffic noise criteria have been taken from the *RNP* and are shown in Table 4-1.

Table 4-1 Road Noise Criteria

Road Category	Type of Project / Land Use	Assessment Criteria – dBA	
		Day (7am-10pm)	Night (10pm-7am)
Local Roads	Existing residences affected by additional traffic on existing local roads generated by land use developments	$L_{Aeq,1hr}$ 55 (external)	$L_{Aeq,1hr}$ 50 (external)
Sub-Arterial Roads	Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	$L_{Aeq,15hr}$ 60 (external)	$L_{Aeq,9hr}$ 55 (external)

A review of the road noise criteria in Table 4-1 indicates that the applicable criteria are $L_{Aeq,1hr}$ of 55dBA for local roads and $L_{Aeq,15hr}$ of 60dBA for sub-arterial roads.

4.2 Road Traffic Noise Assessment

Road traffic noise has been calculated for heavy vehicle movements to the site and existing traffic movements have been ignored. The anticipated peak movements per day is five concrete trucks per day at the peak of the construction. Typically, there will be an average of two truck movements per day for the delivery of other plant, materials and equipment. Based on this information the following noise levels have been calculated:

- Red Gables Road – $L_{Aeq,1hr}$ of 40dBA at the façade of the nearest noise sensitive receiver (approximately 75m from the road). This is based on 1 movement per hour; and
- Boundary Road – $L_{Aeq,15hr}$ of 49dBA at the façade of the nearest noise sensitive receiver (approximately 20m from the road). This is based on 5 movements per day.

The predicted road traffic noise levels above are well within the *RNP* criteria. Therefore, noise impacts would be minimal.

5 CONSTRUCTION NOISE & VIBRATION ASSESSMENT

5.1 Construction Noise & Vibration Criteria

The following sections detail the applicable site-specific noise and vibration criteria based on the guidelines from EPA, being the *Interim Construction Noise Guideline* and *Assessing Vibration: A Technical Guideline*.

5.1.1 Construction Noise Management Levels (NML's)

The EPA released the "*Interim Construction Noise Guideline*" *(CNG)* in July 2009. The guideline provides noise goals that assist in assessing the impact of construction noise.

For residences, the basic daytime construction noise goal is that the $L_{Aeq,\ 15min}$ noise management level should not exceed the background noise by more than 10dBA. This is for standard hours: Monday to Friday 7.00am-6.00pm, and Saturday 8.00am-1.00pm. Outside the standard hours, where construction is justified, the noise management level would be background + 5dBA. Table 5-1 details the *ICNG* noise management levels and its application.

Table 5-1 Construction Noise Management Levels at Residences

Time of Day	Management Level $L_{Aeq,15min}$ (dBA)	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dBA	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.

Time of Day	Management Level $L_{Aeq,15min}$ (dBA)	How to Apply
Outside recommended standard hours	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Typically, no works should be undertaken on Sundays.

Based on the measured RBLs levels, the following applicable noise management levels (NML's) for construction activities at surrounding residential receivers have been adopted:

- Monday-Friday 7.00am-6.00pm $L_{Aeq,15min}$ 46 (36+10) dBA
- Saturday 7.00am to 1.00pm $L_{Aeq,15min}$ 46 (36+10) dBA
- Highly noise affected $L_{Aeq,15min}$ 75 dBA

5.1.2 Site Vibration Criteria

Typically, vibration impacts are determined using following documents:

- Building damage – German Standard DIN 4150: Part 3 – 1999 *Structural vibration in buildings: Effects on structures*. Since vibration in the frequency band below 10Hz is not expected, the limit at the residential foundation would be 5mm/s peak component particle velocity (pcpv); and
- Human comfort – *Environmental noise management assessing vibration: A technical guide* (DEC, 2006). Since vibration from the construction site below 8Hz is not expected, the comfort limit becomes 0.4mm/s rms vertical vibration.

However, as the distance from vibration intensive plant to the nearest residential receiver is considered to be large (approximately 70m), ground vibration at surrounding residential receivers would be low. On this basis, the recommended safe working distances for vibration intensive plant suggested in the Transport Construction Authority's *Construction Noise Strategy* (2012) have been adopted in this assessment to evaluate the vibration impacts. Table 5-2 sets out the recommended safe working distances for various vibration intensive plant.

Table 5-2 Recommended Safe Working Distances for Vibration Intensive Plant

Item	Description	Safe Working Distance	
		Cosmetic Damage	Human Response
Small Hydraulic Hammer	(300 kg – 5 to 12t excavator)	2m	7m
Medium Hydraulic Hammer	(900 kg – 12 to 18t excavator)	7m	23m
Pile Boring	≤ 800 mm	2m (nominal)	N/A
Jackhammer	Hand held	1m (nominal)	Avoid contact with structure

- Construction Noise Strategy, 2012, Transportation Construction Authority

A review of the information in Table 5-2 indicates that the human comfort vibration impacts at surrounding residences would be minimal when using rock breakers. Furthermore, structural damage vibration criteria in residential buildings are much higher than human comfort criteria, and the nearest residential receiver is situated far enough for impacts to be minimal in all circumstances. Therefore, no further vibration consideration is required.

5.2 Construction Equipment and Noise Source Levels

Sound Power Levels (SWLs) for typical construction plant are detailed in Table 5-3. These SWLs have been measured at other similar construction sites. The table provides both Sound Power Level and Sound Pressure Levels (SPL) at 7m for the equipment. Sound Power Level is independent of measurement position.

Table 5-3 Typical Construction Plant Sound Levels (dBA)

Plant	Sound Power Level	Sound Pressure Level at 7m
Concrete Truck	105	80
Concrete Pump – 120 mm diameter / 50 bar	103	78
Concrete Saw	116	91
50t Crane	105	80
Dump Truck	108	83
Compressor	100	75
Bobcat	103	78
Generator and Power Hand Tools	105	80
D10 Bulldozer	114	89
15t Excavator	103	83
40t Excavator	110	90
Crawler Cranes	98	73
16H Grader	108	83
Front End Loader	112	87
Hammer Hydraulic	122	97
Wood Chipper	117	102

5.3 Predicted Construction Noise Levels

Calculation of likely construction noise at surrounding receivers has been undertaken for the proposed construction works.

Site-related noise emissions were modeled with the "CadnaA" noise prediction software using the ISO 9613 noise prediction algorithms. Factors that are addressed in the noise model are:

- equipment sound level emissions and location;
- screening effects from barriers;
- receiver locations;
- ground topography;
- noise attenuation due to geometric spreading;
- ground absorption; and
- atmospheric absorption.

Noise predictions have been made based on the possible worst-case impacts taking into consideration the most likely construction scenarios. This has been made based on Wilkinson Murray's previous experience with similar scale construction projects. As a worst-case scenario, this assumes that most of the relevant plant would be operating during most of the 15-minute assessment period. The following have been assumed for each of the noise significant scenarios:

- Site Clearing / Grubbing

  As the site has no large trees the noisiest activity in this scenario would be from the use of a front end loader to clear land. $L_{Aeq,15min}$ noise level for this activity would be 108dBA.

- Bulk Earthworks

  Noisiest activity in this scenario would be from excavation works carried out by a 15t excavator, tipper trucks and articulated trucks working at the same time. $L_{Aeq,15min}$ noise level for this activity would be 113dBA.

- Foundation Construction

  Noisiest activity in this scenario would be from the pouring of concrete floors and walls. This would be carried out by a concrete agitator truck idling on site and a concrete pump transferring liquid concrete to the designated areas. $L_{Aeq,15min}$ noise level for this activity would be 107dBA.

- Superstructure Construction

  Noisiest activity in this scenario would be from the steel cage installation that would involve lifting of heavy loads using a 50t crane, an 8 wheel crane truck with delivery truck idling on site. $L_{Aeq,15min}$ noise level for this activity would be 108dBA.

- General Construction / Scaffolding

  Noisiest activity in this scenario would be from the use of power hand tools. $L_{Aeq,15min}$ noise level for this activity would be 105dBA

Some specific control measures, which are referred to in Sections 5.5 and 5.6 below, have been considered necessary for the site and these have been included in the predicted noise levels.

There are a number of stages of the work proposed and some stages will be noisier than others. Table 5-4 shows the predicted noise levels at each of the NCAs for the noise significant stages of the work during normal construction hours.

Table 5-4 Predicted Construction Noise Levels at Residence – $L_{Aeq,15\ min}$ (dBA)

Receiver	Predicted Noise Level	Weekday NML	Exceedance
Site Clearing and Grubbing			
1	51	46	5
2	54	46	8
3	64	46	18
4	66	46	20
Bulk Earthworks			
1	56	46	10
2	59	46	13
3	69	46	23
4	71	46	25
Foundation Construction			
1	50	46	4
2	53	46	7
3	63	46	17
4	65	46	19
Superstructure Construction			
1	51	46	5
2	54	46	8
3	66	46	20
4	67	46	21

A review of results in Table 5-4 indicates the following:

- During the land clearing stage, exceedances of up to 20 dBA are predicted during standard hours at the nearby existing residences at Receivers 3 and 4. This magnitude of exceedance is consistent with similar sites where residences overlook development sites.
- During the structure stage exceedances of up to 25 dBA are predicted during standard hours at the nearby existing residences at Receivers 3 and 4. Fit-out works are less noise intensive and this would result in general compliance at residences during this stage (not shown in Table 5-4).

Based on these findings the adoption of reasonable and feasible noise management and mitigation will be required. These measures should be determined in detail when a contractor, with defined construction techniques, has been engaged on the project. However, "in-principle" mitigation measures are detailed in Section 6.4 and Section 6.5.

5.4 Construction Noise Mitigation Measures

Without mitigation, noise levels from construction activities have been predicted to exceed the noise management levels nominated in the guidelines at some surrounding receivers. Therefore, noise control measures are recommended to ensure that noise is reduced where feasible.

The following project specific mitigation measures are recommended;

- Selection of quietest feasible construction equipment;
- Localised treatment such as barriers, shrouds and the like around fixed plant such as pumps, generators and concrete pumps; and
- Provision of respite periods.

In addition, the following measures should be included in a Noise and Vibration Management Plan to be prepared prior to issue of a Construction Certificate (CC):

- *Plant Noise Audit* – Noise emission levels of all critical items of mobile plant and equipment should be checked for compliance with noise limits appropriate to those items prior to the equipment going into regular service. To this end, testing should be established with the contractor;
- *Environmental Inductions* – It is important that an induction is provided to all site personnel with an emphasis on understanding and managing noise impacts;
- *Equipment Selection* – All fixed plant at the work sites should be appropriately selected, and where necessary, fitted with silencers, acoustical enclosures and other noise attenuation measures in order to ensure that the total noise emission from each work site complies with EPA guidelines;
- *Site Noise Planning* – Where practical, the layout and positioning of noise-producing plant and activities on each work site should be optimised to minimise noise emission levels; and
- Install a 2.4 metre type-A hoarding on the boundary of the site. This should be a minimum 17mm thick structural plywood or equivalent panel.

The adoptions of the above measures are aimed at working towards achieving the noise management levels established at surrounding receivers.

5.5 Community Liaison & General Approaches to Mitigation

An effective community relations programme should be put in place to keep the community that has been identified as being potentially affected appraised of progress of the works, and to forewarn potentially affected groups (e.g. by letterbox drop, meetings with surrounding owners / tenants, etc.) of any anticipated changes in noise and vibration emissions prior to critical stages of the works, and to explain complaint procedures and response mechanisms. Close liaison should be maintained between the communities overlooking work sites and the parties associated with the construction works to provide effective feedback in regard to perceived emissions. In this manner, equipment selections and work activities can be coordinated where necessary to minimise disturbance to neighbouring communities, and to ensure prompt response to complaints, should they occur.

5.6 Noise & Vibration Management Plan

A Construction Noise and Vibration Management Plan for the site is recommended prior to construction. Areas that should be addressed in plan include:

- noise and vibration monitoring;
- response to complaints**;**
- responsibilities;
- monitoring of noise emissions from plant items;
- reporting and record keeping;
- non-compliance and corrective action; and
- Community consultation and complaint handling.

The plan should be developed by the successful contractor and be part of their Construction Environmental Management Plan.

6 OPERATIONAL NOISE ASSESSMENT

6.1 Relevant Operational Noise Criteria

This section of the report discusses noise guidelines and criteria for the assessment of operational noise. Appropriate criteria are contained within the NSW Environmental Protection Authority (EPA) *NSW Industrial Noise Policy (INP).*

6.1.1 *Industrial Noise Policy*

The *INP* is designed to assess noise using the more stringent of the following two approaches:

- Intrusive noise impacts in the short term for residences; and
- Amenity for particular land uses such as residences.

The *INP's* intrusive noise goal is the noise level 5dBA above the background noise level for each time period (daytime, evening or night time) of interest. The background noise level is derived from the measured L_{A90} noise levels.

The amenity goal sets an upper limit to the total industrial noise level ($L_{Aeq,period}$) in an area from all industrial noise sources (existing and future). The criterion depends on the time of day, area classifications and the relationship of the total measured $L_{Aeq,period}$ (and contribution from existing industrial noise) to determine the Acceptable Noise Level (ANL) for the development. Traffic noise would also be taken into account in areas where the noise environment is significantly affected by traffic noise.

The potentially affected area will be rural-residential. Given this, the acceptable amenity noise levels ($L_{Aeq,period}$ dBA) which apply over the whole day, evening or night period are as follows and are applicable only to noise from industrial sources:

- Daytime 55dBA
- Evening 45dBA
- Night Time 40dBA

In summary, the overall industrial noise from all industrial noise sources in the area (including the subject development) should not exceed the above amenity noise levels over the day evening and night periods.

Furthermore, the *INP* also suggests some sources may cause less annoyance where only a single event occurs for a limited duration, such as the back-up generator where it does not usually operate and will be tested in operation during daytime hours either once per month for 30 minutes, or once every 2 months for 1 hour. The adjustment for duration is presented below in Table 6-1. This applies where a single noise-event noise is continuous for a period of less than two and a half hours in any 24-hour period. The acceptable noise level may be increased by the adjustment as shown in Table 6-1 on the following page. This adjustment is designed to account for unusual and one-off events, and does not apply to regular high-noise levels that occur more frequently than once per day.

Table 6-1 Adjustments for Duration (dBA)

Duration of Noise (one event in any 24-hr period)	Increase in Acceptable Noise Level at Receptor	
	Daytime & Evening (0700-2200 h)	Night Time (2200-0700 h)
1.0 to 2.5 hours	2	Nil
15 minutes to 1 hour	5	Nil
6 minutes to 15 minutes	7	2
1.5 minutes to 6 minutes	15	5
Less than 1.5 minutes	20	10

6.1.2 Project Specific Criteria

Both amenity and intrusiveness criteria are adopted for this assessment. Table 6-2 presents a summary of the noise criteria for the existing residential receivers surrounding the proposed site using the measured RBL values presented in Table 3-1.

Table 6-2 Project Specific Criteria (dBA)

Time Period[1]	Intrusiveness Criterion $L_{Aeq,15min}$	Amenity Criterion $L_{Aeq,period}$
Daytime	**41**	55
Evening	**41**	45
Night Time	**41**	40

Notes: 1. Daytime 7.00am–6.00am; Evening 6.00pm–10.00pm; Night 10.00pm-7.00am
2. Noise criteria applicable to this assessment are highlighted in **bold**

Since the noise will be constant and not varying in level, the lower criterion for each period will apply, as highlighted in the table.

As the back-up generator does not usually operate and will be tested in operation during daytime hours either once per month for 30 minutes, or once every 2 months for 1 hour, a positive adjustment of 5dB will apply to the daytime project specific criteria of 41dBA. The adjusted daytime acceptable level is 46dBA L_{Aeq}.

6.2 Calculation Method

Noise levels were calculated using the Bruel & Kjaer Predictor computer modelling program based on ISO 9613 algorithms. Using Predictor it is possible to build a model of the facility noise sources and the surrounding area. The model is capable of taking account of the following parameters:

- noise source levels;
- topography between the facility and the residences;
- any shielding by buildings between noise sources and receivers; and
- meteorological effects which could change noise propagation.

Because the facility is well within 300m of the nearest proposed residences, meteorological enhancement of noise propagation are not significant and have not been considered in the assessment.

Noise source levels used in this assessment were provided by Permeate Partners Pty Ltd unless otherwise indicated. The noise source levels are summarised in Table 6-3.

Table 6-3 Noise Source Levels per Local Water Centre

Description	Qty	Sound Pressure Level at 1m
Back-up Generator	1x duty	81dBA each
Membrane Tank Drain Pump	1x duty	75dBA each
WAS Pump	1x duty	72dBA each
Permeate Pump	1x duty / 1x standby	75dBA each
Membrane Blower	1x duty / 1x standby	75dBA each
Process Blower	2x duty / 1x standby	75dBA each
Compressor	1x duty / 1x standby	65dBA each
WAS Dewatering	1x duty	72dBA each
Drinking Water Distribution Pumps	2x duty / 1x standby	75dBA each
Recycled Water Distribution Pumps	2x duty / 1x standby	75dBA each
6hp Air-Con Unit (Wilkinson Murray database)	1x duty	64dBA each

Based on the noise source levels in Table 6-3 the reverberant noise levels inside the equipment room was calculated to be 86dBA and 82dBA inside the sheds enclosing drinking/recycled water distribution pumps.

Sheds enclosing drinking water distribution pumps and recycled water distribution pumps are assumed to be constructed from Colorbond to be consistent with the equipment building and control room.

Noise emission from the site were calculated to the nearest residential properties and are presented in Section 6.3 and Section 6.4.

With respect to the ISST, noise emission would be from a tanker truck attached to the outlet of the tank. For assessment of this temporary facility it was assumed to have a sound power level of 100 dBA.

6.3 Noise from ISST

When the interim tanks are at full capacity (noting it will take time to build up to this as houses are built and connect), there will be up to six tankers visit the site per day for up to an hour each, and for 7 days per week and potentially sometimes at night.

It is recommended that if the existing residences at receiver 3 and 4 are occupied, they should be shielded from the tanker pump by movable temporary screens while the tanks are emptied. The temporary screens should be 2.1m high.

Wilkinson Murray understands that it is unlikely that any new residences will be built and occupied in the vicinity of this ISST while operational. By the time the development grows to near the LWC, the ISST will have been decommissioned and the LWC commissioned.

Scenario	Criteria Day / Evening / Night (dBA)	Receiver				
		1	2	3	4	5
Interim Storage Tanks	41/41/41	37	37	45	50	N/A
Interim Storage Tanks with Shielding	41/41/41	37	37	40	38	N/A

6.4 Operational Noise Emission Levels – All Equipment (Excluding Back-Up Generator)

The results of the modelling for all equipment operating (excluding back-up generator) are presented in Table 6-4.

The table shows the following:

- Noise from the ISST is predicted to comply at all receivers;
- Noise from the LWC 1 without Specific Noise Mitigation applied is predicted to exceed the criterion at the nearest future residence. For this reason the following predictions assume that Specific Noise Mitigation is applied to both Local Water Centres;
- Noise from the Local Water Centre 1 **with** Specific Noise Mitigation applied is predicted to comply with the criteria at all receivers.
- Noise from the Local Water Centre 1 and Local Water Centre 2 combined **with** Specific Noise Mitigation applied is predicted to comply with the criteria at all receivers.

The specific mitigation required is:

- Specific Noise Mitigation (1) – lining of Colorbond on the internal face of the plant room with appropriate air gap to accommodate minimum 50mm thick polyester or glasswool insulation of density 14kg/m3
- Specific Noise Mitigation (2) – The internal walls of the pump house should be lined with minimum 50mm thick polyester or glasswool insulation of density 30kg/m3

Table 6-4 Predicted $L_{Aeq,15min}$ Noise Levels At Residences – dBA

Scenario	Criteria Day / Evening / Night (dBA)	Receiver				
		1	2	3	4	5
Local Water Centre 1 without Specific Noise Mitigation	41 / 41 / 41	20	24	39	39	43
Local Water Centre 1 with Specific Noise Mitigation	41 / 41/ 41	17	19	27	25	29
Local Water Centre 1 & 2 with Specific Noise Mitigation	41 / 41 / 41	21	22	33	31	33

The first line of the table indicates that without the specified noise mitigation, compliance will not be achieved at receiver 5.

The second line of the table indicates that without any mitigation applied, noise from the plant is predicted to exceed the 41 dBA goal at location 5.

As indicated in the final two lines of the table, when all plant are operating, excluding back-up generator, the predicted noise levels comply with the limiting 41 dBA night time noise criterion at the nearest existing residential receivers and new residential receivers. Therefore, no further acoustic consideration is required.

Noise contours for the mitigated case are shown in Appendix A.

6.5 Noise Emission Levels – With Back-Up Generator

The generator will be surrounded by a block wall up to 1m above the height of the generator.

The predicted noise levels when the back-up generator is in operation are presented in Table 6-5.

Note that as the back-up generator does not usually operate and will be tested during daytime hours either once per month for 30 minutes, or once every 2 months for 1 hour, a positive adjustment of 5dB will apply to the daytime project specific criteria of 41 dBA.

Table 6-5 Predicted $L_{Aeq,15min}$ Noise Levels At Residences (Existing & Future) With Back-Up Generator – dBA

Scenario	Criteria Daytime	Receiver				
		1	2	3	4	5
Operation with Backup Generator	46	30	34	34	40	39

A review of the predicted noise levels from all noise sources with the back-up generator in Table 6-5 indicates compliance with the adjusted daytime acceptable noise level of 46 dBA at the

nearest existing residential receivers and new residential receivers. Therefore, no further acoustic consideration is required.

Noise contours for the case of operation with the back-up generator are shown in Appendix B.

6.6 Tonality of Noise

There is some potential that the noise may be tonal in character. According to the *INP*, a modification factor of 5 dBA should be added to account for the higher intrusiveness of the noise in such circumstances. Should a 5 dBA modification factor be applicable, noise emission from site could exceed the night time criterion of 41 dBA at the nearest new residential receivers. It is therefore recommended that equipment with tonal characteristic are to be avoided at the procurement stage.

7 CONCLUSION

Operational noise associated with the proposed Box Hill North LWC has been assessed against noise criteria set out in the EPA's *Industrial Noise Policy*.

Preliminary calculations showed that the predicted noise level from the LWC would exceed the noise criteria at the nearest receivers. Therefore mitigation measures have been recommended.

With appropriate mitigation the predicted noise levels from the plant comply with all criteria on all occasions at the nearest existing and future residential receivers given that the following recommended treatment is implemented:

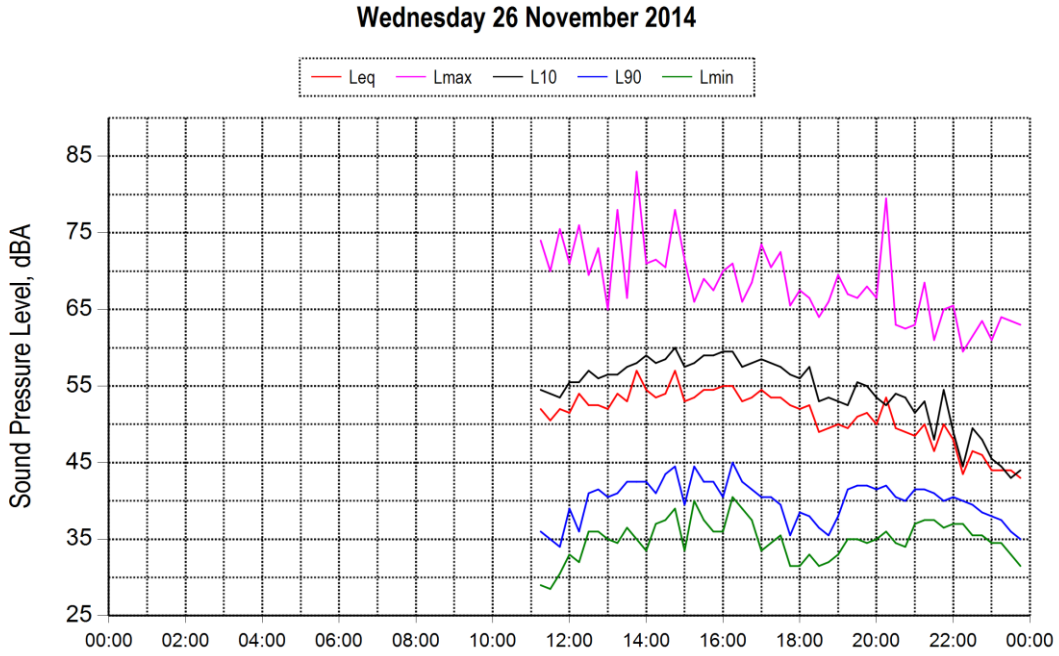
- Specific Noise Mitigation (1) – lining of Colorbond on the internal face of the plant room with appropriate air gap to accommodate minimum 50mm thick polyester or glasswool insulation of density 14kg/m^3.
- Specific Noise Mitigation (2) – The internal walls of the pump house should be lined with minimum 50mm thick polyester or glasswool insulation of density 30kg/m3.

Noise from the back-up generator is screened block wall 1m higher than the generator itself. Predicted noise levels from the back-up generator comply with the adjusted acceptable daytime noise level on all occasions at the nearest existing and future residential receivers.

Should the existing residential receivers 3 and 4 be occupied, when it comes time to empty the interim tanks, a 2.1m high temporary movable screen should be used to shield these receivers from the pump of the tankers.

APPENDIX A

NOISE MEASUREMENT RESULTS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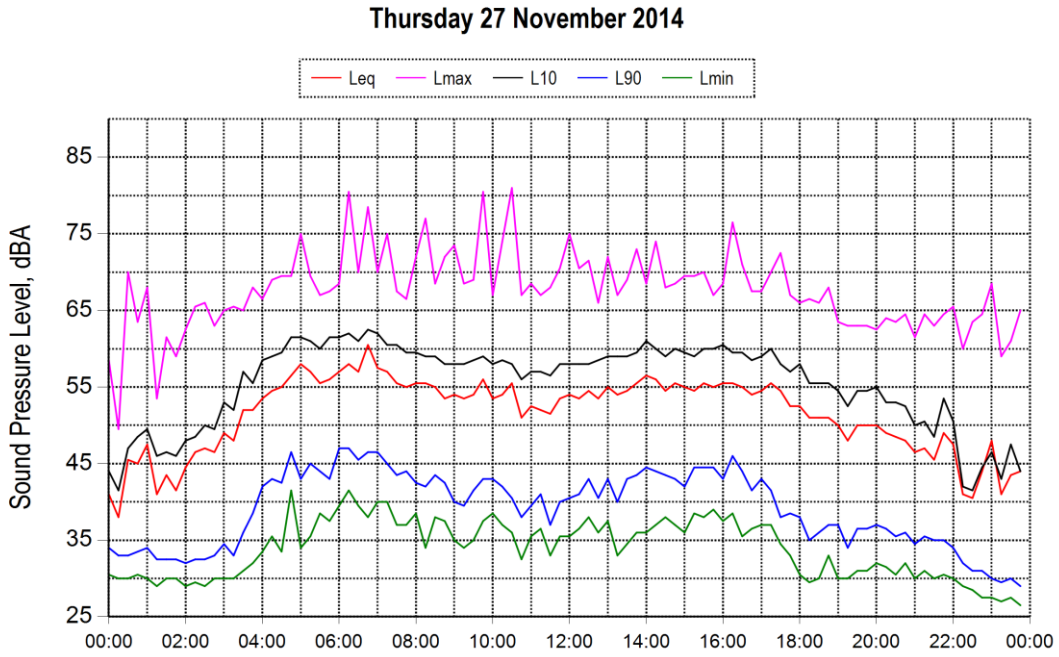
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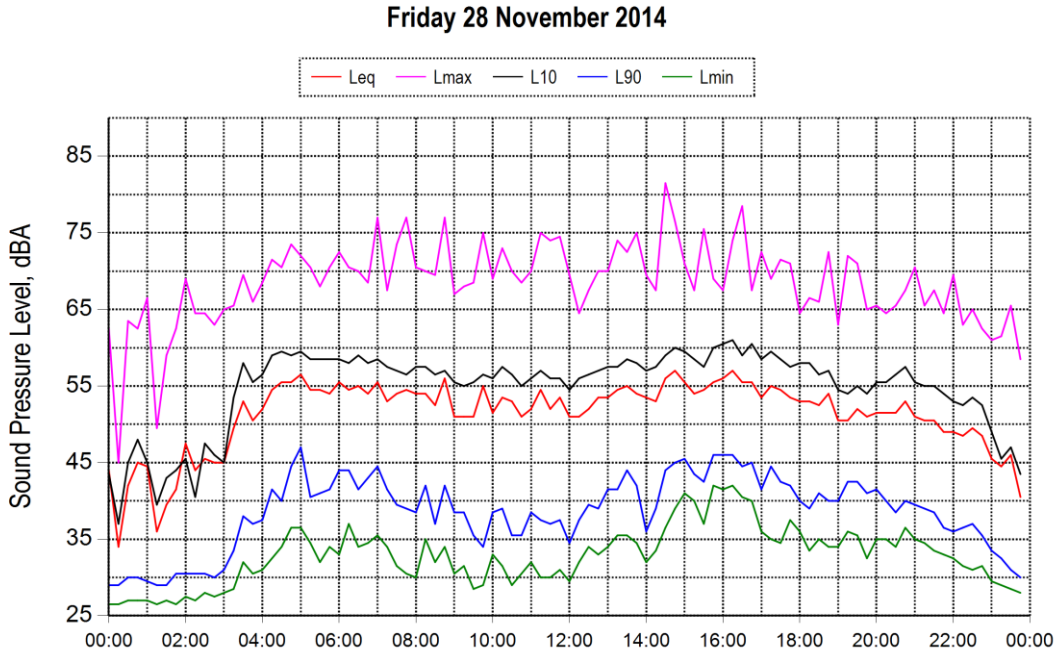
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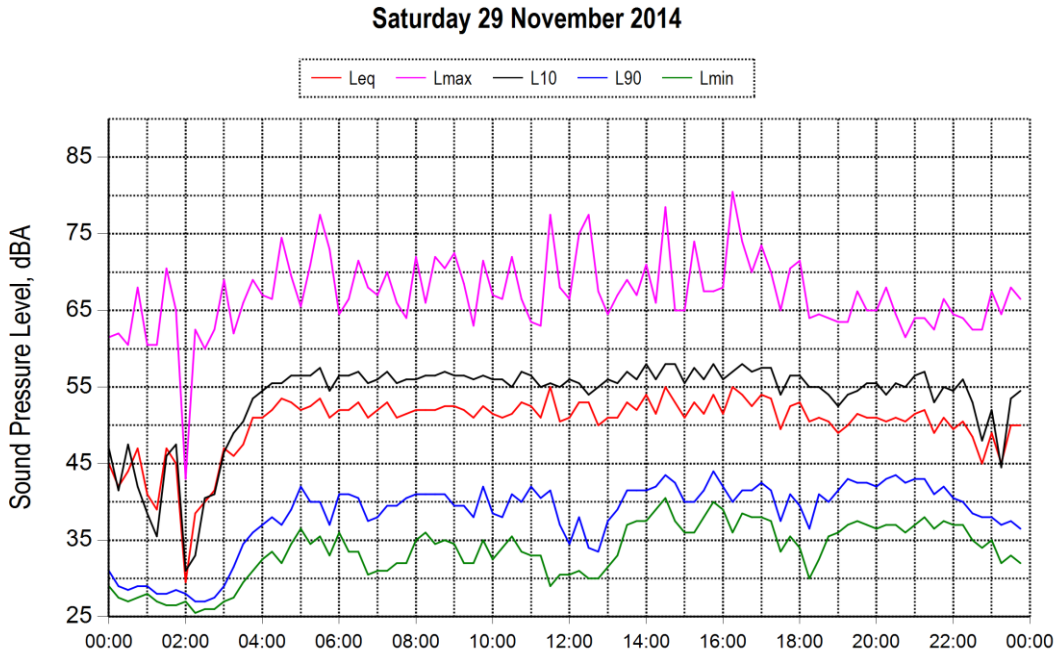
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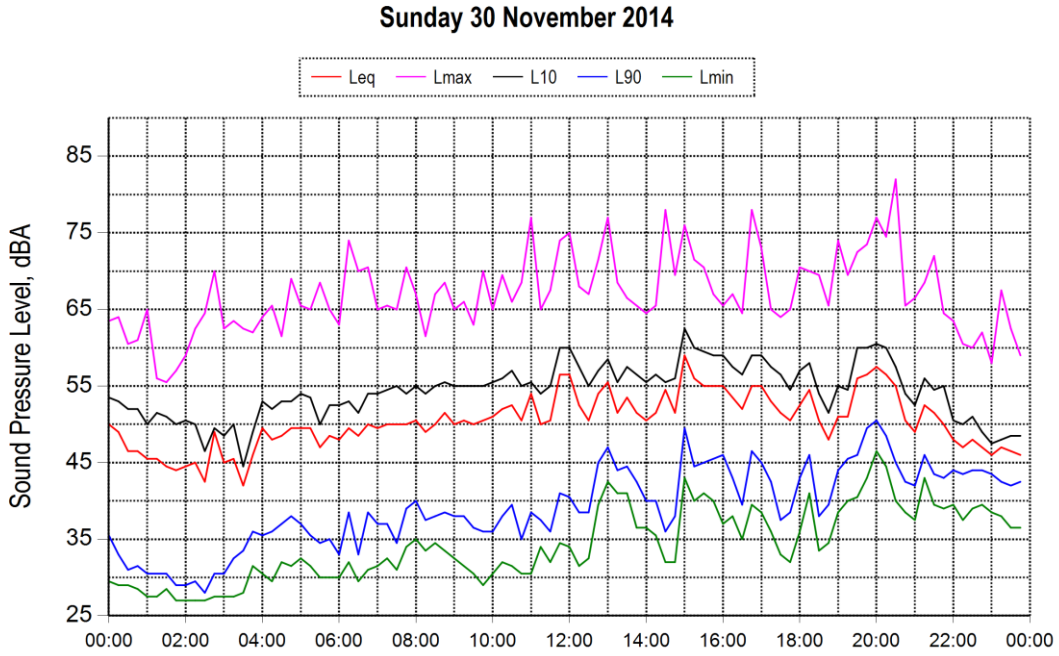
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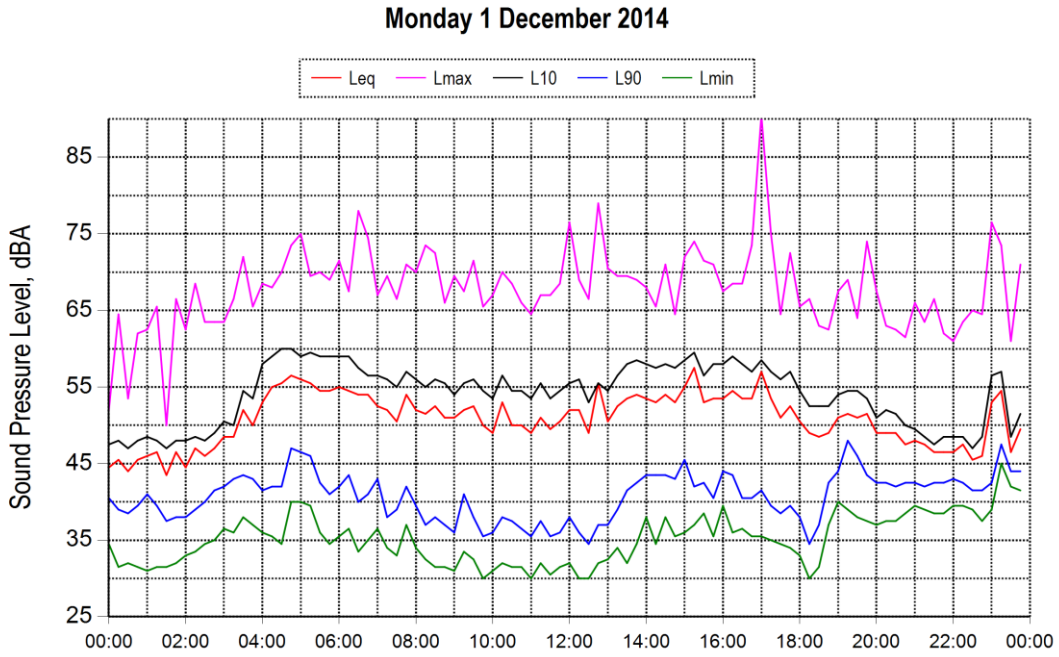
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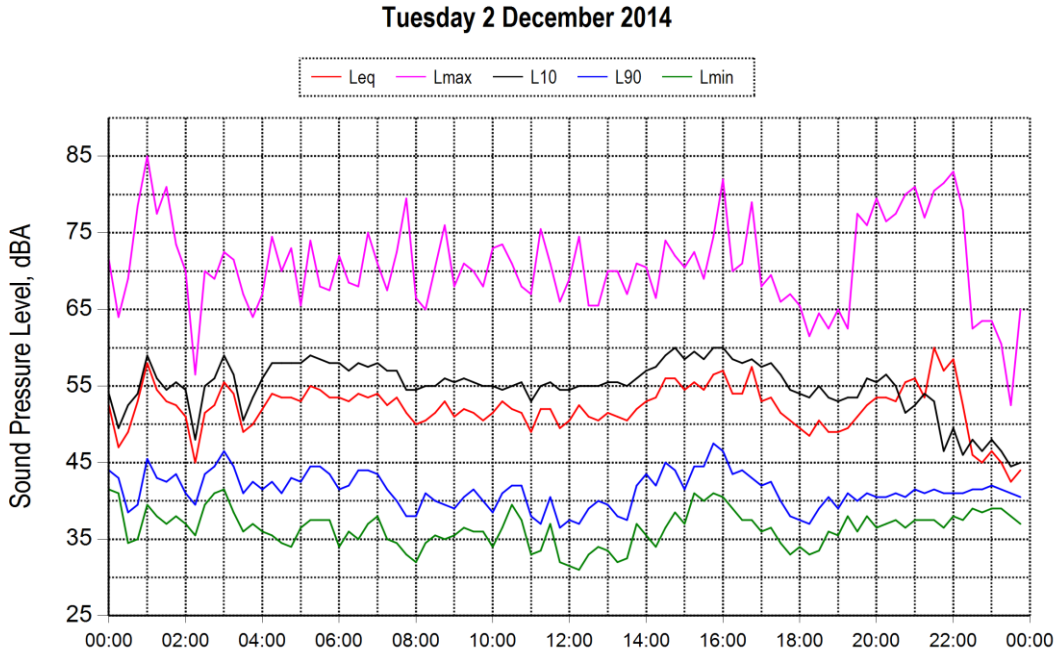
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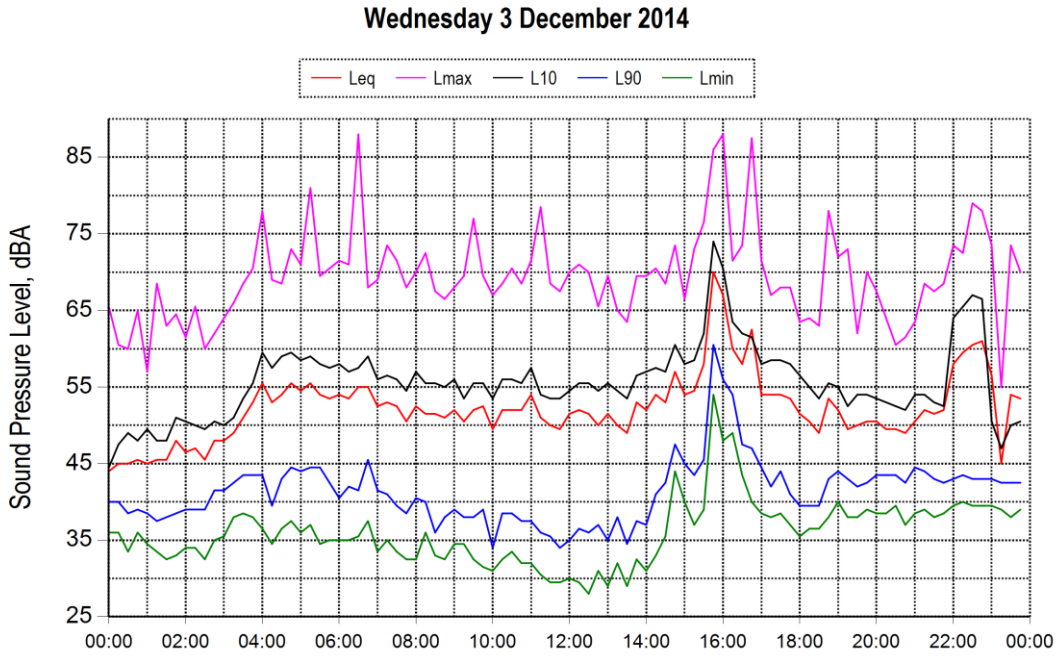
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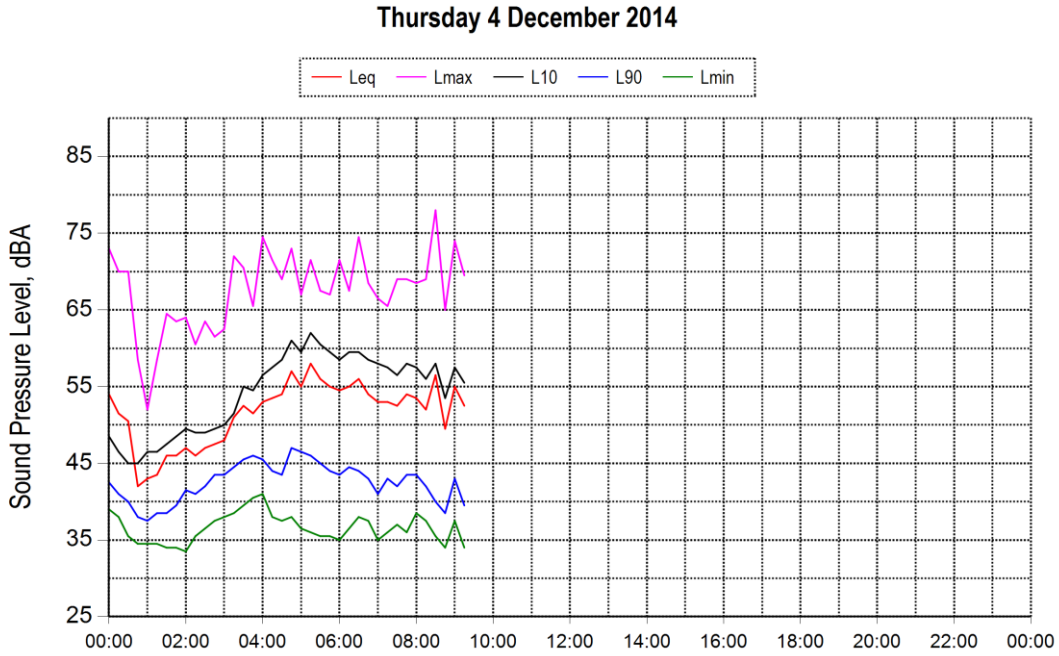
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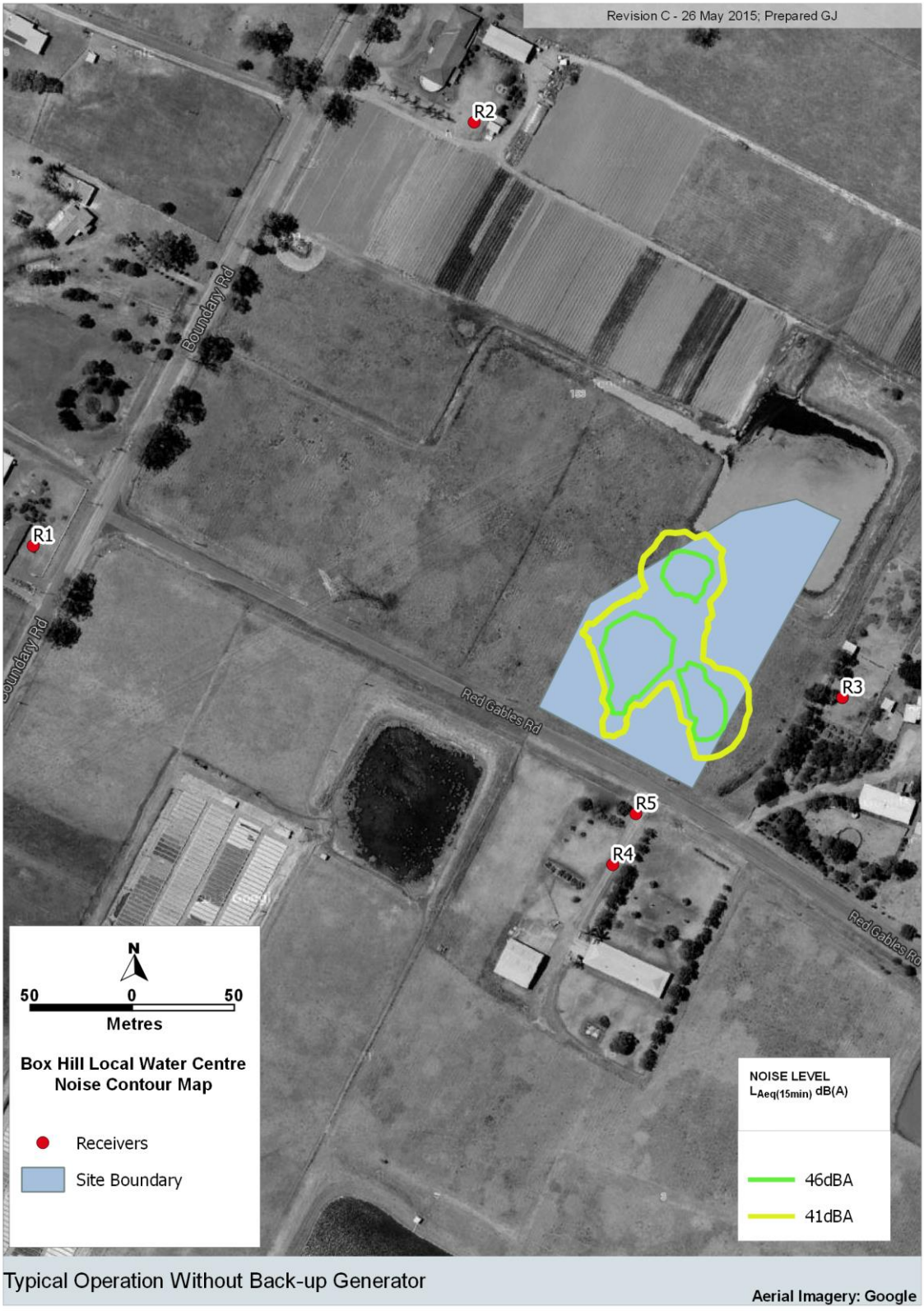
APPENDIX B

OPERATIONAL NOISE CONTOUR


Revision C - 26 May 2015; Prepared GJ
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R2
R3
R4
R5
Boundary Rd
Red Gables Rd
N
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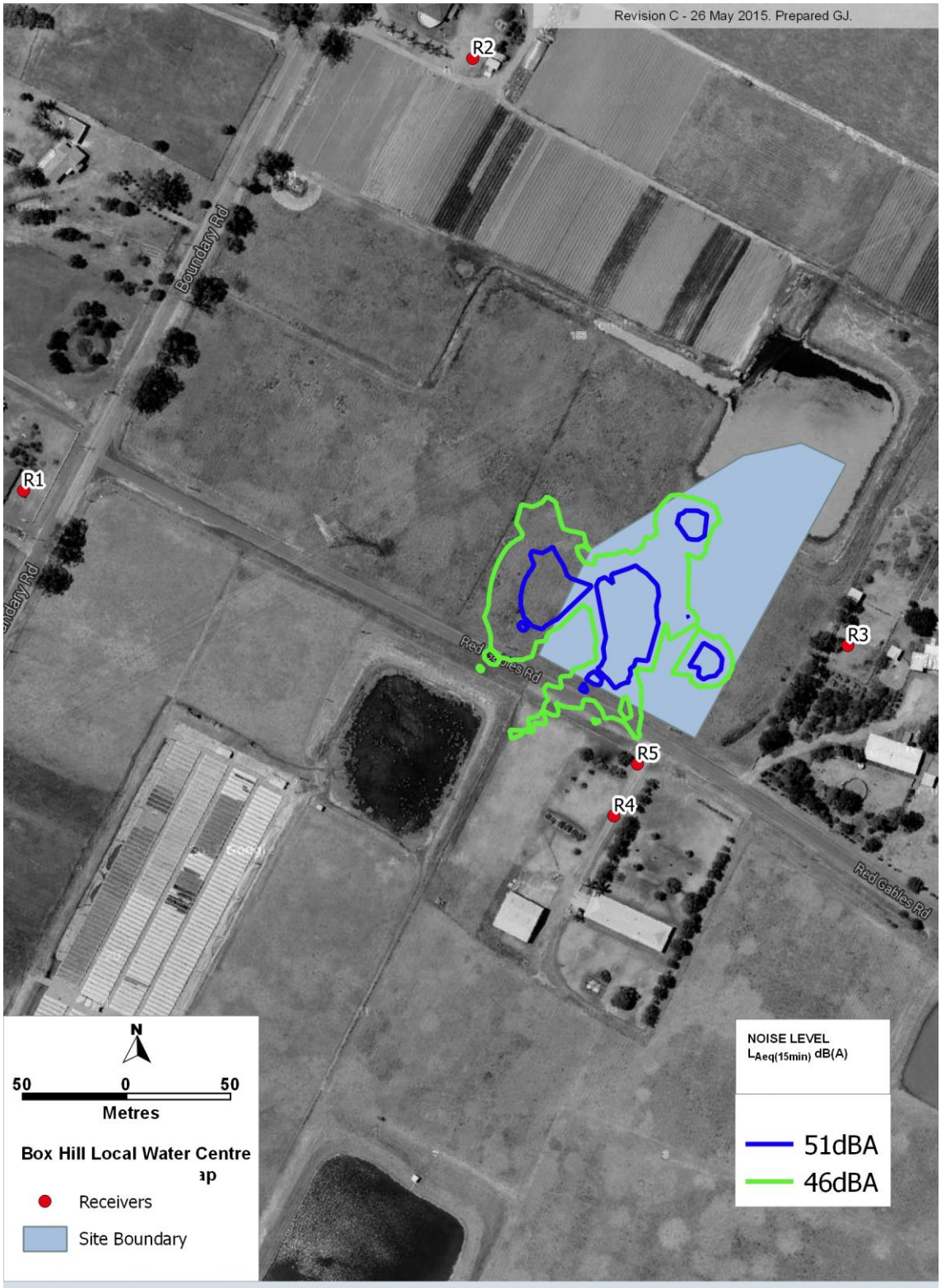
0
50
Metres
Box Hill Local Water Centre
Noise Contour Map
Receivers
Site Boundary
NOISE LEVEL
LAeq(15min) dB(A)
46dBA
41dBA
Typical Operation Without Back-up Generator
Aerial Imagery: Google

APPENDIX C

OPERATIONAL NOISE CONTOUR WITH BACK-UP GENERATOR



Typical Operation with Back-up Generator

Aerial Imagery: Google

Appendix 5

Odour Impact Assessment

Pacific Environment Limited

Consulting • Technologies • Monitoring • Toxicology

Report

Box Hill North Local Water Centre

RPS Australia & Asia Pacific

Job ID. 09464

26 May 2015

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JOB ID:	09464
DOCUMENT CONTROL NUMBER	AQU-NW-006-09464
PREPARED FOR:	RPS Australia & Asia Pacific
APPROVED FOR RELEASE BY:	J. Barnett
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DOCUMENT CONTROL			
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Fax: +61 2 9870 0999

CONTENTS

LIST OF FIGURES

1 INTRODUCTION

This report has been prepared by Pacific Environment for RPS Australia Asia Pacific (RPS) for the Box Hill North Residential Precinct. Flow Systems Operations trading as Box Hill North Water, a wholly-owned subsidiary of Flow Systems, is being considered by the developer as the private water utility for the Box Hill North development. Box Hill North Water will construct, operate and maintain a water recycling facility known as the Local Water Centre (LWC) and will provide all properties within the development with drinking water, sewerage and recycled non-potable water.

The study seeks to determine the odour concentrations at nearby sensitive receptors using atmospheric dispersion modelling. Odour sampling data for the Membrane, Aerobic and Anoxic chambers was collected at an existing Flow Systems water recycling facility located at Pitt Town. These data are used as inputs into the Box Hill North plant model. The flow balance tank (FBT) odour control unit (OCU) proposed for Box Hill North is different to that operating at Pitt Town and as such, the measurements at the Pitt Town FBT OCU have not been used for Box Hill North.

Modelling has been completed using the US-EPA regulatory AERMOD model, approved for use in NSW.

The report comprises the following components:

- A description of the project,
- A discussion of air quality issues with respect to odour,
- A review of the dispersion meteorology in the area, and
- An assessment of potential odour impacts for four operational scenarios.

2 PROJECT DESCRIPTION

The project site (shown on **Figure 2.1**), is part of a proposed residential sub-division located on the urban fringe of The Hills Shire Council, approximately 48 km northwest of Sydney central business district (CBD).

Provision of infrastructure, namely the LWC, will allow subdivision of lands within an area being developed as Box Hill North. The land is undergoing rezoning for residential development.

The intended LWC will utilise sewage from the future residential area to produce high quality recycled water. The sewage will be treated at the LWC through a multi-stage process of screening, anaerobic and aerobic processing, chemical treatment, membrane filtration, ultraviolet disinfection and chlorination. The recycled water will be plumbed into houses for non-potable uses such as toilet flushing, washing machines, irrigation and car washing, thus reducing potable water demand. The LWC is intended to operate 24 hours, 7 days per week, housed in a low-scale, single level building within an open space setting.

The intended hydraulic capacity of the LWC is approximately 3,000 kilolitres (kL) per day, servicing approximately 5,000 dwellings or equivalent, although it has been designed to achieve this benchmark over time in line with uptake in the residential area surrounding the development.

For the first lots in the precinct, interim sewage servicing tanks (ISSTs) will receive raw sewage to be collected by tankers at regular intervals. An interim odour control unit associated with these tanks will operate during this initial period.

An indicative site layout plan is shown in **Figure 2.2**. The potential sources of odour are from the screens (enclosed) used to remove inorganic material prior to treatment of the liquid flow, as well as emissions from the individual odour scrubbers attached to both the FBTs and ISSTs vented via a stack. These sources and the measured data used for this assessment are discussed in **Section 5**.

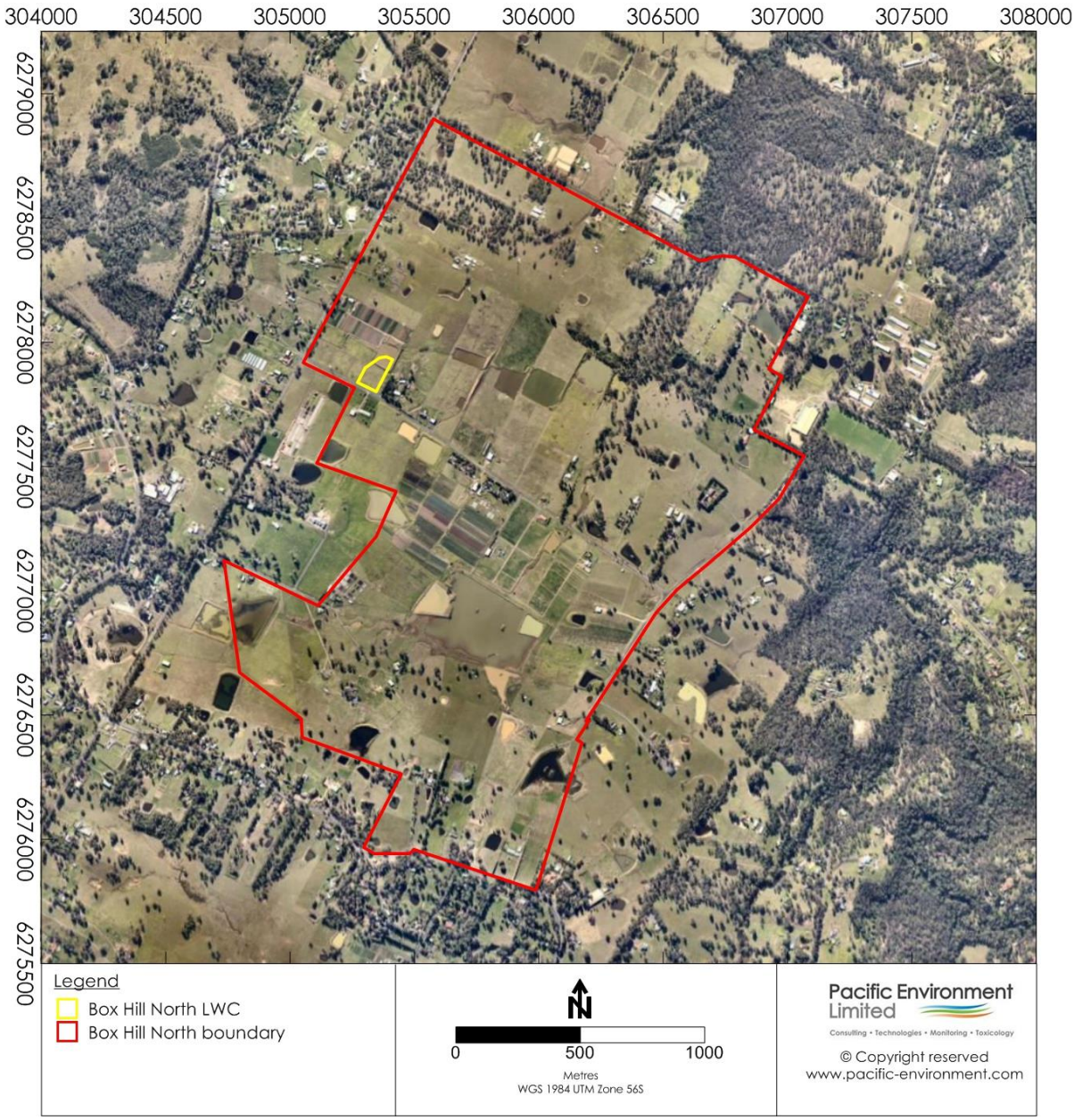


Figure 2.1: Proposed project site location

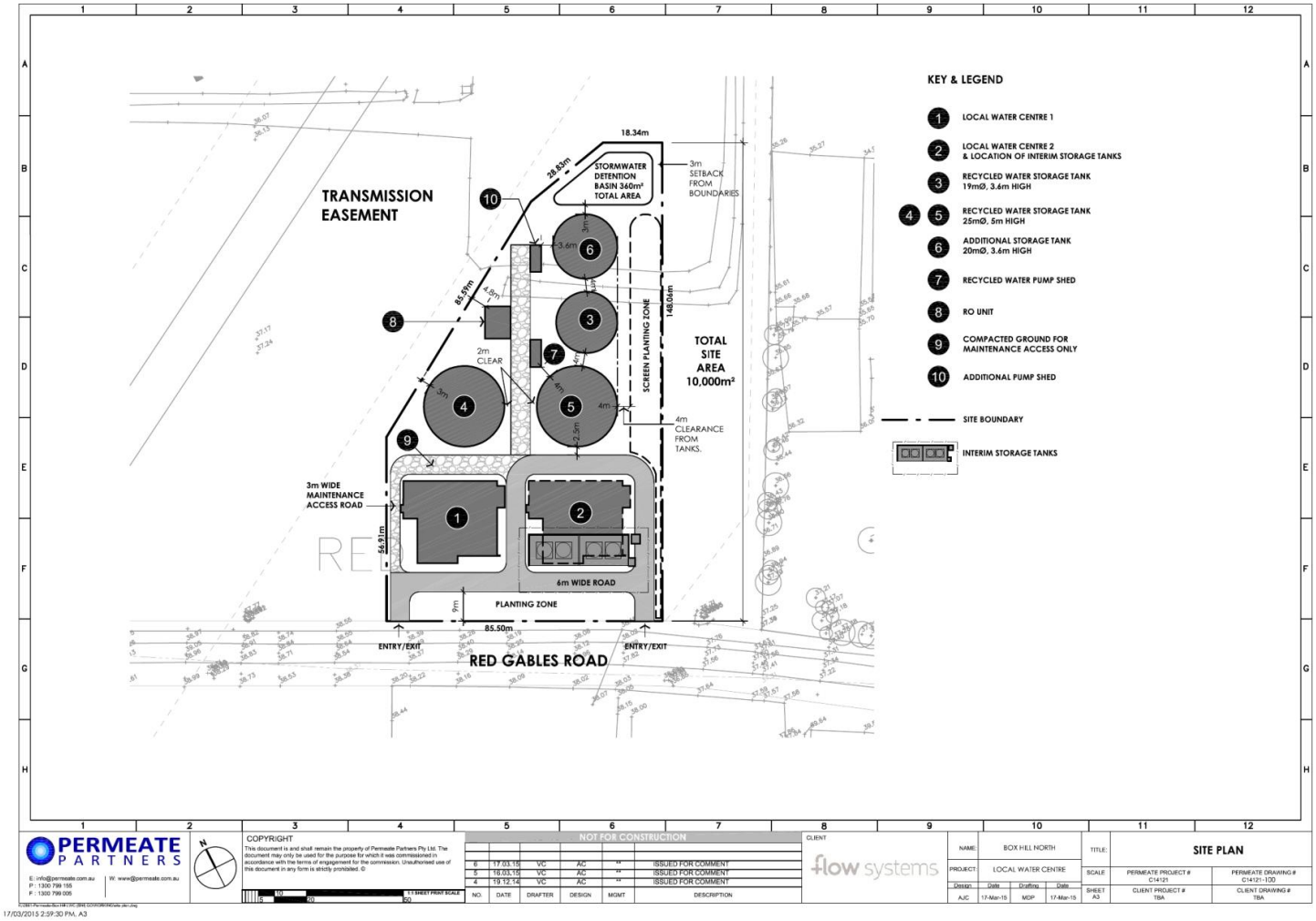


Figure 2.2: Indicative Plant Layout

3 DISCUSSION OF AIR QUALITY ISSUES

3.1 Odour Performance Criteria

3.1.1 Introduction

The determination of air quality goals for odour and their use in the assessment of odour impacts is recognised as a difficult topic in air pollution science. The topic has received considerable attention in recent years and the procedures for assessing odour impacts using dispersion models have been refined considerably. There is still considerable debate in the scientific community about appropriate odour goals as determined by dispersion modelling.

The NSW Environment Protection Authority (NSW EPA) has developed odour goals and the way in which they should be applied with dispersion models to assess the likelihood of nuisance impact arising from the emission of odour.

There are two factors that need to be considered:

1. What "level of exposure" to odour is considered acceptable to meet current community standards in NSW and
2. How can dispersion models be used to determine if a source of odour meets the goals which are based on this acceptable level of exposure

The term "level of exposure" has been used to reflect the fact that odour impacts are determined by several factors the most important of which are (the so-called **FIDOL** factors):

- the **F**requency of the exposure
- the **I**ntensity of the odour
- the **D**uration of the odour episodes
- the **O**ffensiveness of the odour
- the **L**ocation of the source

In determining the offensiveness of an odour it needs to be recognised that for most odours the context in which an odour is perceived is also relevant. Some odours, for example the smell of sewage, hydrogen sulfide, butyric acid, landfill gas etc., are likely to be judged offensive regardless of the context in which they occur. Other odours such as the smell of jet fuel may be acceptable at an airport, but not in a house, and diesel exhaust may be acceptable near a busy road, but not in a restaurant.

In summary, whether or not an individual considers an odour to be a nuisance will depend on the FIDOL factors outlined above and although it is possible to derive formulae for assessing odour annoyance in a community, the response of any individual to an odour is still unpredictable. Odour goals need to take account of these factors.

3.1.2 Complex Mixture of Odorous Air Pollutants

The Approved Methods and Guidance for the Modelling and Assessment of Air Pollutants in NSW (**EPA, 2005**) include ground-level concentration (glc) criterion for complex mixtures of odorous air pollutants. They have been refined by the NSW EPA to take account of population density in the area. **Table 3.1** lists the odour glc criterion to be exceeded not more than 1% of the time, for different population densities.

The difference between odour goals is based on considerations of risk of odour impact rather than differences in odour acceptability between urban and rural areas. For a given odour level there will be a wide range of responses in the population exposed to the odour. In a densely populated area there will therefore be a greater risk that some individuals within the community will find the odour unacceptable than in a sparsely populated area.

The most stringent of the impact assessment criterion of 2 ou (at the 99th percentile; **EPA, 2005**) has been applied for this assessment.

Table 3.1: Odour Performance Criteria for the Assessment of Odour

Population of affected community	Criteria for complex mixtures of odour (OU)
≤ ~2	7
~10	6
~30	5
~125	4
~500	3
Urban (>2000) and/or schools and hospitals	2

3.2 Peak-to-mean ratios

It is common practice to use dispersion models to determine compliance with odour goals. This introduces a complication because Gaussian dispersion models directly predict concentrations over an averaging period of 3-minutes or greater. The human nose, however, responds to odours over periods of the order of a second or so. During a 3-minute period, odour levels can fluctuate significantly above and below the mean depending on the nature of the source.

To determine more rigorously the ratio between the one-second peak concentrations and 3-minute and longer period average concentrations (referred to as the peak-to-mean ratio) that might be predicted by a Gaussian dispersion model, the EPA commissioned a study by **Katestone Scientific Pty Ltd (1995, 1998)**. This study recommended peak-to-mean ratios for a range of variables, such as source type, receptor distance, stability class and stack height (for point sources).

It is important to note that those peak-to-mean factors determined are based on the Pasquill-Gifford stability classes. Since AERMOD replaces the Pasquill-Gifford stability based dispersion with a turbulence-based approach that uses the Monin-Obukhov length scale to account for the effects of atmospheric turbulence based dispersion, a conservative approach has been taken for area sources and a value of 2.5 has been applied. A value of 2.3 has been applied for wake-affected point and volume sources. A summary of the factors is provided in **Appendix A**.

The Approved Methods take account of this peaking factor and the goals shown in **Table 3.1** are based on nose-response time.

4 LOCAL METEOROLOGY

This section described the dispersion meteorology in the study area. Information on prevailing wind patterns, atmospheric stability and climatic conditions are presented.

4.1 Wind speed and direction

Meteorological data are collected by the Bureau of Meteorology from Richmond RAAF, NSW, approximately 11 km northwest of the site. Wind roses of the data collected from Richmond RAAF are shown in **Figure 4.1**. The wind roses show that on an annual basis winds are predominantly from the southwest and northeast quadrants. Winds from these quadrants are also dominant in autumn with very few winds from the other quadrants. The annual wind speed was 3.3 m/s and the annual percentage of calms, wind speed < 0.5 m/s, was 7.2%.

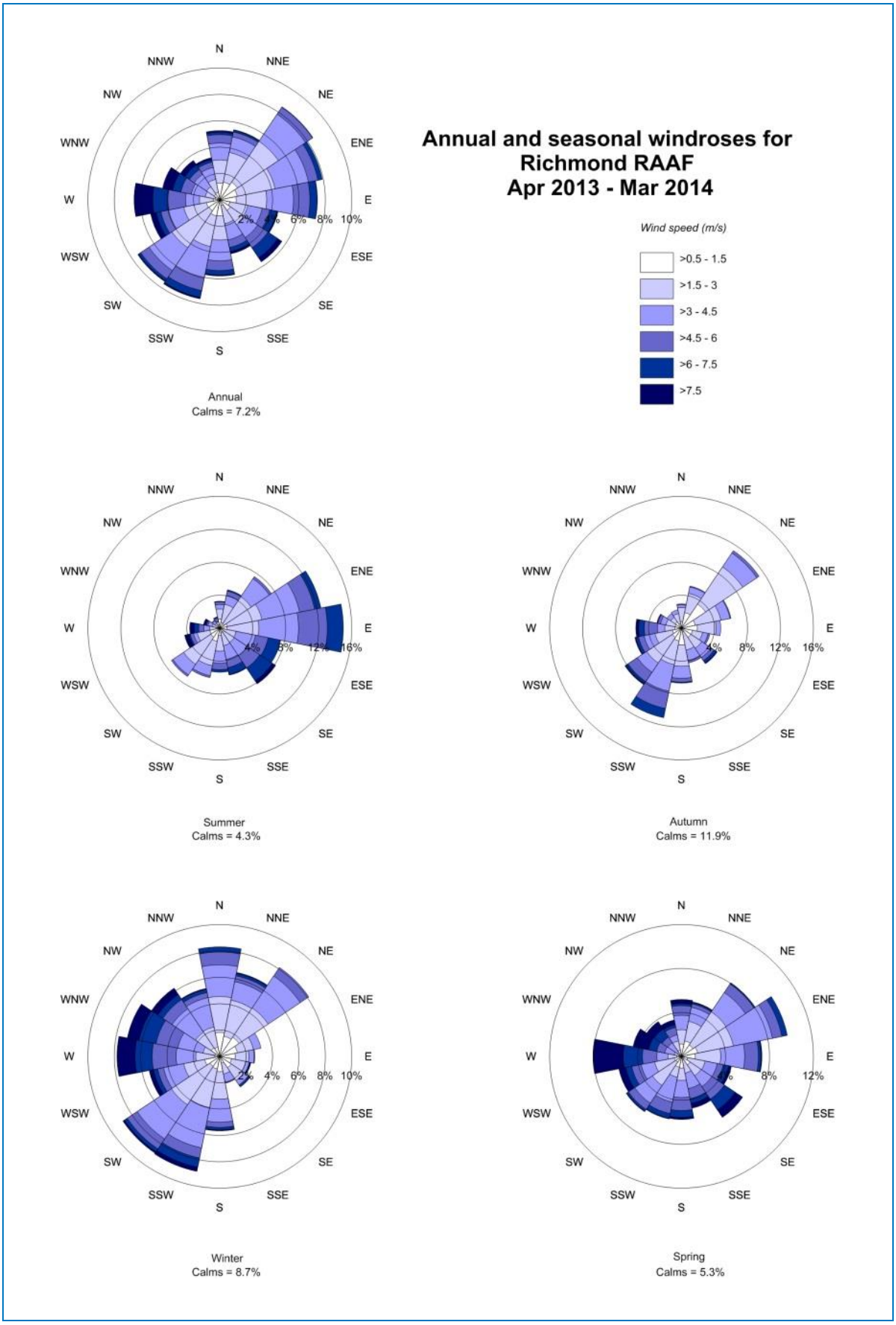


Figure 4.1: Annual and Seasonal wind roses for Richmond RAAF BoM Station

4.2 Local Climatic Conditions

Table 4.1 presents the temperature, humidity and rainfall data for the closest Bureau of Meteorology (BoM) site which is located at Richmond RAAF (Site number 067105), approximately 11 km northwest of the site. Humidity data consist of monthly averages of 9 am and 3 pm readings. Also presented are monthly averages of maximum and minimum temperatures. Rainfall data consist of mean monthly rainfall and the average number of rain days per month.

The annual average maximum and minimum temperatures recorded at the Richmond RAAF station are 24.1°C and 11.0 °C, respectively. On average, January is the hottest month, with an average maximum temperature of 30.0°C. July is the coldest month, with average minimum temperature of 3.6°C. The annual average relative humidity reading collected at 9am from the Peats Ridge station is 73% and at 3pm the annual average is 47%. The month with the highest relative humidity on average June with 9am averages of 83% and the months with the lowest relative humidity is September and October with 3pm averages of 39%.

Rainfall data collected at the Richmond RAAF station shows that February is the wettest month, with an average rainfall of 123 mm over an average of 12 rain days. The average annual rainfall is 716 mm with an average of 118 rain days per year.

Table 4.1: Climate Averages for the Richmond RAAF

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am Mean Dry-bulb and Wet-bulb Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	22.1	21.3	19.1	17.0	13.1	10.0	8.9	11.4	15.4	18.3	19.2	20.9	16.4
Humidity	72	78	80	76	82	83	80	69	63	58	68	68	73
3pm Mean Dry-bulb and Wet-bulb Temperatures (°C) and Relative Humidity (%)													
Dry-bulb	28.5	27.4	25.8	23.0	19.7	17.0	16.5	18.7	21.5	23.5	25.2	27.5	22.9
Humidity	47	52	52	49	53	53	48	39	39	40	46	44	47
Daily Maximum Temperature (°C)													
Mean	30.0	29.0	26.8	23.9	20.7	17.9	17.6	19.8	22.9	25.1	26.7	28.5	24.1
Daily Minimum Temperature (°C)													
Mean	17.6	17.7	15.6	11.5	7.5	5.1	3.6	4.4	8.0	10.9	14.1	15.9	11.0
Rainfall (mm)													
Mean	76	123	76	49	49	48	29	33	47	50	83	60	716
Rain days (Number)													
Mean	11	12	11	10	10	10	8	6	7	9	12	11	118

Source: BOM (2014) Climate averages for Station: 067105; Commenced: 1993 – last record 2014; Latitude: 33.60°S; Longitude: 150.24 °E

5 ODOUR EMISSIONS

To characterise the potential odour impacts of the proposed development, odour sampling was completed at a similar facility in Pitt Town, NSW (**Pacific Environment 2013**, **Pacific Environment 2014**). The purpose of the monitoring was to characterise the odour from the existing facility and use the data to derive odour emission rates (OERs) for use in odour impact assessments for future proposed facilities.

5.1 Monitoring Methodology

Odour samples from each chamber were taken using an isolation flux hood (in accordance with AS/NZS 4323.4:2009 "Area source sampling – Flux chamber technique" and the method described in the US EPA technical report "EPA/60068-86/008"). The IFH was floated on the surface of each chamber and odour-free nitrogen was forced into the hood via odour free Teflon tubing until it has reached equilibrium. The nitrogen flow (5 L/min) purges the flux hood with a residence time of 4 times the chamber volume occurring before sampling begins (24 minutes). The odorous sample is then drawn at a sample rate of approximately 3 L/min over a period of 30 minutes into a single use, odour-free Nalophan sample bag, secured inside a drum kept under vacuum using a pump.

The odour samples were collected on the morning of 20 November 2014 as part of the most recent odour monitoring campaign:

- 1 x sample taken at the MBR Membrane Chamber. The sample was drawn from the surface of the liquid inside the chamber.
- 1 x sample taken at the MBR Aerobic Chamber. The sample was drawn from the surface of the liquid inside the chamber.
- 1 x sample taken at the MBR Anoxic Chamber. The sample was drawn from the surface of the liquid inside the chamber.

Following collection, all odour samples were analysed within 30 hours at a NATA accredited laboratory using dynamic olfactometry [a] (in accordance with AS/NZS 4323.3:2001 "Determination of Odour Concentration by Dynamic Olfactometry" (**AS/NZS, 2001**).

The results of the odour monitoring are presented as odour concentrations measured in odour units (OU) in **Table 5.2**. The laboratory report from the odour monitoring in is presented in **Appendix B**.

[a] There are no instrument-based methods that can measure an odour response in the same way as the human nose and "dynamic olfactometry" is therefore the preferred method for odour analysis. Dynamic olfactometry is the measurement of odour by presenting a sample of odorous air to a panel of people with decreasing quantities of clean odour-free air. The panellists then note when the smell becomes detectable. The correlations between the known dilution ratios and the panellists' responses are then used to calculate the number of dilutions of the original sample required to achieve the odour detection threshold. The units for odour measurement using dynamic olfactometry are "odour units" (OU) which are dimensionless and are effectively "dilutions to threshold".

Table 5.1: Odour Monitoring Results

Sample	Sample Date	Sample Time	Odour Concentration (OU)	Specific Odour Emission Rate (OU.m³/s/m²)[b]
1 – MBR Tank – Membrane Chamber	20/11/2014	13:51	197	0.068
2 – MBR Tank – Aerobic Chamber	20/11/2014	11:37	362	0.119
3 – MBR Tank –Anoxic Chamber	20/11/2014	11:35	431	0.142

5.2 Odour Control Unit

Flow Systems propose to install an odour control system at Box Hill North similar to that installed at their, as yet non-operational, Wyee local water centre. The system includes both biological and activated carbon filtration to remove the majority of the odorous air from the flow balance tanks. The Operating and Maintenance Manual for the proposed Odour Control System (**OCR, 2014**) advises that between 90-98% of odours can be removed via biological treatment (FiltaOdor™), and then a further 99% via the activated carbon filter (FiltaCarb™).

This OCU proposed for Box Hill North is very different to the OCU currently operating at Pitt Town and so the measurements made at the Pitt Town OCU vent stack are not relevant for this study. In March 2013 and November 2014, odour samples were also taken from the head space in the Pitt Town FBT which would represent the odours prior to treatment and ventilation through the OCU stack. These samples were taken using the same flux-hood methodology as described in **Section 5.1** and listed in **Table 5.2**. Assuming that the untreated odour in the Pitt Town FBT will be similar to that at Box Hill North, the minimum biofilter efficiency of 90% control and a further 99% via the activated carbon filter was applied to these values to represent the resulting odour concentrations (shaded) which may be present in the vent stack.

Table 5.2: Odour sampling of the FBT headspace

Sample	Odour Concentration (OU)	90% control after biological filtration (OU)	Further 99% control after activated carbon filtration (OU)
FBT headspace March 2013	77,900	779	78
FBT headspace November 2014	114,000	1,140	114

In 2011, Sydney Water published standard specifications for manufacturers and installers of odour control units (**Sydney Water, 2011**). It is required that reliable and effective odour removal is provided, to a level of the minimum requirements outlined in that document. One such requirement is that the odour concentrations at the exit of the vent stack be no more than 500 OU, which is only slightly higher than the 446 OU level measured at the Pitt Town OCU stack in March 2013, and significantly higher than the values in **Table 5.2**, calculated by applying the combined control efficiencies likely to be achieved using the biological and activated carbon filtration system proposed for Box Hill North. Applying the minimum Sydney Water requirement of 500 OU at the vent stack is therefore conservative and has been used for this modelling study.

[b] Specific odour emission rate (SOER) is calculated from the sweep gas flow rate and area of flux hood. That is: SOER = odour concentration (ou) x sweep gas flow rate (Nm^3/s) x area (m^2). The SOER is only used when the source is represented as an area source. For the point source (FBT OCU vent), the measured odour concentration is multiplied by the volumetric flow rate to determine an estimated emission rate.

6 APPROACH TO ASSESSMENT

The overall approach to the assessment follows the Approved Methods using the Level 2 assessment methodology. The Approved Methods specify how assessments based on the use of air dispersion models should be completed. They include guidelines for the preparation of meteorological data to be used in dispersion models and the relevant air quality criteria for assessing the significance of predicted concentration and deposition rates from the project. The approach taken in this assessment follows as closely as possible the approaches suggested by the guidelines.

6.1 Dispersion model

The air dispersion modelling conducted for this assessment is based on an advanced modelling system using the AERMET/AERMOD model. AERMOD was chosen as the most suitable model due to the source types, location of nearest receptors and nature of local topography. AERMOD is the US-EPA's recommended steady-state plume dispersion model for regulatory purposes. AERMOD replaced the Industrial Source Complex (ISC) model for regulatory purposes in the US in December 2006 as it incorporates more recent, and potentially more accurate, algorithms to represent both meteorological interactions and air quality dispersion. AUSPLUME, a steady state Gaussian plume dispersion model developed by the Victorian EPA and frequently used in Australia for simple near-field applications is based on ISC, which has now been replaced by AERMOD.

A significant feature of AERMOD is the Pasquill-Gifford stability based dispersion is replaced with a turbulence-based approach that uses the Monin-Obukhov length scale to account for the effects of atmospheric turbulence based dispersion.

The AERMOD system includes AERMET, used for the preparation of meteorological input files and AERMAP, used for the preparation of terrain data. Terrain data were sourced from NASA's Shuttle Radar Topography Mission (SRTM) Data (3 arc-second (~90m) resolution) and processed within AERMAP to create the necessary input files.

AERMET requires surface and upper air meteorological data as inputs. Surface data were sourced from the BoM meteorological station at Richmond RAAF located approximately 11 km northwest of the project. Cloud cover data are required for AERMET and these were sourced from the Richmond RAAF station.

Appropriate values for three surface characteristics are required for AERMET as follows:

- Surface roughness, which is the height at which the mean horizontal wind speed approaches zero, based on a logarithmic profile.
- Albedo, which is an indicator of reflectivity of the surface.
- Bowen ratio, which is an indicator of surface moisture.

Values of surface roughness, bowen ratio and albedo were determined based on a review of aerial photography for a radius of 3 km centred on the Project site. Default values for cultivated land were chosen for a single sector sectors to represent the land use type in the surrounding area.

Building wake effects were included in the modelling simulations to represent the plant building on-site at a height of 3.5 m. The OCU stack was represented as a point source at 6.4 m above ground level.

6.1.1 Atmospheric Stability

An important aspect of pollutant dispersion is the level of turbulence in the lowest 1 km or so of the atmosphere, known as the planetary boundary layer (PBL). Turbulence controls how effectively a plume is diffused into the surrounding air and hence diluted. It acts by increasing the cross-sectional area of the plume due to random motions. With stronger turbulence, the rate of plume diffusion increases. Weak turbulence limits diffusion and contributes to high plume concentrations downwind of a source.

Turbulence is generated by both thermal and mechanical effects to varying degrees. Thermally driven turbulence occurs when the surface is being heated, in turn transferring heat to the air above by convection. Mechanical turbulence is caused by the frictional effects of wind moving over the earth's surface, and depends on the roughness of the surface as well as the flow characteristics.

Turbulence in the boundary layer is influenced by the vertical temperature gradient, which is one of several indicators of stability. Plume models use indicators of atmospheric stability in conjunction with other meteorological data to estimate the dispersion conditions in the atmosphere.

Stability can be described across a spectrum ranging from highly unstable through neutral to highly stable. A highly unstable boundary layer is characterised by strong surface heating and relatively light winds, leading to intense convective turbulence and enhanced plume diffusion. At the other extreme, very stable conditions are often associated with strong temperature inversions and light winds, which commonly occur under clear skies at night and in the early morning. Under these conditions plumes can remain relatively undiluted for considerable distances downwind. Neutral conditions are linked to windy and/or cloudy weather, and short periods around sunset and sunrise, when surface rates of heating or cooling are very low.

The stability of the atmosphere plays a large role in determining the dispersion of a plume and it is important to have it correctly represented in dispersion models. Current air quality dispersion models (such as AERMOD and CALPUFF) use the Monin-Obukhov Similarity Theory (MOST) to characterise turbulence and other processes in the PBL. One of the measures of the PBL is the Monin-Obukhov length (L), which approximates the height at which turbulence is generated equally by thermal and mechanical effects (**Seinfeld and Pandis 2006**). It is a measure of the relative importance of mechanical and thermal forcing on atmospheric turbulence. Because values of L diverge to + and - infinity as stability approaches neutral from the stable and unstable sides, respectively, it is often more convenient to use the inverse of L (i.e., 1/L) when describing stability.

Figure 6.1 shows the hourly averaged 1/L for the site computed from all data in the AERMET surface file. Based on **Table 6.1** this plot indicates that the PBL is stable overnight and becomes unstable as radiation from the sun heats the surface layer of the atmosphere and drives convection. The changes from positive to negative occur at the shifts between day and night. This indicates that the diurnal patterns of stability are realistic.

Table 6.1: Inverse of the Monin-Obukhov length L with respect to atmospheric stability

1/L	Atmospheric Stability
Negative	Unstable
Zero	Neutral
Positive	Stable

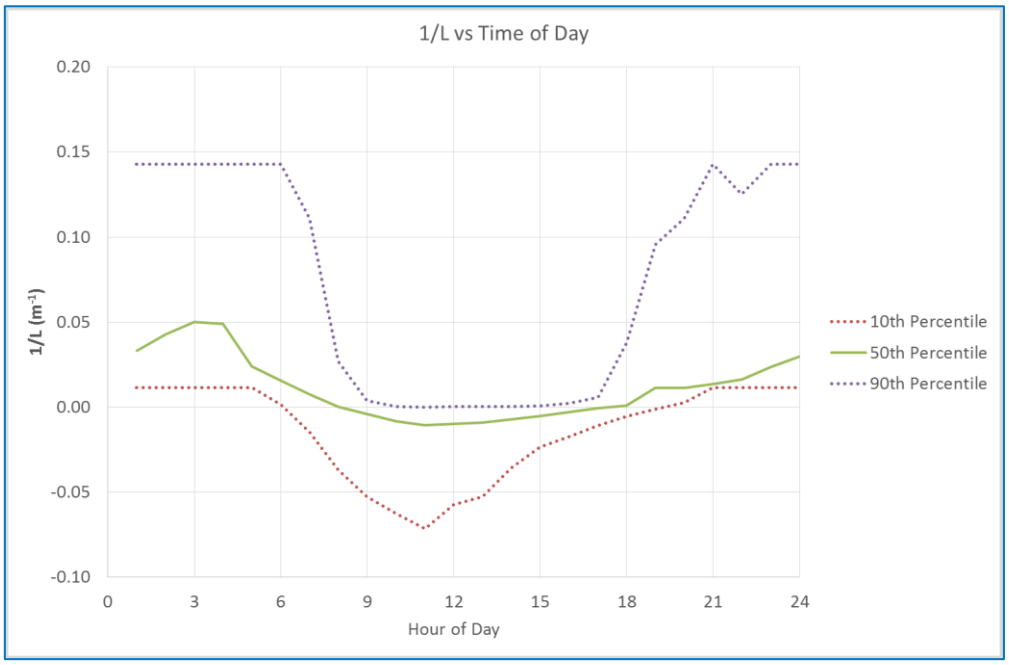


Figure 6.1: Annual statistics of 1/L by hour of the day

Figure 6.2 shows the variations in stability over the year by hour of the day, with reference to the widely known Pasquill-Gifford classes of stability. The relationship between L and stability classes is based on values derived by **Golder (1972)** set out in **EPA 2005**. Note that the reference to stability categories here is only for convenience in describing stability. The model uses calculated values of L across a continuum.

Figure 6.2 shows that neutral and very stable conditions occur for about 50% of the time, which is typical for inland locations that regularly experience temperature inversions at night. Atmospheric instability increases during the day and reaches a peak around noon as solar-driven convective energy peaks. A stable atmosphere is prevalent during the night. These profiles indicate that pollutant dispersion is most effective during the daytime and least effective at night.

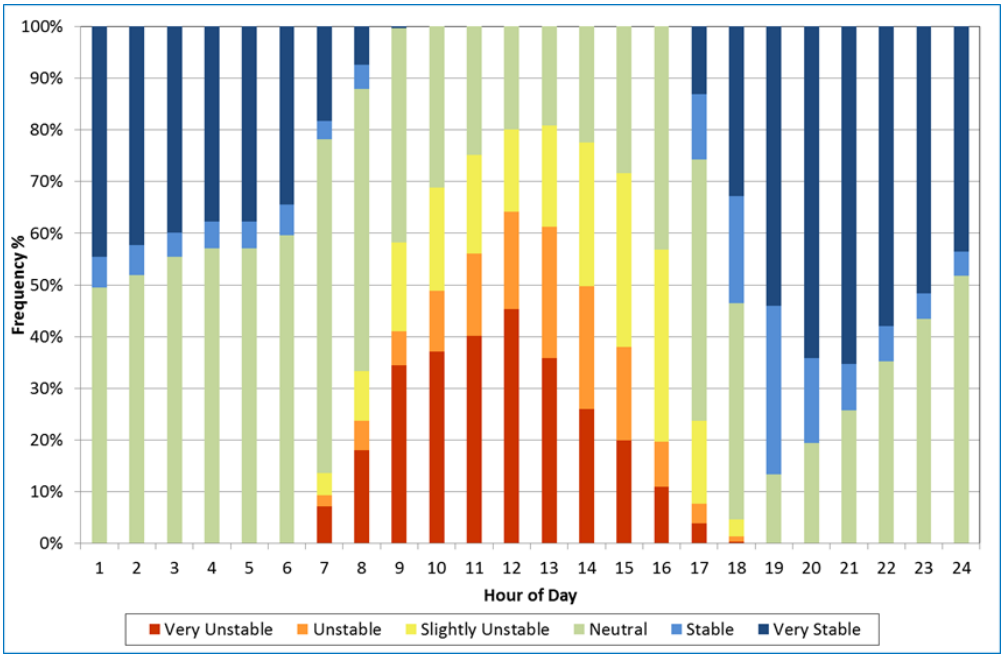


Figure 6.2: Annual distribution of stability type by hour of the day

6.2 Odour emission rates

Odour emission rates (OER) and other input parameters are shown in **Table 6.2** and **Table 6.3** for point and area sources, respectively. The OERs from the measured data and the OERs used in the modelling are both presented. The modelled OERs include a peak-to-mean of 2.3 for point sources, and a value of 2.5 for area sources, as described in **Section 3.2**.

Table 6.2: Modelling parameters used for point source (FBT OCU stack)

Model Parameter	Value
Stack location FBT OCU Vents	305,310 m, 6,277,835 m 305,349 m, 6,277,818 m
Release height	6.4 m
Temperature	27.75 °C
Stack diameter	0.3 m
Exit velocity	11.8 m/s
Flow rate	0.83 m^3/s
In-stack odour concentration	500 OU
Odour emission rate (OER)	416 $OU.m^3/s$
Peak to mean factor	2.3
OER incorporating peak to mean	958 $OU.m^3/s$

Table 6.3: Modelling parameters used for area sources

Source Name	Odour Concentration (OU)	SOER ($OU.m^3/s/m^2$)	Peak to mean factor	SOER used for modelling ($OU.m^3/s/m^2$)
Pre-anoxic Tank A	431	0.142	2.5	0.35
Pre-anoxic Tank B	431	0.142	2.5	0.35
Post-anoxic Tank A	431	0.142	2.5	0.35
Post-anoxic Tank B	431	0.142	2.5	0.35
Membrane Tank A	197	0.068	2.5	0.17
Membrane Tank B	197	0.068	2.5	0.17
Bioreactor A	362	0.119	2.5	0.30
Bioreactor B	362	0.119	2.5	0.30

For the purposes of presenting the results, all predicted odour levels at each receptor have been retained by the model and a contour plot has been prepared showing the distribution of the 99^{th} percentile 1-hour levels at ground-level. The 99^{th} percentile levels are plotted as the impact assessment criteria are set to ensure that the predicted odour level is not exceeded more than 1 percent of the year. Predicted odour levels are shown in **Section 7**.

7 ASSESSMENT OF IMPACTS

The odour impact at the site was assessed for two scenarios as follows:

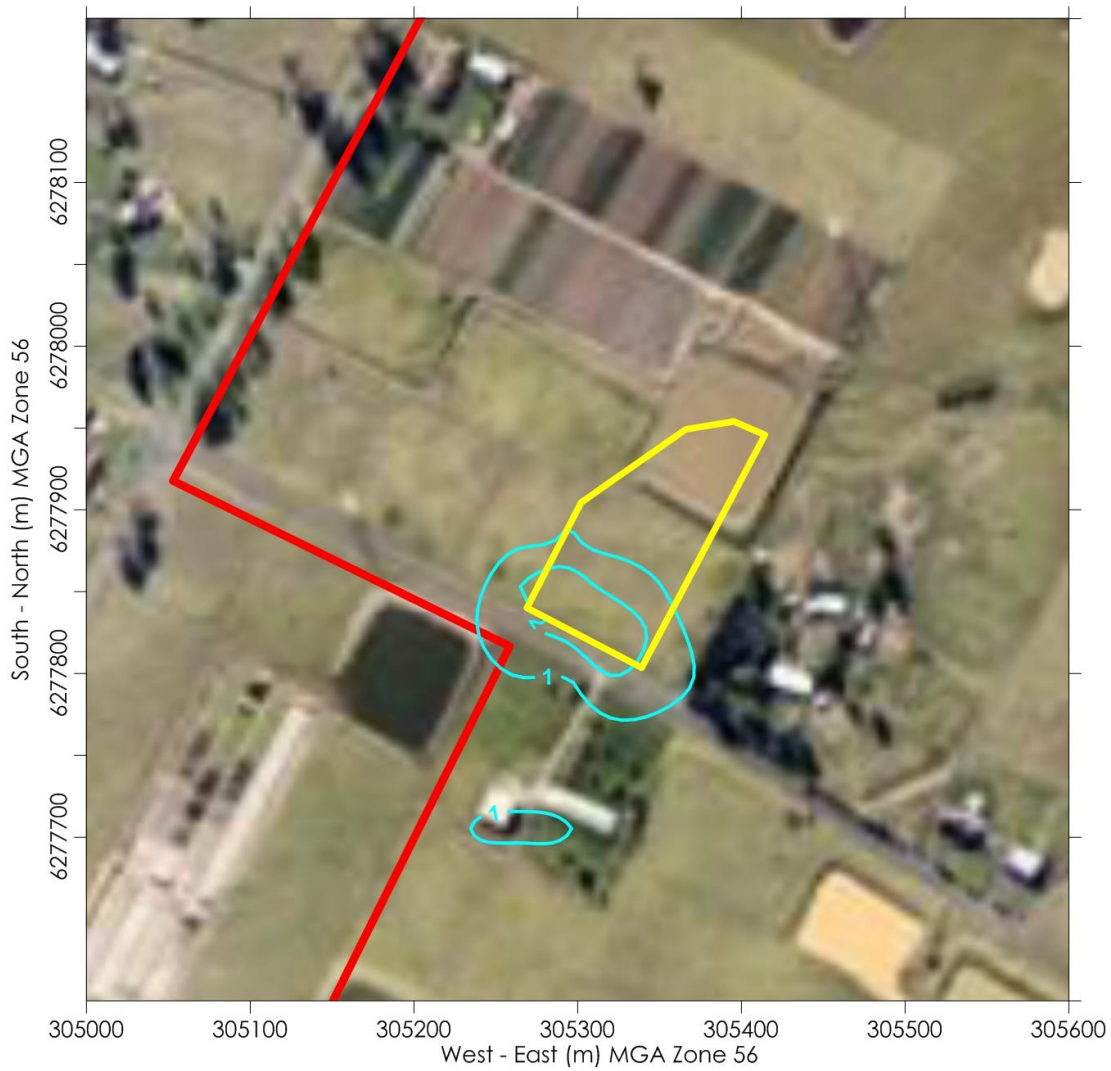
- Only ISST operational
- Two fully operational plants and ISST decommissioned

The predicted odour concentrations for the ISST only are shown in **Figure 7.1** and for the two fully operational plants combined, in **Figure 7.2**. Peak-to-mean factors have been applied in the modelling and are included in the predictions. It is also noted that the OCU vent stack emissions are likely to be conservative, for the reasons outlined in **Section 5.2** and therefore ground level odour concentrations may be lower than those predicted.

It can be seen from both plots that 2 OU (99th percentile) is not predicted to be exceeded at any of the nearest sensitive receptors and is considered to comply with the NSW EPA odour assessment criterion.

Species: Odour	Location: Box Hill North	Scenario: ISST Only	Percentile: 99%	Averaging Time: 1-hour
Model Used: AERMOD v8.2	Units: Odour Units (OU)	Criterion: 2 OU	Met Data: 2013 – 2014	Plot: J. Firth

Figure 7.1: Predicted 99th percentile odour concentration (OU) for Interim FBT operations



Species: Odour	Location: Box Hill North	Scenario: Fully Operational	Percentile: 99%	Averaging Time: 1-hour
Model Used: AERMOD v8.2	Units: Odour Units (OU)	Criterion: 2 OU	Met Data: 2013 – 2014	Plot: J. Firth

Figure 7.2: Predicted 99th percentile odour concentration (OU) for the fully operational plant

8 CONCLUSIONS

This study assessed the air quality impacts of the proposed Local Water Centre at Box Hill North. The odour assessment was based on odour emission rates derived both from measurements at a similar facility, Sydney Water standards for odour control units and technical specifications for the odour control units proposed to be used. This information was combined with local meteorological data and computer-based dispersion modelling to predict the ground level odour concentrations in the vicinity of the plant.

Results from the dispersion modelling indicated that predicted odour concentrations from the proposed facility would comply with the most stringent assessment criterion of 2 OU (99th percentile) at all sensitive receivers outside the plant boundary.

The predicted odour concentrations are at or below 1 OU, the theoretical level at which odour becomes detectable but not necessarily distinguishable, at all receivers.

9 REFERENCES

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Appendix A PEAK TO MEAN RATIOS

Table A.1: Factors for Estimating Peak Concentration

Source Type	Pasquill-Gifford stability class	Near field P/M60*	Far field P/M60
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A – F	6	6
Surface point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A – F	2.3	2.3
Volume	A – F	2.3	2.3

*Ratio of peak 1-second average concentrations to mean 1-hour average concentrations

Appendix B ODOUR MEASUREMENTS FROM PITT TOWN

Measurements taken at the open sources and FBT headspace taken in November 2014

Odour Sample Measurement Results
Panel Roster Number: SYD20141121_101

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Panel Size	Valid ITEs	Nominal Sample Dilution	Actual Sample Dilution (Adjusted for Temperature)	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Specific Odour Emission Rate ($ou.m^3/m^2/s$)
Sample #1 – Anoxic	SC14715	20/11/2014 1135hrs	21/11/2014 1031hrs	4	8	-	-	431	431	-
Sample #2 – Aerobic	SC14716	20/11/2014 1137hrs	21/11/2014 1103hrs	4	8	-	-	362	362	-
Sample #3 – Membrane	SC14717	20/11/2014 1351hrs	21/11/2014 1134hrs	4	8	-	-	197	197	-
Sample #6 – FBT Headspace	SC14720	20/11/2014 1340hrs	21/11/2014 1341hrs	4	8	-	-	77,900	77,900	-

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:
1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd. have performed the dilution of samples.

Measurements at the FBT headspace and OCU stack taken in March 2013

Sample Location	TOU Sample ID	Sampling Date & Time	Analysis Date & Time	Sample Odour Concentration (as received, in the bag) (ou)	Sample Odour Concentration (Final, allowing for dilution) (ou)	Odour Character
Sample #1 – Membrane Chamber	SC13176	18/03/2013 1405hrs	19/03/2013 1031hrs	34	34	Musty
Sample #2 – Aerobic Chamber	SC13177	18/03/2013 1444hrs	19/03/2013 1059hrs	42	42	Musty
Sample #3 – Anoxic Chamber	SC13178	18/03/2013 1544hrs	19/03/2013 1127hrs	52	52	Musty, Rubbery, Garlic
Sample #4 – FBT OCU Vent	SC13179	18/03/2013 1615hrs	19/03/2013 1201hrs	446	446	H^2S, Rotten Egg, Cabbage
Sample #5 – FBT Headspace	SC13180	18/03/2013 1645hrs	19/03/2013 1227hrs	114,000	114,000	H2S, Rotten Egg

Note: The following are not covered by the NATA Accreditation issued to The Odour Unit Pty Ltd:
1. The collection of Isolation Flux Hood (IFH) samples and the calculation of the Specific Odour Emission Rate (SOER).
2. Final results that have been modified by the dilution factors where parties other than The Odour Unit Pty Ltd. have performed the dilution of samples.