

COUNCIL ASSESSMENT PANEL MEETING

11 August 2021

AGENDA – 8.1

Applicant: Cartwheel Resources Pty Ltd	Landowner: Cartwheel Resources Pty Ltd
Agent: N/A	Originating Officer: Sarah Davenport
Development Application:	20/366/473
Application Description: Change of use of detached dwelling to tourist accommodation facility with associated functions (maximum 12 per year for a maximum of 40 persons) together with alterations & additions to the building, construction of a new detached dwelling, in-ground swimming pool, jetty, demolition of ground mounted solar array, alterations and additions to Local Heritage Place (re-vegetating Silver Lake), demolition of farm building and construction of 2 outbuildings, associated car parking, landscaping & earthworks (non-complying)	
Subject Land: Lot:10 Sec: P386 FP:101385 CT:5107/485	General Location: 118 Silver Lake Road Mylor Attachment – Locality Plan
Development Plan Consolidated : 8 August 2019 Map AdHi/3	Zone/Policy Area: Watershed (Primary Production) Zone - Watershed Protection Policy Area
Form of Development: Non-complying	Site Area: 6.6ha
Public Notice Category: Category 3 Notice published in The Advertiser on 18 September 2020	Representations Received: 21 Representations to be Heard: 6

1. EXECUTIVE SUMMARY

The purpose of this application is to change the use of the existing dwelling to tourist accommodation including the undertaking of 12 annual functions. The tourist accommodation will accommodate a maximum of 14 guests at a time with functions carrying a maximum capacity of 40 people. The proposal includes the construction of a new detached dwelling, swimming pool and jetty, demolition of farm building and construction of two outbuildings. The proposal has incorporated extensive landscaping and rejuvenation of Silver Lake – a local heritage item and the establishment of very low scale “hobby” aquaculture. The proposed landscaping including a wetland, has been designed in conjunction with a bushfire management plan and comprehensive stormwater management plan. On site car parking has been provided using permeable compacted gravel to reduce pollutant runoff.

The subject land is located within the Watershed (Primary Production) Zone - Watershed Protection Policy Area Zone and the proposal is a non-complying form of development. Twenty one (21) representations were received in response to the Category 3 public notification period, 18 in opposition and three representations in support of the proposal.

As per the CAP delegations, the CAP is the relevant authority for determining Category 3 forms of development where representations wish to be heard.

The main issues relating to the proposal are intensity of the development, environmental impacts, bushfire risk and flood risk.

Following an assessment against the relevant zone and Council Wide provisions within the Development Plan, staff are recommending that the Council Assessment Panel **seeks the CONCURRENCE of the State Commission Assessment Panel to GRANT** Development Plan Consent.

2. DESCRIPTION OF THE PROPOSAL

The proposal is for the following:

- Change of use of detached dwelling to tourist accommodation for 14 guests –and alterations and additions
- The undertaking of 12 annual functions with maximum capacity of 40 persons within the tourist accommodation building
- Construction of new detached dwelling
- Construction of in- ground swimming pool
- Construction of Jetty
- Alterations and additions to local heritage place (revegetation of Silver Lake)
- Demolition of farm building and solar array
- Construction of 2 outbuildings
- Establishment of low scale aquaculture
- New Water Storage Tank- 60,000 litres

The proposed plans are included as **Attachment – Proposal Plans** with other information included as **Attachment – Application Information** and **Attachment – Applicant’s Professional Reports**.

3. BACKGROUND AND HISTORY

The subject land has an extensive history with the lake being used both privately and for public enjoyment at different stages over time. The land currently is being used for private purposes and there is no public access.

APPROVAL DATE	APPLICATION NUMBER	DESCRIPTION OF PROPOSAL
6 September 2019	17/1030/473	Construction of second dwelling (dependent accommodation)- Non-Complying
27 April 1995	95/15/330	Demolition of detached and construction of detached dwelling including double carport and addition to shed
24 February 1994	94/22/330	Concrete water storage tank
23 September 1993	93/498/330	Shed
24 February 1976	10282	Brick Veneer dwelling & alterations to existing building (previously kiosk) into painting studio

The initial application submission included dredging of the lake, which constituted a Schedule 22 referral to the EPA and separate application. Following conversations with the EPA the dredging of the lake has been removed from the proposal but may be pursued at a later date.

4. REFERRAL RESPONSES

- **CFS**
 - The CFS has no objection to the proposal
 - BAL rating of 12.5
 - Standard access and water supply conditions imposed in alignment with Minister's Specification 78 (refer recommended conditions 14-18)
 - Current vegetation coverage within 20m of dwelling exceeds 30%, implementation of landscaping plan will remove the hazardous vegetation from dwelling
 - Prepare and display a Bushfire Survival Plan for fire danger season
- **EPA**
 - Removal of cattle and alpacas from the site will assist in improving water quality
 - Construction of the wetland will better deal with overland flows from neighbouring properties as well as run off from the development
 - The upgrade of the on- site waste control system will result in the waste system being in a more appropriate location
 - The EPA is satisfied that the proposal has demonstrated a neutral impact on water quality
 - Six conditions are recommended (refer recommended conditions 8-13)
- **DEW**
 - Excavation and removal of rock, sand or soil must not adversely impact on the ecology of any existing watercourse/s, lake or floodplain and must not adversely impact on migration of aquatic biota or alter the natural flow regime of a watercourse/s either on or, near to the subject site
 - The construction should be undertaken in a manner that prevents silt or sediment leaving the site including, but not being limited to, the use of erosion and sediment control measures, such as catchment/diversion drains, re-vegetation, straw bale barriers, filter fences, sediment traps and basins
 - It is recommended that there is a minimum distance of 20 metres between a watercourse or any well on the site and the fuelling location for machinery used to undertake construction
 - Proposed swale works are considered a good outcome
 - Sediment that is removed from Silver Lake will be done using a suction dredge, and the sediment will be de-watered and spread out over the site
 - The proposed wetland development has been considered not at variance with section 104 Water affecting activities, part 3(d) of the Landscape South Australia Act 2019, and the water management principles in the Western Mount Lofty Ranges Prescribed Water Resources Area and Water Allocation Plan
- **Local Heritage Advice – Grieve Gillet Anderson**
 - The proposed works will not affect the identified heritage values of Silver Lake
 - The assessment of heritage value for the place relates largely to its historical and associative values, which are not affected by the proposed works

- **AHC Engineering**
 - No concerns with the proposal
 - Stormwater discharge to be managed on site
 - Driveways to be constructed with permeable material to minimise run off (refer recommended condition)
- **AHC EHU**
 - Waste application 20/W154 approved 21 July 2021

The above responses are included as ***Attachment – Referral Responses***.

5. CONSULTATION

The application was categorised as a Category 3 form of development in accordance with Section 38(2) (c) of the *Development Act 1993* requiring formal public notification and a public notice. Twenty One (21) representations were received. Of these eighteen (18) representations are opposing the proposal, and three (3) are in support of the proposal. Some were from adjacent and nearby properties.

The following representors wish to be heard:

Name of Representor	Representor's Property Address	Nominated Speaker
Phillp Allen	137 Silver Lake Road Mylor	Phillip Allen
Colleen Heppner	137 Silver Lake Road Mylor	Colleen Heppner
Ian Hobbs	6 Pillinda Lane Mylor	Ian Hobbs
Frauke Hobbs	6 Pillinda Lane Mylor	Frauke Hobbs
Poppy Kentish	99 Silver Lake Road Mylor	Poppy Kentish
Alexandra Kentish	99 Silver Lake Road Mylor	Alexandra Kentish

The applicant(s) and their representative, Ian Hannaford, may be in attendance.

The issues contained in the representations can be briefly summarised as follows:

- Scale of development
- Excess traffic
- Tree removal
- Environmental impact on water quality
- Flood concerns

These issues are discussed in detail in the following sections of the report.

Copies of the submissions are included as ***Attachment – Representations*** and the response is provided in ***Attachment – Applicant's Response to Representations***. A copy of the plans which were provided for notification are included as ***Attachment – Publically Notified Plans***

6. PLANNING & TECHNICAL CONSIDERATIONS

This application has been evaluated in accordance with the following matters:

i. The Site's Physical Characteristics

The subject land is 6.6 hectares in area with dual frontage to Silver Lake Road and Pillinda Lane. The land slopes steeply from Pillinda Lane on the southern boundary down to the northern boundary where it becomes flat. The land is currently being used for residential purposes with some low scale animal keeping. The land is mapped as being flood prone and within a high bushfire risk area. The lake on the land is a listed Local Heritage Place due to its association with the nearby gold mine dating back to the 1800's. Following the closure of the mine, the lake was used as a public swimming pool and dance venue.

ii. The Surrounding Area

Properties located on Silver Lake Road are being used for rural residential purposes, with allotments in a range of sizes and shapes. Land on Pillinda Lane is being used solely for residential use on smaller rural living sized allotments. The locality is characterised by very low- density residential development in association with low scale rural activity

iii. Development Plan Policy considerations

a) *Policy Area/Zone Provisions*

The subject land lies within the Watershed (Primary Production) Zone - Watershed Protection Policy Area and these provisions seek:

Policy Area

- *The preservation of natural resources and natural open space*
- *Limiting animal keeping and horticultural activities*
- *Maintenance of rural amenity and scenic attractiveness*
- *Development that does not warrant extensive clearance of native vegetation*

The following are considered to be the relevant Policy Area provisions:

Objectives: 1

PDCs: 3, 4 & 5

Zone

- Enhancement of natural resources and rural amenity
- Preservation and enhancement of water quality
- Protection of primary production land uses
- Development of sustainable tourism

The following are considered to be the relevant Zone provisions:

Objectives: 1, 2, 5 & 6

PDCs: 1, 2, 3, 6, 7, 10, 11, 14, 15, 24, 27, 28, 30, 35, 36, 37, 39, & 47

Accordance with Zone

The Zone Objectives specifically reference tourism development as one of the envisaged uses for the area, in conjunction with appropriate land management and water resource protection. The proposed development has incorporated a number of environmentally focused aspects with the tourist accommodation, including a revegetation plan and establishment of a wetland using water purifying plant species. The project will mean all stormwater and wastewater is filtered and managed on-site, including from the proposed car park.

In alignment with PDC 47, the development will result in the removal of existing stock from the land to improve the quality of the water runoff from the site and reduce risk of pollution in waterways.

Appropriateness of Proposal in Locality

The locality is characterised by very low-density residential development in association with low scale rural activity. There are no similar type developments within the locality, however the nearest dwelling is greater than 100m from where functions/tourist accommodation would be held. The number of functions within the tourist accommodation have been limited to 12 per year with capacity capped at 40 persons. For ancillary functions the capacity and frequency of events is considered small scale and acceptable. The tourist accommodation will house a maximum of 14 persons - this number is also considered acceptable based on the size of the land and size of the existing dwelling.

Residential Development

In alignment with PDCs 11, 14, 15 and 23 the proposed new dwelling will be located in an 'unobtrusive' location, at the lower area of the subject land. The design is modest in nature being single storey and located on a level portion of the lake's bank to minimise the extent of cut and fill. Extensive landscaping will be established around the dwelling. Pursuant to PDC 30 the landscaping plan will improve the appearance whilst reducing the existing vegetative fuel load. The CFS have viewed the landscaping plan and have no objections to the proposal.

Appearance of Land and Buildings

PDCs 1, 2 and 7 call for development which will not detrimentally affect the scenic attractiveness of the locality. The proposed change in use is to take place within an existing building which will be enhanced to facilitate its function as both tourist accommodation and a function centre on occasion. The proposed new dwelling will be sited adjacent Silver Lake, well set back from property boundaries and surrounded by new landscaping. The development has access to a bore on site and will include the establishment of a new waste control system, pursuant to PDC3.

In keeping with PDC 8 the proposal includes demolition of an existing farm building and construction of two (2) new outbuildings, ensuring the number of buildings on-site is limited. Each building measures no more than 72sqm and they are sited in close proximity to one another.

Conservation

PDCs 28, 30, 35, 36, 37 and 39 are primarily concerned with retaining natural resources and protecting native vegetation. The development has sufficiently addressed the above mentioned policies by incorporating a vegetation management plan and establishing a wetland with an inbuilt filtration system.

The revegetation of Silver Lake will involve removing “Typha” from the lake which is currently producing excess sediment. The improvement of the lake in conjunction with the wetland and installation of the new waste control system will ensure that both stormwater and waste water will be filtered and managed on site. The development has sufficiently addressed PDCs 35 and 36.

b) Council Wide provisions

The Council Wide provisions of relevance to this proposal seek (in summary):

- The extension of the economic base of the Mount Lofty Ranges Region in an environmentally sensitive and sustainable manner.
- The development of a high design standard and appearance that responds to and reinforces positive aspects of the local environment and built form.
- To mitigate the risk to reasonable and anticipated development from natural hazards
- The overall enhancement of places of local heritage value.
- Retention, protection and restoration of the natural resources and environment.
- Environmentally sustainable and innovative tourism development.
- Development that includes the treatment and management of solid and liquid waste to prevent undesired impacts on the environment including, soil, plant and animal biodiversity, human health and the amenity of the locality.

Animal Keeping and Rural Development

Objectives: 1, 3 & 5

PDCs: 1, 4, 19, 20, 21 & 22

The proposed range of development activities including the establishment of a small scale orchard and aquaculture use are considered to cumulatively demonstrate a commitment to continuing the agricultural use of the land. Although these uses will not be of a commercial nature they will support the residential and tourism operations. In addition they are not being established at the detriment of any existing high value agricultural use of the land. This demonstrates consistency with PDC 1.

PDC 4 encourages that any rural development adequately considers stormwater management and disposal, waste management, fire management and vegetation management as key components of any design. In order to minimise impacts and ensure acceptable outcomes in this regard the applicant has engaged suitably qualified experts in each of these key areas. The details of each design response as they relate to the above, can be reviewed in the applicant’s professional reports and proposal plans attached to this report, it is noted that both the EPA and DEW in their capacity as statutory bodies have reviewed and provided conditional in principle support for the design concepts.

With respect to the proposed aquaculture use, it is noted that the concept has been professionally designed and the engineering details have been reviewed by the EPA and DEW. The use is sited and designed to address the key outcomes sought by the relevant aquaculture PDCs 19, 20, 21 and 22. It is also noted that the system will be integrated holistically with the proposed water management plans for the site.

Based on the purpose of the application and level of detail provided addressing the key rural development considerations above and, the in-principle support from EPA and DEW, the proposal is considered to meet the relevant Objectives and demonstrate consistency with the PDCs of this Council Wide section.

Design and Appearance

Objectives: 1

PDCs: 1, 3 & 8

The built form components of the proposal have been considered in the context of this Council Wide section, in particular the new dwelling, two outbuildings and the small addition to the proposed tourist accommodation. In terms of siting, the new buildings will form a cluster across the lower third of the site.

The two outbuildings are likely to be the most visible aspect of the built form from Silver Lake Road, although they are set back more than 20 metres from this eastern boundary. The Proposed Site Section 1 (Draw. No: 12817) in *Attachment Proposed Plans* depicts the streetscape elevation and how the eastern façade of the outbuildings will present. It is noted that the proposed skillion roof form will minimise the bulk of this cluster of outbuildings and the retention and addition of landscaping will soften the overall mass of these two outbuildings. Based on the size of the allotment and siting of the proposed structures the size and scale of the outbuildings are considered reasonable and anticipated.

The new dwelling has a modest footprint, is single storey and has been designed to respond sensitively to its context in terms of massing, form and materials and capitalise on the natural features of the site. It is noted that the skillion roof form and non-reflective material selection of the dwelling creates a coherent architectural language between the outbuildings. The siting also provides a sense of integration that is a favourable outcome on larger rural allotments. Considering the mix of proposed land uses, this outcome appropriately articulates that the rural/residential components of the development have a level of primacy. This is consistent with the majority of development in the locality and the expectations of the Zone more broadly.

The existing dwelling will be subject to internal alterations that will enable its conversion to tourist accommodation. An addition will also see a conservatory added to the south eastern elevation. This addition is considered proportionally minor when compared to the overall footprint of the building. It will also improve the amenity of the building and will better visually connect the internal space to the heritage listed lake.

The relevant Council-wide Objectives and PDCs have been addressed and it is considered that the proposed built form demonstrates sufficient and appropriate design responses in the context of the site and locality.

Energy Efficiency

Objectives: 1 & 2

PDCs: 1, 2 & 3

The living areas of the proposed dwelling and tourist accommodation take advantage of the available solar access by orientating living areas to the north. The outbuildings have been designed to incorporate high level glazing to provide natural light, with a portion of the aquaponics shed component taking on a greenhouse form to assist and aid with the required processes.

Energy efficiency measures include double glazing to the new dwelling and a large solar system proposed on the roof of the outbuildings. The lake reticulation system will also be powered by a solar pump.

The design demonstrates a considered approach to passive design outcomes and energy efficiency performance including on site energy generation. This satisfies the relevant Council-wide Objectives and PDCs.

Hazards

Objectives: 1, 4, 5 & 6

PDCs: 1, 2, 3, 4, 7 & 10

The site is susceptible to flooding and is located in high a bushfire risk area. The impacts of these hazards have been extensively considered by the applicant and the design response aims to mitigate the identified risks.

With regard to flooding of the nearby Onkaparinga River, based on Council mapping the site is likely to be inundated during a 1 in 10 ARI year event particularly adjacent to the eastern boundary. The flood mapping shows areas impacted to contain open fencing and vegetation with no proposed buildings located within this flood plain.

The 1 in 100 ARI year event predicts a far larger portion of the low lying areas of the site to be subject to flooding. The risk from such an event is largely mitigated by the siting of the proposed buildings outside of the 1 in 100 year ARI flood zone. The proposed dwelling will have a floor level 300mm above the projected flood level for a 1 in 100 ARI flood event.

Groundworks within the flood zone seek to extend or modify existing levy banks and to direct overland flow into the proposed wetland located in the northern low lying portion of the site. In considering the impact of this groundwork on water quality a Report prepared by Water Technology (refer *Attachment Applicant's Professional Reports*) concludes that the water quality impact of the development is within acceptable limits or in some instances will be improved. The EPA and NRM have both noted within their referral responses, that the establishment of a wetland system will improve the management of existing overland flows from neighbouring properties as well as capturing any additional runoff the development will produce.

The proposal demonstrates that the risk of flooding can be reasonably mitigated and this can be achieved without increasing the risk of flooding on adjoining land. As such the development is considered to sufficiently address PDCs 3 and 4 of this Council-wide section.

The site of the development is located within a High Bushfire Risk Area and the Minister's Code: Undertaking development in Bushfire Prone Areas must be complied with. A referral response from the CFS confirms that with respect to access to building assets, water supply access, water tank storage capacity and vegetation management, that the proposal can comply with the Minister's Code. In its response the CFS recommended a number of conditions that will be attached to any subsequent approval (refer recommended conditions 14-18). On this basis the proposal demonstrates compliance with PDC 7 of this Council-wide section.

In summary the proposal demonstrates how it can reasonably mitigate hazard risk to accepted levels – whether from flooding or bushfire – and how this can be achieved without significant interference with natural processes. This is consistent with the outcomes sought by the relevant Objectives and PDCs 1 and 2 of this Council-wide section.

Heritage Places

Objectives: 1, 2, 3 & 4

PDCs: 1, 2, 3, 4 & 11

Silver Lake is identified as a Local Heritage Place (Heritage NR 17640). It has an extensive history as a mineral extraction site and later as a culturally important place. The lake will retain its existing extent, however a revegetation scheme will be implemented to remove the dominant rush species which have propagated around the dam perimeter, to the detriment of a more diverse ecosystem. Council have undertaken a referral to Council's heritage advisor who has concurred the works will not impact on the heritage value of the lake.

It is considered that the works to the lake will ensure its long term functionality whilst the revegetation works over the long term will enhance the setting of the lake. The applicant is also seeking to improve water quality in the lake, in particular filtering out tannin stain caused by the bark and leaf litter of nearby eucalyptus trees, via a sophisticated wetland and reticulation system.

The above demonstrates consistency with the Objectives and relevant PDCs of this Council-wide section.

Interface between Land Uses

Objectives: 1

PDCs: 1, 4, 7, 10, 15 & 16

The Zone generally envisages the proposed land use components subject of this application and therefore any associated impacts from these uses, within reason, are considered to be anticipated in the locality. Notwithstanding, the function centre use poses potential to cause nuisance to nearby sensitive receivers on account of noise, hours of operation, and traffic. In this regard the applicant has given careful

consideration to the number of events and total capacities and is only proposing 12 functions be held per calendar year with a total capacity of 40 people at each event. The limited frequency and capacity of these events, in addition to limited operating hours and noise attenuation measures relating to music (in accordance with PDC 10) will mitigate the impact of this land use within anticipated levels so as to not detrimentally effect the amenity of the locality in accordance with PDC 1.

The proposed land use components are not considered to jeopardise the operation of adjacent land used for primary production. This is largely on account of the existing dwelling being converted to tourism accommodation, a use similar in sensitivity to residential use. The new dwelling is being proposed centrally in the allotment with good separation and buffer distances from adjoining allotments. This adequately addresses PDCs 15 and 16 of this Council-wide section.

Natural Resources

Objectives: 1, 2, 3, 5, 6, 13 & 14

PDCs: 1, 2, 8, 10, 12, 13, 14, 20, 22, 23, 24, 35, 37 & 47

The sensitive management and integration of water underpins the proposed development. This includes onsite water retention for domestic reuse, fire-fighting purposes and use in the aquaponics, as well as the construction of a new wetland and reticulation system to filtrate and improve water quality of surface water and Silver Lake.

Detailed analysis has informed the hydrological design approach (refer to *Attachment Applicant's Professional Reports*). This report concludes that water quality impact and wastewater generation impact are within "acceptable" limits or improved, and both the EPA and DEW have endorsed this finding and have subsequently provided in principle support through the statutory referral process. The proposal is therefore considered to address PDCs 8, 10, 12, 13, 14, 20, 22, 24 and 35 of this Council-wide section.

With regard to vegetation it is noted some trees will be removed to allow for the construction of the dwelling. However, significant additional plantings are proposed across the site as detailed in the proposed plans. The implementation of these plans will result in an overall increase in the number of trees that provide appropriate landscaping for screening purposes and environmental services, whilst limiting the impact of bushfire. This is considered to address PDC 37 of the Council-wide section.

With regard to soil health the proposal will result in the need for groundworks and soil disturbance, but as detailed in the relevant expert reports the impact of this will likely be offset by the long term benefits from reduced soil erosion potential, increased aquatic and semi-aquatic environments increasing soil diversity and the filtration of potential pollutants before they enter the soil. These outcomes are considered to reasonably address PDC 47.

The above demonstrates that the proposal has given careful consideration to the natural environment as part of design phase. This has resulted in a holistic approach to natural resource management that is integrated across the site. This will provide a high level of amenity for the primary land users and will promote biodiversity and afford land management efficiencies. The proposal is therefore considered to address the relevant Objectives and PDCs 1 and 2 of the Council-wide section.

Orderly and Sustainable Development

Objectives: 3

PDCs: 3 & 12

The proposed development is considered orderly and sustainable, and this has been achieved through a holistic site and contextual analysis and meticulous planning. The tourism and function centre uses will contribute to the economic base in the region and its integration with Silver Lake and its surrounds will likely become an iconic tourism drawcard. The proposal demonstrates this can be achieved whilst mitigating hazard risk and improving environmental outcomes. For these reasons the proposal adequately addresses the relevant Objectives and PDCs of the Council-wide section.

Residential Development

Objectives: 1

PDCs: 9, 13 & 14

The proposed dwelling and associated outbuildings are considered to exhibit a form and function that would meet and exceed the minimum expectations of the relevant Objectives and PDCs of the Council-wide section. In particular, the dwelling has a positive relationship to its surrounds and complimentary relationship to associated outbuildings.

Siting and Visibility

Objectives: 1

PDCs: 1, 2, 6, 7, 9 & 10

The new buildings proposed as part of this application, are considered to have been designed and sited to be as least obtrusive as possible, within the site limitations, in particular its susceptibility to flooding. All buildings are clustered across the lower third of the site and will be obscured by existing and proposed vegetation. The profile of the buildings is low on account of the skillion roof design and this also complements the natural form of land in the locality. Variations in wall and roof lines on both the outbuildings and the house has the effect of minimising the mass of the buildings. Material selection is of dark and earthen tones for both the dwelling and the outbuildings. Only one access point will service the site. Where access is gained the driveway forks, providing individual access to the residential dwelling and the tourism accommodation, these driveways despite being expansive will blend sympathetically with the landscape.

The above design responses are considered to adequately address the relevant Objectives and PDCs of the Council-wide section.

Tourism Development

Objectives: 1, 2, 3, 4, 5, 7 & 9

PDCs: 1, 2, 3, 4, 7, 10, 11, 12, 14, 15 & 18

Tourism development within the Adelaide Hills is envisaged to have an emphasis on the natural environment and incorporate environmentally sensitive design to ensure natural resources and amenity are protected.

In alignment with Objective 2 and PDCs 1, 2, 7, 14 and 15 the development will fundamentally involve upgrading an existing dwelling to facilitate the new use for 14 guests whilst conserving and improving a Local Heritage Place – Silver Lake. The development includes extensive environmental improvements with a focus on protecting biodiversity. In accordance with PDC9, functions will be undertaken wholly within the tourist accommodation building and will be limited in number to avoid impacting on residential amenity. Functions are to be low scale, holding no more than 40 persons and no more than 12 times per annum.

In keeping with PDC 10 the proposed development has incorporated on-site parking, with sufficient space for manoeuvring to ensure access and egress from the property is safe. The proposed car park and driveways will be constructed with permeable material to better protect water quality and limit generation of additional stormwater. The formalised carpark will have capacity for 17 cars however there is substantial space on site for informal parking if necessary.

Pursuant to PDC 4 the proposed development will accommodate a generous number of guests at any one time without encroaching on existing primary production land.

The adaptive reuse of the existing building and existing site features is considered to be in keeping with the Council-wide section policies for tourism development.

Transportation and Access

Objectives: 2

PDCs: 25, 32, 33, 34, 35 & 39

The development will involve the upgrade of the existing access from Silver Lake Road, including the establishment of car parking and manoeuvring areas.

The proposal has satisfactorily addressed the above-mentioned objectives and policies relating to transportation and access by establishing formal on-site parking and manoeuvring areas which can facilitate the maximum number of guests proposed as part of this development. The proposed car parking and manoeuvring areas will be constructed using permeable materials to ensure the parking will not produce additional stormwater flows and avoiding the run off of pollutants into waterways. Council's engineers have reviewed the car park design and are satisfied with the outcome.

Waste

Objectives: 1 & 2

PDCs: 1, 2, 6, 7, 12 & 14

The Council-wide policies envisage that development will manage waste and wastewater in a sustainable manner and where possible will involve recycling or sustainable disposal of waste. The proposal has implemented mechanisms to facilitate the reuse of waste water and stormwater in an ecologically sensitive manner such as the establishment of a wetland and the new waste control system.

PDCs 1 and 2 call for development which will manage waste in a way which will not pose risk to public health or the environment. The EPA have concurred with the development including the proposed waste water strategy and stormwater management plan. Waste water produced by the aquaponics will be treated and filtered by the plant system and pumped back into the fish tanks in accordance with the policies. The applicant has confirmed that a private contractor will be engaged to remove hard waste from the site – particularly following functions. Suggested conditions have been attached to this report limiting the hours in which waste can be collected from the site to avoid impacting on neighbouring properties.

In alignment with PDCs 7, 12 and 14, the proposal will result in the installation of a new waste control system. The new system will be located on higher ground, away from the projected flood area with treated water used to irrigate native plants. The EPA have confirmed the proposed system is satisfactory and the siting of the irrigation area will reduce risk of contamination to water supply.

7. SUMMARY & CONCLUSION

The purpose of this application is to change the use of the existing dwelling to tourist accommodation including the undertaking of 12 annual functions. The tourist accommodation will accommodate a maximum of 14 guests at a time with functions for a maximum capacity of 40 people – functions are to be wholly contained within the accommodation building. The proposal includes the construction of a new detached dwelling, swimming pool and jetty, demolition of farm building and construction of two new outbuildings. The outbuildings are to be utilized for the purposes of low scale/ hobby aquaculture and storage of materials to maintain the property. The proposal has incorporated extensive landscaping and rejuvenation of Silver Lake – a Local Heritage Place, including a wetland. The landscaping component has been designed in conjunction with a bushfire management plan and comprehensive stormwater management plan. Not only are the landscaping and wetland purposed for amenity and appearance, but to improve the management of overland flows and improve water quality and biodiversity. Adequate formalised car parking will be provided as part of the project with sufficient space on site for informal parking if necessary.

The proposal is sufficiently consistent with the relevant provisions of the Development Plan, despite its non-complying nature, and it is considered the proposal is not seriously at variance with the Development Plan. In the view of staff, the proposal has sufficient merit to warrant consent. Staff therefore recommend Council Assessment Panel **GRANT** Development Plan Consent, subject to conditions.

8. RECOMMENDATION

That the Council Assessment Panel considers that the proposal is not seriously at variance with the relevant provisions of the Adelaide Hills Council Development Plan, and seeks the CONCURRENCE of the State Commission Assessment Panel to GRANT Development Plan Consent to Development Application 20/366/473 by Cartwheel Resources Pty Ltd for Change of use of detached dwelling to tourist accommodation facility with associated functions (maximum 12 per year for a maximum of 40 persons) together with alterations & additions to the building, construction of a new detached dwelling, in-ground swimming pool, jetty, demolition of ground mounted solar array, alterations and additions to Local Heritage Place (re-vegetating Silver Lake), demolition of farm building and construction of 2 outbuildings, associated car parking, landscaping & earthworks (non-complying) at 118 Silver Lake Road Mylor subject to the following conditions:

(1) Development In Accordance With The Plans

The development herein approved shall be undertaken in accordance with the following plans, details and written submissions accompanying the application, unless varied by a separate condition:

- Proposed Site Plan, prepared by Hannaford Consulting, drawing no. 1817 DA 1.1, revision B, received by Council 9 June 2021
- Proposed Fire Management Plan, prepared by Hannaford Consulting, drawing no. 1817 DA 5.3, revision A, received by Council 9 June 2021
- Proposed Landscaping Maintenance Areas, prepared by Hannaford Consulting, drawing no. 1817 DA 6.1, revision A, received by Council 9 June 2021
- Proposed Part Site Plan, prepared by Hannaford Consulting, drawing no. 1817 DA 1.2, received by Council 20 April 2020
- Proposed Part Site Plan (Impacted Trees & Reference Plan), prepared by Hannaford Consulting, drawing no. 1817 DA 1.3, received by Council 20 April 2020
- Proposed Site Section 1, prepared by Hannaford Consulting, drawing no. 1817 DA 1.4, received by Council 20 April 2020
- Proposed Site Section 2, prepared by Hannaford Consulting, drawing no. 1817 DA 1.5, received by Council 6 August 2020
- Proposed Site Section 3, prepared by Hannaford Consulting, drawing no. 1817 DA 1.5, received by Council 6 August 2020
- Proposed Ground Floor, prepared by Hannaford Consulting, drawing no. 1817 DA 2.2, dated 25 February 2020 received by Council 20 April 2020
- Proposed First Floor, prepared by Hannaford Consulting, drawing no. 1817 DA 2.3, dated 25 February 2020 received by Council 20 April 2020
- Proposed Elevations, prepared by Hannaford Consulting, drawing no. 1817 DA 2.4, dated 25 February 2020 received by Council 20 April 2020
- Proposed New Dwelling Floor Plan, prepared by Hannaford Consulting, drawing no. 1817 DA 3.1, dated 25 February 2020 received by Council 20 April 2020
- Proposed New Dwelling Elevations, prepared by Hannaford Consulting, drawing no. 1817 DA 3.2, dated 25 February 2020 received by Council 20 April 2020
- Sheds Floor Plan, prepared by Hannaford Consulting, drawing no. 1817 DA 4.1, dated 14 April 2020, received by Council 20 April 2020
- Sheds Elevations, prepared by Hannaford Consulting, drawing no. 1817 DA 4.2, dated 14 April 2020, received by Council 20 April 2020
- Proposed Function Area Plan, prepared by Hannaford Consulting, drawing no. 1817 DA2.2, dated 2 August 2021, received by Council 2 August 2021

(2) Stormwater Runoff to be Dealt With On-Site

All roof run-off generated by the development hereby approved shall be managed on-site in accordance with the Stormwater Management Plan 'Silver Lake Development – Stormwater Quality Issues Report by Barrie Ormsby', dated 22 February 2021, to the satisfaction of Council

Stormwater overflow management shall be designed so as to not permit trespass into the effluent disposal area. Stormwater should be managed on site with no stormwater to trespass onto adjoining properties to the satisfaction of Council.

(3) Prior to Building Rules Consent Being Granted - Requirement for Soil Erosion And Drainage Management Plan (SEDMP)

Prior to Building Rules Consent being granted the applicant shall prepare and submit to Council a Soil Erosion and Drainage Management Plan (SEDMP) for the site for Council's approval. The SEDMP shall comprise a site plan and design sketches that detail erosion control methods and installation of sediment collection devices that will prevent:

- a) soil moving off the site during periods of rainfall;
- b) erosion and deposition of soil moving into the remaining native vegetation; and
- c) soil transfer onto roadways by vehicles and machinery.

The works contained in the approved SEDMP shall be implemented prior to construction commencing and maintained to the reasonable satisfaction of Council during the construction period.

(4) Access Upgrade

The vehicle access point(s) and cross-over shall be constructed at a maximum width of 6 metres with splays. Any existing crossing places not providing vehicle access shall be considered redundant and shall be closed off.

(5) Maximum Number of Guests for Tourist Accommodation

The tourist accommodation (bed and breakfast) shall accommodate a maximum number of 14 guests at any given time.

(6) Tourist Accommodation not to be used as Second Dwelling

The person(s) having the benefit of this consent shall refrain from permitting the use of the building (or any part thereof) for provision of long term accommodation or as a separate dwelling. The tourist accommodation unit shall be used and operated on a short term rental arrangement with a maximum of a 28 day per occupancy.

A logbook shall be kept of all occupancies for each calendar year and made available for inspection by the Council upon request.

(7) Timeframe For Landscaping To Be Planted

Landscaping, detailed in Landscape Development Maintenance Report, prepared by Barrie Ormsby, dated 22 February 2021, shall be planted in the planting season following occupation and maintained in good health and condition at all times. Any such vegetation shall be replaced in the next planting season if and when it dies or becomes seriously diseased.

(8) External Materials and Finishes

All external materials and finishes of the new approved buildings shall be of subdued colours which blend with the natural features of the landscape and are of a low-light reflective nature.

NOTE: Browns, greys, greens and beige are suitable and galvanised iron and zincalume are not suitable

(9) Restriction On Number Of Functions

The number of functions in a calendar year shall not exceed 12. Such functions shall have a maximum capacity of 40. Any increase in the number of functions/capacity will require separate development approval.

(10) Restriction on Hours of Functions

Functions shall only take place between the following hours:

Sunday to Friday:	9.00am to 10.00pm
Saturday:	9.00am to 12.00 midnight

(11) Entertainment

Entertainment in the form of live music shall not be provided on the premises. Music shall only be played through a sound system and be limited to internal areas only to maintain the amenity of the area to the reasonable satisfaction of Council.

EPA Conditions

(12) Wastewater System in accordance with Plans

The on-site wastewater systems (including the new irrigation area) must be constructed and operational in accordance with the manufacturer's specifications and the report 'Site and Soil Assessment, On-Site Wastewater Management System Design – Upgrade to facilitated the proposed Silver Lake development by RFE Consulting', dated 1 March 2021, prior to occupation of the converted tourist accommodation building, the new dwelling and functions occurring on the site.

(13) Pool Backwash Disposal

Pool backwash water must be disposed of via the proposed soakage trench proposed in the Site and Soil Assessment, On-Site Wastewater Management System Design – Upgrade to facilitate the proposed Silver Lake development by RFE Consulting dated 1 March 2021.

(14) Aquaponics Systems Closure

The aquaponics/hydroponics systems must be closed and recirculating with any resultant wastewater not being discharged on site.

(15) Stormwater Management Design

Detailed design of the stormwater management system (including rainwater tanks, permeable paving and swales) must be established in accordance with the treatment train in the report 'Silver Lake Development – Stormwater Quality Issues Report by Barrie Ormsby', dated 22 February 2021 and construction of these elements must occur prior to occupation of the converted tourist accommodation building, the new dwelling and functions occurring on the site.

(16) Wetland System

The design, operation and maintenance of the wetland system must be in accordance with the report 'Silver Lake Development – Stormwater Quality Issues Report by Barrie Ormsby', dated 22 February 2021.

(17) Wetland System Construction Prior To Occupation Of Buildings

The construction of the wetland must occur prior to occupation of the converted tourist accommodation building, the new dwelling and functions occurring on the site.

CFS Conditions

(18) Access to Habitable Building

- Access to the habitable buildings shall be of all-weather construction, with a minimum formed road surface width of 3 metres and must allow forward entry and exit for large fire-fighting vehicles.
- The all-weather road shall allow fire-fighting vehicles to safely enter and exit the allotment in a forward direction by incorporating either:
 - i. A loop road around the building, OR
 - ii. A turning area with a minimum radius of 12.5 metres, OR
 - iii. A 'T' or 'Y' shaped turning area with a minimum formed length of 11 metres and minimum internal radii of 9.5 metres.
- Private access shall have minimum internal radii of 9.5 metres on all bends.
- Vegetation overhanging the access road shall be pruned to achieve a minimum vehicular clearance of not less than 4 metres in width and a vertical height clearance of 4 metres.

(19) Access to Dedicated Water Supply

- The water supply outlet shall be easily accessible and clearly identifiable from the access way and at a distance of no greater than 30 metres from the proposed habitable buildings.
- The dedicated water supply and its location should be identified with suitable signage (i.e. blue sign with white lettering "FIRE WATER").
- Access to the dedicated water supply shall be of all-weather construction, with a minimum formed road surface width of 3 metres.
- Provision shall be made adjacent to the water supply for a flat hardstand area (capable of supporting fire-fighting vehicles with a gross vehicle mass (GVM) of 21 tonnes) that is a distance equal to or less than 6 metres from the water supply outlet.
- SA CFS appliance inlet is rear mounted; therefore the outlet/water storage shall be positioned so that the SA CFS appliance can easily connect to it rear facing.
- A gravity fed water supply outlet may be remotely located from the tank to provide adequate access.
- All non-metal water supply pipes for bushfire fighting purposes (other than flexible connections and hoses for fire-fighting) shall be buried below ground to a minimum depth of 300mm with no non-metal parts above ground level.
- All water supply pipes for draughting purposes shall be capable of withstanding the required pressure for draughting.
- Ideally a remote water supply outlet should be gravity fed, where this is not possible the following dimensions shall be considered as the maximum capability in any hydraulic design for draughting purposes:
 - The dedicated water supply outlet for draughting purposes shall not exceed 5 metre maximum vertical lift (calculated on the height of the hardstand surface to the lowest point of the storage) and no greater than 6 metre horizontal distance.

The suction outlet pipework from the tank shall be fitted with an inline non return valve of nominal internal diameter not less than that of the suction pipe and be located from the lowest point of extract from the tank. All fittings shall be installed to allow for easy maintenance.

SA CFS notes that a remote outlet from one of the dedicated tanks will need to be provided within 30m of the existing dwelling to comply with the above conditions.

(20) Water Supply

- A minimum supply of 22,000 litres of water for each dwelling shall be available at all times for bushfire fighting purposes.

SA CFS notes that additional water will be required to operate sprinkler systems.

- The bushfire fighting water supply shall be clearly identified and fitted with an outlet of at least 50mm diameter terminating with a compliant SA CFS fire service adapter, which shall be accessible to bushfire fighting vehicles at all times.
- The water storage facility (and any support structure) shall be constructed of non-combustible material.
- The dedicated fire-fighting water supply shall be pressurised by a pump that has:
 - i. A minimum inlet diameter of 38mm, AND
 - ii. Is powered by a petrol or diesel engine with a power rating of at least 3.7kW (5hp), OR
 - iii. A pumping system that operates independently of mains electricity and is capable of pressurising the water for fire-fighting purposes.
- The dedicated fire-fighting water supply pump shall be located at or adjacent to the dwelling to ensure occupants safety when operating the pump during a bushfire. An 'Operations Instruction Procedure' shall be located with the pump control panel.
- The fire-fighting pump and any flexible connections to the water supply shall be protected by a non-combustible cover that allows adequate air ventilation for efficient pump operation.
- All bushfire fighting water pipes and connections between the water storage facility and a pump shall be no smaller in diameter than the diameter of the pump inlet.
- All non-metal water supply pipes for bushfire fighting purposes (other than flexible connections and hoses for fire-fighting) shall be buried below ground to a minimum depth of 300mm with no non-metal parts above ground level.
- A fire-fighting hose (or hoses) shall be located so that all parts of the building are within reach of the nozzle end of the hose and if more than one hose is required they should be positioned to provide maximum coverage of the building and surrounds (i.e., at opposite ends of the dwelling).
- All fire-fighting hoses shall be capable of withstanding the pressures of the supplied water.
- All fire-fighting hoses shall be of reinforced construction manufactured in accordance with AS 2620 or AS 1221.
- All fire-fighting hoses shall have a minimum nominal internal diameter of 18mm and a maximum length of 36 metres.
- All fire-fighting hoses shall have an adjustable metal nozzle, or an adjustable PVC nozzle manufactured in accordance with AS 1221.
- All fire-fighting hoses shall be readily available at all times.

(21) Vegetation Management

- A vegetation management zone (VMZ) shall be established and maintained within 20 metres of each dwelling (or to the property boundaries – whichever comes first) as follows:
 - i. The number of trees and understorey plants existing and to be established within the VMZ shall be reduced and maintained such that when considered overall a maximum coverage of 30% is attained, and so that the leaf area of shrubs is not continuous. Careful selection of the vegetation will permit the 'clumping' of shrubs where desirable, for diversity and privacy, and yet achieve the 'overall maximum coverage of 30%'.
SA CFS notes that coverage of vegetation within 20m to the east and west of the proposed new dwelling is currently greater than 30%. SA CFS notes that the implementation of proposed landscaping within the above mentioned report will result in the removal of existing hazardous vegetation.
 - ii. Reduction of vegetation shall be in accordance with SA Native Vegetation Act 1991 and SA Native Vegetation Regulations 2017.
 - iii. Trees and shrubs shall not be planted closer to the building(s) than the distance equivalent to their mature height.
 - iv. Trees and shrubs must not overhang the roofline of the building, touch walls, windows or other elements of the building.
 - v. Shrubs must not be planted under trees or must be separated by at least 1.5 times their mature height from the trees' lowest branches.
 - vi. Grasses within the zone shall be reduced to a maximum height of 10cm during the Fire Danger Season.
 - vii. No understorey vegetation shall be established within 1 metre of the dwelling (understorey is defined as plants and bushes up to 2 metres in height).
 - viii. Flammable objects such as plants, mulches and fences must not be located adjacent to vulnerable parts of the building such as windows, decks and eaves.
 - ix. The VMZ shall be maintained to be free of accumulated dead vegetation.

NOTES

(1) Development Plan Consent

This Development Plan Consent (DPC) is valid for a period of twelve (12) months commencing from the date of the decision or, if an appeal has been commenced, the date on which it is determined, whichever is later.

Building Consent must be applied for prior to the expiry of the DPC and lodged through the PlanSA portal unless a private certifier was engaged prior to 19 March 2021.

Further details in relation to the Planning Reforms can be found https://www.saplanningportal.sa.gov.au/planning_reforms

(2) Works On Boundary

The development herein approved involves work within close proximity to the boundary. The onus of ensuring development is in the approved position on the correct allotment is the responsibility of the land owner/applicant. This may necessitate a survey being carried out by a licensed land surveyor prior to the work commencing.

(3) Erosion Control During Construction

Management of the property during construction shall be undertaken in such a manner as to prevent denudation, erosion or pollution of the environment.

(4) EPA Environmental Duty

The applicant is reminded of his/her general environmental duty, as required by Section 25 of the Environment Protection Act 1993, to take all reasonable and practical measures to ensure that the activities on the whole site, including during construction, do not pollute the environment in a way which causes, or may cause, environmental harm.

(5) Tourist Accommodation – Bushfire Survival Plan

- The applicants to prepare and display a BUSHFIRE SURVIVAL PLAN (BSP) designed specifically for the purpose of any guests that may be in residence during a bushfire event, especially during the Fire Danger Season.
- This BSP should give clear directions to persons that may be unfamiliar with the area/locality and unfamiliar with what protective actions they may need to take to protect their lives during a bushfire event, including when to take such protective actions.
- The BSP should address the possibility that the owners may not be present at the time of the bushfire event.
- The BSP should not expect guests to be involved in fire-fighting operations.
- The SA CFS 'Bushfire Safety and Survival for Business and Organisations' document (refer to CFS website) should be utilised as a basis for information and the drafting of the (GUEST) BSP.
- The applicant should consider reducing operating hours and restrictions on days of extreme weather or bushfire events.

SA CFS recommends that the Bushfire Planning Recommendations, as outlined in the report called Silver Lake Bushfire Management & Vegetation Review For Planning Purposes (Author: Environments by Design), dated March 2020, are implemented and reviewed on a regular basis.

(6) Department of Environment and Water (DEW) - Native Vegetation Council

The applicant is advised that any proposal to clear, remove limbs or trim native vegetation on the land, unless the proposed clearance is subject to an exemption under the Regulations of the Native Vegetation Act 1991, requires the approval of the Native Vegetation Council. The clearance of native vegetation includes the flooding of land, or any other act or activity that causes the killing or destruction of native vegetation, the severing of branches or any other substantial damage to native vegetation. For further information visit:

www.environment.sa.gov.au/Conservation/Native_Vegetation/Managing_native_vegetation

Any queries regarding the clearance of native vegetation should be directed to the Native Vegetation Council Secretariat on 8303 9777. This must be sought prior to Full Development Approval being granted by Council.

9. ATTACHMENTS

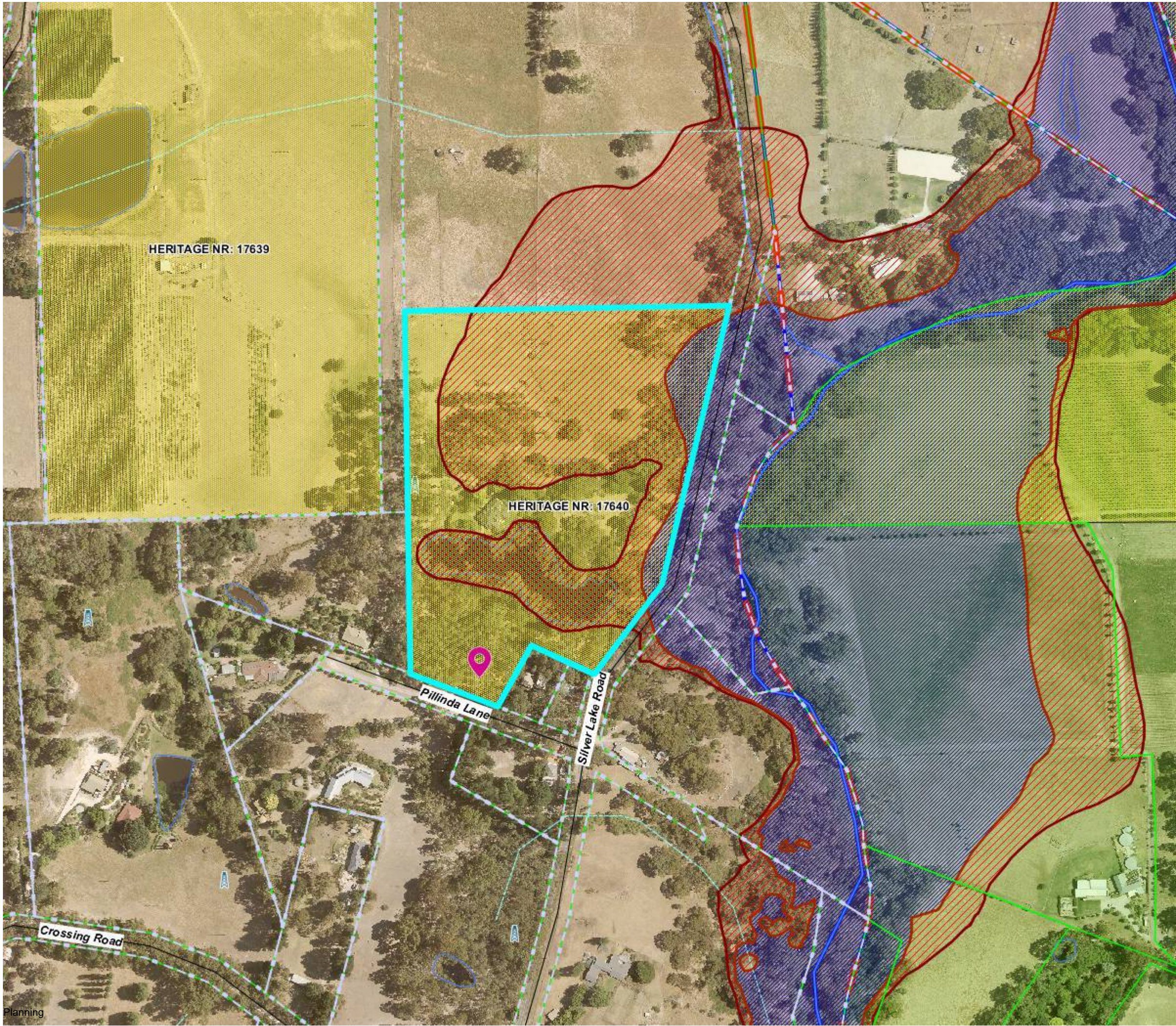
Locality Plan
Proposal Plans
Application Information
Applicant's Professional Reports
Referral Responses
Representation
Applicant's response to representations
Publically Notified Plans

Respectfully submitted

Concurrence

Sarah Davenport
Statutory Planner

Deryn Atkinson
Assessment Manager



Annotations

Feature1

Planners Summary

PlanningSummary

AHC Core

Parks

Townships

Parcels

Roads

Rivers

River

Creeks

Streams

Flood Study Data

TorrensFloodZones_20Yr

TorrensFloodZones_100Yr

OnkaFloodPlain10Yr

FloodPlain100Year

Zones_ Policy & Landuse

Zones

Policy

LMAs & Heritage

LMA LSG Sourced

LMA AHC Sourced

HeritageITEMs

Local

State

DrillHoles (Bores) & Surface Water

Drill Holes (aka Bores)

Waterbodies (Dams)

Rivers

-9

Intermittent Stream

Stream

Creek (Low Lvl)

Creek (mid Lvl)

River (Low to Mid Lvl)

River

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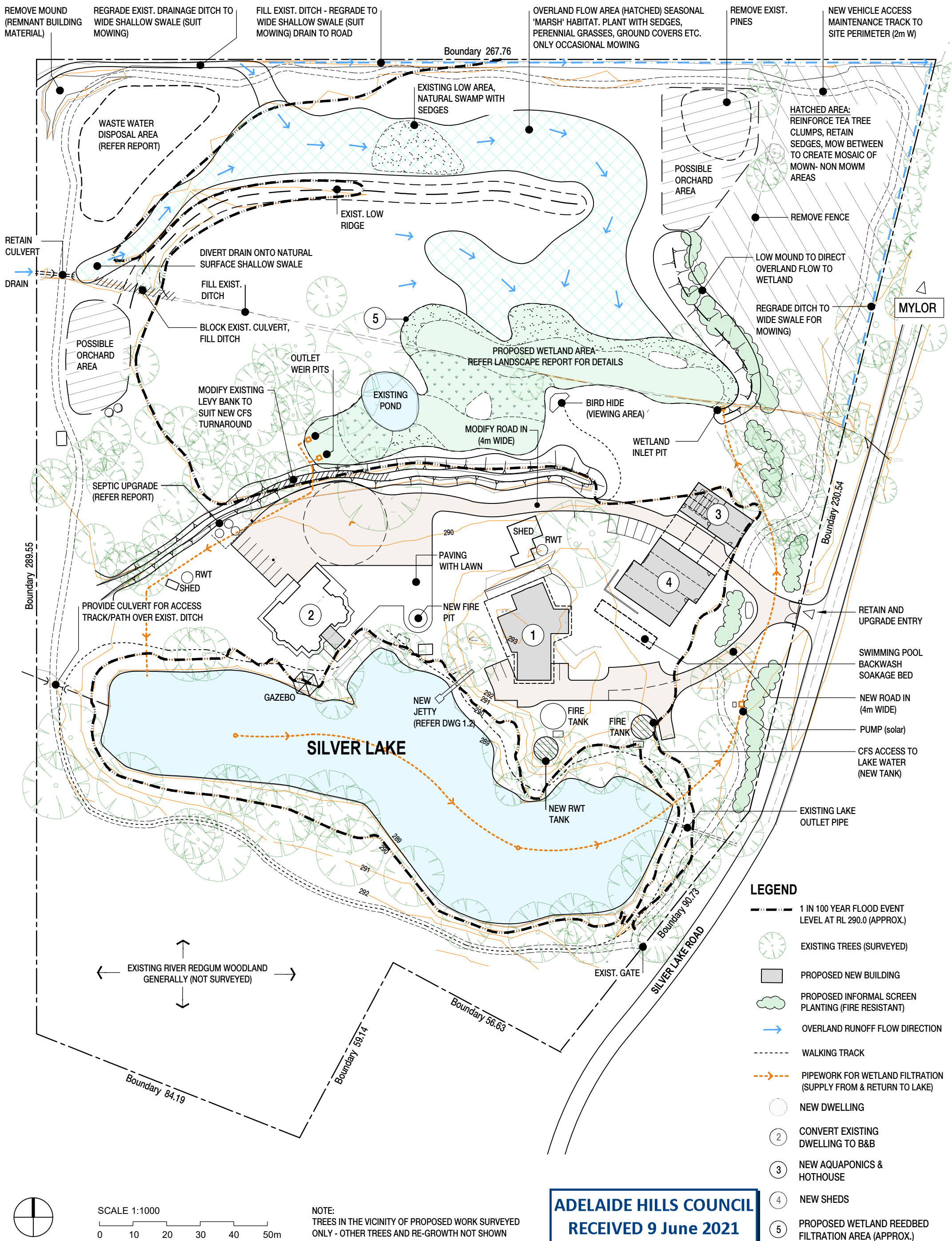
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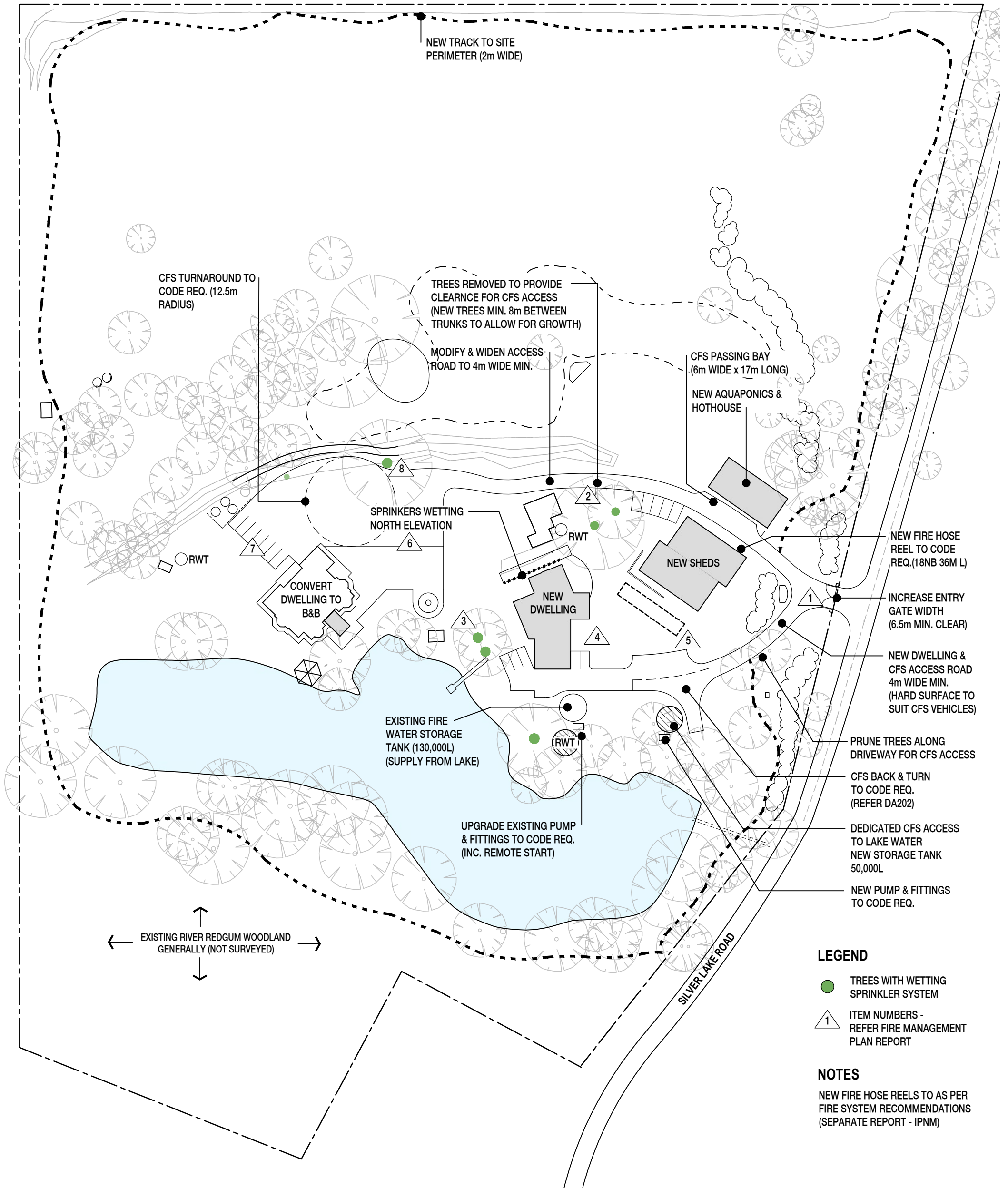
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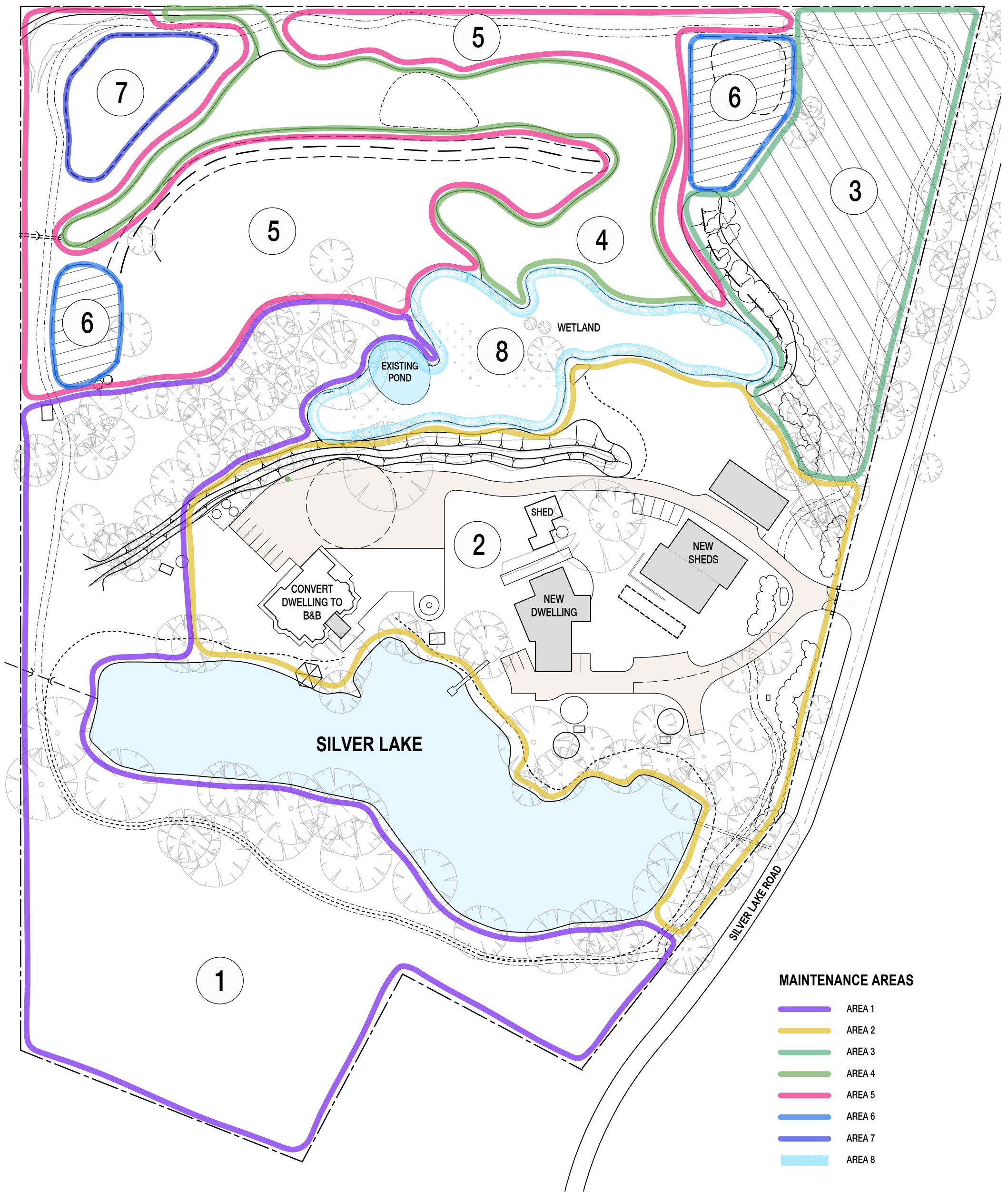
-2021





SCALE 1:1000
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ADELAIDE HILLS COUNCIL
RECEIVED 9 June 2021



MAINTENANCE AREAS

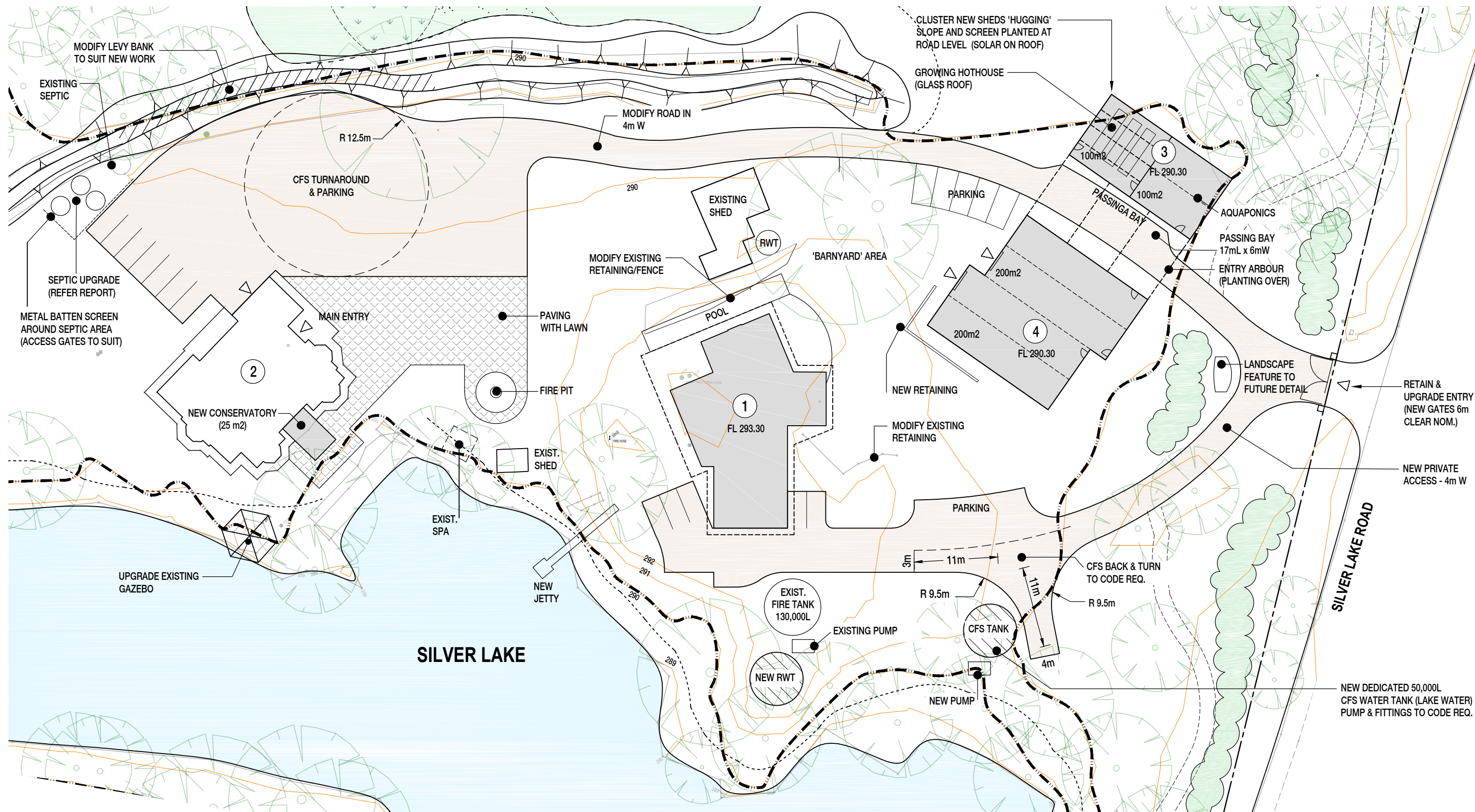
- AREA 1
- AREA 2
- AREA 3
- AREA 4
- AREA 5
- AREA 6
- AREA 7
- AREA 8



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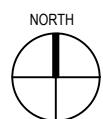
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RECEIVED 9 June 2021



LEGEND

- 1 IN 100 YEAR FLOOD EVENT LEVEL AT RL 290.0 (APPROX.)
- EXISTING TREES (SURVEYED)
- PROPOSED NEW BUILDING
- PROPOSED SCREEN PLANTING (REFER LANDSCAPE PLAN DA701)
- 1 NEW DWELLING
- 2 CONVERT EXISTING DWELLING TO B&B
- 3 NEW AQUAPONICS & HOTHOUSE (100m2 approx each)
- 4 NEW SHEDS



SCALE 1:500

ADLAIDE HILLS COUNCIL
RECEIVED 20/04/2020

HANNAFORD CONSULTING
m: 0401 693 552 hannaforconsulting@bigpond.com

SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD MYLOR SA

Scale: 1:500 (A3)

Proj. / Draw. No: 1817 DA1.2

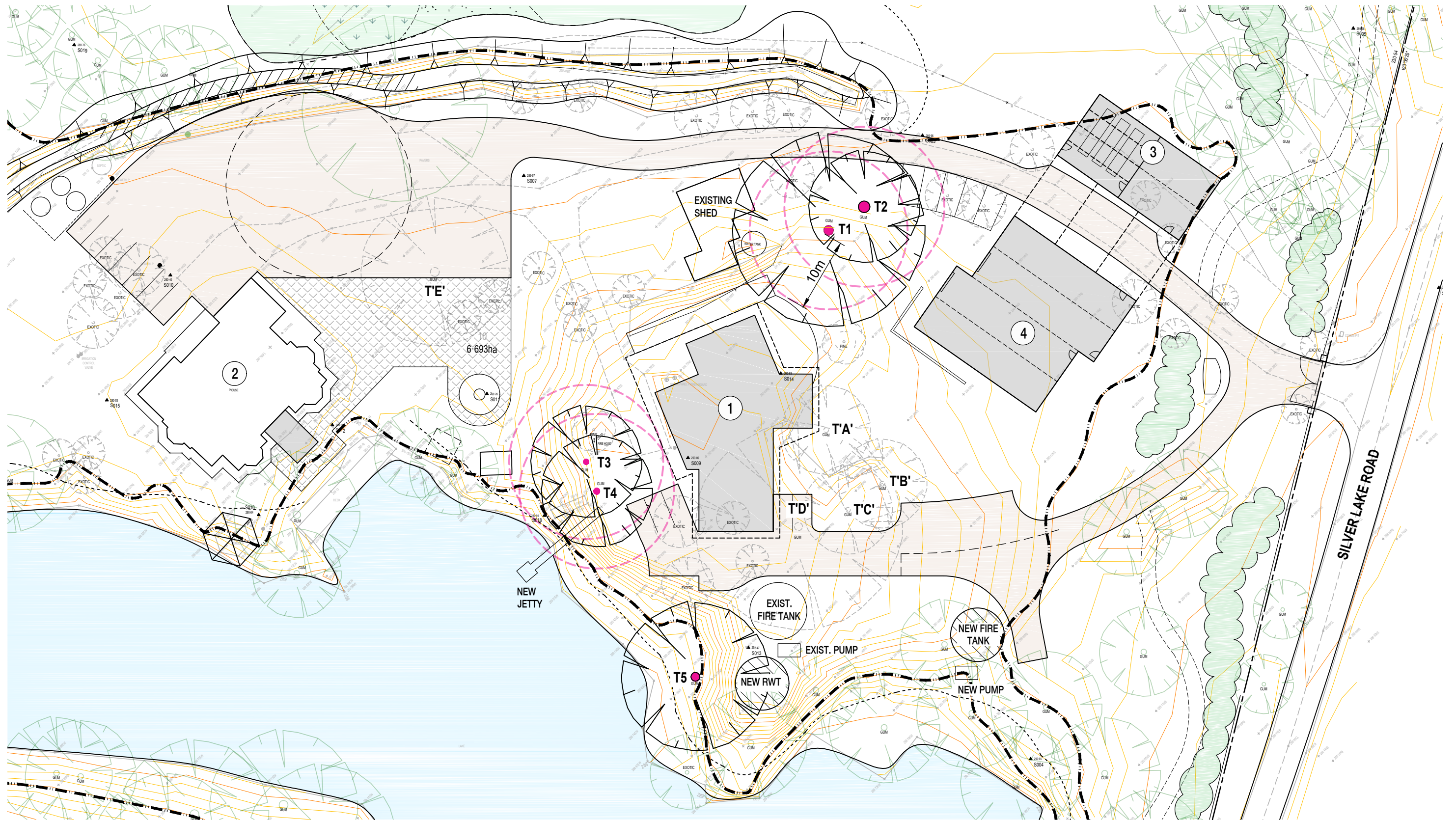
for RUDY GOMEZ

PROPOSED PART SITE PLAN

Proj. Area: SITE

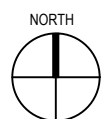
25.02.2020 Rev:

1.2



LEGEND

- | | | | | | |
|--|---|---|---|--|--|
| <p>--- 1 IN 100 YEAR FLOOD EVENT LEVEL AT RL 290.0 (APPROX.)</p> <p> EXISTING TREES (SURVEYED)</p> | <p> PROPOSED NEW BUILDING</p> <p> PROPOSED SCREEN PLANTING (REFER LANDSCAPE PLAN DA701)</p> | <p> TREES TO BE REMOVED (REFER FIRE MANAGEMENT REPORT & DRAWINGS)</p> | <p>① NEW DWELLING</p> <p>② CONVERT EXISTING DWELLING TO B&B</p> | <p>③ NEW AQUAPONICS & HOTOUSE (100m2 approx each)</p> <p>④ NEW SHEDS</p> | <p> 10m TPZ RADIUS FROM TREE TRUNK (APPROX.)</p> |
|--|---|---|---|--|--|



SCALE 1:500

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RECEIVED 20/04/2020

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SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD MYLOR SA

Scale: 1:500 (A3)

Proj. / Draw. No: **1817 DA1.3**

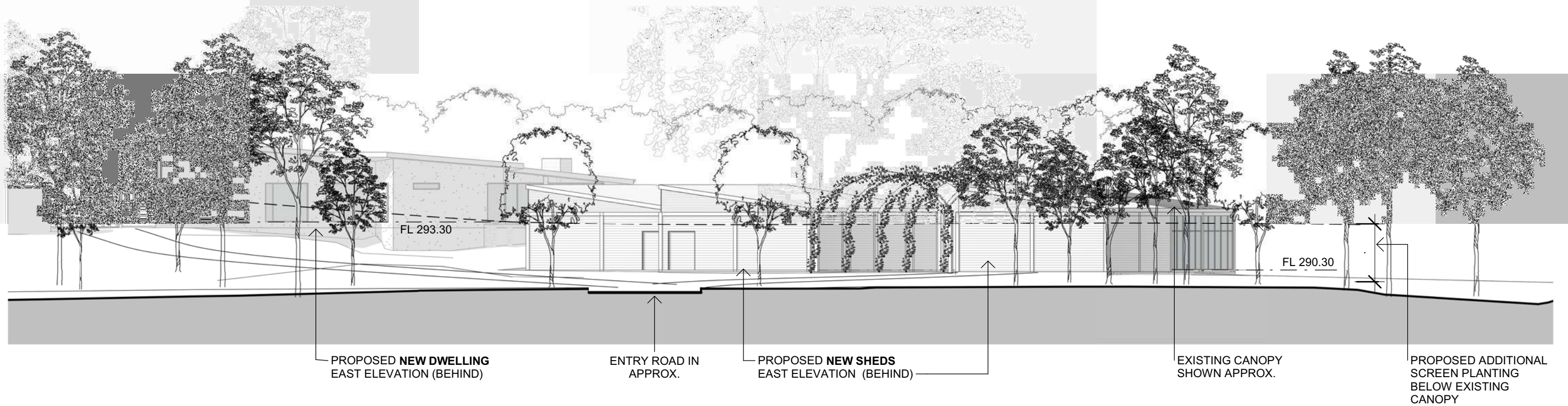
for RUDY GOMEZ

PROPOSED PART SITE PLAN (IMPACTED TREES & REFERENCE PLAN)

Proj. Area: **SITE**

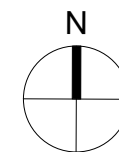
25.02.2020 Rev:

1.3



SECTION AT SITE ENTRY

1:250



KEY PLAN

1:2500



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m: 0401 693 552 hannaforconsulting@bigpond.com

SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: As indicated (A3)

Proj. / Draw. No: **1817 DA1.4**

for RUDY GOMEZ

PROPOSED SITE SECTION 1

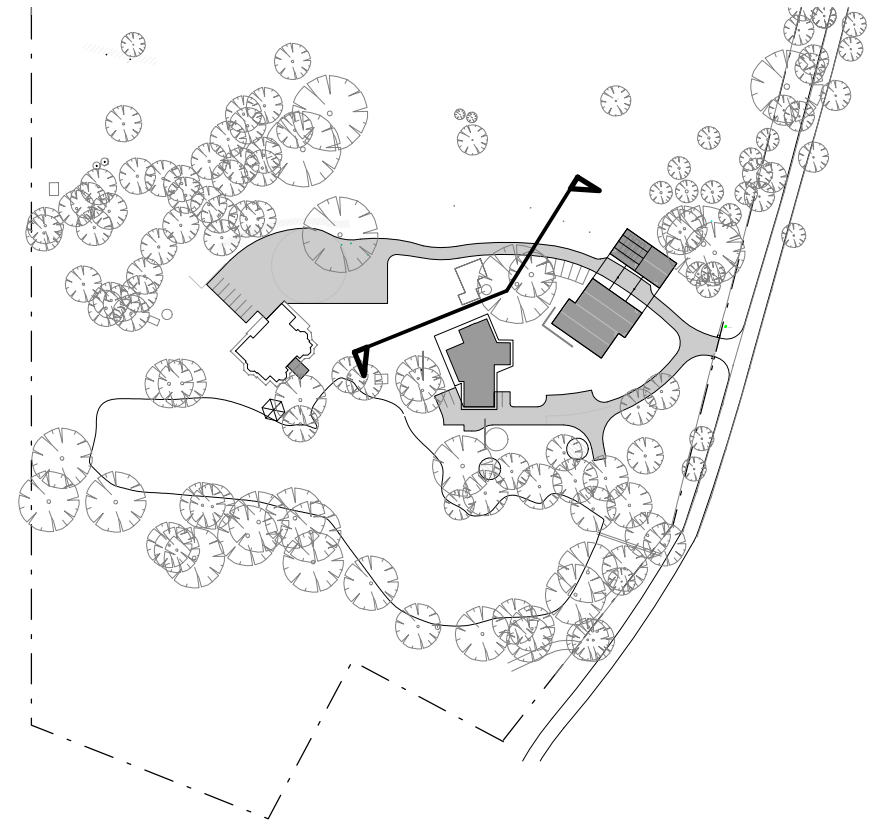
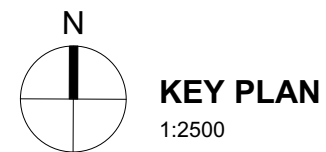
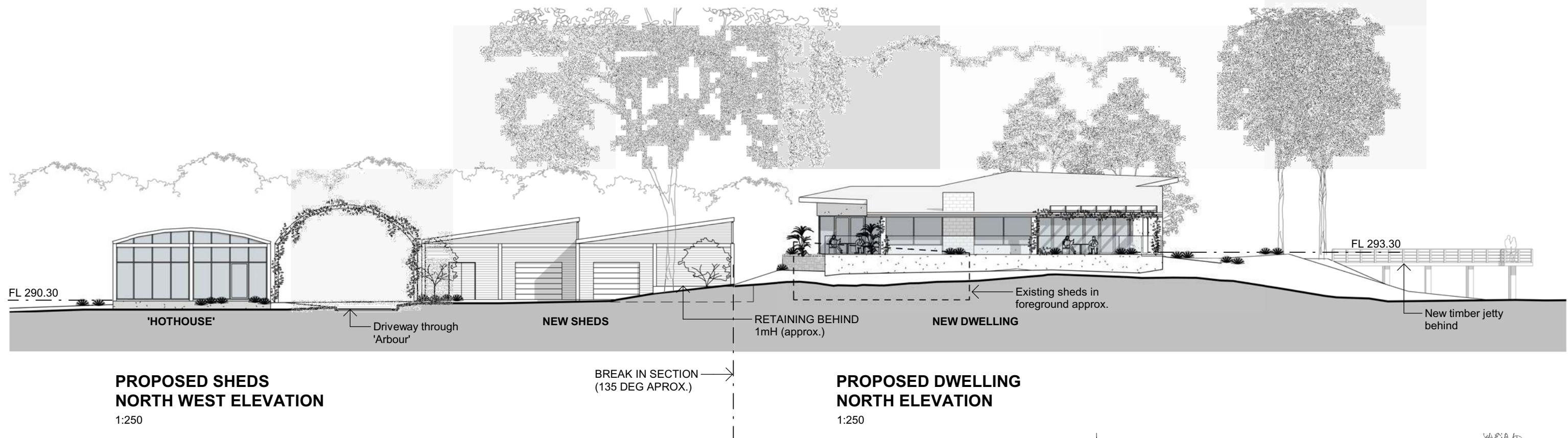
Proj. Area: **SITE**

25.02.2020

Rev:

1.4

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SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: As indicated (A3)

Proj. / Draw. No: **1817 DA1.5**

for RUDY GOMEZ

PROPOSED SITE SECTION 2

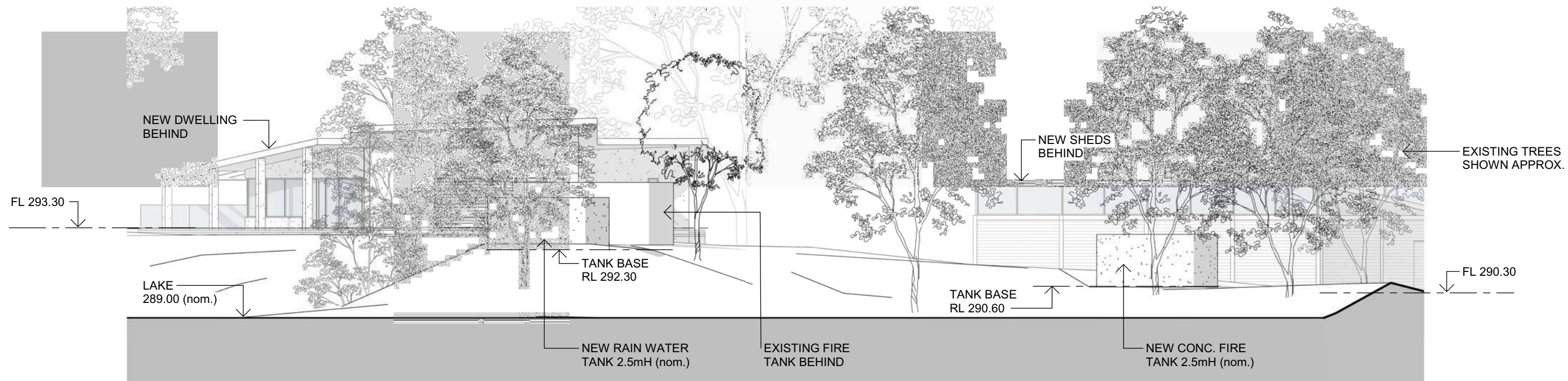
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24.02.2020

Rev:

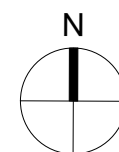
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**ADELAIDE HILLS COUNCIL
RECEIVED 20/04/2020**

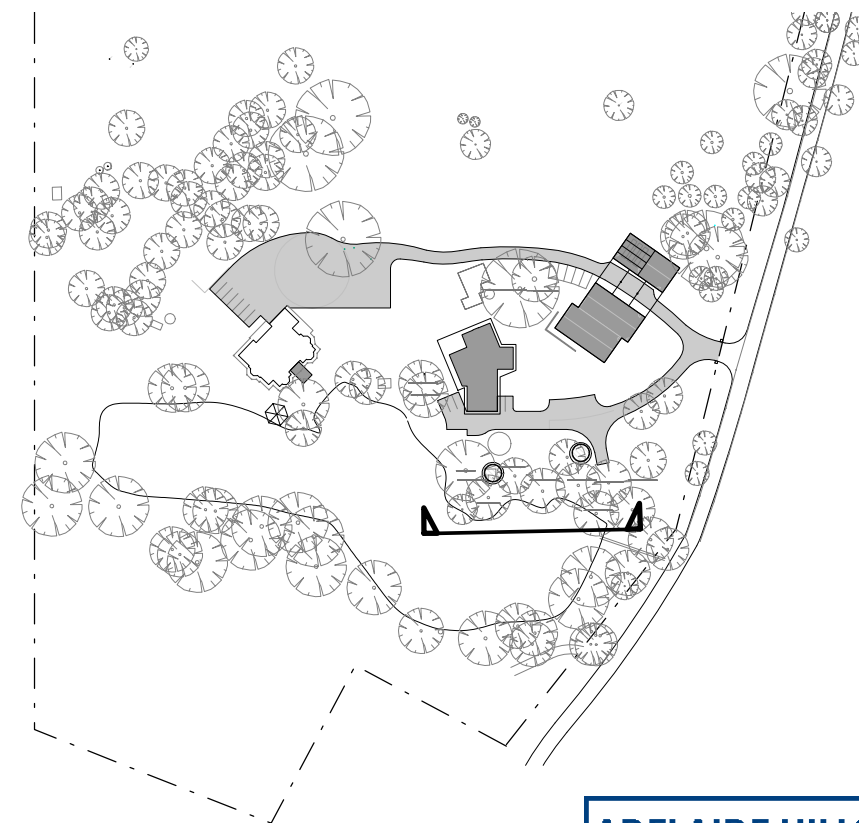


**PROPOSED TANKS
SOUTH ELEVATION**

1:200



KEY PLAN
1:2500



**ADELAIDE HILLS COUNCIL
RECEIVED 06 08 2020**

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m: 0401 693 552 hannaforconsulting@bigpond.com

**SILVER LAKE
SITE REGENERATION & DEVELOPMENT**

SILVER LAKE RD, MYLOR SA

Scale: As indicated (A3)

Proj. / Draw. No: **1817 DA1.6**

for RUDY GOMEZ

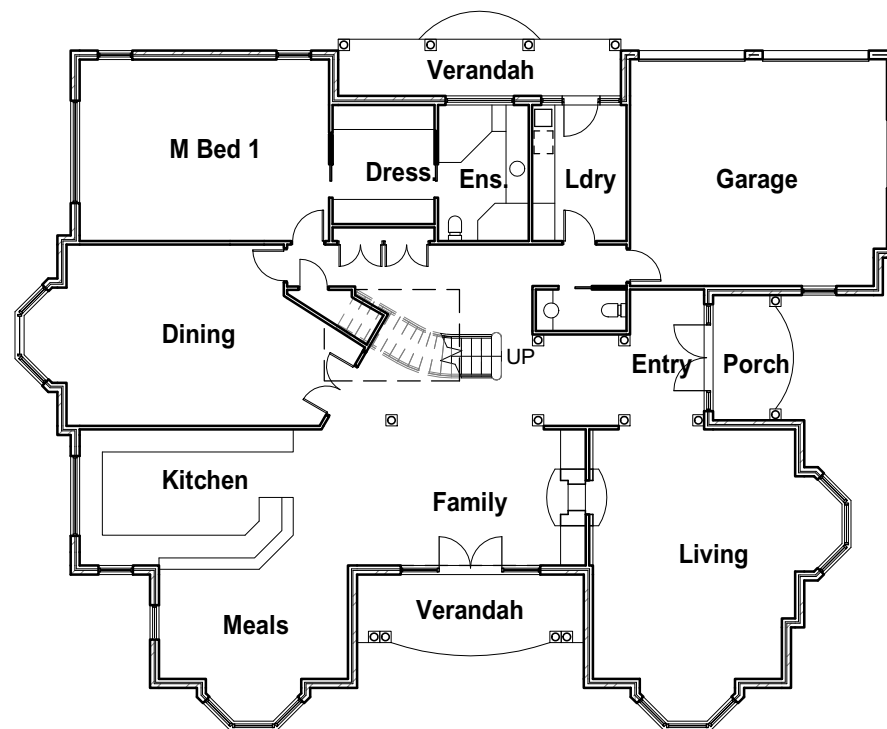
**PROPOSED SITE SECTION 3
NEW TANKS**

Proj. Area: **SITE**

19.06.2020

Rev:

1.6

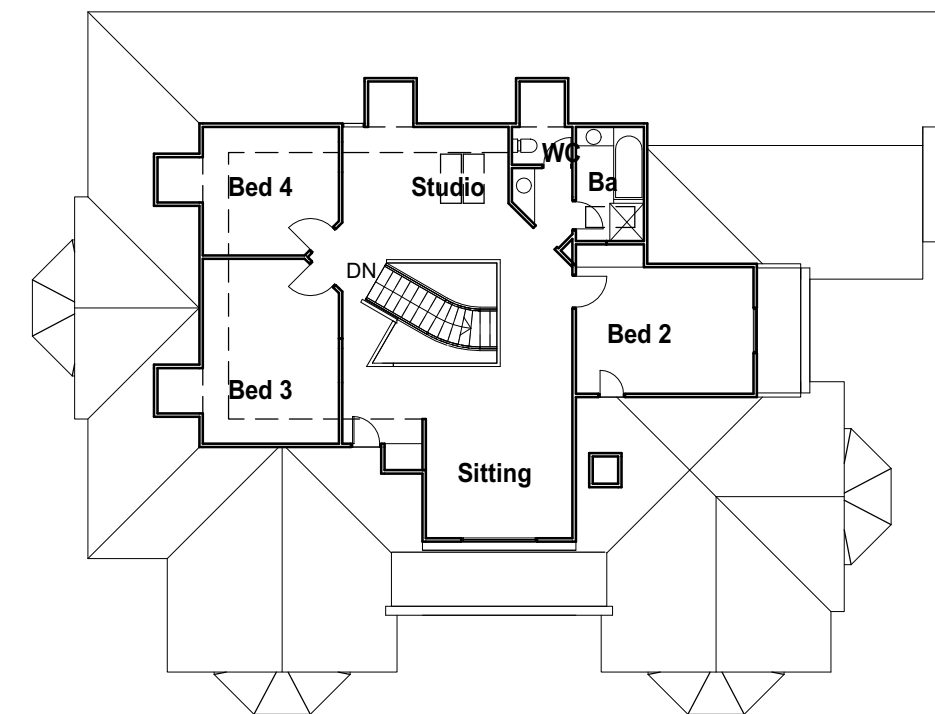


EXISTING GROUND FLOOR

1 : 200

GROUND FLOOR AREA
(inside face external walls)

GARAGE	40 m ²
LIVING	250 m ²



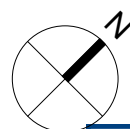
EXISTING FIRST FLOOR

1 : 200

FIRST FLOOR AREA
(inside face external walls,
exc. stair void)

LIVING	112 m ²
--------	--------------------

DRAWING PROVIDED FOR REFERENCE



SCALE 1:200 @ A3

0 2 4 6 8 10 M

ADELAIDE HILLS COUNCIL
RECEIVED 20/04/2020

HANNAFORD CONSULTING
m: 0401 693 552 hannaforconsulting@bigpond.com

SILVER LAKE SITE REGENERATION & DEVELOPMENT

for RUDY GOMEZ

SILVER LAKE RD, MYLOR SA

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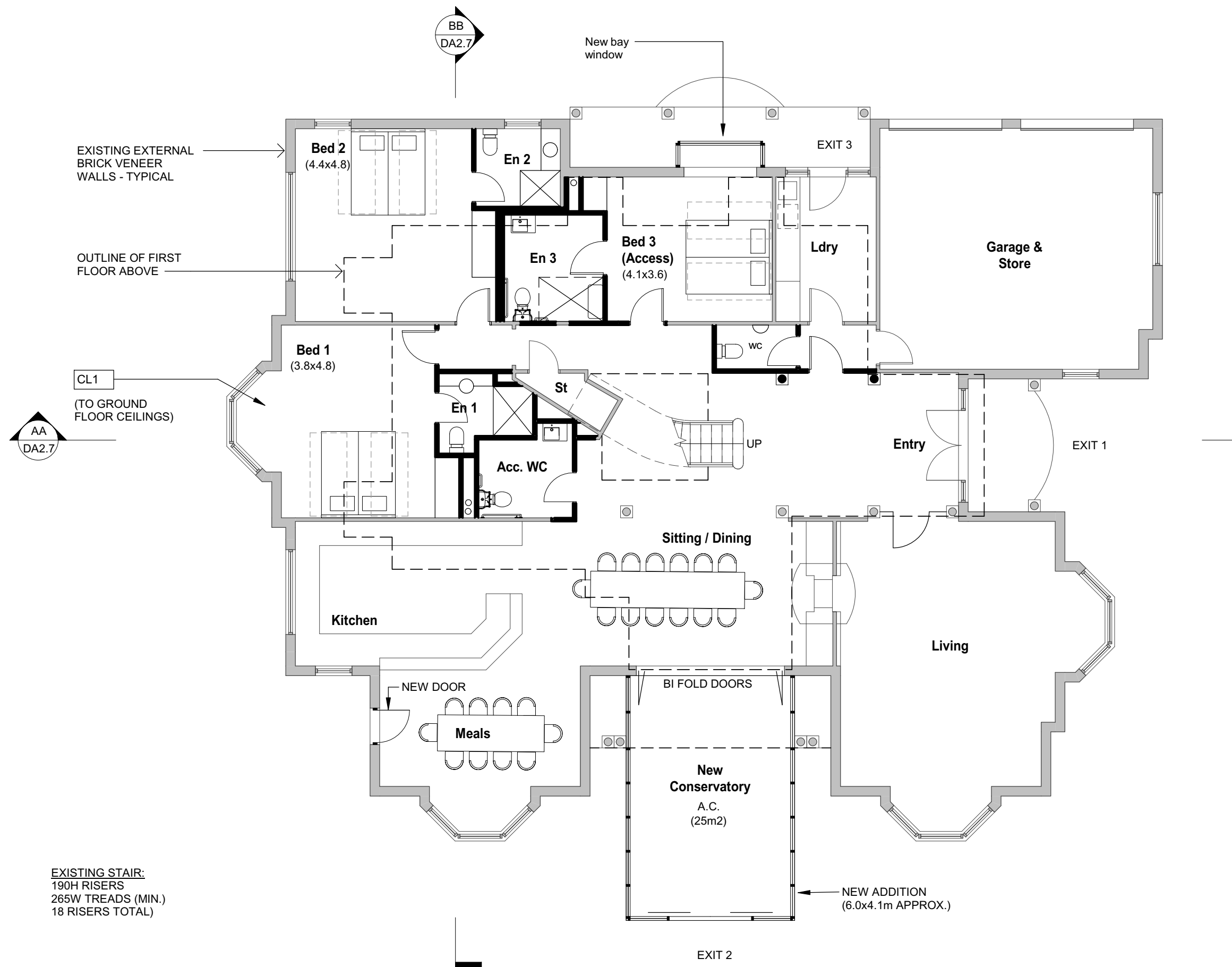
Proj. / Draw. No: **1817 DA2.1**

EXISTING FLOOR PLANS

Proj. Area: **B&B (Existing Dwelling)** 25.02.2020

Rev:

2.1



LEGEND

- EXISTING WALLS
- NEW WALLS

EXISTING STAIR:
190H RISERS
265W TREADS (MIN.)
18 RISERS TOTAL)

HANNAFORD CONSULTING
m: 0401 693 552 hannaforconsulting@bigpond.com

SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: 1 : 100 (A3)

Proj. / Draw. No: 1817 DA2.2

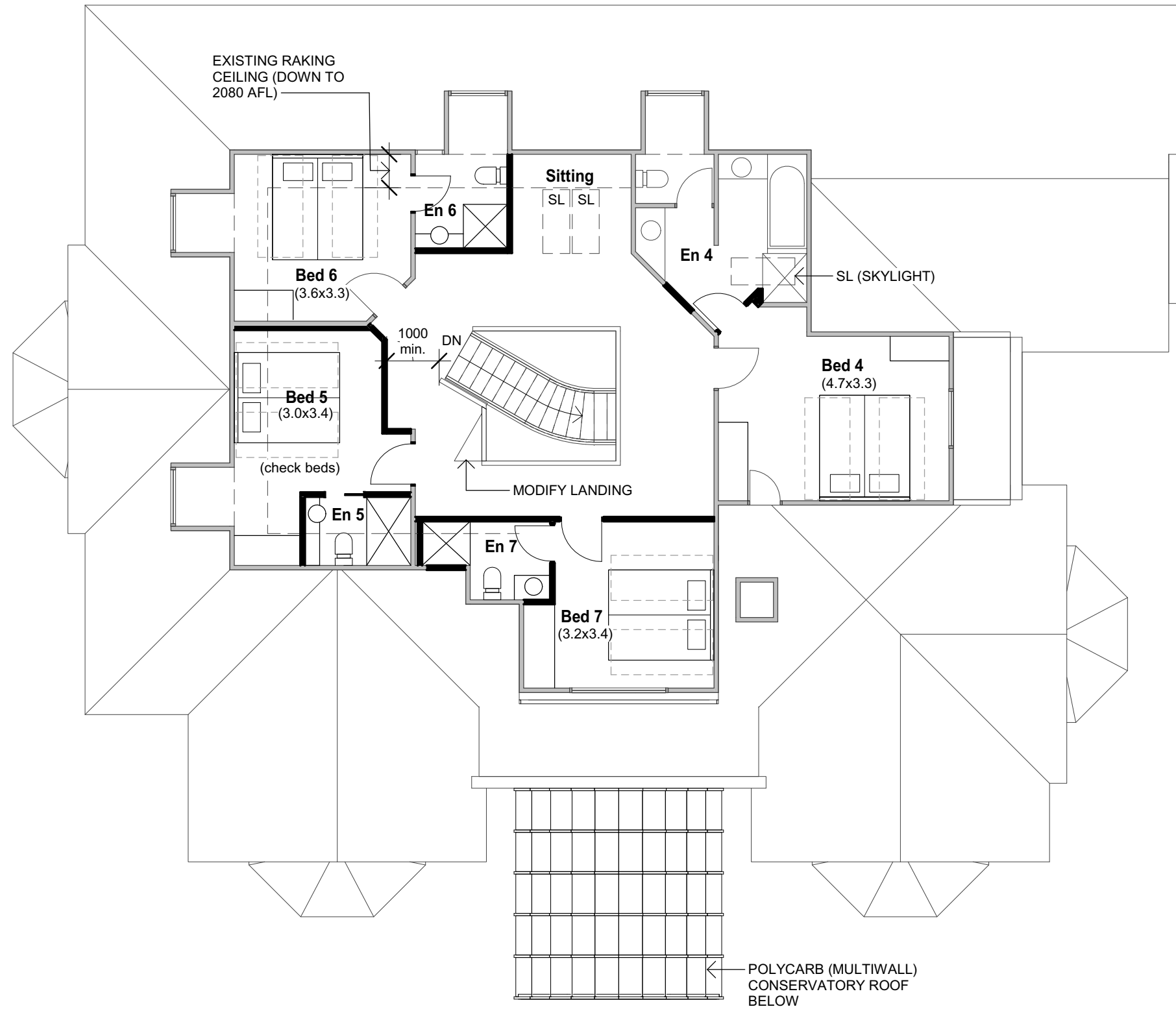
for RUDY GOMEZ

PROPOSED GROUND FLOOR PLAN

Proj. Area: B&B (Existing Dwelling) 25.02.2020 Rev:

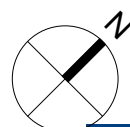
2.2

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LEGEND

- EXISTING WALLS
- NEW WALLS



SCALE 1:100



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SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: 1 : 100 (A3)

Proj. / Draw. No: **1817 DA2.3**

for RUDY GOMEZ

PROPOSED FIRST FLOOR PLAN

Proj. Area: **B&B (Existing Dwelling)** 25.02.2020 Rev:

2.3



PROPOSED NE ELEVATION
1 : 200



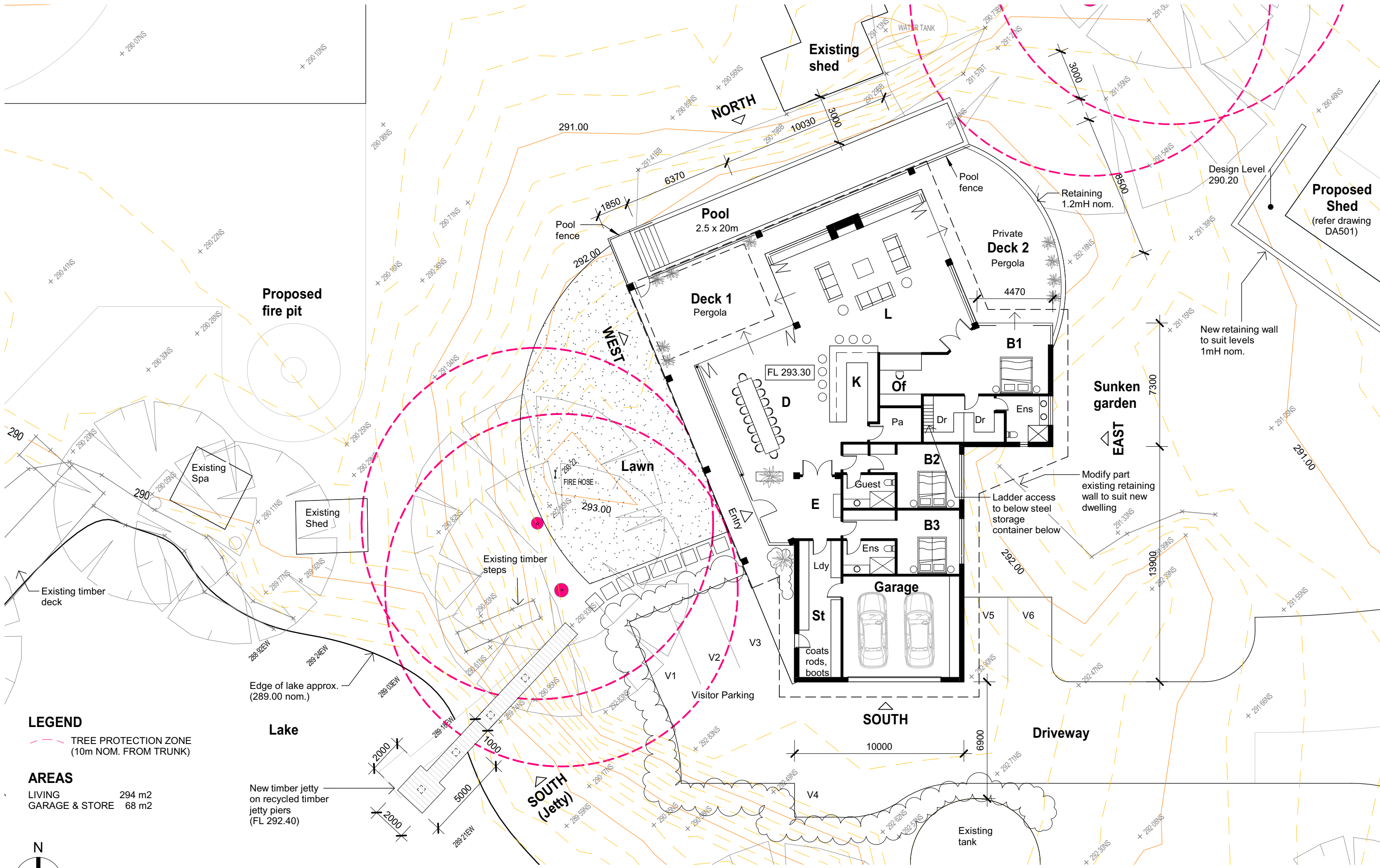
PROPOSED SE ELEVATION
1 : 200



PROPOSED SW ELEVATION
1 : 200



PROPOSED NW ELEVATION
1 : 200

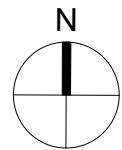


LEGEND

— TREE PROTECTION ZONE
(10m NOM. FROM TRUNK)

AREAS

LIVING 294 m2
GARAGE & STORE 68 m2



SCALE 1:200 @ A3

0 2 4 6 8 10 M
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SILVER LAKE SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: 1 : 200 (A3)

for RUDY GOMEZ

Proj. / Draw. No: **1817 DA3.1**

PROPOSED NEW DWELLING FLOOR PLAN

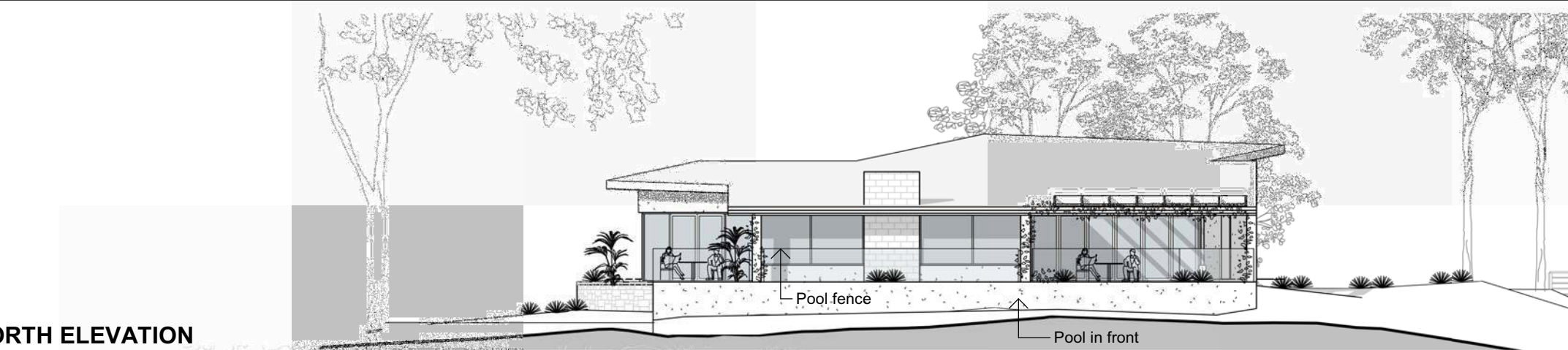
Proj. Area: **NEW DWELLING**

25.02.2020

Rev:

3.1

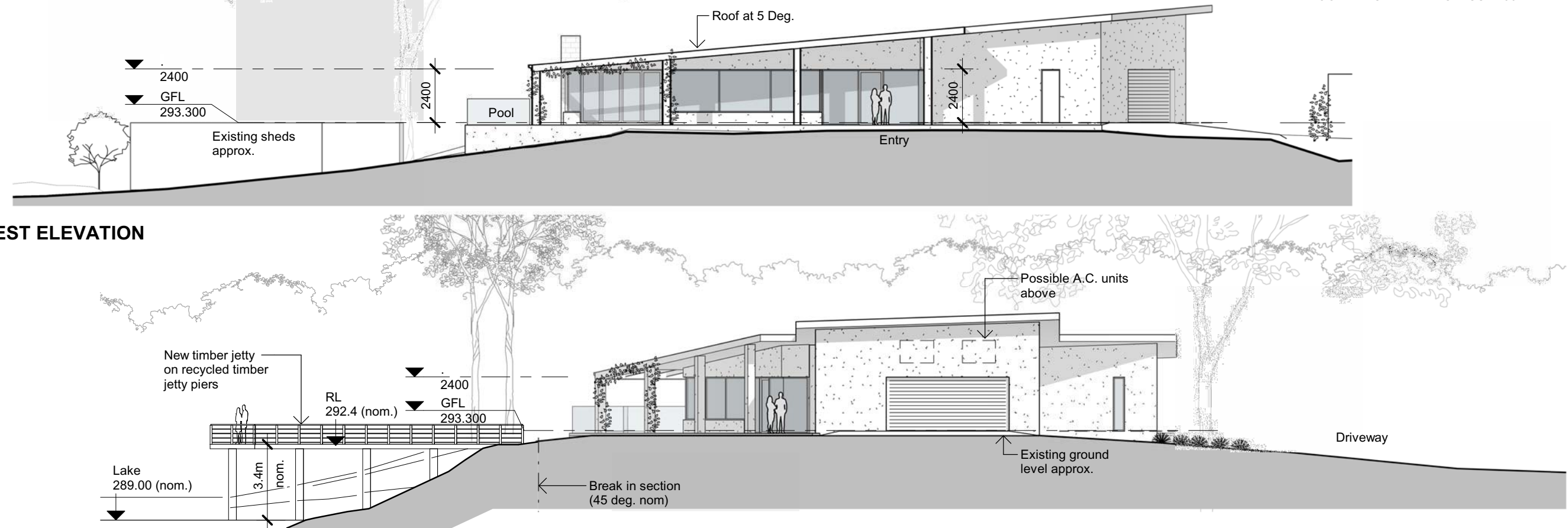
NORTH ELEVATION



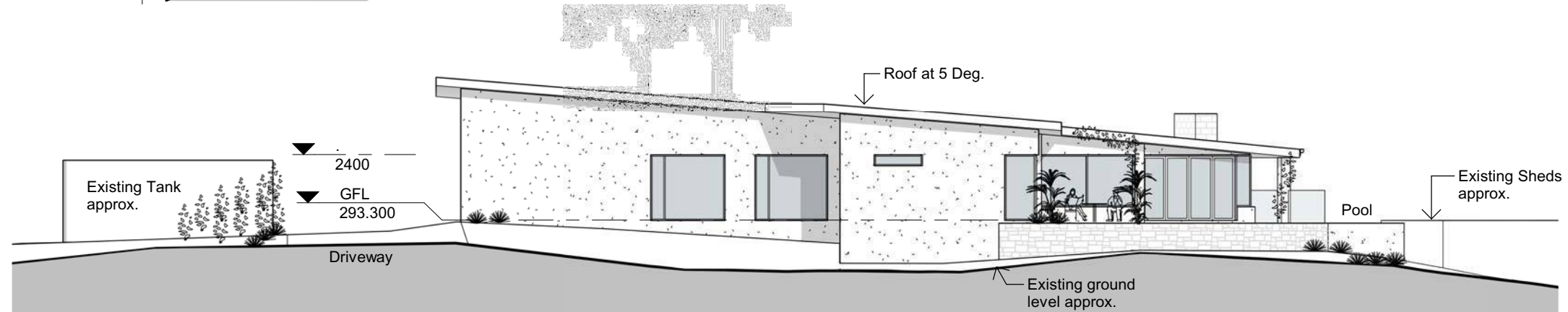
EXTERNAL FINISHES

EXTERNAL WALLS	TEXTURE COAT FINISH GREY/GREEN NATURAL
ROOF CLADDING	CORRUGATED METAL ROOF MID - DARK GREY OR SIMILAR TO APPROVAL
GUTTERS	HALF ROUND, COLORBOND DARK GREY OR SIMIALR
FASCIAS	PAINTED TIMBER DARK GREY OR SIMIALR
WINDOWS	TO BE ALUMINIUM FRAMED, WITH POWDERCOAT FINISH TO MATCH COLORBOND MONUMENT OR SIMILAR. OPENING PANE LOCATIONS & TYPES TO BE CONFIRMED WITH CLIENT.
POOL FENCE	GLASS 1200H MIN.

WEST ELEVATION



SOUTH ELEVATION



EAST ELEVATION

SCALE 1:200 @ A3



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SILVER LAKE
SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: 1 : 200 (A3)

Proj. / Draw. No: **1817 DA3.2**

for RUDY GOMEZ

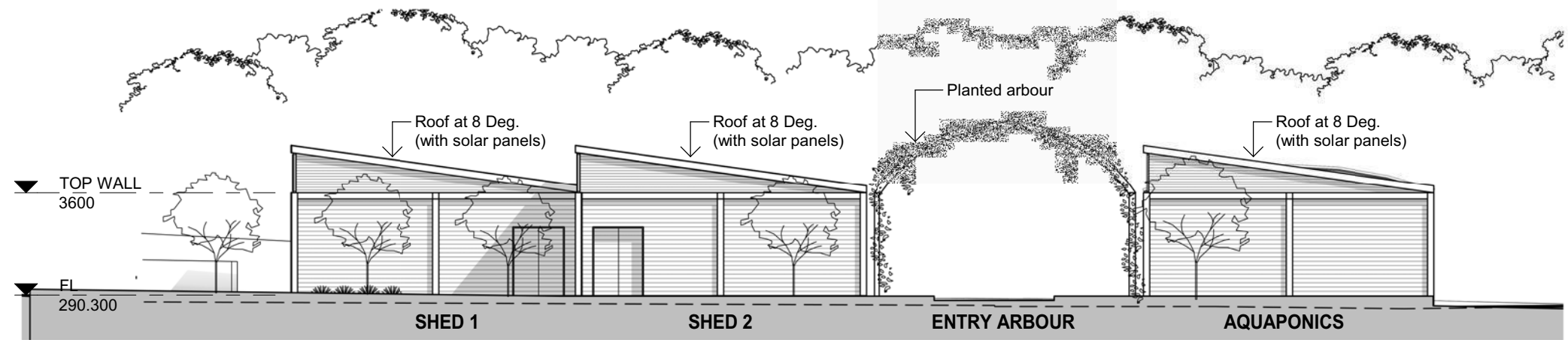
PROPOSED NEW DWELLING
ELEVATIONS

Proj. Area: **NEW DWELLING**

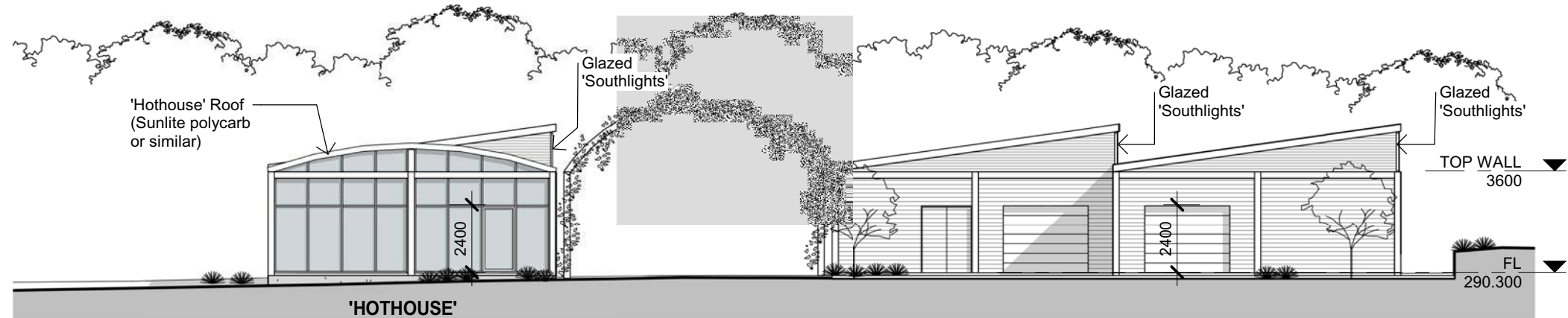
25.02.2020

Rev:

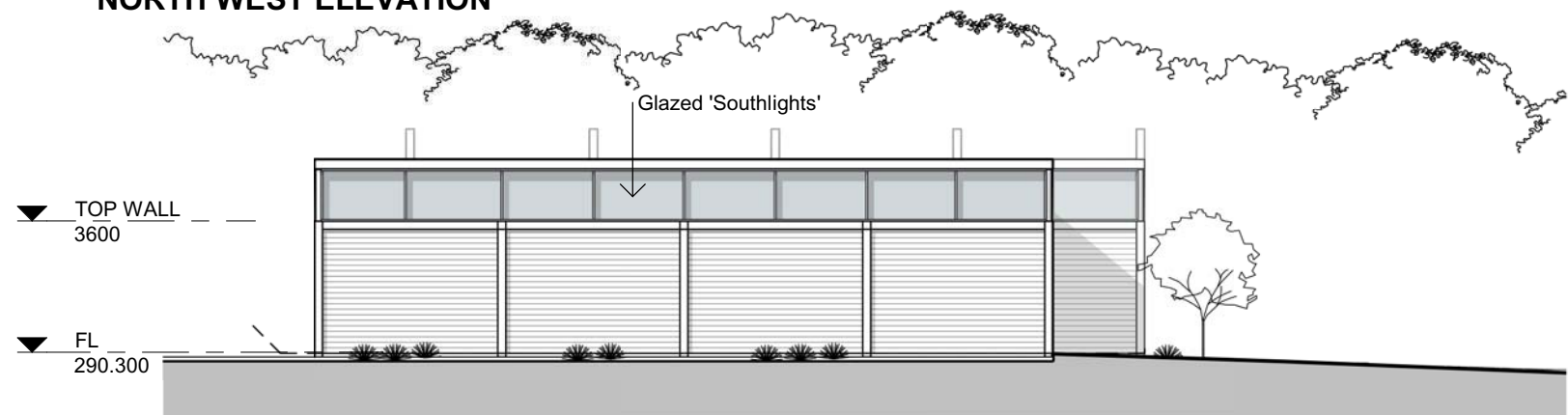
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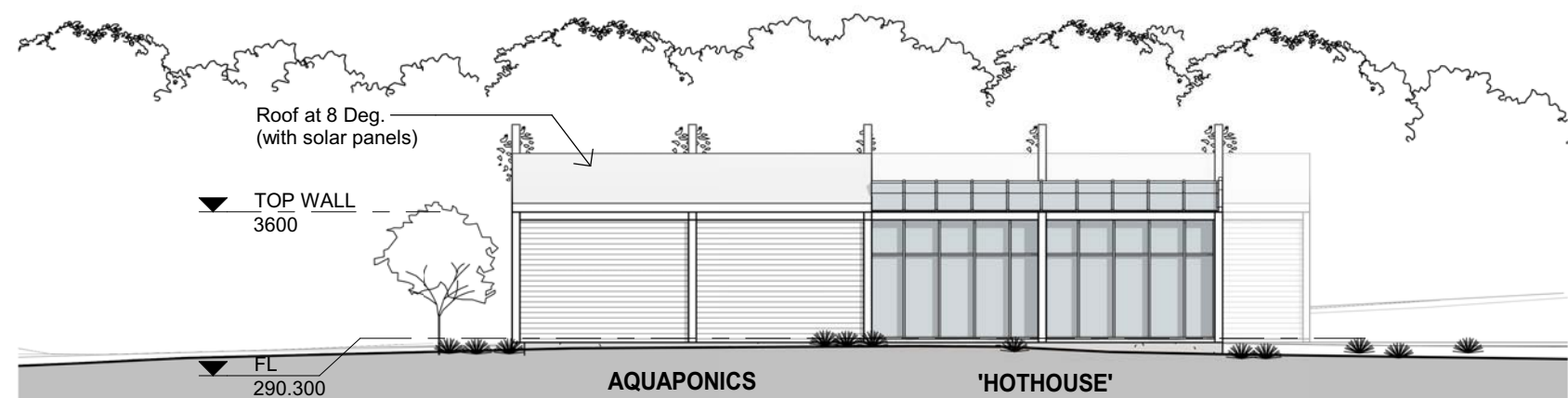
SOUTH EAST ELEVATION



NORTH WEST ELEVATION



SOUTH WEST ELEVATION



NORTH EAST ELEVATION

FINISHES LEGEND

EXTERNAL FRAME	LARGE SCALE HARDWOOD (FIRE RESISTANT)
EXTERNAL WALLS	METAL COLORBOND WALL CLADDING MID GREY/GREEN (NATURAL EARTH TONES)
ROOF CLADDING	CORRUGATED METAL ROOF CLADDING COLORBOND (MID-DARK GREY) OR SIMILAR TO APPROVAL
GUTTERS	HALF ROUND, COLORBOND MONUMENT (DARK CHARCOAL) OR SIMILAR
FASCIAS	PAINTED TIMBER, TO MATCH NEW DWELLING
ARBOUR	PAINTED STEEL, TO MATCH COLORBOND MONUMENT OR SIMILAR
WINDOWS	ALUMINIUM FRAMED, WITH POWDERCOAT FINISH TO MATCH COLORBOND MONUMENT OR SIMILAR. OPENING PANE LOCATIONS & TYPES TO BE CONFIRMED WITH CLIENT.

SCALE 1:200 @ A3

0 2 4 6 8 10 M

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HANNAFORD CONSULTING

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SILVER LAKE

SITE REGENERATION & DEVELOPMENT

SILVER LAKE RD, MYLOR SA

Scale: 1 : 200 (A3)

Proj. / Draw. No: **1817 DA4.2**

for RUDY GOMEZ

PROPOSED SHEDS

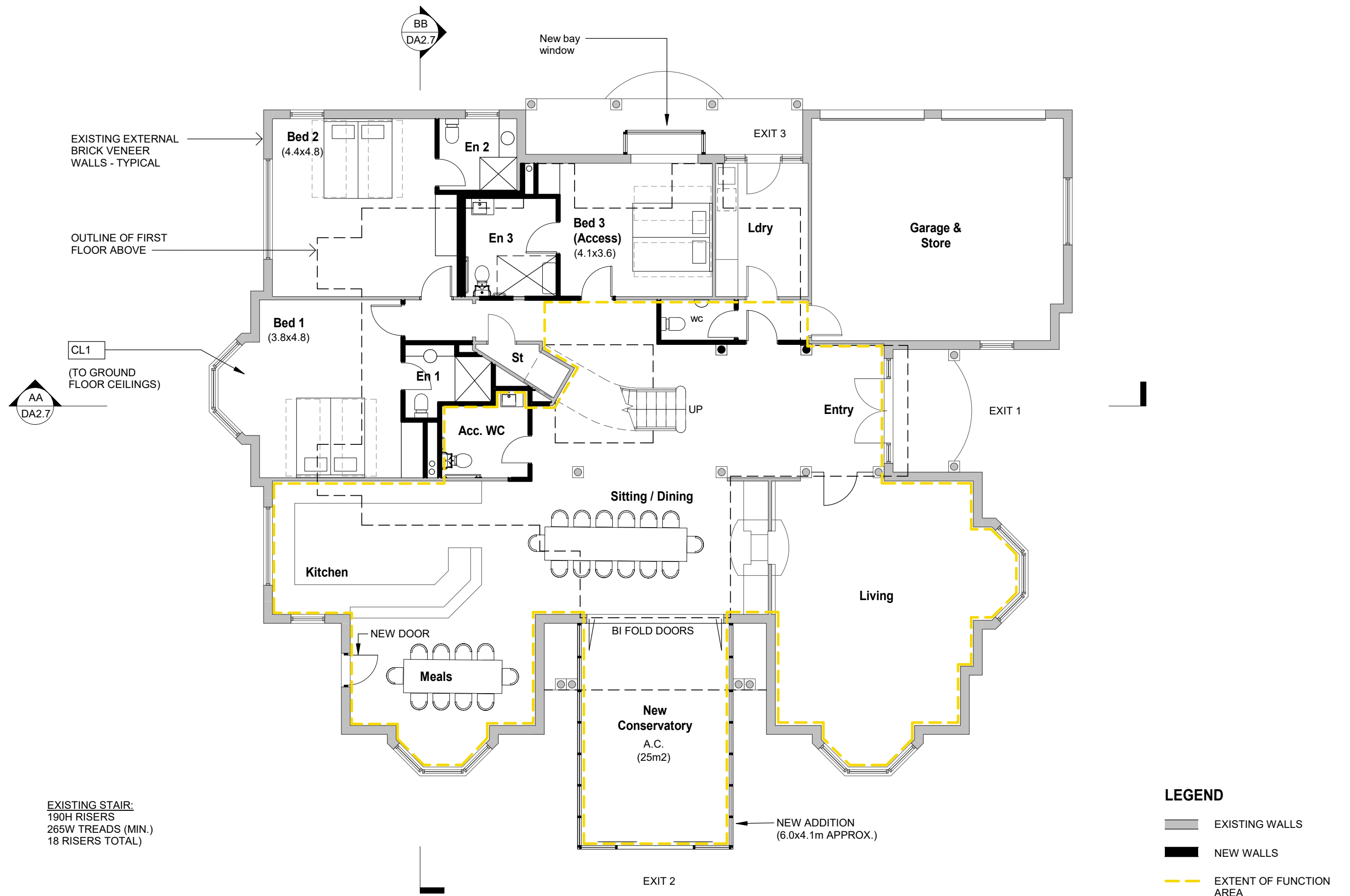
ELEVATIONS

Proj. Area: **NEW SHEDS**

14.04.2020

Rev:

4.2



Sarah Davenport

From: Ian Hannaford <hannafordconsulting@bigpond.com>
Sent: Monday, 2 August 2021 3:41 PM
To: Sarah Davenport
Cc: Rudy Gomez; Grant Pietsch
Subject: Reply to queries

[EXTERNAL]

Good afternoon Sarah,

Thank you for your queries of today's date to which I have been authorised to answer as follows by Mr Gomez.

- 1/ there is no plan to license any of the tourist accommodation or function space.
 - 2/ the function area will be on the ground level only and be as outlined on the attached plan prepared by Grant Pietsch under separate cover.
 - 3/ Hard waste will be removed by private contractors all in accordance with authority requirements.
- Please advise if further information is required.

Sincerely

Ian Hannaford FRAIA
Project Coordinator
Sent from my iPhone

REAL PROPERTY ACT, 1886



The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.



Certificate of Title - Volume 5107 Folio 485

Parent Title(s) CT 4214/542
Creating Dealing(s) CONVERTED TITLE
Title Issued 10/02/1993 Edition 5 Edition Issued 19/09/2015

Estate Type

FEE SIMPLE

Registered Proprietor

CARTWHEEL RESOURCES PTY. LTD. (ACN: 149 766 647)
OF 5 MAIS STREET BROMPTON SA 5007

Description of Land

ALLOTMENT 10 FILED PLAN 101385
IN THE AREA NAMED MYLOR
HUNDRED OF NOARLUNGA

Easements

NIL

Schedule of Dealings

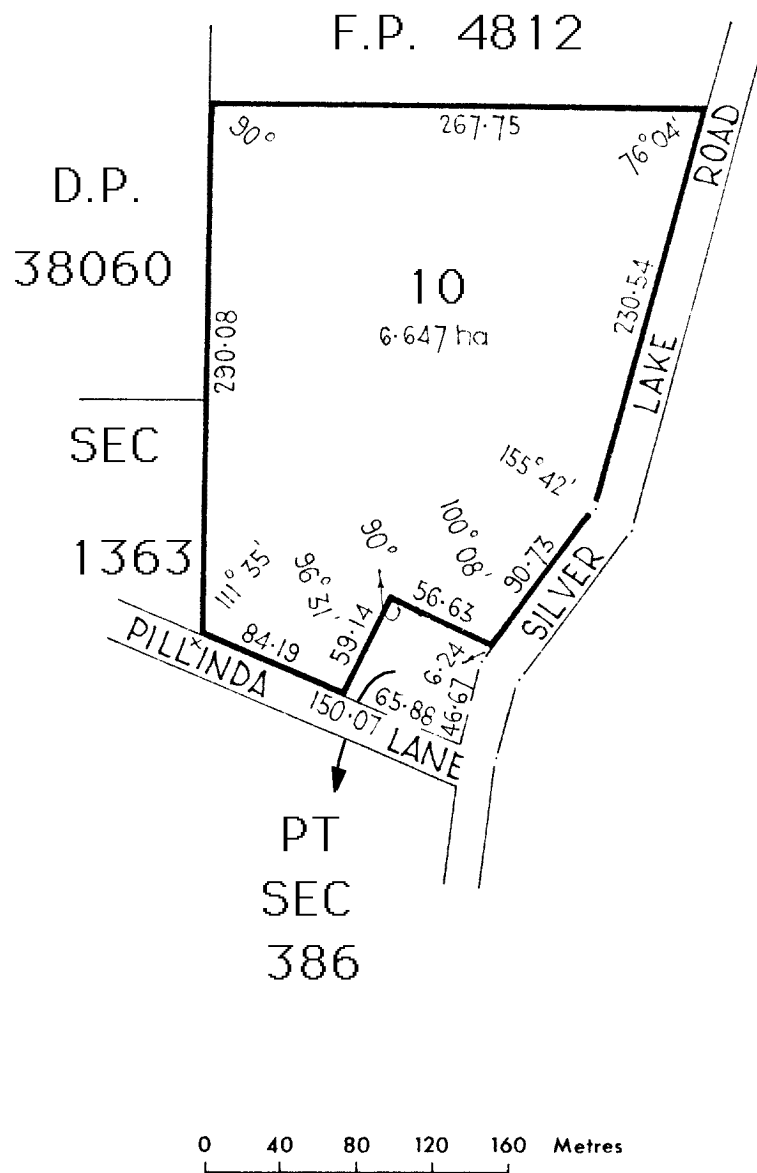
NIL

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL

ADELAIDE HILLS COUNCIL
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This plan is scanned from Certificate of Title 4214/542



Note: Subject to all lawfully existing plans of division

ADELAIDE HILLS COUNCIL
RECEIVED 20/04/2020

Statement of Effect

Development Application
20/366/473
118 Silver Lake Road, Mylor

Cartwheel Resources Pty Ltd

Statement of Effect

Development Application DA 20/366/473 seeking Development Plan Consent for development described by the Council as:

Change of use of detached dwelling to tourist accommodation facility (maximum of 14 guests) & associated function venue, together with alterations and additions to the building, construction of a new detached dwelling, swimming pool, replacement jetty, removal of ground mounted solar array, clearing and re-vegetating Silver Lake (Local Heritage Place), construction of a wetland system, demolition of farm building, construction of outbuildings (for "hobby" aquaponics and vehicle and equipment storage), associated landscaping, car parks & earthworks (non-complying).

This statement of effect is prepared pursuant to regulation 17(1) and (4) of the *Development Regulations 2008* (**the regulations**) and section 39(2)(d) of the *Development Act 1993* (**the Act**).

This statement of effect is made on behalf of Cartwheel Resources Pty Ltd, the owner of the subject land and the applicant for Development Plan Consent.

BACKGROUND

1. By Development Application 20/366/473 (**the application**) submitted to the Adelaide Hills Council (**the Council**) application has been made for development plan consent to develop the land known as 118 Silver Lake Road, Mylor (**the land**) for the purposes described above.
2. The application has been treated as a "*non-complying*" application.
3. By letter dated 25 May 2020 the Council advised that it had resolved to proceed to assess the application and sought a statement of effect in accordance with s. 39(2)(d) of the Act.
4. This statement of effect is prepared pursuant to regulation 17(4) of the regulations. In accordance with sub-regulation 17(5), this statement includes:
 - 4.1 a description of the nature of the development and the nature of its locality;
 - 4.2 a statement as to the provisions of the Development Plan, which are relevant to an assessment of the proposed development;
 - 4.3 an assessment of the extent to which the proposed development complies with the provisions of the Development Plan; and
 - 4.4 an assessment of the expected social, economic and environmental effects of the development on its locality.
5. In preparing this statement of effect the proposal plans have been examined. The proposal has been reviewed with respect to the relevant provisions of the Development Plan, namely the Adelaide Hill Council Development Plan, consolidated 8 August 2019 (**the Development Plan**).
6. As noted, the land is owned by Cartwheel Resources Pty Ltd. The Managing Director of Cartwheel Resources Pty Ltd is Rudy Gomez, a well-known South Australian scientist and entrepreneur with an established track record in mineral exploration, and invention.

-
7. The land has an area of 6.647ha and is currently developed in the manner described below. It is located in the valley floor relatively close to the Onkaparinga River, and approximately 2km from the Mylor Oval. It abuts on its eastern boundary Silver Lake Road and, on part of its southern boundary, Pillinda Lane.
 8. Presently situated on the land is a substantial residence, a number of outbuildings, a small number of cattle and llamas, three gazebo style garden structures, vegetation and a lake known as "Silver Lake" (**the Lake**).
 9. The land is presently used for residential purposes and for low key, "hobby farm" type purposes.
 10. The Lake is designated by the Development Plan as a *local heritage place*.
 11. The Lake was originally excavated during alluvial gold mining operations. However, during that period the Lake naturally filled by groundwater and/or spring water, ultimately causing the mining operations to cease in 1911. Thereafter the Lake area was used, by the public, for boating and picnics and a range of sporting activities on the land e.g., cricket and tennis. During the 1920s the Lake was used on a commercial basis as a swimming pool. A dance floor was erected near the Lake, with dances held on Saturday and Sunday nights until about the 1960s. The Lake is no longer used by the public.
 12. In December 2017 application for Development Plan Consent was made to Council for the construction of a second dwelling on the land. The proposed second dwelling was in the form of a freestanding, single storey building to be used as dependent accommodation in association with the existing (detached) dwelling on the land. The proposal envisaged that the dependent housing would house Mr Gomez, while Mr Gomez's daughter, son-in-law and their children would reside in the existing (detached) dwelling on the land.
 13. The Council granted Development Plan Consent to the dependent accommodation application on 6 September 2018. That application was processed by the Council as a "*non-complying*" kind of development.
 14. The dependent accommodation proposal included the installation of a 4250 litre Aerated Wastewater Treatment System (**AWTS**) in the ground to the east of the proposed building. It had a capacity for up to 8 persons.
 15. Although the implementation of the dependent accommodation proposal has been put on hold pending the lodgement and determination of the (subject) application, the Development Plan Consent for that proposal remains operative.
 16. Further, by way of background, until 2017 there existed on the land an approved "studio" of similar size, location and layout to the dependent accommodation the subject of the 2007 proposal. A shower block adjoined that studio. The studio was, we are instructed, operated for some time as a form of accommodation.
 17. Cartwheel Resources has, over the last few years, undertaken a review of its plans for the future use of the land. Broadly speaking, Cartwheel Resources wishes to:
 - 17.1 improve the environmental performance of the land, including that of the Lake;
 - 17.2 remove grazing stock from the land;
 - 17.3 implement a significant landscaping plan;

-
- 17.4 convert the existing (detached) dwelling to a tourist accommodation/small function facility;
 - 17.5 implement and establish a bushfire management plan;
 - 17.6 construct a new residence for use by Mr Gomez;
 - 17.7 re-use a small number of existing outbuildings, and construct 2 new outbuildings on the proposal plans;
 - 17.8 establish areas for the growing of fruit, herbs and vegetables. These activities will be of a small-scale and incidental to the residential and tourist accommodation uses of the land;
 - 17.9 breed fish in small quantities in the Lake, on a hobby basis, in accordance with PIRSA recommendations for stocking purposes; and
 - 17.10 have limited use of the Lake such as fishing, by occupants of the proposed new dwelling and guests staying in the tourist accommodation or utilising the small function facility.
18. The vision/design brief is for a blended architecture that nestles into the existing, and proposed enhanced, natural landscape with minimal visual public impact, while creating internal vistas and "feeling" for occupants.

THE LOCALITY

- 19. The locality is primarily put to rural living type uses, including the land. Two smaller residential allotments are located to the south of the land, while allotments adjoining the northern and western boundary are used primarily for livestock.
- 20. The locality displays a natural "hills" character, derived from allotments containing native vegetation, well setback buildings with open style fencing along allotment boundaries, relatively gentle ground undulations and a narrow gently curving internal road.
- 21. Should the proposed development be approved the predominant use in the area will remain for rural living purposes.

MORE DETAILED DESCRIPTION AND NATURE OF PROPOSED DEVELOPMENT AND ASSOCIATED WORKS

- 22. Fundamentally, the proposed development contains a number of elements, but largely it seeks to:
 - 22.1 establish a new residence on the Lake for Mr Gomez;
 - 22.2 remove stock from the land, and to modify the nature of the "hobby farm" type use of the land;
 - 22.3 improve the appearance and environmental qualities of the land to appear more natural and "park like";
 - 22.4 using portion of the land for tourist accommodation/small function type purposes;
 - 22.5 improve the function and appearance of the local heritage listed Lake;

- 22.6 to construct a wetland to the north of the main entrance roadway (**the proposed wetland**);

whilst ensuring that the proposed activities on the land are proactive in a bushfire management sense and improving the water quality.

23. More specifically, the proposal comprises:

- 23.1 constructing a new dwelling on the land. The proposal is for the construction of a single level building to be occupied by Mr Gomez. It is to be located near to the Lake, and in the general area of the site of the now demolished amenities building site. The proposed new dwelling has been designed to "hug" the former mining hillock location on the edge of the Lake, and to take advantage of the north facing aspect and pleasant views in that direction.

The new dwelling is of a relatively modest in size, being single storey, with the materials proposed to be rendered composite walling on steel framing in grey/green colours to blend with the natural background. Windows are proposed to be double-glazed in commercial grade aluminium to match the wall colours. The roof will be of metal deck construction in a colour to blend with the walls and to accommodate flat solar panels. A lap pool is proposed.

- 23.2 the conversion of the existing substantial two-storey detached dwelling building on the land to a high quality tourist accommodation/small function type facility, together with spaces suitable for associated small functions such as corporate retreats, small weddings and birthday parties generally of less than 40 persons, **including** tourist accommodation facility guests.

The proposed tourist accommodation/small function facility will contain seven bedrooms, one of which will be designed for universal access.

The proposed conversion of the existing dwelling to the tourist accommodation/small function facility requires some internal modifications to the existing dwelling, but the elevation plans demonstrate that minimal external visual impact will result from the changes proposed. The main modification proposed is the establishment of a conservatory room overlooking the Lake, which room will catch both morning and afternoon sun and act as a living space, and can also be used as a meeting room. This is an appropriate minor extension and will add to the ambience for guests and add a focal point by enhancing the indoor/outdoor experience for all concerned, focusing on the heritage Lake. The building addition is to be sited in a location where it is not readily visible from the public realm. Further, the additions are compatible with the existing building. The form and materials to be used will mean the building integrates with the existing improvements on the land.

- 23.3 Guests in the tourist accommodation/small function facility will be responsible for their own food and beverage;

It is expected that the tourist accommodation facility and function area will be principally used by family and other small groups.

- 23.4 The construction of a small (replacement) jetty.

24. The proposed development also comprises:

- 24.1 the demolition of the existing hay shed;

-
- 24.2 the construction of two new outbuildings;
 - 24.3 the southern of the two new proposed outbuildings will be used for hobby fish growing/aquaponics;
 - 24.4 the use of the larger of the 2 outbuildings to house equipment, vehicles and a workshop; and
 - 24.5 the construction of the proposed new outbuildings with fire resistant timber and steel framing, with metal deck roofing and cladding in colours to blend with the proposed new dwelling and landscape.
 - 24.6 All of the above new buildings are to be established above the 1:100 ARI (flood) level.
- 25. There is ample room for car parking to take place in association with the proposed development.
 - 26. A series of driveways will access various areas on the land.
 - 27. Improvements proposed to the Lake include:
 - 27.1 the margins of the Lake are well vegetated, mostly with *typha domingensis*, being a species otherwise known as bulrush or cumbungi. The Lake is also surrounded by mature river red gums, which shed leaf, bark and twigs into the Lake during the course of the year;
 - 27.2 existing water quality within the Lake is considered to be good, although the Lake water is discoloured by tannins which leach from the eucalyptus leaf and bark debris;
 - 27.3 there are some fish in the Lake, and some waterbirds such as water hen. There are also native duck and other species present at various time;
 - 27.4 it is reported that there is up to 2m of sediment on the invert of the lake, which has accumulated over more than 100 years. It is intended to remove this sediment by a suction dredge, and dispose of this material after dewatering, by spreading and cultivating into the soil in some of the northern sections of the land, generally in areas above the 1 in 100 year floor level.

The sediment has been assessed for any possible contamination for a wide range of parameters by Water Technologies, and the results show that all samples are below the upper threshold limits for Waste Derived Fill Material, and so are suitable for site based disposal.
 - 27.5 it is also intended to circulate water from the Lake to the proposed wetland that is to be established in the northern section of the land. It is expected that that circulation process - and other works - will reduce the discolouration of the water in the Lake and improve water quality;

- 27.6 the existing bulrush which (as noted above) lines the edge of the Lake grows up to 2m or more in height. In winter it is deciduous, dying off and resulting in an unattractive appearance. Advice provided by Barrie Ormsby (Landscape Architect)¹ is that the bulrush can dominate the vegetation of a Lake or a wetland, competing with, and suppressing, other emergent wetland plants. This results in significantly reducing diversity and habitat value. Thus, it is proposed that the existing stands of bulrush be removed from the Lake in a staged program to at least reduce its extent, and that additional complimentary species be planted to replace the bulrush removed.
28. The **proposed wetland** will involve the following works:
- 28.1 the construction of a wetland with areas of open water, shallow reed beds and shallow marsh areas to the north of the main entrance roadway;
- 28.2 the wetland will receive water (solar pumped) from the Lake, which will then be recirculated back to the Lake. It will also receive run-off from the north western sections of the land, as well as run-off from adjacent properties that drain through the land. It is proposed that the wetland will be kept active throughout the year;
29. The proposed wetland (and its reed bed filter system) will provide a number of functions and fulfil a number of purposes, viz:
- 29.1 provide a significant area of wetland and marsh habitat for water birds, particularly species that require shallow water/marsh areas for feeding (waders, egrets, ibis, herons etc); this habitat is not present in the existing Lake;
- 29.2 as a water quality treatment wetland, it will be able to filter water flowing through the wetland, improving water quality by filtering out suspended matter, and removing nutrients, heavy metals and other contaminants from the water;
- 29.3 if needed, it can receive any excess waste water from the aquaponics system that is not used by the hydroponic vegetable and herb growing beds, and treat and clean this water as it passes through the wetland reed beds;
- 29.4 act as a filter that may remove some of the tannins and reduce the discolouration of the Lake water;
- 29.5 by interacting with water pumped from the Lake and returning this water to the Lake, transfer some of the macro and micro invertebrates etc that the wetland will produce to the Lake, so improving the biology of the Lake;
- 29.6 to create a visually attractive and interesting landscape feature which can be experienced and enjoyed by visitors etc. A bird hide will enable bird watching to be undertaken and enjoyed with minimal disturbance to bird life.
30. Two drainage ditches presently cross the land from west. Both of these ditches carry natural surface run-off from adjoining properties, which appear to be mainly used for cattle grazing. Once livestock is removed it is proposed new drainage ditches or swales (and any remaining existing ones) will be regraded to wide shallow swales that can be readily maintained by mowing;

¹ The Landscape Development and Maintenance Report prepared by Barrie Ormsby, Landscape Architect

-
31. It is proposed that the two main existing drainage ditches will be diverted, and graded out to flow out on the existing natural surface, on the north side of the low ridge on the land. The diverted inflow from those drains will initially flow into an existing shallow "swamp" area, which will then overflow to the east around the end of the low mound and then to the south, finally discharging into the proposed wetland. As water will flow for a good part of the year, the wide shallow overland flow areas will become an ephemeral marsh (winter wet, summer dry), which are proposed for planting with suitable marsh and wetland vegetation. In the report from Barrie Ormsby of Barrie Ormsby Landscape Architecture accompanying the application (**the Ormsby report**) Barrie Ormsby advises that this will create a significant area of marsh habitat for waterbirds and wildlife. He further advises that the low perennial vegetation that will be established will remain green for much of the year, and many of the species, even in the summer months, will remain green, thus creating an extensive firebreak to retard the spread of fire. Further, this will result in an improvement of the visual amenity of the land and locality.
32. The proposal includes the implementation, and ongoing maintenance of a **landscaping program**, for all of the land, which, amongst other things, includes the proposed selective removal of certain non-native and native trees. That program is detailed in the Ormsby report.
33. It is proposed to **remove stock** from the land given the limited scope of the land and the degrading effect that stocking has had on the land generally. This will improve the condition of the land as there will be a reduction of pollutants from say cattle and the improvement of the land itself by removing active grazing by stock.
34. Other works include:
- 34.1 a walking trail around the perimeter of the Lake for the use of guests at the tourist accommodation/small function facility; and
- 34.2 a track suitable for use by small vehicles and mowing machinery around the perimeter of the land (as shown on plan DA 1.1) to provide access mainly for maintenance activities. This trail will also function as a longer distance walking trail and link with the Lake walking trail. This track will be maintained by regular close mowing, to minimise the cover of grass (or as the case may be, to be kept clear of grass) and will also assist as a firebreak around the property.
35. It is proposed to establish **small orchard activities** in the more elevated areas of the northern land, consistent with the land being used for primary production.
36. A limited, hobby based aquaponics facility for growing fish (resulting in the harvesting of less than 1 tonne of live fish per year) linked with the growing of foodstuffs on the land is to be established, again consistent with the land being used for productive purposes. The use of the Lake for 'fish growing' is a form farming.
37. It is proposed to add to the existing **on-site wastewater management** arrangements. Currently the on-site wastewater management system is a RI-Treat 4250 AWTs to surface irrigation with an area of 267m². A new larger scaled on-site, wastewater management system with the infrastructure to be located above the 1:100 year flood level is to be established. Secondary treated wastewater discharges from each AWTs, noting the existing irrigation area which is positioned within the 1:50 year flood level will be decommissioned.

-
38. The more specific details of the wastewater management arrangements are detailed Wastewater Management Report prepared by RFE Consulting.²
 39. The full extent of the elements of the proposed development are referred to the reports submitted with the application being:
 - 39.1 the Ormsby report;
 - 39.2 the Fire System Report prepared by Ben Johnson of Irrigation Pumps N More;
 - 39.3 Silver Lakes Bushfire Management and Vegetation Report prepared by Environments by Design (**the Environments by Design report**);
 - 39.4 the abovementioned Wastewater Management Report prepared by Ross Fitzgerald, Principal Environmental Engineer from RFE Consulting (**the RFE report**);
 - 39.5 Water Resources Report prepared by Tamar Haviv, David Pennington and Melinda Lutton of Water Technology, Water, Coastal and Environmental Consultants (**the Water Technology report**);
 - 39.6 Aquaponics concept - shed area diagram prepared by KM Natural Resources.

THE DEVELOPMENT PLAN GENERALLY

General

40. The Development Plan places the land:
 - 40.1 within the Watershed Protection Policy Area (**the Policy Area**) of the Watershed (Primary Production) Zone (**the Zone**);
 - 40.2 in a High Bushfire Risk Protection Area (refer Figure AdHi (BPA)/1);
 - 40.3 partly within a Flood Prone Area, and more particularly with portions of the subject land being in the "low-high flood hazard area", a portion within the "extreme flood hazard area", and the balance in neither such area (Figure AdHiFPA/19); and
 - 40.4 designates the Lake to be a "local heritage place".
41. The land does **not** fall within Watershed Area 1. It is, however, within a broader area designated as the "Mount Lofty Ranges Watershed" established pursuant to the *Natural Resources Management Act*.
42. The policy thrust for the Zone and the Policy Area is reasonably clear. In essence, the Zone and Policy Area provisions seek or encourage development to achieve various outcomes, including:
 - 42.1 the maintenance and enhancement of the natural resources of the South Mount Lofty Ranges;

² Wastewater Management Report prepared by Ross Fitzgerald, Principal Environmental Engineer from RFE Consulting;

-
- 42.2 the enhancement of the Mount Lofty Ranges Watershed as a source of high-quality water;
 - 42.3 the maintenance and enhancement of the pleasant, attractive rural landscape for the enjoyment of residents and visitors;
 - 42.4 the development of a sustainable tourism industry with accommodation, attractions and facilities which relate to and interpret the natural and culture resources of the South Mount Lofty Ranges, and increase the opportunities for visitors to stay overnight;
 - 42.5 horticultural activities that do not contribute to pollution;
 - 42.6 buildings, that are unobtrusive and do not detract from the natural character of the zone;
 - 42.7 the number of outbuildings being limited, and where appropriate being grouped together in located in unobtrusive locations;
 - 42.8 trees, other vegetation and earth mounding being retained or provided as part of development where the environment will be visually improved by such a provision;
 - 42.9 development should include the treatment and management of solid and liquid waste to prevent undesirable impacts on the environment.
43. The relevant provisions of the Development Plan also seek or encourage development:
- 43.1 to be responsive to bushfire risk;
 - 43.2 to conserve, and where possible, enhance places of heritage value; and
 - 43.3 to be located outside of identified flood prone areas;

Overview

Relevantly, farming (and, in particular, non-intensive farming), tourism based development, including tourist accommodation, and residential development are all kinds of development contemplated in the Zone. Thus, the proposal in broad land use terms, comprising as it does tourism accommodation (with a small-scale function capacity), residential development, associated small-scale vegetable and fruit growing/aquaponic (fish breeding/farming) activities and Lake improvement works, wetland development works and landscaping on a relatively large holding characterised by relatively open undulating land is consistent with the policy thrust of the relevant provisions of the Development Plan.

- 44. In addition, the proposal delivers **a number of most important environmental benefits**, including the improvement of the aesthetic quality of the local heritage place listed Lake, improved landscaping across the entire land, and improved and better located wastewater management system, a reduction (when compared to the existing condition of the land) of the bushfire risk, an improvement to overall water quality and the construction of the proposed wetland.
- 45. Further, the proposed development conserves, and, indeed, enhances, the Lake in terms of its scenic beauty and general "health". Also, its proposed low-key use is compatible with its historic values.

-
46. The vision/design brief, in developing the proposal, has had careful regard to the Development Plan and, in that process, expert advice has been obtained from a range of consultants on relevant issues.
 47. Specifically (and as noted above) expert advice was sought and obtained as to:
 - 47.1 the landscaping of the Lake itself and the balance of the subject land; and
 - 47.2 the development of the:
 - 47.2.1 proposed wetlands;
 - 47.2.2 bushfire management;
 - 47.2.3 aquaponics;
 - 47.2.4 wastewater disposal and management; and
 - 47.2.5 water quality impacts with a view to water quality improvement.
 48. It is submitted that the proposed development has significant planning merit, and warrants the grant of Development Plan Consent.

Non-complying development designation

49. Subject to certain exceptions listed in PDC 70 of the Zone provisions, all kinds of development within the zone that are "*non-complying*".
50. The proposed development does not fall within any of the exceptions. Thus, the proposed development is a non-complying kind of development. That, of course, is why a statement of effect is required in relation to this matter.
51. While the proposed development is in the nature of a non-complying development it ought to be remembered that a "non-complying" characterisation does not render the proposal unworthy of Development Plan Consent.
52. The designation of the development as "non-complying" affects the procedures governing the processing of an application, but it is not determinative of whether Development Plan Consent should be granted or refused.³ The application is otherwise to be assessed on its merits.

Suitability of the proposed land uses

General

53. As contended above, in broad land use terms all of the land uses comprising the proposed development are contemplated or envisaged in the Zone.

Conversion of existing dwelling to tourist accommodation/small function facility

54. The existing dwelling is to be converted for tourist accommodation, and also available as a function facility.

³ *Klein Research Institute v District Council of Mount Barker (2000)* SASC 377

"Tourist accommodation" is listed as an exception to the non-complying list of development, subject to certain limitations. Those exceptions are not all achieved. Nonetheless the Zone provisions recognise that tourist accommodation is, broadly, an appropriate land use. In particular, note Objective 6 for the Zone which seeks the "... *development of a sustainable **tourist industry** with **accommodation**, attractions and facilities which relate to and interpret the natural and cultural resources of the south Mount Lofty Ranges and increase the opportunities for visitors to stay overnight*". (our emphasis)

Those provisions are to be read in conjunction with the Council Wide part of the Plan, in particular the (Module) "**Tourism Development**" - page 97 of the Development Plan.

55. There are 9 Objectives under that heading, most of which are specifically relevant to this part of the proposal. Generally speaking, the proposed development meets those Objectives. For example, the proposal will provide for *environmentally of sustainable and innovative tourism* in the form of an existing building that can readily be converted for accommodation purposes and to also be used as a functions centre. The use and location of that building is consistent with Objective 1 that seeks environmentally sustainable and innovative tourism. It also clearly meets Objective 2 which seeks tourism development that assists in *public appreciation of significant natural and cultural features including local heritage places*. Given the existing use of the building as a residence and also the rural living nature of the locality, the new uses proposed will *not adversely affect the use of agricultural land for primary production*. Further, there will also be *increased opportunity for visitors to stay overnight* - Objective 7.
56. The uses proposed on the land and the proposed improvements to the Lake are more generally consistent with Policy Area Objective 3. That Objective seeks that recreational or visitor facilities should be compatible with the character and protection of the Mount Lofty Ranges Watershed and the character and amenity of the locality.
57. There are then a number of Council Wide (Tourism Development) Principles of Development Control (**PDC**) which are generally met by the proposed development. Whilst it is not proposed to discuss all of them the following points are made:
 - 57.1 PDC 1: *Tourism development* should have a functional or locational link with its natural, cultural or *historical setting*. The tourism accommodation is to be used in association with the historic Lake.
 - 57.2 PDC 2: *Tourism development and any associated activities should not damage or degrade any significant natural and cultural features*. The use proposed will not damage any areas and the application overall will, in fact, positively upgrade the land and the locality.
 - 57.3 PDC 3: *Tourism development should ensure that its scale, form and location will not overwhelm, over commercialise or detract from the intrinsic natural values of the land on which it is sited or the character of its locality*. There is an existing building that is to be converted and slightly enlarged to provide all appropriate facilities and services for the tourist accommodation use (and the functions), including car parking.
 - 57.4 PDC 4: *Tourism development should, where appropriate, add to the range of services and accommodation types available in an area*. The tourism use unquestionably is consistent with this provision.

58. The upgrade of the whole of the land and the Lake and the works associated with the conversion of the existing dwelling to a tourist accommodation/small function facility will also assist in achieving the goals in PDC 7 (a) - enhancing the character in the locality and (d) enhancing the visual amenity.

59. Council Wide (Tourism Development) PDC 14 is satisfied in terms of:

Tourism developments in rural areas should primarily be developed in association with one or more of the following:

- (a) *agricultural, horticultural, viticultural or winery development*
- (b) *a heritage place or area - the Lake*
- (c) *walking ... trails.*

60. The Zone provisions also place an emphasis on tourism development. Whilst the land is in the Watershed Zone, it is clear that that Zone is not to be used solely for rural production purposes. This is reflected in the abovementioned Objective 6 which (as noted) seeks:

"... the development of the sustainable tourism industry with accommodation" and an increase in the opportunities for visitors to stay overnight.

61. Further, the overall development proposed is consistent with Zone Objective 5, viz:

*The **enhancement of the amenity and landscape** of the south Mount Lofty Ranges for the enjoyment of residents **and visitors**.*

62. In summary, the Development Plan provisions support the use of the land for tourist accommodation.

Small-scale functions use

63. The tourist accommodation building is also proposed to be used for small functions associated with the tourism accommodation use in the form of corporate retreats, small weddings and birthday parties generally of less than 40 persons, including overnight guests.

64. Some of the discussion above relating to the *Tourist Accommodation* use also applies to the functions component proposed.

65. The nature of the existing building, with its building addition, and the setting of the building, lends itself to providing associated functions of up to 40 persons.

66. The function offering is anticipated to be used as an adjunct activity to the overnight guests thus resulting in a direct association between the small scale functions. For example, there may be 14 guests celebrating the birthday of one of the guests which will mean a function is an adjunct activity and no additional car parking is proposed. Or the 14 guests are joined by 10-15 additional guests.

Another example is a small corporate retreat where there may be 14 people staying overnight and they (or some of them) meet during the day and then have a dinner together on-site. Again the function component is an adjunct activity. More examples readily come to mind.

In short, the function facility offering is essentially in the nature of an adjunct one.

The proposed new dwelling

67. The Development Plan, it is submitted, clearly contemplates residential development in the Zone.
68. As noted above, a substantial dwelling already exists on the land. Further, in 2017 the Council granted development plan consent for a second residential use building (in the form of a dependant residence) on the land. Thus, the proposal will result in there being only 1 dwelling on the land, with the conversion of the existing dwelling to a tourist/small function facility.
69. PDC's 23 - 26 for the Zone, under the heading "Residential Development", are relevant.

PDC 23 sets out criteria as to the location of a dwelling on land.

Other Zone PDCs (and Policy Area PDC 4) refer to the siting of development generally. So too does the section in the Council Wide part under the headings of *Design and Appearance*, *Residential Development* and *Siting and Visibility*.

70. One draws from the Development Plan that:
 - 70.1 buildings need to be appropriately designed and sited limiting the visibility of the same;
 - 70.2 additional landscaping should be provided;
 - 70.3 there should be an emphasis on the design and form of a new dwelling;
 - 70.4 buildings should be designed to accommodate solar panels (energy efficiency);
 - 70.5 appropriate orientation and location; and
 - 70.6 the use of appropriate materials.
71. Other provisions also seek that dwellings (indeed buildings generally) should be:
 - 71.1 sited in a cleared area;
 - 71.2 limits the need for Native Vegetation removal;
 - 71.3 be located below ridgelines
 - 71.4 setback from roads;
 - 71.5 limit excavation and fill;
 - 71.6 limit impacts on adjacent buildings;
 - 71.7 outbuildings being grouped; and
 - 71.8 driveways blended sympathetically into the landscape.
72. The provisions discussed broadly seek to maintain or enhance the amenity of an area and to not cause any negative impacts visually or otherwise. When one considers the overall proposed development it is clear these aims are generally satisfied.

-
73. In this instance it is noted some trees will be removed so as to allow for the construction of the dwelling in its setting adjacent the Lake. However, significant additional plantings are proposed - the Ormsby report and the Environments by Design report collectively detail this aspect of the proposal - and see also the plans 1817 DA 1.1 "Site Regeneration & Development" and the Site Plan 1817 DA 1.1.
 74. There will be an overall increase in the number of trees that provide appropriate landscaping for screening purposes, whilst limiting the impact of bushfire, by adopting a bushfire management plan - see the report of Environments by Design report.
 75. In short, the location of and the establishment of the new dwelling is consistent with the relevant provisions of the Development Plan.

The proposed outbuildings

76. The location of the proposed outbuildings has been determined by reference to the overall plan for the land, whilst ensuring achieving compliance with the Development Plan provisions relating to sensitive design and form, and the grouping of such buildings generally together.
77. In particular, the number of proposed outbuildings has been limited in number, and they have been grouped together in an unobtrusive location. The proposal thus satisfies the provisions of the Zone PDC 8.

Conservation and enhancement of local heritage place (the Lake) and the land generally, including the proposed landscaping works

78. The Development Plan seeks:
 - 78.1 the conservation and enhancement of places of heritage value (Council Wide (Heritage Places Objectives and Zone PDC 28);
 - 78.2 the continued, or adaptive reuse of local heritage places that supports the conservation of their cultural, historical etc significance (refer Council Wide (Heritage Places) objectives);
 - 78.3 the enhancement of the amenity and landscape of the south Mount Lofty Ranges for the enjoyment of residents and visitors (Zone Objective 5);
 - 78.4 trees and other vegetation should be provided as part of the development where the environment will be visually improved by such a provision (refer Zone PDC 37).
79. As noted an important part of the proposed development includes:
 - 79.1 improvements to the appearance and function of the Lake;
 - 79.2 the construction of proposed wetlands;
 - 79.3 the implementation of a whole of the land landscaping plan (and associated maintenance plan).
80. The recommended works are detailed in the Ormsby report and have an emphasis on the following:
 - 80.1 maintaining and protecting the heritage characteristics of the Lake, while enhancing its visual and habitat values, and water quality;

-
- 80.2 maintaining and improving the quality of all water discharged from the subject land to the nearby Onkaparinga River;
 - 80.3 maintaining and enhancing the extent of existing habitat and increasing habitat diversity throughout the subject land, both aquatic and terrestrial;
 - 80.4 creating and maintaining a visually attractive and interesting landscape compatible with and integrated into the character of the broader landscape;
 - 80.5 developing a landscape that, as much as possible, reduces bushfire hazard risks to the developed infrastructure and residents; and
 - 80.6 development of a landscape that can be maintained in a practical and systematic manner into the future.
81. The elements of the proposed landscaping works (and the maintenance program proposed) are outlined in Mr Ormsby's report. The elements include:
- 81.1 the circulation of water from the Lake to the proposed wetland, the removal of sediment from the Lake and the use of that sediment (after dewatering) by spreading and cultivating into the soil in the northern section of the subject land;
 - 81.2 the removal of around the water edge of the lake of bulrush and its replacement with more suitable species;
 - 81.3 the construction of a wetland with areas of open, shallow reed beds and shallow marsh areas to the north of the main entrance roadway; and
 - 81.4 the removal of stock altogether from the property.
82. As concluded by Barrie Ormsby in the Ormsby report there will be a number of important environmental benefits that will result from the proposed development (and the maintenance regime for the northern part of the subject land). He summarises those benefits as follows:
- 82.1 water quality - all run off from the northern area of the subject land and that flowing into the subject land from adjoining rural areas to the north and west will pass through large areas of grass and sedge vegetation. That way, sediment and possible nutrient loads in the run-off will be significantly reduced. This run-off will then flow into and through the proposed wetland, undergoing further treatment, before flowing into the Lake and ultimately into the nearby Onkaparinga River;
 - 82.2 removal of livestock from the subject land will eliminate the present nutrient load from animal manure, and the production of sediment through soil disturbance;
 - 82.3 there are a small number of remnant native plants on the land. They are presently severely impacted by grazing and trampling. The removal of livestock and the implementation of a selective mowing regime will allow these plants to survive and spread thereby increasing the biodiversity and habitat value of the land.

- 82.4 diversion of the drainage ditches to discharge onto the natural surface in place of confining run-off to faster flowing ditches, will create significant areas of native "swamp" vegetation and habitat, with associated benefit to water quality and creation of habitat for wildlife. Further, these areas will provide an opportunity to plant and establish a range of local swamp and wetland species not presently found on the subject land and to supplement the few remnant species that can be found on the subject land;
- 82.5 the proposed selective mowing of the area, while minimising fire fuel loads, will allow low flammability native vegetation, such as perennial sedges and groundcovers to survive, establish and spread. Visually, Barrie Ormsby is of the opinion (and habitat-wise) that the land will become an attractive and interesting landscape of open woodland with mown understory, significant open areas of rush, sedge and wetland landscape, with some orchard plantings.
83. In overview, the proposed development will deliver significant environmental benefits to the land and the locality and, in so doing, will conserve and enhance the Lake and the amenity and landscape of the area.

Design, appearance and siting

84. The siting, design and form of buildings is an important consideration. The architectural plans propose appropriately sited and designed buildings suitable for their proposed use. Care has been taken as to the siting of all buildings, including the removal of a number of existing outbuildings. The buildings each have a purpose and the design respects and reflects that purpose, whilst at the same time blending into the environment, aided by the material overall upgrade of the land in terms of landscaping. Further, the siting reflects suitable locations so as to minimize bushfire risks consistent with the Bushfire Management Plan.
85. The addition to the existing dwelling to be converted to tourist accommodation is modest in area (25m²), but important to the function and performance of that building. It is well setback from Silver Lake Road, and has been designed to reflect the important architectural features of the existing building. It will largely be undetected.
86. The new dwelling is single storey in height, and is not large in floor area. It will benefit from its siting near the Lake. New landscaping is proposed to add to its setting that will also assist in limiting public views of the dwelling. The dwelling will at least conserve the land whilst the additional landscaping will enhance the setting and the land overall. It will have adequate and appropriately located car parking (as will the tourist accommodation building).

Wastewater and water quality

87. The Development Plan places a high value on the maintenance and enhancement of the natural resources of the south Mount Lofty Ranges and the enhancement of the Mount Lofty Watershed as a source of high quality water (refer Zone Objectives 1 and 2).
88. Further, and by way of example, Zone PDC 36 provides that development should not take place in a manner which will interfere with the utilization, conservation or quality of water resources. That PDC also seeks the protection of the natural systems that contribute to the natural improvement in water quality.

Refer also to Objective 1 for the Policy Area which seeks, amongst other things, that development does not pollute surface or underground water resources.

89. The abovementioned policy goals of the Development Plan have been carefully taken into account in the design and configuration of the proposed development. As with the above discussion concerning the conservation and enhancement of the Lake and the land generally by the proposed development, reference to a number of the conclusions reached in a number of the expert reports accompanying the application is instructive. In particular, your attention is drawn to the following comments made and/or conclusions reached in those:

89.1 **Ross Fitzgerald of RFE Consulting**

- 89.1.1 Ross Fitzgerald (BEng Civil/Environmental MIE Aust NER (Principal Environmental Engineer) of RFE Consulting in the RFE report indicates that he has had regard to site and soil assessment/analysis for the purposes of determining the suitability of the proposed on-site wastewater management system upgrade associated with the proposed development. In the process he advises that he has had regard to a previous assessment undertaken by Ron Selth and Associates in May 2018 and also the Water Technology report in relation to the proposed development.
- 89.1.2 Also Mr Fitzgerald states that his assessment has been completed in accordance with the Government of South Australia's, Department of Health and Aging On-Site Wastewater Systems Code dated April 2013.
- 89.1.3 The wastewater system proposed (being a combination of an upgrade to the existing wastewater management system on the subject land, the installation of a new system and the creation of surface irrigation land application of secondary treated wastewater) is described by Mr Fitzgerald in the RFE report. Relevantly, Mr Fitzgerald concludes that:
- (a) *"The proposal provided herein provides a sustainable solution to facilitate the proposed wider Silver Lake Development project which will provide **significant environmental benefit** to the site".*
 - (b) *"The proposed on-site waste water management system provides **additional net environmental benefit** by facilitating the wider environment benefit achieved through the proposed Silver Lake Development"* (our emphasis).
- 89.1.4 The proposed on-site wastewater management system has been designed to manage the proposed design wastewater load at the site without the additional capacity from portaloo's.

89.2 **Report of Tamar Haviv, Dave Pennington and Melinda Lutton of Water Technology**

- 89.2.1 the Water Technology report which has been prepared by Tamar Haviv, Dave Pennington and Melinda Lutton of Water Technology (Water Coastal and Environmental Consultants) comprises a groundwater, surface water and wastewater assessment of the proposed development. The report assesses the potential water and wastewater quality and quantity impacts associated with the proposed development. It includes a water balance assessment to ensure that there are no adverse effects from additional water

supply, increased surface run-off or increased wastewater generation.

- 89.2.2 as noted in the Water Technology report it is intended that there will be **no** disposal offsite of any wastewater generated from the proposed development. All wastewater will be retained, treated and disposed of on the land above the 1:100 year flood line.

The only water leaving the land will be that generated by rainfall, as run-off from the natural grass and vegetated land, as overflow from the Lake, and possibly from roof run-off in excess of what is captured and stored for on site uses. The authors of the Water Technology report consider that the proposed development will, when compared to the existing use, increase wastewater generation in a negligible fashion only.

They conclude that the water quality impact and wastewater generation impact are within acceptable limits or, indeed, improved.

They also conclude the following benefits may be realised by implementing the proposed development:

- 89.2.2.1 re-engineering of current land drains - the changes proposed are in alignment only, which will not affect water balance. Benefits, they advise, may be gained by improving habitat and aesthetics;
- 89.2.2.2 improved Lake water quality by providing additional "polishing" treatment and recirculation using the new wetland; and
- 89.2.2.3 increased rainwater storage for domestic use.

Bushfire management

90. As noted, the Development Plan places the land in a High Bushfire Risk Protection Area. With that in mind, the proposed development has been designed with careful regard to ensuring that it does not constitute an unacceptable bushfire risk. In particular, expert advice has been sought and obtained from Dr Geoffrey Bishop and Wayne Brown of Environments by Design on this matter. In the Environments by Design report, Dr Bishop and Mr Brown have prepared a detailed Bushfire Management Plan for the proposed development. They indicate that in developing that plan they have had regard to the relevant provisions of the Development Plan and the Minister's Code: Undertaken development in Bushfire Protection Areas.
91. It is submitted that with the implementation of the recommended Bushfire Management Plan prepared by Environments by Design, the proposed development will satisfy the relevant provisions of the Development Plan and the Minister's Code relating to bushfire management matters.

ASSESSMENT OF THE EXPECTED SOCIAL, ECONOMIC AND ENVIRONMENTAL EFFECTS

Social

92. The proposed development will have no negative social effects.

-
93. The proposal will provide increased, good quality overnight accommodation with associated small scale function facilities;
 94. It is anticipated that the proposed development will bring additional visitors to the south Mount Lofty Ranges;
 95. Guests of the tourist accommodation of the small scale function facility will be exposed to the environmental, aesthetic and domestic scale agricultural uses of the land.
 96. The proposed development will take place in a manner which does not interfere with the effective and proper use of other land in the locality.
 97. The construction and use of the proposed development will not result in any nuisance or loss of amenity to the community generally nor to any immediate neighbours. Indeed, the proposed development will enhance the amenity and landscape of the locality.
 98. The proposed development, by increasing the range of tourist accommodation and associated function opportunities in the south Mount Lofty Ranges area, will strengthen the tourism appeal of that region and will assist the local economy, including the nearby township of Mylor.

Economic

99. The proposal is orderly and economic in that it allows for the appropriate use of existing infrastructure.
100. Services such as electricity and internet connection are available to the land. The proposed development will provide more than sufficient water for use on the land by persons occupying the land and appropriate provision is made for wastewater disposal and treatment. As such, there will be no imposition on the costs to be borne by the community.
101. As noted above, guests of the proposed tourist accommodation/small function facility will increase the potential for more spending in the local community by reason on those guests making use of the general area and nearby facilities, including Mylor. Such guests will most probably use local attractions such as wineries and the like.
102. Also the proposed development will provide economic benefit by providing employment during the construction of the proposed development.

Environmental

103. The proposed development will deliver significant environmental benefits in terms of the works proposed in relation to the Lake, the construction of new wetlands, the implementation of a detailed landscaping plan and the implementation of a detailed Bushfire Management Plan.
104. Furthermore, for all of the reasons detailed in Water Technology report, the proposed development will not adversely impact on water quality. Also, for all of the reasons detailed in the Water Technology report, the RFE report and the Ormsby report, the proposal will have appropriate wastewater treatment and disposal systems.

CONCLUSION

105. The designation of a kind of development that is *non-complying* affects the procedures governing the processing of an application, but is not determinative of whether development plan consent should be granted consent or refused.
106. The proposed development has been assessed against the relevant provisions of the Development Plan. Amongst other things, the proposed development:
- 106.1 involves uses that are envisaged or contemplated within the Zone and Policy Area;
 - 106.2 has been designed in a thoughtful and detailed manner so as to sit comfortably within the natural landscape;
 - 106.3 delivers a range of important environmental benefits that will enhance the amenity and the landscape of the locality and the heritage listed Lake;
 - 106.4 will provide a new, good quality tourist accommodation/small scale function facility which will act as a tourist destination and also provide increased attraction to the south Mount Lofty Ranges region.

It is submitted that the proposed development has significant planning merit and is therefore worthy of the grant of Development Plan Consent.

DATED 4th day of September 2020



BOTTEN LEVINSON

Solicitors for Cartwheel Resources Pty Ltd

Silver Lake Bushfire Management & Vegetation Review

For Planning Purposes

Mylor SA

March 2020

This document reviews the exiting property vegetation and outlines proposed bushfire safety measures for the Silver Lake property at Mylor South Australia.

Silver Lake Bushfire Management & Vegetation Review

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Disclaimer

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Silver Lake Bushfire Management & Vegetation Review

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Silver Lake Bushfire Management & Vegetation Review

Review - Property Location

Council Area - Adelaide Hills Council

Site Address - Silver Lake Road at Mylor SA

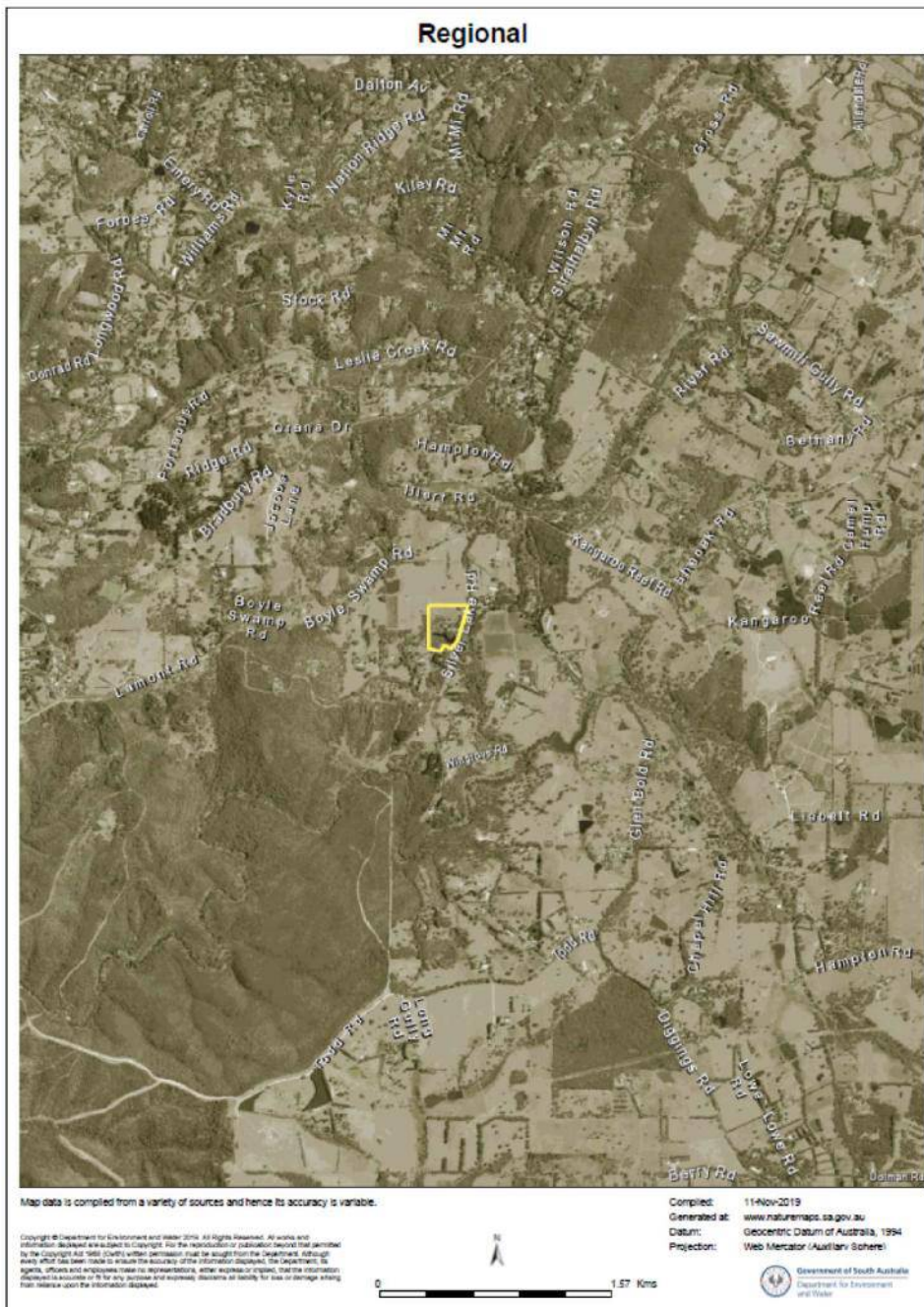
Parcel ID: F101385 A10

Title/Volume/Folio: CT/5107/485

Property Area (Hectares): 6.6371 ha

Mean Annual Rainfall 1976 - 2005: 767mm

Location map - General Area



Silver Lake Bushfire Management & Vegetation Review

The Property

The property is located in the valley floor close to the Onkaparinga River near Mylor and is a very flat property.

Land to the North of the property is grazed by livestock and is clear of dense native vegetation with only scattered trees present.

Native vegetation within the property is dominated by an overstory of *Eucalyptus camaldulensis* (red gums) woodland and some remaining *Eucalyptus obliqua* (stringy bark) and *Eucalyptus leucoxylon* ssp, in patches, found on the eastern boundary.

Irrigated lawns and deciduous trees are around the existing house structure and driveway.



Bushfire Knowledge- Overview

The primary influences upon how bushfires move through the landscape are humidity, topography, wind and temperature.

The impact of a fire on infrastructure can be influenced by the type of structure, the materials used in the structure build, maintenance of fuel loads around the structure / property and the presence or absence of volatile liquids or gases.

The four main attributes that fire danger warnings are based on;

- wind speed
- air temperature
- relative humidity
- recent rainfall

Fire behaviour

There are a number of items which can affect the way a fire burns. They include;

The Slope— it is known that a fire travelling uphill will travel faster. In fact, for every 10 degrees of slope a fire can double its speed. As a fire speeds up it becomes more intense and more dangerous.

Vegetation (and type)—smaller items such as twigs, branches and leaves are known as 'fine fuels' and these can burn very easily. Burning bark, twigs and leaves can also be blown a long way on windy days. The type of vegetation (grasses or trees or a mix) can dramatically change the speed and nature of a fire.

Weather— this can be influenced by past dry days and humidity. When it's hot, dry and windy, fires can be more intense and unpredictable. Strong winds can send a fire in different directions and cause burning embers to be blown through the air.

Embers -An ember attack is the most common way houses, sheds and outbuildings initially catch fire during a bushfire. To note:

- Embers are burning twigs, leaves and pieces of debris
- Ember attack occur when twigs and leaves are carried by the wind and land on or around houses
- Ember attack is the most common way houses catch fire during bushfires
- Embers can land on top of debris in your gutters and set fire to your house
- Ember attack can happen before, during and after the bushfire
- Fire embers are glowing hot and remain after or precede a fire. Embers are often as hot as the fire which created them
- During a fire, embers can travel up to 40 kilometres, starting spot fires well ahead of the fire-front – often without warning
- An ember attack is how many properties are lost in a bushfire. Leaving a high fire-risk area early is always the safest option

Top ten things you need to know about bushfire behaviour¹

1. The steeper the land the faster the bushfire will spread up it; for every 10 degrees in uphill slope the speed of a fire will double.
2. Fires can overcome downward slopes or breaks in fuel by 'spotting'; throwing burning embers well ahead of the fire front that can start new fires.
3. The lower the humidity and higher the temperatures, the drier the fuel and the easier it is to ignite and the more intense the fire will be.
4. The bulk of a bushfire's energy is actually from the fine fuel on the ground; stuff less than 6mm in size such as twigs, leaves and bark. This is what the fire feeds most on, rather than the heavier fuel such as branches which tends to burn after the fire front has passed through.
5. In extreme conditions, fires can 'crown', which is when they burn through the canopies of the trees rather than burning through the undergrowth.
6. Wind speed has a linear relationship with the speed of the bushfire; the faster the wind, the faster the bushfire will travel.
7. The Fire Danger Index is an open-ended score of fire risk; in the Forest Fire Danger Rating System, 'severe' is above 50 points, 'extreme' is above 75, and 'catastrophic/Code Red' is above 100.
8. Once the fire danger rating gets above 'extreme', there is little that can be done to control bushfires.
9. Reducing fuel hazard through clearing and hazard reduction burns is one of the few things we can do before bushfire season to reduce the risk of bushfires starting and their intensity when they do, and improve the chances of fire fighters getting them under control.
10. Climate change is forecast to increase the number of extreme bushfire weather events but also to extend the bushfire season well into autumn.

CSIRO research shows the frequency and severity of fire weather has increased over recent decades.

¹ Produced from CSIRO Research

Silver Lake Bushfire Management & Vegetation Review

Know Your Bushfire Risk²

A. I live in an area surrounded by bush

What to expect:

- Fires in dense bushland can be very hot, intense and fast moving
- Burning embers may be blown from the bush, landing on your property and starting spot fires or setting fire to your home
- Embers may land for many hours even after the main fire front has passed
- Smoke and fire may affect driveways or homes, making it difficult to leave
- The radiant heat from a fire nearby may set fire to your home or surrounds

B. I live close to grassland or paddocks

What to expect:

- Grass fires can start easily and spread quickly, not only destroying homes but also crops and livelihoods
- Grass fires are very hot and can produce huge amounts of heat which can kill anyone out in the open
- As grass dries out or cures, it can catch fire more easily
- Fires in tall grass will have tall flames that may burn across trails, roads or fire breaks
- Grass fires can move much faster than a bush fire, catching people off guard

C. I live in an area where the bush or grasslands meet built-up areas

What to expect:

- Fires can spread quickly from parks and reserves threatening your home, fences or gardens
- Thick smoke from the fire might make it difficult to see or breathe
- Even if you live a few streets back from the bush you are at risk from ember attack
- Burning embers can travel through the air, setting fire to homes a few streets back from the bush

Silver Lake Assessment

The Silver Lake property is;

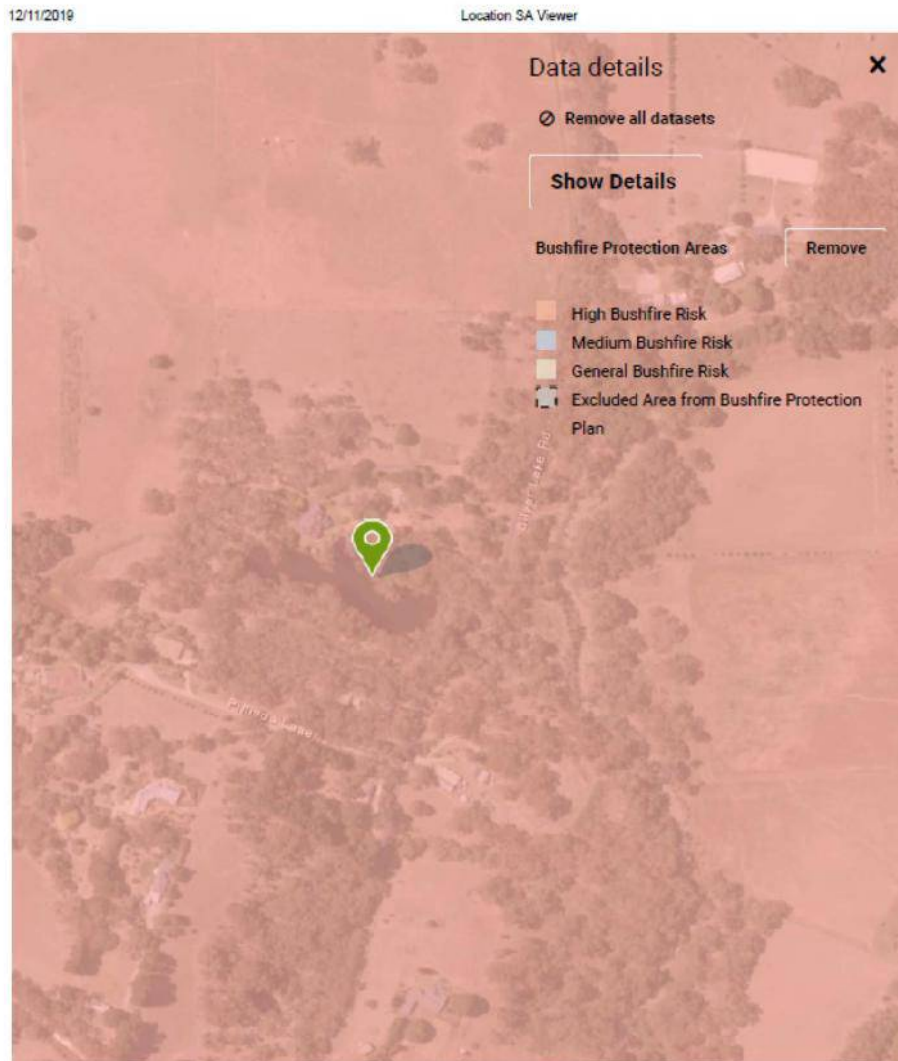
- Regionally surrounded by native vegetation (A)
- Has paddocks of introduced grasses surrounding the property and within (B)
- Is in an area which is semi-rural with houses close to the property (C)

Given the locality of the property and surrounding landscape Silver Lake is likely to fit in all three (A,B,C) scenarios suggesting it is a High Fire Risk site.

² Extracted from NSW RFS

Silver Lake Bushfire Risk Planning Zone

The silver Lake property is located in a **High Bushfire Risk** planning zone.



A High Fire Risk Zone must fully consider;

The proposed development designed and sited so as to appropriately manage the risk of bushfires, having regard to the relevant provisions of the Adelaide Hills Council Development Plan and the Ministers Code: Undertaking development in Bushfire Protection Areas.

Regulations

The development of this property is covered by numerous controls and directions including;

- Adelaide Hills Council Development Plan August, 2019
- Adelaide Hills Council Bushfire Services Design fact sheet, December 2018
- SA Government Ministers for Plan Code - Undertaking development in Bushfire Protection Areas, as amended 2012
- SA Government Minister for Planning - Ministers Specifications, Additional requirements in designated bushfire prone areas, May 2011
- Housing Industry Association. Construction of Buildings in a Bushfire Prone Area 2019
- Native Vegetation Act 1991
- Native Vegetation Regulations 2017
- Development Act 1993 and Regulations
- CFS regulations

Fire Danger Ratings SA

Extracted from CFS website https://www.cfs.sa.gov.au/site/bans_and_ratings.jsp

No Fire Danger Rating

- Generally, there is no Fire Danger Rating calculated outside the Fire Danger Season.

Catastrophic (Total Fire Ban Days)

- These are the worst conditions for a bush or grass fire
- If a fire starts and takes hold, it will be extremely difficult to control and will take significant firefighting resources and cooler conditions to bring it under control
- Spot fires will start well ahead of the main fire and cause rapid spread of the fire. Embers will come from many directions
- Homes are not designed or constructed to withstand fires in these conditions
- The safest place to be is away from bushfire prone areas

Extreme (Total Fire Ban Days)

- These are very hot, dry and windy conditions for a bush or grass fire
- If a fire starts and takes hold, it will be unpredictable, move very fast and very difficult for fire fighters to bring under control
- Spot fires will start and move quickly. Embers may come from many directions
- Homes that are prepared to the highest level, have been constructed to bushfire protection levels and are actively defended may provide safety
- You must be physically and mentally prepared to defend in these conditions
- The safest place to be is away from bushfire prone area

Severe

- These are hot, dry and possibly windy conditions for a bush or grass fire
- If a fire starts and takes hold, it will be hard for fire fighters to bring under control
- Well prepared homes that are actively defended can provide safety
- You must be physically and mentally prepared to defend in these conditions

Very High

- If a fire starts, it is likely to be controlled in these conditions and homes can provide safety
- Be aware of how fires can start and reduce the risk

High

- If a fire starts, it is likely to be controlled in these conditions and homes can provide safety
- Be aware of how fires can start and reduce the risk

Low-Moderate

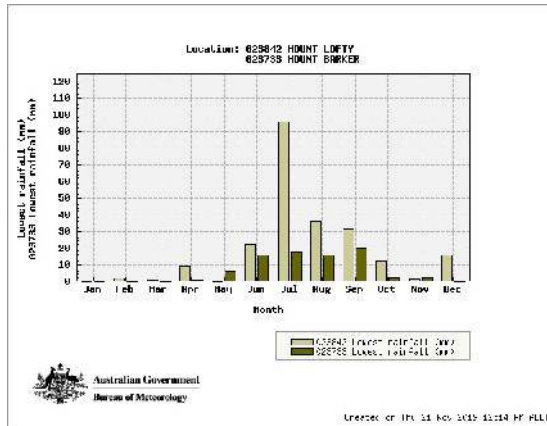
- If a fire starts, it is likely to be controlled in these conditions and homes can provide safety
- Be aware of how fires can start and reduce the risk

Silver Lake Bushfire Management & Vegetation Review

Review of Climatic Conditions

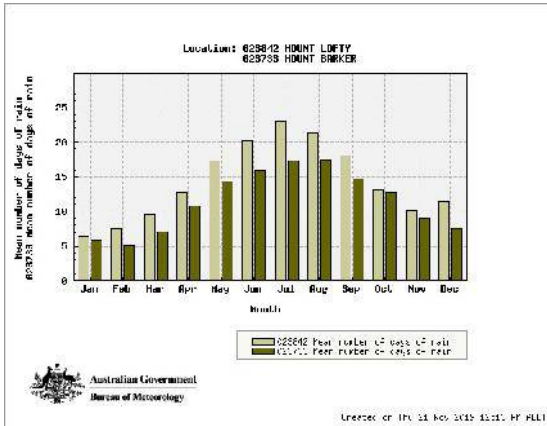
The following data has been taken from the Australian Government Bureau of Meteorology historical records. Data has been selected from 2 official sites located as close to Silver Lake as possible (Mount Lofty - 19 years - 8.2 km away) and Mount Barker (63 years - 8.7 km away).

Minimum Rainfall



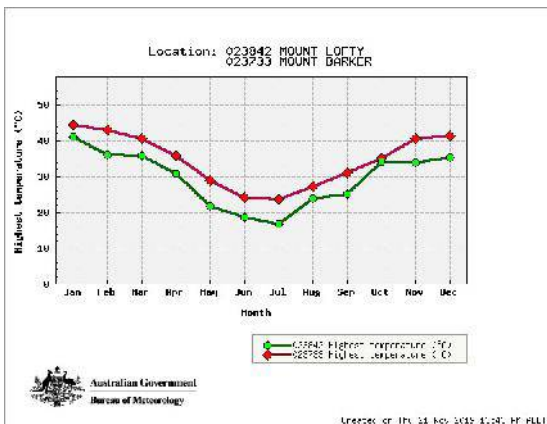
Lowest rainfall is between October and May with minor improvements in December, usually caused by thunderstorms.

Mean Number Of Rainy Days



This graph shows rainfall is likely in some form under 10 day/ month between Nov and March.

Maximum temperatures



Temperature records from Mount Lofty show December to March to regularly top temperatures over 35 degrees.

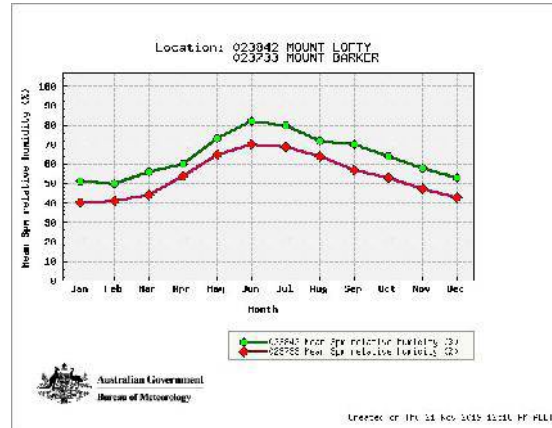
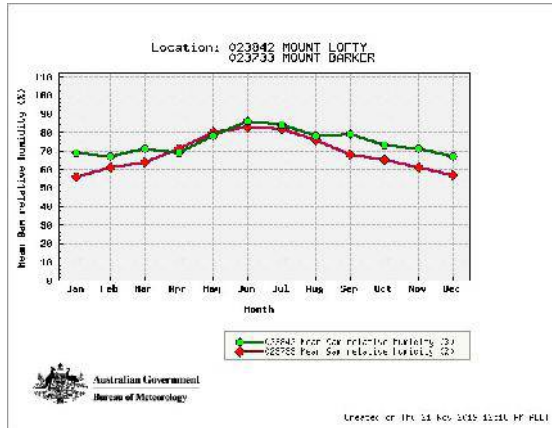
Temperature records from Mount Barker show October to April to regularly top temperatures over 35 degrees.

A rapidly changing (warming) climate is likely to increase these temperatures.

Silver Lake Bushfire Management & Vegetation Review

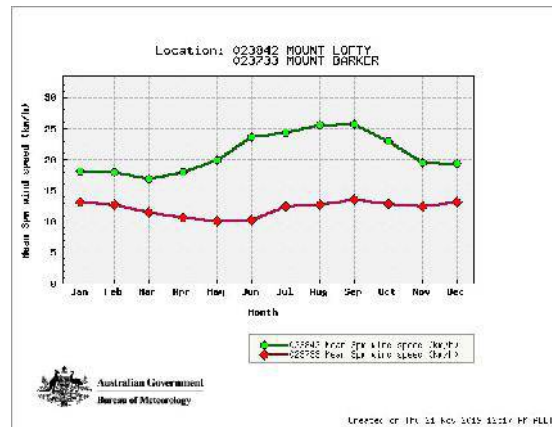
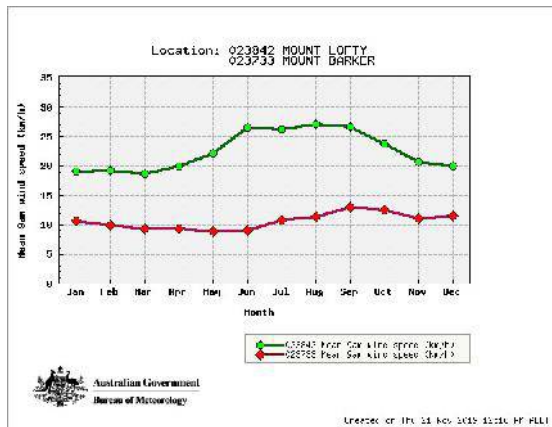
Relative Humidity (9am & 3pm)

These graph averages indicate the lowest relative humidity to in the months of October to March with the afternoon to be the time of lowest humidity.



Wind Speed

These graphs indicate wind speeds are similar at any time of the day



Climatic Review for Potential Bushfire threats

The Mount Lofty Ranges bushfire threat is most likely highest during the months October to April with extreme conditions likely November to March, however due to the impacts of climate change extremes of temperature, periods of little or no rainfall, lower humidity and increased wind speeds will all add to increased fire risks for the Silver Lake property. .

Silver Lake Bushfire Management & Vegetation Review

Direction of Wind

These charts indicate morning wind direction to be from the West/ North West/ North and East in the morning with stronger winds from the West and North West in the afternoon.

Rose of Wind direction versus Wind speed in km/h (01 Oct 1987 to 11 Aug 2019)

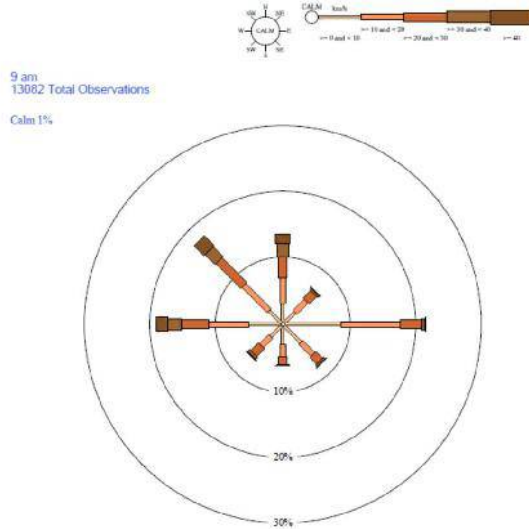
Custom times selected, refer to attached note for details

MOUNT LOFTY

Site No: 523842 • Opened Feb 1985 • 001 Open • Latitude: -34.9764° • Longitude: 138.7089° • Elevation: 685m

An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



Rose of Wind direction versus Wind speed in km/h (01 Oct 1987 to 11 Aug 2019)

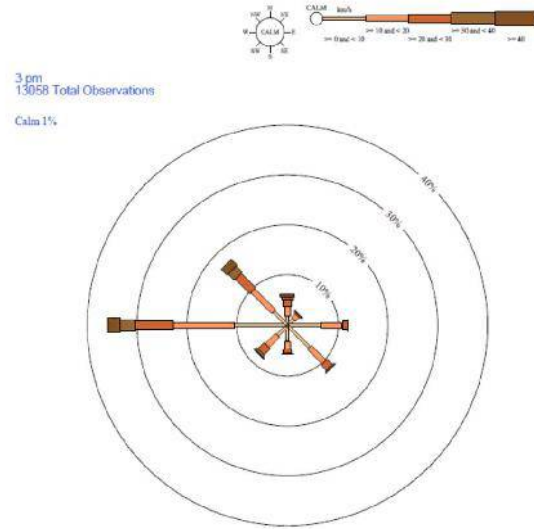
Custom times selected, refer to attached note for details

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Other important info about this analysis is available in the accompanying notes.



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Contact us by phone on (02) 9669 4000, by fax on (02) 9669 4515, or by email on climate.data@bom.gov.au.
We have taken all due care but cannot provide any warranty nor accept any liability for this information.

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We have taken all due care but cannot provide any warranty nor accept any liability for this information.

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Possible Direction of a Bushfire

The location of Silver Lake in the landscape indicates, under "normal" bushfire conditions an ember attack is most likely from the West/North West/ North.

However, under Extreme or Catastrophic conditions, due to the surrounding vegetation and unpredictability of winds all surrounding sides must be considered as a threat to infrastructure assets.

If a bushfire passes the property and is burning in the vicinity of Mount Bold Reservoir, a southerly wind change is likely to bring any fire back over the property.

NOTE: Recent bushfires indicate extremes of unpredictability of conditions and fire behaviour. Measures should be taken to deal with all fire conditions from all directions.

Silver Lake Bushfire Management & Vegetation Review

Possible Bushfire Direction Map

A fire is likely to come from the West, North West or North, however easterly fires should not be ruled out. Embers from these directions are highly likely.

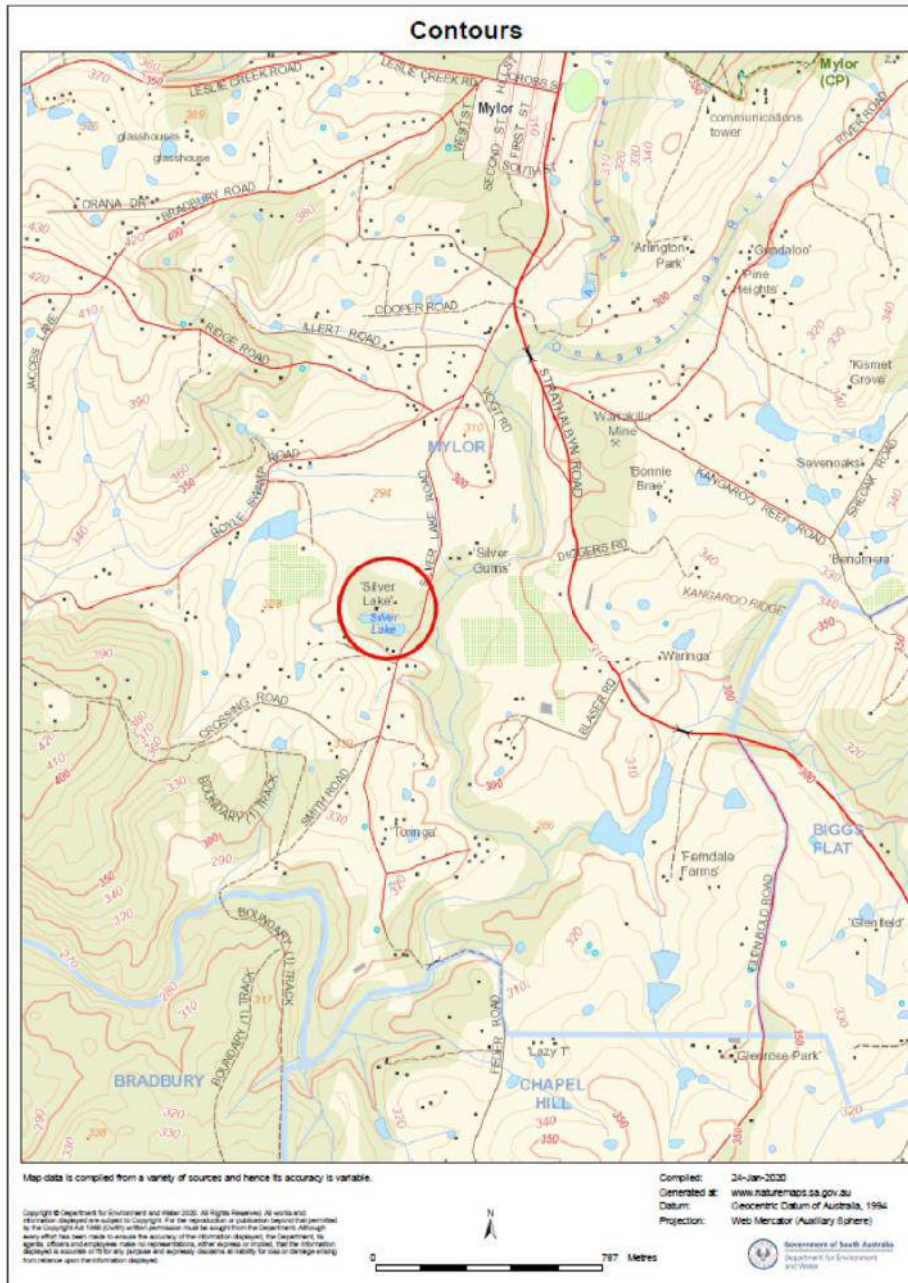


Once the fire has passed a Southerly (South Westerly) change could bring another ember attach from this direction based on the close proximity to a large area of Native Vegetation dominated by Eucalyptus species.

Silver Lake Bushfire Management & Vegetation Review

Local Contours

Contours show Silver Lake to be relatively flat; however, within 1.5km, are steeper hills containing cover of Eucalyptus sp with a high chance of spraying embers over the property during a bushfire.



The surrounding topography and the nature of the local vegetation (outside of the property owners' control); in this case ember attack is likely to be the biggest single uncontrolled event to cause spot fires within the property's boundary.

Silver Lake Bushfire Management & Vegetation Review

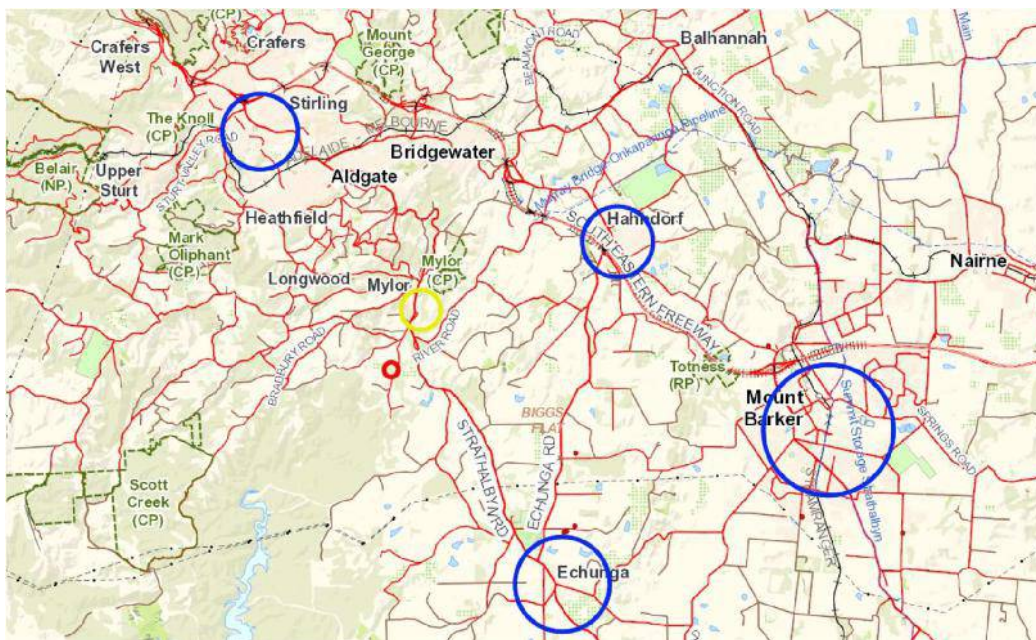
Property Access and Exit

The property is located on Silver Lake road approximately 2km south from the Mylor Oval.

The closest approved³bushfire safer place is Hahndorf located 9.3km North, North East of the property, Stirling located 10km North, North West of the property and Mount Barker located 15.9km to the West of the property.

The closest approved Bushfire last resort refuge is Echunga located 8.3km to the south of the property

The roads linking all of these sites are lined with very large trees with tall introduced grasses.



CFS Meanings - Protect Life

A **Bushfire Safer Place** is a place of relative safety. It may be used as a **place** for people to stay in or as a **place** of first resort for those who have decided they will leave high risk locations early on a **high fire risk day**.

A **Bushfire Last Resort Refuge** is a space or building which you could go to and remain in during a **bushfire** in your area. It is an area that provides a minimum level of protection from the immediate life-threatening effects of radiant heat and direct flame contact in a **bushfire**.

³https://www.cfs.sa.gov.au/site/prepare_for_a_fire/bushfire_safer_places/list_of_bushfire_safer_places_and_bushfire_last_resort_refuges.jsp

Potential for Fire

There are numerous ways a fire could start that may impact on the Silver Lake property which include but are not limited to;

Internal Property

- Property owner activities
- Maintenance contractor
- Arsonist (mostly likely roadside)
- Personal threat
- Storm damage
- Lightning
- Equipment failure
- Stationary machinery
- Battery explosion
- Vehicle
- Electric fencing or other electrical items
- House fire
- Other

External to Property

- Embers
- Lightning
- Ground flame travel
- Roadside arsonist
- Powerlines
- Vehicle accident
- Machinery / Equipment use

Bushfire Season - Mount Lofty Ranges

The bushfire season is usually 1st December to 30 April however during times of low rainfall and hotter temperatures these dates are usually brought forwards and extended meaning earlier fire protection measures are required along with additional fire control strategies.

Pre-European Vegetation

The pre-European Vegetation for the property contains two main vegetation types;

Type 1 - Broad Structural Formation Description

Woodland

- Structural Formation Description

Woodland

- Dominant Overstorey

Eucalyptus camaldulensis var. camaldulensis

- Dominant Understorey

An open understorey of sedges, rushes, grasses and herbs.

Type 2 - Broad Structural Formation Description

Open Forest

- Structural Formation Description

Open Forest

- Dominant Overstorey

Eucalyptus obliqua

- Dominant Understorey

- A sclerophyll shrub understorey including Exocarposcupressiformis, Olearia grandiflora, O. ramulosa, Acacia myrtifolia, Hakea rostrata, Leucopogonvirgatus, Daviesialeptophylla, Banksia marginata, Pultenaeadaphnoides, P. largiflorens. Pteridiumesculentum

- Other Dominant overstorey Eucalyptus species within the site would have beenEucalyptus leucoxylon ssp. leucoxylon.

It is well known that oils secreted by eucalyptus trees (some more than others) are highly flammable, along with leaf and bark drop, adds to any fire risk.

Representation of these Pre-European Vegetation types still exist, with the added problem of introduced grass species. The existence of introduced grasses that are mostly winter active species (C3) - (the term refers to the different pathway that plants use to capture carbon dioxide during photosynthesis), normally dry off when soil moisture reduces and temperature increases. This occurs at the end of spring (October/ November) and early summer (December) in this area.

In contrast many native grasses which once existed in the landscape (before modification), were C4 species, meaning they are summer active providing green vegetative materials throughout the fire season.

In general, deciduous trees are less flammable than native species and should be considered as replacement shade trees if the native tree is growing too close to assets. If the native tree is identified as a significant habitat or significant in size all options need to be considered to retain the tree. C4 native grasses will have less thatch to contend with than some introduced species.

Silver Lake Bushfire Management & Vegetation Review

Silver Lake Property Review - Native Trees

A review of the property with a view to fire controls is reflected in the following:

Analysis of Dominant Species

Botanical Name	Common Name	Estimated % trees over property	Notes
<i>Eucalyptus camaldulensis</i> var. <i>camaldulensis</i>	Red Gum	40%	Mostly smooth trunks, however sheds large amount of leaves and bark during dry periods leaving potential ignition hazard. Branches fall from this species unexpectedly. Where rough bark exists embers may ignite by way of dry leaves falling onto the trunks of trees. Medium to high oil content in leaves
<i>Eucalyptus obliqua</i>	Brown Stringy Bark	5%	Rough stringy bark truck which sheds in times of dry conditions. Drops significant amount of fruits, nuts, dead stags and leaves during times of dryness. Fruit/nuts and leaves from the trees will drop daily, blocking gutters. High oil content in leaves
<i>Eucalyptus leucoxylon</i> ssp. <i>leucoxylon</i>	SA Blue Gum	<1%	Rough bark to 3 from the ground up. Prolific flowing period usually prior to Summer where stamens and new fruits/nuts are shed naturally to enable a small quantity of fruits to grow to maturity. This process along with daily leaf drop can settle in infrastructure wall cracks and gutters providing an ideal area for ignition. High oil content in leaves

Like many plants native to fire-prone regions, Eucalyptus trees are adapted to survive a bushfire. After a bushfire sweeps through an area, the Eucalyptus trees have an advantage over other plants as their seed capsules open up when burned, and the seedlings thrive in freshly burned, ash-rich soils with even little soil moisture. They can easily become dominant in the landscape if not managed.

Fallen Eucalyptus leaves create dense carpets of flammable material, and the trees' bark peels off in long streamers that drop to the ground, providing additional fuel that draws ground fires up into the leaves, creating massive, fast-spreading crown fire in the canopy of Eucalyptus specie.

Eucalyptus oil contained in the leaves of the trees is flammable. This oil, combined with leaf litter and peeling bark during periods of dry, windy weather can turn a small ground fire into an explosive fire in a matter of minutes.

Native trees and vegetation provide significant habitats for many fauna species and resources for beneficial insects therefore maintaining and keeping Eucalyptus trees around the property is important. It is the way they are managed, maintained and improved that will assist in a fire situation.

Silver Lake Bushfire Management & Vegetation Review

Native trees are found within the asset protection zone (refer to map on page 27). Some are recommended to be retained or removed for asset protection purposes should the development proceed. Trees analysis data is in attachment C.

All of Property Specific Recommendation - Existing Eucalyptus

When developing human inhabited infrastructure in a High Bushfire Risk Zone the following actions need consideration to assist with asset and human protection strategies:

- a) Remove any fallen branches as they fall on the ground
- b) Rake-up excessive leaves and place in a mulch heap away from any infrastructure or burn prior to the fire season
- c) Do not pile the branches up and around exiting trees
- d) Remove any branches overhanging buildings or infrastructure
- e) Remove ⁴any Eucalyptus within 10m of a structure
- f) Seek CFS advice regarding Eucalyptus within 20m of a structure and Native Vegetation Council approval
- g) For those trees outside 20m of a structure, remove introduced grasses within a 3m circumference of the main trunk. Consider replacement of this grass with a fewer flammable species
- h) Control naturally regenerating thickets of Eucalyptus sp on the property. This is an unnatural process that needs managing
- i) Remove all organic/ wood-based mulches replacing with gravel materials



Photo - An example of poor practices. In an ember attack the drying grass would catch fire, the dry branch heaps would then burn, assist the trees to catch fire and the open shed would burn down.

⁴ Obtain permission from Native Vegetation Council first

Exiting Vegetation Issues near Structures

CFS guidelines in a High Fire risk zone recommend the removal of vegetation within 20m of a structure.

All plants will burn under dry and extreme conditions. Reducing the fuel load reduces the risk.

A review of the property indicates the following recommendations for now and into the future.

Refer to native and exotic tree removal map on page 27.

1. Entrance road



Entrance trees are introduced species. The access road must be 6m wide from trunk to trunk to allow for the growth of the trees and pruned 4m high to enable CFS truck access.

This should be measured and any introduced trees not complying removed and replanted to provide suitable separation distance.

2. Exotics close to native tree trunk



Remove introduced shrubs or trees close to the trunks of existing Eucalyptus trees.



Remove trees close to infrastructure (e.g. shed) and enable fire truck access when trees grow larger.

Silver Lake Bushfire Management & Vegetation Review

3. Introduced trees touching Native Trees



Plants like this easily ignite in an ember attack. This would then provide the light fuel to set the Eucalyptus on fire.

4. Remove Hedge



At the proposed location of the house remove Photinia hedge from around Eucalyptus.

5. Remove planted vegetation



Although this is planted vegetation it poses a fire risk by way of increased fuels close to the proposed new house.

Silver Lake Bushfire Management & Vegetation Review

6. Existing Infrastructure



Remove any pine bark mulch from base of tree and replace with gravel.

Remove this tree Eucalyptus camaldulensis. It is a potential canopy bushfire “wick” between the existing structure and proposed structure.

7. Remove large introduced (exotic) trees



Remove 20m from the existing structure.

It is preferred that these trees are dug-up and replanted to reflect the 20m standard separation distance from houses and sheds.

8. Large shrubs and Eucalyptus

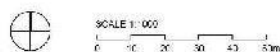
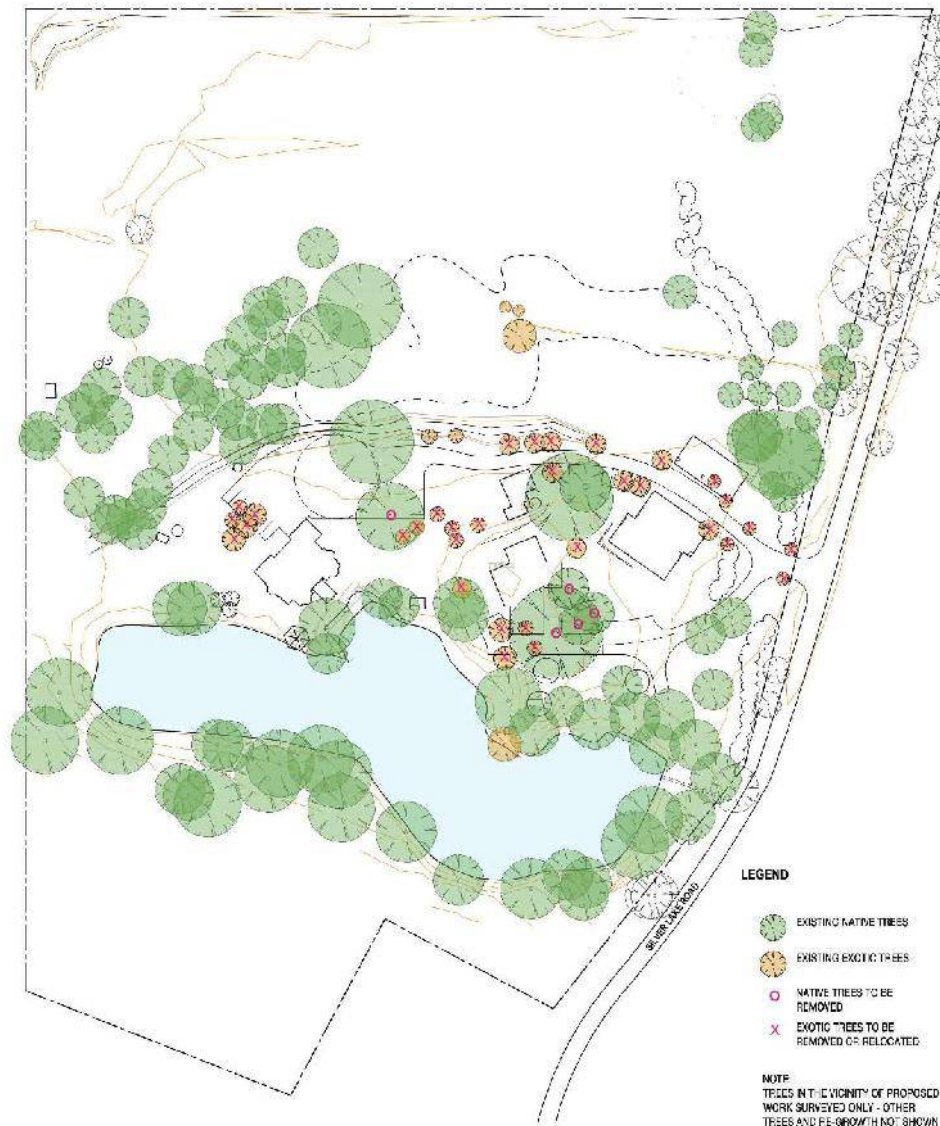


Remove large introduced shrubs from trunk of Eucalyptus to maintain a smooth and clean tree trunk.

Silver Lake Bushfire Management & Vegetation Review

MAP # 5.2 - Survey of Native and Introduced Trees

Shown below are native and non-native trees recommended for removal to protect the proposed development.



HANNAFORD CONSULTING
11 HANFORD ST. SYDNEY NSW 2010
hanford@hannafordconsulting.com.au

SILVER LAKE
SITE REGENERATION & DEVELOPMENT

SILVER LAKE TO EMPLOY 53 Scale: 1:1000 (A3)

Project No: 1817 DA5.2

PROPOSED
NATIVE & EXOTIC TREES

Project Area: SITE

5.2

25.02.2020 Rev

Silver Lake Bushfire Management & Vegetation Review

The Garden

Given the proposed development, as it is understood, it would be wise to develop a simple garden with low flammability (refer to species in attachment A).

A green lawn, watered with appropriate sprinklers that can also be used to control an ember attack is recommended. This means a 20m lawn buffer around houses and sheds where possible.

The use of plastics for irrigation in a High bushfire area is unwise and **should not be** considered.

Recommendation - An irrigation expert who has experience in bushfire controls should be engaged to design such a system.

Yearly Maintenance Actions - a minimum

All activities outlined in this review are only as good as the maintenance that follows the development.

1. Gutters – cleaning and clearing monthly.
2. Tree and shrub – trimming or removal as per plan.
3. Grass and vegetation management - regular mowing and cutting as per landscape plan.
4. Fire break construction and management as per landscape plan.
5. Creating vehicle access points.
6. Inspection of firefighting equipment / run the system monthly and fill all water tanks.
7. Reducing any other risks or hazards associated with bushfires.
8. Check all fire extinguishers.
9. Check radios and communications.
10. All personal safety equipment accounted for and updated where necessary.

A week of fire action on the first of October is a sensible way to prepare for the fire season ahead.

Assistance for others

Visitors and those who are unfamiliar with the property and area should be given a briefing when they arrive for the first time. A guide for family and guests can be found in attachment B.

The Property as a Whole - Bushfire Control Zones Overview

In order to manage the fire risk over the entire property manageable zones should be established. Keeping each zone simple will aid the effectiveness of controls (refer to map on page 30).

Zone 1 - Asset (Houses and Shed) Control Zone

- A 20m (native) treeless buffer around the assets
- Replaced with lawn and fire-retardant species
- An effective non plastic irrigation system that can be turned on remotely using water from the lake
- Lawn kept green
- Mowed every 2 weeks during the fire season

Zone 2 - Bushfire Buffer Zone

- The North and West side of the property is essential
- Unless Regulated or Significant trees exist, remove Eucalyptus trees
- Replace with deciduous species
- Install ground sprinklers
- This buffer is 10m
- Move wooden fence beyond this zone

Zone 3 - Property Controls

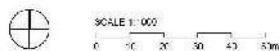
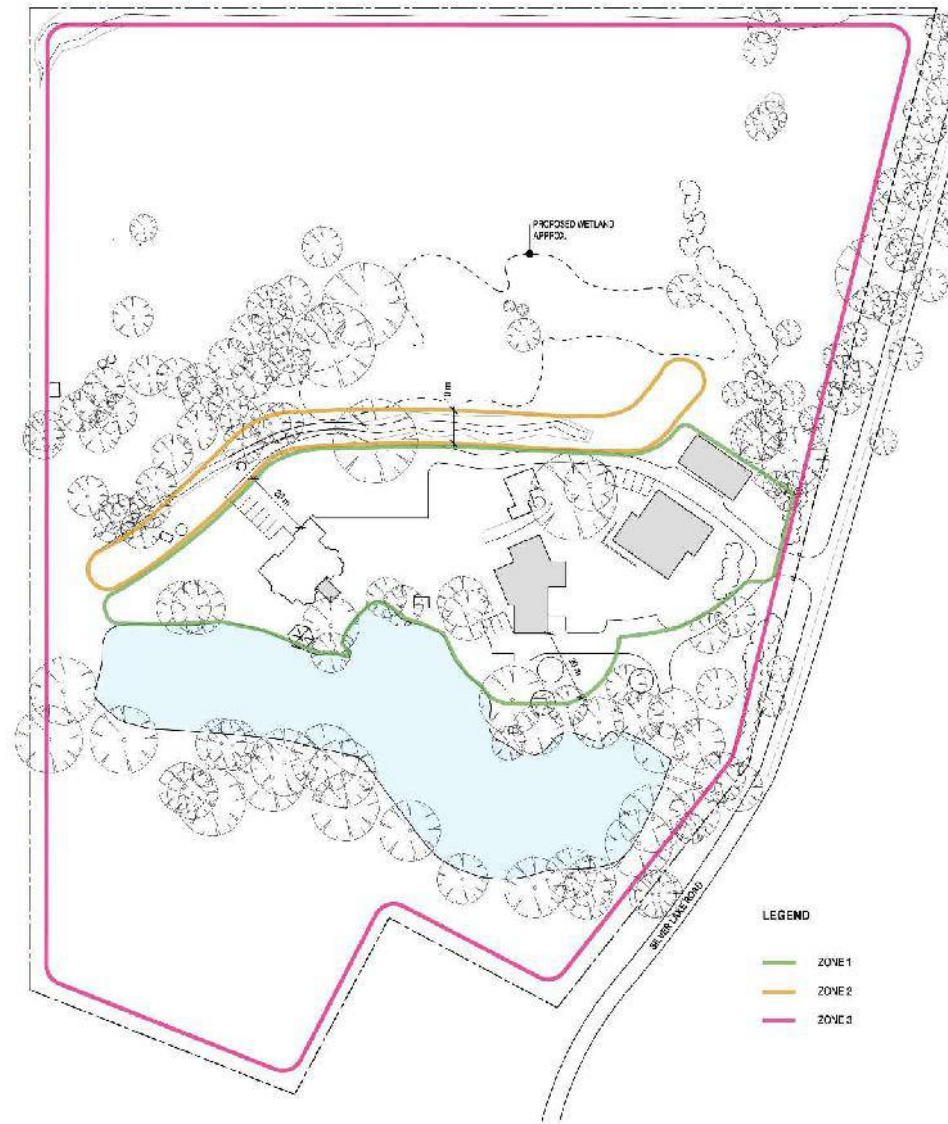
- Establish a 2m wide access track around the perimeter fence. A track that is kept as close to mineral earth as possible
- Remove all introduced grasses from along fence lines by chemical or manual means
- Maintain mowing in open areas to control grass growth
- Replace introduced grasses with native *Microleana stipoides* (weeping rice grass)
- Pick-up any fallen branches and cut-up fallen trees
- Control natural regeneration of Eucalyptus species
- Implement a landscape plan with a management schedule

The following map indicates the zones.

Silver Lake Bushfire Management & Vegetation Review

MAP # 5.1 - Bushfire Management Zones Map

- Zone 1 = Asset Control
- Zone 2 = Fire Buffer Zone
- Zone 3 = Property controls



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SILVER LAKE
SITE REGENERATION & DEVELOPMENT

SILVER LAKE AND EMPLOYER SA Scale: 1:10,000 (A3) Project No: 1817 DAS.1

PROPOSED
MANAGEMENT ZONES

Proj Area: SITE

5.1

25.02.2020 Rev:

Zone 1 - Proposed House - Vegetation Review

A review of the existing native vegetation found in the location of the proposed new house and other infrastructure has considered many variables taking into consideration policy settings and relevant acts from a variety of sources such as Adelaide Hills Council Strategic Plan, CFS, Planning Act 1993 (Significant & Regulated Trees) and Native Vegetation Act 1991 and Regulations 1997.

This location is in a high fire risk part of the Mount Lofty Ranges. As such a 20m vegetation buffer is usually recommended by CFS. However other considerations, such as proposed measures taken to avoid and minimize impacts on biodiversity and rare or threatened species or ecological communities within the property or immediate vicinity of the development, should be taken into account.

It is proposed a sensible approach is taken considering the opportunity to avoid, minimise and rehabilitate the landscape.

Avoidance

Consideration has been given to location of the proposed new house and associated infrastructure.

- Do all native trees need to be removed within 20m of the footprint?
- Is there another alternative to the current house site proposed with less impact?
- Can irrigated water assist with bushfire protection of assets?
- Can landscapes be modified to assist with bushfire controls?
- Can the use of different building materials enable the retention of existing Eucalyptus trees?

Minimization

This site is void of native understory and middle story shrubs; therefore, it is just the trees in question.

- Moving the house slightly enables a separation distance to the trunk of the trees to a minimum of 10m
- Incorporating a bushfire irrigation system to the trees and the house will assist with bushfire controls
- Minor pruning of unsafe or overhanging limbs will assist to retain the trees
- Rough bark trees within 20m should be removed due to quick flammability in a bushfire situation

Rehabilitation or restoration

A complex landscape plan has been created for the rest of the property which outlines measures taken to rehabilitate ecosystems on the property and re-establishment of the vegetation types. The property will be better enhanced than the condition it is currently found in now.

Proposed house - Existing Native Trees

A review and assessment has been completed regarding the location of existing trees and impacts from the building of a new house (data can be found in attachment C).

The examination of the site included;

- Trees species & type
- Regulated or Significant Tree (the Planning Act 1993)
- Implication of the Native Vegetation Act (1991) and Regulations (2007)
- Structural separation distance and opportunities to reduce burning

Trees 10m from infrastructure to retain



Tree1



Tree 2



Trees 3 & 4

Recommendation

1. The infrastructure is built outside the canopy of the existing Eucalyptus species and conforming with the TPZ separation distances as outlined in attachment C or a minimum of 10m from the trunk of the tree.
2. All trees other than the Eucalyptus species, above, are removed from 20m of the new structure.
3. A firefighting system to be installed to the trunks of the existing Eucalyptus species, so they can be wet with water during a bushfire.
4. Irrigated lawn surrounds the new house.
5. Only gravel mulches are used.
6. The house is built to bushfire standards AS3959-2009, *Design of Buildings in Bushfire Prone Areas*.
7. Other plants are removed from the existing Eucalyptus to 10m from their trunks.
8. Branches and leaf drop are regularly removed reflecting information contained in the document.
9. Trees recommended for removal are assessed by an accredited Native Vegetation Council consultant with an application to remove processed.
10. An arborist or qualified horticultural consultant provides an assessment of the trees with the building consent application to council.
11. All trees are protected during construction.

Existing Eucalyptus Trees within Asset Protection Zone

Retain



Trees 3 & 4 - *Eucalyptus leucoxylon ssp*

- Excellent flowering habitat
- Remove any bushes or small trees within 10m
- Maintain grass free to base of tree
- Mow or use a blower vac around frequently around trunks to pick-up fallen leaves and fruits

Recommend - Keep and Maintain

- No replant any plants within 10m of the trunk
- No wooden mulches used only gravel types
- Install a fire sprinkler to water down rough bark on trunk during a bushfire



Trees 1 & 2 - *Eucalyptus camaldulensis* & *Eucalyptus obliqua*

- Remove any bushes or small trees within 10m
- Prune canopy of *Eucalyptus camaldulensis*
- Maintain grass free to base of tree
- Mow or use a blower vac around frequently around trunks to pick-up fallen leaves and fruits

Recommend - Keep and Maintain

- No replant any plants within 10m of the trunk
- No wooden mulches used only gravel types
- Install a fire sprinkler to water down tree trunk during a bushfire



Tree Parking- *Eucalyptus camaldulensis*

- Larger tree
- Needs pruning
- No hollows present

Note

- Tree is a good shade tree for parking area and has relatively smooth bark
- Install a fire sprinkler to water down tree trunk during a bushfire

Recommend - Retain

Silver Lake Bushfire Management & Vegetation Review

Remove



Tree A- Eucalyptus camaldulensis

- Smaller tree
- No hollows present

Note

- Tree is natural regeneration in the middle of the proposed house site

Recommend - Removal



Trees B & C - Eucalyptus obliqua

- Is a rough bark tree
- Drops significant leaves during summer periods
- Will be too close to proposed structure

Recommend - Removal



Tree D - Eucalyptus obliqua

- Has a dangerous/ cracked large branch
- Is a rough bark tree
- Drops significant leaves during summer periods
- Will be too close to proposed structure

Recommend - Removal

Silver Lake Bushfire Management & Vegetation Review



Tree E - Eucalyptus camaldulensis

- Is in good condition
- No hollows present
- Has pine bark mulch around the tree
- Frequently drops fallen branches

Note

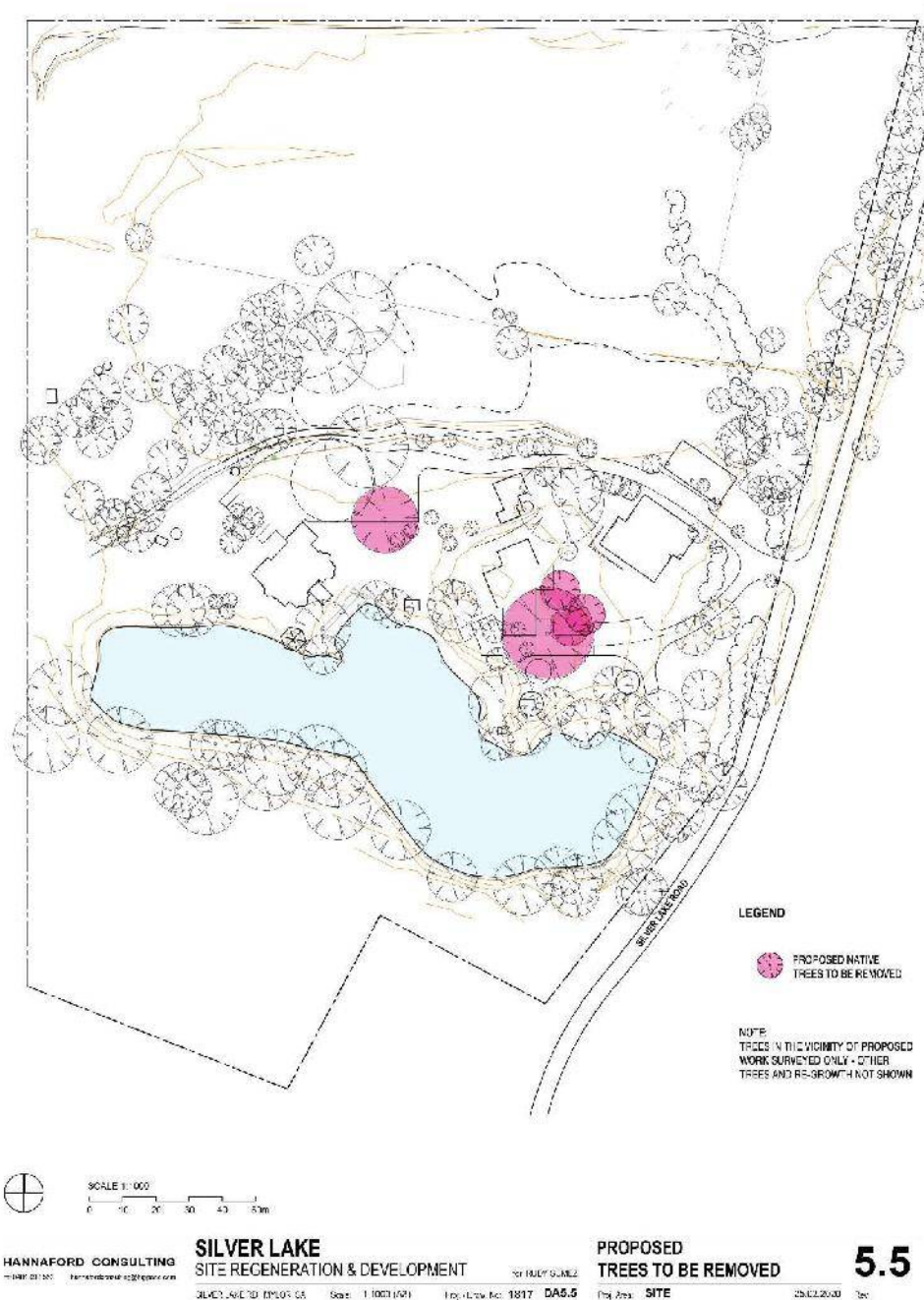
- Tree provides possible overhead canopy link in a bushfire situation between assets

Recommend - Removal

Silver Lake Bushfire Management & Vegetation Review

MAP # 5.5 - Proposed Native Vegetation Removal

Five (5) trees are recommended for removal⁵ as part of the development.



⁵ Seek Native Vegetation Council Approval via NVC accredited consultant

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Zone2 - Deciduous Tree and Fire-Retardant Species Buffer

Deciduous trees that are within 20m of the existing or proposed infrastructure can be transplanted to zone 2. In doing so the action will;

1. Enable CFS truck clear access via the property access road, even after the trees mature.
2. The planting of Agapanthus under the deciduous trees will provide a fire break to grass fires.
3. The collective planting will provide a spark arrestor.
4. This planting will split the paddocks from the house yard acting as a buffer.
5. Provide beautification for the property.



Photo - Example of narrow access once trees mature.
Relocate into the defined zone 2.

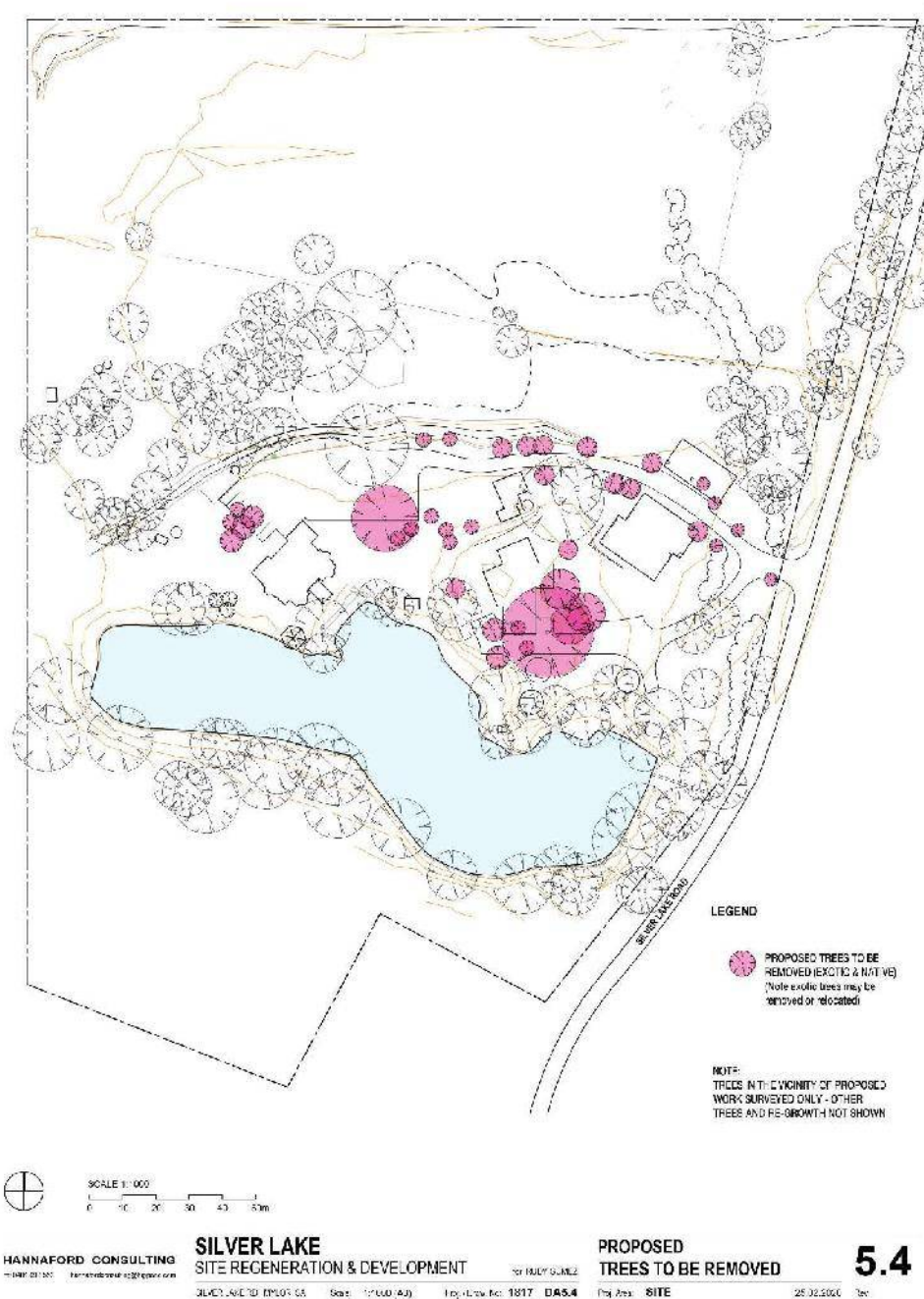


Photo - Zone 2 a strip of deciduous trees to be planted along with agapanthus designed to assist with asset protection during bushfires.

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MAP # 5.4 - Existing tree native removal & exotic tree relocation

The following recommends changes to existing native and introduced tree separation from infrastructure within proposed development.



Silver Lake Bushfire Management & Vegetation Review

Zone 3 - Analysis of Fuel Loads

All of the introduced plant species in the table below increases the threat of a bushfire's intensity, spread and destruction. During an ember attack it is these species where most of the fires begin. Introduced plants found on the property include;

Botanical name	Common Name	Notes
Dactyloctenium	Cocksfoot	At this site generally dries out from December
Phalaris aquatica	Phalaris	At this site generally dries from January. High level of thatch. Burns very hot with high flames if fuel level is not reduced.
Bromus	Brome	At this site generally dries out from October
Holcus lanatus	Fog Grass	At this site generally dries out from January. High level of thatch. Burns very hot with high flames if fuel level is not reduced.
Ulex europaeus	Gorse	Burns well when dead (after spraying) Burns very hot with high flames if fuel level is not reduced.
Rubus fruticosus	Blackberry	Burns well when dead (after spraying) Burns very hot with high flames if fuel level is not reduced.
Cytisus scoparius	Broome	Burns well when dead (after spraying)
Watsonia meriana var. Bulbillifera	Watsonia	Dries out from January and easily catches on fire by falling embers. Burns well and keeps burning inside bulbs after fire has passed.
Asparagus asparagoides	Bridal Creeper	Burns well and keeps burning inside bulbs after fire has passed.

Recommend - Constant fuel reduction is vitally important from October each year.



Photo - Phalaris and other mixed species once dry will become an extreme fire hazard.



Photo - Watsonia bulb when dead, becomes a fire hotspot once it is burnt. Best to hand pull out bulbs in late winter and remove.

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Other Areas of the Property

This is the area that is the larger landscape (refer to landscape plan for additional details).

When grazing is removed from this property to improve water quality it will be important to implement the landscape plan. Once this plan is implemented continued mowing of areas will be essential to keep fuel loads to a minimum.

Other items include;



Photo Northern Boundary - Install an access track around the perimeter for fire control purposes.



Removal of Pinus radiata found on the northern side of the property.



Dead and dry gorse is removed.

Silver Lake Bushfire Management & Vegetation Review



Continued mowing of exotic grass and encourage *Microleana stipoides* (native rice grass).



Woody weed, grass and tree management around southern boundary.



Pick-up fallen branches regularly and mulch.

Bushfire Planning Recommendations

The analysis of the properties existing vegetation and assets, along with an understanding of the proposed development and current regulations provides a guide to the development.

Access

- Work within the Ministers Code- undertaking development in Bushfire Protection Areas (as amended 2012)
- Entrance gate and drive (or track) at least 4m wide
- Drive is maintained and free of all over-hanging branches and electric wires below 4m
- Two turnaround areas are established minimum inner diameter 12m, outer diameter 20m. One in front of the accommodation and one at the main house
- A sign indicating truck turnaround is available
- Surface is bitumen, unit paving or compacted rubble suitable for 15 tonne vehicles
- No plastic pipes are found along the entrance road
- The main gates are opened on a catastrophic fire rated day and during known local bushfires

Vegetation

- Establish the 3 zones and a management regime for each to make vegetation controls easier to follow and effective
- Weekly pickup of fine fuels such as leaves, grass and twigs less than 6mm diameter within 20m from any asset structure (shed and houses -the asset zone), this includes mulches, weeds, bark and piles of wood
- No organic mulch to be used on garden beds - gravel mulch is to be used
- Maintain an irrigated green grass lawn 20m within the asset zone
- Remove planted trees within the asset zone (20m from shed and houses)
- Leave existing trees paying potential notice to regulated and significant trees
- Prune lower branches on trees to 4m high and remove any branches over-hanging house or sheds
- Outside the 20m asset protection zone, called the bushfire buffer zone, which is to be planted with deciduous trees. Remove⁶ any Eucalyptus species from this zone
- Planted fire resistant deciduous vegetation-high water content, low oil content, high salt content, smooth barked, no branches touching ground on the north and west sides
- Hedges and small plants will be fire resistant deciduous vegetation-high water content, low oil content, high salt content, smooth barked, no branches touching ground on the north and west sides (refer to plant list)
- Slash or graze all grassed open areas on entire property
- Remove overhanging limbs on neighbour's property
- Remove and maintain woody weed controls such as gorse, blackberry and pinus species
- Removed flammable mulch from garden within 20m of house
- Replanting species to be selected from fire retardant list provided in attachment A

⁶ Except those recommended keeping within 10m of proposed structure.

Silver Lake Bushfire Management & Vegetation Review

Water

Water is available all year from Silver Lake. It is proposed water pumped to separate tanks for the purpose of firefighting and landscape irrigation, as set out below.

- Install a 50,000 litre (minimum) concrete or steel water tank⁷ for only firefighting purposes only, near the entrance of the property fitted with a large diameter gate valve to the bottom of the tank, ideally with a 65NB London fire male thread for CFS fire piping to connect to.
- Use the current 130,000 litre tank as firefighting and landscape irrigation water for the existing structure and proposed house
- The existing pump house to have installed a separate pump for use around the proposed house and new sheds, keeping it separate to the existing system.
- Install one or more hose reels with enough 20NB rubber (or flat canvas) hose to reach all around the house (usually longer than 30m) with an adjustable nozzle on the end
- Install a 3.5kW (or larger) pump independent from mains electricity near the house in an easy to reach spot on a concrete base inside a fire-resistant masonry or steel enclosure
- Install perimeter sprinkler system on northern face of house (and any sides facing bush) with brass butterfly or impact drive sprinklers on top of 20NB galvanised steel pipe 3min to air
- Install sprinklers at edge of eaves above windows and doors to create wall of spray (not required above brick or stone walls)
- Construct all piping and fittings of steel or copper if above ground
- Service pump and engine annually
- Fill pump engine full of fresh petrol or diesel annually
- Charge engine batteries every month in fire season
- Check pump starts (with inlet & outlet valves open) every month in fire season
- Check piping for leaks when pressurised with pump running
- Check that all fittings on hoses and pumps are compatible
- Check gaskets are fitted, joints are tight and do not leak
- Check sprinklers for blockages by insects, geckos etc.
- Store fire hoses with a cork or bung in the open ends to stop ingress of insects and geckos etc.
- Family members familiar with firefighting equipment, especially location and operation
- Family members know how to operate valves (straight handles are open when handles are in line with, or parallel to, the pipe and circular handles are open by turning anti-clockwise from above)
- Family members practice with pumps (operation of pull cords, fuel on/off, choke, throttle, stop)
- Install a 500-litre water tank, pump and hose on a utility or tray-top or a trailer for mopping up
- Place a couple of 20 litre knapsack sprayers in easy to reach places
- Place about ten 10 to 20 litre steel buckets filled with water around the perimeter of the house for mopping up and dousing spot fires
- Place two or three 200 litre steel drums, filled with water throughout the fire season, with one or two empty 10 to 20 litre steel buckets attached to the rim of the 200-litre drum, around the perimeter of the house for mopping up and spot fires
- Add washing up detergent to all containers of firefighting water to improve wetting of surfaces

⁷ Refer to planning map for location

Silver Lake Bushfire Management & Vegetation Review

NOTE - sprinkler systems should be able to operate from a remote position or by easy to use manual system (a single button).

House

- House designed to AS3959-2009, *Design of Buildings in Bushfire Prone Areas*
- Fix street number and Id number in an easy to read location on the front gate
- Install window treatments to meet building code
- Construct so there are no gaps under external doors
- An insulation / fire blanket is used between the roof and the roof trusses/structural timbers
- Spark controls are installed for the fire season for whirly birds, chimney and other openings
- Reinforce any sky-lights with steel wire embedded in glass
- Only galvanised downpipes are used from the gutter
- Half round gutter with outside brackets
- Maintain the 20m lawn around the house with professionally installed sprinklers that can also be used to douse out spot fires caused by an ember attack
- Construct hard paving (brick, pavers, gravel or concrete) immediately around house
- Protect fascia' sand barge boards with fire retardant paint or encase in fibre cement board
- Use steel posts in verandas, pergola or deck construction
- Install window sills with sloping brick sills
- Install minimum 4kg pressurised fire extinguisher at all entrances to all houses and sheds
- Provide a large fire blanket at all entrances to all houses and sheds
- Install a pull-down ladder to enable quick access to the roof space on all houses
- Install approved firefighting hose reels / hoses so that the entire house can be wet - one at each of the 4 corners. Add these outside to any structure
- Close off any under-floor areas or decks
- Have to ability to shut down or enclose all garages and sheds
- On total fire ban days turn off valves on top of 45kg LPG bottles
- Remove any paper, boxes, crates and bales from outside of house or sheds
- All water supply tap uprights should be galvanised steel pipe
- Install battery operated radios in houses and sheds
- Make available professional first aid kits and maintain
- Personal oxygen systems should be stored in each house, easily identified and easily accessed

Vehicles / Shed / Storage items

- Never drive through long grass in a vehicle with a catalytic converter during the fire season. This includes current diesel engines
- Store all paint, lawn mower petrol, BBQ 5kg and 9kg gas bottles etc. more than 20m away from house on the southern or eastern side in a steel or masonry shed
- Place in car prior to any fire ban day, a metal "space blanket" or large woollen blanket, bowsaw, rake hoe and water bottles if planning to leave
- All vehicles (including farm vehicles) should be fitted with a 1kg pressurised dry powder fire extinguisher
- Install diesel and/ or petrol fuel tanks underground more than 30m away from house

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- Store firewood more than 20m away from house on the eastern side in a steel or masonry shed
- Keep along handled shovel, rake hoe, 20 litre knapsack, small 1kg pressurised dry powder fire extinguisher close by or easy to reach when mounted on machinery
- Never use slashers, grinders, mowers on a total fire ban day
- Install two CFS truck turn around areas on the property
- A map of the turnaround areas should be professionally made on a metal sign and placed on the entrance statement at the front of the property's gates.

Visitors

- Anyone visiting the area should be made familiar with fire danger ratings, especially severe, extreme and catastrophic and what to do. [Refer to attachment B for visitor information](#)
- During the fire season all persons visiting should be site inducted regarding fire emergency
- On the day of a catastrophic fire ban all persons should leave the property by 9am and stay away for the period of time the fire ban exists
- All visitors must know the location of a refuge of last resort e.g. shopping centre, oval, school and how to get there safely
- Maps of how to travel to the refuge of last resort should be provided as part of the site induction process
- All emergency service numbers should be visible on entry to houses and sheds
- Emergency survival kits should be stored in a place easily identifiable and accessible. They should include as a minimum
 - First aid Kit
 - 2kg fire extinguisher
 - Water
 - Torch
 - Smoke masks
 - Safety glasses
 - Battery powered radio
 - Spare mobile phone
 - Computer tablet to connect to the CFS website
 - Long sleeved cotton shirts or cotton overalls
 - Instruction on how to assist a person with burns

Water for fire fighting

A separate steel or concrete water storage tank will be allocated for firefighting purposes with a storage capacity of a minimum of 50,000 litres. This will be filled, via pumping from Silver Lake; a standalone system.

A stand pipe for trucks will be connected to the tank, pressurised via mechanical pumps to provide required water pressure.

The existing 130,000 litre concrete tank to supply firefighting and landscape irrigation water to the existing structure and on a separate pump supply the proposed house and sheds with firefighting and irrigation water.

Human Protection

Visitors to the property will not be allowed to visit or stay in residence on days of Catastrophic Fire rated days.

During these days:

- No additional visitation will be allowed or encouraged
- Any visitors staying at the property will be sent away by 9am in the morning to a safe local place such as Hahndorf, Mount Barker or Adelaide for the duration of the fire ban

In the case where a current bushfire is restricting the movement of visitors back to Adelaide they will be escorted to a safe place. The selected safe place is Hahndorf or Mount Barker.

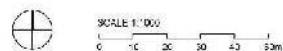
In the event that bushfire warnings come late and fires are burning freely refuge will be sought at a place of last resort.

A Bushfire Last Resort Refuge is intended to provide a place of relative safety during a bushfire. It does not guarantee the survival of those who assemble there. You should only use a Bushfire Last Resort Refuge when your personal Bushfire Survival Plans cannot be implemented or have failed.

Risks associated with Bushfire Last Resort Refuges are:

- Travelling to a Bushfire Last Resort Refuge may be dangerous. Traffic congestion, fire activity, heavy smoke, accidents or fallen trees may block the route
- There is no guarantee that you will be safe from fire or radiant heat when travelling to or sheltering at a Bushfire Last Resort Refuge
- Emergency services may not be present
- There may be limited capacity
- Bushfire Last Resort Refuges do not cater for animals
- Bushfire Last Resort Refuges do not provide meals, amenities or special needs (e.g. for infants, the elderly, the ill or disabled)
- Bushfire Last Resort Refuges may not provide shelter from the elements, particularly flying sparks and embers

Should it be too late to leave the property due to smoke, flames or excessive embers all people at the property will be escorted to a safe room within the house. The fire sprinkles will be designed to cover the property with water from the lake during the fire emergency.

[illegible]

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Attachment A - Low flammability species

To be used in conjunction with a professional landscape plan.

Replanting Species Selection- Evergreen

Common Name	Botanical Name	Form
Coast Saltbush	<i>Atriplex cinerea</i>	Shrub to 1.5m
Old Man Saltbush	<i>Atriplex nummularia</i>	Shrub to 2.5m
Berry Saltbush	<i>Atriplex semibaccata</i>	Groundcover
Karkalla	<i>Carpobrotu srossii</i>	Groundcover
Bluebush	<i>Maireana sedifolia</i>	Shrub to 1m
Creeping Boobialla	<i>Myoporum parvifolium</i>	Groundcover
Boobialla	<i>Myoporum insulare</i>	Shrub to 4m
Pigface	<i>Disphyma crassifoliumssp</i>	Groundcover
Seaberry Saltbush	<i>Rhagodia candolleana</i>	Shrub to 1m
Hedge saltbush	<i>Rhagodia spinescens</i>	Groundcover to 0.5m
Coastal fan flower	<i>Scaevola crassifolia</i>	Shrub to 1m
Iron Grass	<i>Lomandra longifolia (Tanika)</i>	Ground cover
White Correa	<i>Correa alba</i>	Shrub to 2m
Black-anther Flax Lilly	<i>Dianella revoluta</i>	Groundcover
Pale Flx Lilly	<i>Dianella longifolia</i>	Groundcover
Lemon Grass	<i>Cymbopogon citratus</i>	Groundcover
White Cedar	<i>Melia azedarach</i>	Tree
Date Palm	<i>Phoenix dactylifera</i>	Tree
Rosemary	<i>Rosmarinus officinalis</i>	Shrub to 1.5m
Carob	<i>Ceratonia siliqua</i>	Tree
Agapanthus	<i>Agapanthus africanus</i>	Bulb

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Deciduous trees

Common Name	Botanical Name	Estimated size at maturity
Field Maple	<i>Acer campestre 'Elsrijk'</i>	Deciduous Tree 5m - 7m
Japanese Maple	<i>Acer palmatum</i>	Deciduous Tree 5m - 7m
Common Beech	<i>Fagus sylvatica</i>	Deciduous Tree 5m - 11m
Manna Ash	<i>Fraxinus ornus</i>	Deciduous Tree 5m - 11m
Crepe Myrtle	<i>Lagerstroemia indica x fauriei 'Natchez'</i>	Deciduous Tree 5m - 11m
Box Elder Maple	<i>Acer negundo</i>	Deciduous Tree 10m +
Chinese Elm	<i>Ulmus parvifolia</i>	Deciduous Tree 5m - 11m
Cimmaron	<i>Fraxinus pennsylvanica 'Cimmzam'</i>	Deciduous Tree 10m +
Liquidambar	<i>Liquidambar styraciflua</i>	Deciduous Tree 10m +
Manchurian Pear	<i>Pyrus ussuriensis</i>	Deciduous Tree 10m +
English Oak	<i>Quercus robur</i>	Deciduous Tree 10m +
Red Oak	<i>Quercus rubra</i>	Deciduous Tree 10m +
Golden Elm	<i>Ulmus glabra 'Lutescens'</i>	

Attachment B - Basic Knowledge Family and Guests Induction

Terrain (topography)

- A fire will burn faster uphill. This is because the flames can easily reach more unburnt fuel in front of the fire. Radiant heat pre-heats the fuel in front of the fire, making the fuel even more flammable.

Vegetation (Fuel)

- Grass can burn early and quickly on hot, dry, windy days.
- Branches, twigs and leaves dropped from shrubs and trees become fine fuels, which burn easily. These can give off far more heat when they burn
- Fibrous and dry tree bark can carry fire to treetops. The fire can then break away and spread further
- Dry branches, twigs and leaves and other fine fuels found on the ground can also burn easily.

Weather Conditions

- Bushfires are unpredictable and vary greatly according to weather conditions. They often start on hot, dry, windy days.

Temperature

- A string of hot days dries out vegetation, making it easier to burn. This can be made even worse by underlying dry conditions caused by lack of rain.
- The drier the vegetation the easier it will burn.
- A fire spreads as a result of burning embers, radiant heat and direct flame contact.

Wind

Wind influences the:

- speed at which a fire spreads
- direction in which a fire travels and the size of the fire front
- intensity of a fire— wind provides more oxygen
- likelihood of spotting— burning pieces of leaves, twigs and bark (embers) that the wind carries ahead of the fire. This causes new 'spot fires' to ignite.

Wind Change

- A change in wind direction is one of the most dangerous influences on fire behaviour. Many people who die in bushfires get caught during or after a wind change.
- Stay well away after the fire has passed until contacted to return

What is an Ember Attack?

- An Ember attack is the most common way houses, sheds and outbuildings initially catch fire during a bushfire.
- During a fire, embers can travel up to 40 kilometres, starting spot fires well ahead of the fire-front – often without warning.
- An ember attack is how many properties are lost in a bushfire. Leaving a high fire-risk area early is always the safest option.

Spot Fires

- The term spot fire describes a fire ignited outside of a burning unit as a result of a windborne ember (sometimes referred to as a firebrand).
- Spot fires can start new bushfires well ahead of the main fire front.
- In large fires, there's the potential for many spot fires to start and quickly join together, blocking a safe escape.

A simple garden hose is no match for spot fires. Using fire hoses attached to a pressure pump is best or leave a high fire-risk area early is always the safest option.

Radiant Heat

Radiant heat is the heat you feel from a fire. It is the biggest killer in a fire. The best protection is distance.

Protection from radiant heat

- Make sure all skin is covered.
- Do not wear shorts, t-shirt and thongs.
- Cover up as soon as you are aware of a fire in your area.
- A solid object, such as a brick wall, can provide some protection from radiant heat.
- Distance is the best protection from radiant heat. Move as far away from the fire as you can, don't get caught out in the open.
- During a bushfire, the atmosphere will literally feel like hell on earth.
- Flame temperatures can reach up to 1100°C and radiant heat fluxes high enough to vaporise vegetation, only adding speed to the scorching hot flames.
- There's no questioning the facts, if you are stuck in a bushfire, your chances of survival are slim. Leaving early is always the safest option.

Clothes to Wear:

- a long-sleeved, collared shirt made from cotton or wool
- pants made from cotton or some other natural fibre
- sturdy boots and woollen socks
- tough leather garden gloves – not rubber or synthetic
- a wide-brimmed hat to protect your head
- a face mask (P2 type) or towel to cover your mouth and nose
- eye protection such as smoke goggles to shield your eyes.
- Protective clothing and a solid shield may NOT save your life.

Attachment C - Trees Review

An application to the Native Vegetation Council under regulation is required for the trees proposed for clearance.

SCATTERED TREE SURVEY - Site assessment Data													
						Day	Month	Year					
Applicants Name - Silver Lake					Date	17	10	2019		Total # trees:		9	
Observer/s:		Wayne Brown & Dr Geoffrey Bishop						Regeneration present Y/N:			No		
Site Name or Id		Silver Lake Mylor											
Tree #	Photo #	WGS 84 way-point	Die-back %	Species	Ht (m)	Circ (mm)	Diam cm	Hollows			TPZ	10% encroach	Notes
								# S	# M	# L			
Trees Impacted Retain													
1	145	1010	5	Eucalyptus camaldulensis	22	4000	127	1	2	1	15	10.3	Very large
2	146	1012	40	Eucalyptus obliqua	14	4800	153	1	0	0	15	10.3	Very large
3	147	1013	5	Eucalyptus leucoxylon	20	2300	73	0	1	0	8.8	6	
4	148	1014	5	Eucalyptus leucoxylon	19	2600	83	0	0	0	10	6.8	Rough trunk
Recommended clearance													
A	149	1015	0	Eucalyptus camaldulensis	18	2100	67	0	0	0	8	5.5	Young tree
B	150	1016	15	Eucalyptus obliqua	18	2700	86	0	0	0	10.3	7.1	
C	151	1017	10	Eucalyptus obliqua	14	0.500	16	0	0	0	0	0	
D	153	1019	25	Eucalyptus obliqua	20	3400	108	1	0	0	13	8.9	Very Large
E	155	1023	0	Eucalyptus camaldulensis	20	2700	86	0	0	0	10.3	7.1	Large top growth

Significant / Regulated

8 April 2020

Silver Lake Development
Mr Rudy Gomez
C/- Mr Ian Hannaford

SITE AND SOIL ASSESSMENT, ON-SITE WASTEWATER MANAGEMENT SYSTEM - UPGRADE TO FACILITATE THE PROPOSED SILVER LAKE DEVELOPMENT

Dear Mr Rudy Gomez,

1. INTRODUCTION

RFE Consulting Pty Ltd ('RFE') were engaged to undertake a site and soil assessment for the purpose of determining the suitability of the proposed on-site wastewater management system upgrade. The site is located at 118 Silver Lake Road, Mylor, South Australia ('the site').

The on-site wastewater management system upgrade is required to facilitate the proposed Silver Lake Development as described in the Development Application.

In summary, the proposed Silver Lakes Development includes:

- Conversion of the existing residence to a 7-bedroom Bed and Breakfast (14 Equivalent Person (EP) Capacity)
- New owner's residence (6EP)
- Site improvements through removing all grazing stock from site and replacing with selected landscape planting and fruit and nut trees for on-site use; improvement in water quality of Silver Lake through desludging as well as through integration and recirculation of water from Silver Lake with a new wetland system.

Several assessments have been completed at the site including:

- Assessment for On-Site Domestic Wastewater Management, Ron Selth & Associates, reference W1789 dated 1 May 2018; and
- Draft Water Resources Report, Silver Lake Development, Water Technology dated 4 October 2019.

The assessment was completed in accordance with the Government of South Australia, Department of Health and Ageing (DHA) *On-site Wastewater Systems Code* ('the Code') dated April 2013.

2. SITE IDENTIFICATION

Site identification details are provided in Table 1 – Site Identification.

Table 1 - Site Identification

Item	Detail
Subject Land	Allotment 10, Filed Plan 101385, Certificate of Title Volume 5107 Folio 485, Hundred of Noarlunga
Postal Address	118 Silver Lake Road, Mylor 5153
Municipality	Adelaide Hills Council

3. AIM

The aim of this assessment is to determine the suitability of the proposed on-site wastewater management system upgrade for the proposed site development.

The site is located within the EPA Priority Area 2 and 3 Zones. The EPA Priority Area 2 zone requires any development to demonstrate net benefit or negligible adverse effect. This is particularly relevant to the water quality at the site given the location within the Onkaparinga River Catchment area. The proposed surface irrigation land application area is located above the 1 in 100-year flood zone which appears to be within the EPA Priority Area 3 zone.

4. METHODOLOGY

The key features summarised in Table 2 are based on the desktop review of available desktop information as well as an intrusive soil assessment.

5. SITE FEATURES

A summary of the key site features is provided in Table 2.

Table 2 Key site land features

Feature	Description	Recommendations
Landscape Elements		
Soil	<p>Two soil assessments have been completed at the site, one by Ron Selth and Associates in May of 2017 and one by Water Technology in September 2019.</p> <p>The most relevant borehole to the proposed surface irrigation land application area is the Water Technology BH2 soil borehole.</p> <p>Soil borehole was drilled to a depth of 2.0m below ground level and was logged by LAB SA.</p> <p>No sample was retrieved at the surface between 0.0 – 0.2m bgl. A Clayey SAND (SM) with some roots was encountered between 0.2 and 0.8m below ground level (bgl).</p> <p>Underlain the Clayey SAND, a Silty Sandy CLAY (CH/MH) extended to the termination of the borehole at 2.1m bgl.</p>	<p>The proposed surface irrigation land application system appears to be located within an area of low permeability near surface soils classified in accordance with the Code as 'poor soakage'.</p> <p>The following soil improvements are required to increase the efficacy of the proposed surface irrigation area:</p> <ul style="list-style-type: none"> - Ripping the surficial soils within the proposed surface irrigation area to a minimum depth of 150mm; - The addition and mixing in of a gypsum treated mulch to the ripped soils within the proposed irrigation area; and - Planting of the proposed irrigation area with appropriate high nutrient uptake plants. <p>Based on the above treatment of the proposed surface irrigation land disposal area, a Design Irrigation rate (DIR) of 4.5 L/m²/day is suitable for the site. A conservative approach has been adopting in basing the design on a DIR of 2.7 L/m²/day given the nature of the site and its surrounding sensitive receptors.</p>
Slope	<p>The proposed surface irrigation area is located on slight to moderately sloping land.</p>	<p>A diversion trench shall be constructed 3m up-slope of the proposed surface irrigation area to divert surface water flows around the proposed secondary treated wastewater irrigation area. The proposed diversion trench is shown in drawing WW_02 included in Attachment 1.</p>

Feature	Description	Recommendations
		<p>Retention bunds shall be constructed down gradient of each irrigation row and adjacent the down gradient surface irrigation area boundary to retain secondary treated wastewater to within the designated irrigation area.</p> <p>A retention bund shall also be constructed on the down-slope side of the diversion swale to direct surface water flows towards the diversion swale to by-pass the proposed surface irrigation land application area.</p>
Hydrogeology	<p>Based on the groundwater database search, there are no operational boreholes located within the 50m setback of the proposed land application area.</p> <p>The closest registered bores, as summarised in the <i>WaterConnect</i> online Groundwater Database are</p> <ul style="list-style-type: none"> - 6627-15404, located approximately 75m south of the proposed irrigation area - 6627-4213, located approximately 330m south-west of the proposed irrigation area. <p>A summary of the two nearest groundwater bores to the proposed irrigation area is provided in Attachment 4.</p> <p>The nearest bore, unit number 6627-15404 was drilled in April of 2017 to a total depth of 77.5m. The well is constructed from steel casing which extends from the surface to 73.5m bgl and stainless-steel slotted screen from 73.5 to 77.5m bgl. The annulus between the borehole and the bore casing was sealed with cement (grout) from 11 to 18m bgl. The groundwater level was cut at depth of 74.5 to 77m bgl.</p> <p>The underlying fractured rock aquifer, in which the screen interval for bore 6627-15404 is installed within, appears to be pressurised based on the depth of the screen interval (positioned at approximately 73.5m bgl) and the measured standing water level at 5m bgl (in April 2017). Therefore, the groundwater has risen from the underlying aquifer at approximately 73m bgl through the screen interval of the bore to an elevation of 4m bgl.</p> <p>The following lithology is based on the drillers log for bore 6627-15404:</p> <ul style="list-style-type: none"> - Clay from the surface to 4m bgl; - Sand from 4m to 8.5m bgl - Gravel varying in size up to 50mm from 8.5 to 10m bgl - Soft unstable Shale from 10 to 30m bgl; - Firm Shale with soft layers, occasionally breaking off in larger pieces from 30 to 73.5m bgl 	<p>It is considered highly unlikely that secondary treated wastewater from the surface irrigation area would migrate greater than 70m through clay, sands, gravels and shale without natural attenuation of dissolved contaminants (present in the secondary treated wastewater) to potentially contaminate the underlying aquifer.</p> <p>It is considered extremely unlikely that contaminants from the surface irrigation area could migrate through 70m of varying lithology including layers of clay and through to the underlying inferred pressurised fractured rock aquifer.</p> <p>Based on the available information on the groundwater database, it is considered highly unlikely that contamination of the underlying productive aquifer (likely to be the positioned within the Emeroo Subgroup) would result from the proposed surface irrigation land application of secondary treated wastewater at the site.</p> <p>It may be possible that a perched seasonal aquifer is present in the sandy lithology layer between 4.0 and 8.5m bgl (as summarised in the drillers log from the nearest bore). However there remains a significant aquitard to mitigate vertical migration in the form of 4m of clay positioned above the sandy soil horizon.</p> <p>Additionally, any surface run-off and/or perched groundwater flow will likely be captured within the proposed wetland system. The proposed wetland system has been designed to improve the water quality at the site by recirculating water from the existing Silver Lake system and has a designed retention time of 3 – 5 days.</p>

Feature	Description	Recommendations
	<ul style="list-style-type: none"> - Shale with fractures of sand, uniform in size, flowing in the fracture is fine silt, unable to stop fine silt entering bore as too fine to screen off from 73.5 to 78m bgl. <p>The screen interval of bore 6627-1540 is positioned within the underlying fractured rock aquifer which is first encountered at an approximate depth of 73.5m bgl.</p>	
Surface Water	<p>The proposed surface irrigation land application area is located greater than 50m from the nearest identified watercourse (as indicated on the DEW Nature Maps database).</p> <p>The proposed surface irrigation land application area has also been positioned above the 1 in 100-year flood level.</p> <p>The nearest watercourse, the Onkaparinga River, is located approximately 240m to the west of the proposed surface irrigation area.</p>	<p>A diversion trench shall be constructed 3m up-slope of the proposed surface irrigation area land application area to divert surface and any shallow perched groundwater flows around the proposed irrigation area.</p> <p>Retention bunds will be constructed down slope of irrigation rows to retain site flows and down-slope of the diversion swale to direct surface water flows into the trench to be directed around the irrigation area.</p>
Water Table	<p>From the lithological logs provided it was difficult to ascertain the depth below ground level to the seasonal water table.</p> <p>It is anticipated that the depth to the water table would be significantly greater at the proposed surface irrigation land application area positioned above the 1 in 100-year flood level when compared to the current irrigation area positioned within the 1 in 50-year flood level.</p> <p>The proposed surface irrigation utilises evapo-transpiration processes as well as infiltration. Surface irrigation is considered to be a more appropriate land application compared with subsurface disposal options due to the potential for shallow groundwater to exist.</p> <p>Effluent uptake will be assisted by evapotranspiration through the root zone of appropriate vegetation planted in the topsoil, thereby providing an additional factor of safety for the operation of soil absorption systems.</p>	<p>The proposed surface irrigation area shall be planted out with high nutrient uptake vegetation. An Irrigation Management Plan shall be completed summarising the appropriate species and density of planting as well summarising a programmed maintenance scheme outlining the required harvesting required for the vegetation to retain its efficacy in utilising high concentrations of nutrients.</p> <p>Additional soil bores within the proposed surface irrigation area may be required to confirm the depth to the water table beneath the site in the proposed location.</p>
Bedrock	<p>Bedrock was not intersected.</p> <p>Based on the review of the nearest groundwater bores, shale appears to be present at an approximate depth of 10m bgl.</p>	None.
Rainfall	Annual rainfall of 960.8 mm.	Based on data between 1949 to the present day from the Bureau of Meteorology Longwood station (ID: 023727).
Recommended Separation Distances	The location of the proposed wastewater management device's (AWTS) and surface irrigation land application system are indicated on the attached figure (Attachment 1) and are in accordance with the principles of the Code.	Requirements as specified by Appendix B, Tables B1, B2 and B3 of the Code.

Feature	Description	Recommendations
Infrastructure		
Reticulated Water	This site is serviced by roof catchment and storage which is augmented with bore water (i.e. no mains water servicing the site).	Hydraulic and organic loadings are summarised in Table 3 and Attachment 2.

6. DESIGN PARAMETERS

The proposed on-site wastewater management system upgrade at the site is based on the adopted design loadings, as summarised in Table 3. Loadings for non-residential settings have been adopted from Appendix E of the Code.

Table 3 - Design Loadings

Setting	Design Loadings	No. of Persons	Calculated Loadings
Proposed Residential	DF = 125 L/p/d BOD ₅ = 70 g BOD ₅ /p/d	6	DF = 750 L/d BOD ₅ = 420 g BOD ₅ /d
Bed and Breakfast (based on the design loadings for a HOTEL/MOTELS/LIVE IN CONFERENCES premises as summarised in Appendix E)	DF = 100 L/p/d BOD ₅ = 40 BOD ₅ /p/d	14	DF = 1,400L/d BOD ₅ = 560 g BOD ₅ /d
Function Activity (1 event per Month, 12 Months of the year).	DF = 30 L/p/d BOD ₅ = 20 g BOD ₅ /p/d	¹ 40 (once per Month)	DF = 1,200L/d BOD ₅ = 800 g BOD ₅ /d
Gardener (worker)	DF = 40 L/d BOD ₅ = 25 g/d	1 (5 or less days per week)	DF = 40L/d BOD ₅ = 25 g BOD ₅ /d
Total Peak Loadings for the Whole System (with 40% loading applied to organic loadings as per the Code)			
Peak Hydraulic Loading (DF)			3,390 L/d
Peak Organic Loading (BOD ₅)			2,527 g BOD ₅ / d
Peak Loadings for the 5kL Balance Tank/Pump Chamber to Twin RP10 A+ System (with 40% loading applied to organic loadings as per the Code)			
Peak Organic Loading (BOD ₅) for twin RP10 A+ AWTS			1,904 g BOD ₅ /d
Peak Hydraulic Loading ¹			1,911 L/d
Total Peak Loadings at Operation of Whole System (including reduced flow rate due to elevated organic loading through the dual RP10A+ system)			2,661 L/d

¹ - The wastewater system design and irrigation area calculated is based on the highest loadings which occur once per Month. It is noted that the design organic load exceeds during the once per month Function activity, therefore to ensure the organic load remains below the systems threshold (including when the 40% loading is applied), the flow rate through the dual RP10A+ configuration will be reduced by increasing the aeration cycle to a maximum daily flow of 1,911 L/d (73.5% of 2,600L; the peak hydraulic load for the dual RP10A+ configuration). For the majority of the operation, the in-situ Design Irrigation Rate (DIR) will be significantly less than 2.7 L/m²/day. This design allows for a maximum of 40 persons including guests and workers.

The proposed on-site wastewater treatment system design is summarised in more detail in Section 7.2. For the purpose of comparison with the design wastewater loadings, a simplified summary is provided below:

- The residential wastewater and gardeners wastewater load will feed solely and directly to the existing Ri-Treat 4250.

- The remainder of the site's wastewater load (proposed B & B and Function Activity) will be directed to a 5kL balance tank/pump chamber which will feed into the dual Ozzi Kleen RP10 A⁺ Aerobic Wastewater Treatment System configuration.

The proposed Ozzi Kleen P10A⁺ has been approved by SA Health based on a maximum daily organic capacity of 700 g BOD₅/d per unit. Therefore, the maximum SA Health approved organic load for the proposed wastewater infrastructure servicing the proposed Bed and Breakfast and Function Activity is 1,400 g BOD₅/d which provides 73.5% of the design peak daily organic load (1,904 g BOD₅/d with the required 40% loading as per the Code, which occurs at a maximum of once per month). Therefore, to compensate for the one day per month peak load, the aeration cycle of both the Ozzi Kleen RP10A⁺ AWTS units will be increased to reduce the maximum daily flow rate to 73.5% (1,911 L/d) of the design maximum daily hydraulic load (2,600 L/d). The surplus wastewater on the peak day per month will remain within the 5kL pump chamber/ balance tank until the following day, when it will cycle through the system.

The Ozzi Kleen RP10A⁺ Advanced Nutrient Reduction AWTS model has been chosen to provide a higher level of nutrient reduction in the secondary treated wastewater due to the surrounding sensitive water body receptors (Onkaparinga Catchment).

Should larger functions be proposed for the site, it is anticipated that the additional wastewater load would be catered for additionally to the proposed on-site wastewater management system, through management off-site (through additional portable toilets etc) and would occur under a restricted licence (or similar approval).

7. PROPOSED ON-SITE WASTEWATER MANAGEMENT SYSTEM UPGRADE

7.1 Existing On-Site Wastewater Management System

The existing on-site wastewater management system at site, as summarised in the Ron Selth & Associates report dated May 2018, is comprised of a Ri-Treat 4250 AWTS to surface irrigation with an area of 267m². The existing system has been designed based on a hydraulic load 1,200L per day. The current land application appears to be positioned within the 1 in 50-year flood level, approximately 100m west from the Onkaparinga River.

7.2 Proposed On-Site Wastewater Management System Upgrade

The on-site wastewater management system upgrade proposed for the site to facilitate the proposed Silver Lake Development is summarised below and illustrated in the Drawings provided in Attachment 1:

- The proposed on-site wastewater management system upgrade is illustrated in drawing WW_01 and WW-02 provided in Attachment 1.
- The existing Ri-Treat 4250L AWTS will remain part of the wastewater management system by solely servicing the wastewater load from the proposed residence and gardeners shed. The sewer line from the residence and gardeners shed will be routed directly to the Ri-Treat 4250 AWTS. The wastewater load from the gardeners shed will be pumped to the AWTS via a pump chamber.
- The sewer from the proposed Bed and Breakfast and proposed Monthly Functions will be directed to a 5kL Pumping Chamber/Balance Tank to feed into the two proposed Ozzi Kleen RP10A⁺ Advanced Nutrient Reduction AWTS. The Advanced Nutrient Reduction capacity is achieved through alum dosing. The two Ozzi Kleen RP10A⁺ AWTS's will be positioned next to the existing Ri-Treat AWTS.
- All on-site wastewater management system infrastructure will be positioned above the 1 in 100-year flood level.
- Secondary treated wastewater discharges from each AWTS, via a Reeve RHV 220 pump (or similar), positioned in each AWTS through a 40mm lilac PE manifold connecting into a central DN50 lilac PE line. The DN50 lilac PE line will direct the secondary wastewater to the 1.5kL Irrigation Header tank positioned adjacent the proposed surface irrigation land application area.
- The existing irrigation area positioned within the 1 in 50-year flood level will be decommissioned.
- Should it be proposed to manage wastewater from kitchen and catering facilities associated with the proposed monthly functions, an appropriately sized grease arrestor will be installed at the outlet from

the kitchen function centre preparation area prior to entering the 5kL pumping chamber/balance tank.

- The discharge from the 5kL Pump Chamber/Balance Tank to the dual RP10A⁺ AWTS will be limited to 1,911 Litres per day to ensure the SA Health approved organic capacity is not exceeded based on the adopted design loadings. The design flow from the dual RP10A⁺ AWTS devices will be decreased by increasing the duration of each aeration cycle so the required rate is maintained. Therefore, the maximum design daily flow of the whole system is reduced to 2,611 Litres per day.
- Increasing the aeration cycle has the additional benefit of providing additional oxygenation of the system increasing the aerobic treatment capacity, which is likely to result in an increase in biological activity, increasing the rate of biodegradation resulting in lower concentrations.
- Distribution of secondary treated wastewater to the proposed 1,000m² surface irrigation area configured as illustrated in Attachment 1. The secondary treated water will be distributed through DN40 class 12 lilac PE (typical) and surface Antelco ReuzitTM 40585, 3.8mm orifice, 13mm barb inlet flat trajectory sprinklers.

The hydraulic and organic loading will be significantly below the peak design flow and peak organic design loading calculated for the majority of the systems operation and hence the application to surface irrigation will be significantly below 2.7 L/m²/d.

Contingency Measures for the Proposed System:

Contingency 1:

Additional area above the 1 in 100-year flood level is available adjacent the proposed surface irrigation area and will remain vacant and available as a contingency should an additional or alternative irrigation area be required.

Contingency 2:

The system has an in-built capacity to store significant volumes of water (>18kL) should there be no alternative other than to manage wastewater off-site via a vacuum truck, providing nearly five days capacity for peak conditions from an empty system.

7.3 Proposed Residential Swimming Pool Backwash Water Management

The proposed residential building at the site, the adjacent swimming pool and the swimming pool backwash water management system are all positioned above the 1 in 100-year flood level.

The on-site management of the backwash water from the swimming pool will comprise an appropriately sized soakage trench with the design to be based on the soil permeability of the surrounding lithology and the proposed frequency and volume of backwash cycles expected at the site.

Based on the expected rate of application of pool backwash water to the proposed soakage trench land application, the potential for the migration of contaminants to impact on surrounding sensitive receptors is considered unlikely.

8. SYSTEM SIZING

The area proposed for the surface irrigation land application area is based on the indirect assessment in accordance with the Code. The permeability class and corresponding Design Irrigation Rate (DIR) has been based on the visual assessment of the soils encountered within the boreholes excavated at the site. The results are summarised in Table 4.

Table 4 Summary of DIR for soils at the site

Parameter	Rating	Adopted Rating	Reasoning	Irrigation Area
Design Irrigation Rate (DIR) for surface irrigation	4.5 L/m ² /d	2.7 L/m ² /d	<p>Based on the soil encountered and the proposed soil amelioration and site improvements to the designated surface irrigation area, a Design Irrigation Rate (DIR) of 4.5 L/m²/d is determined to be appropriate for the site.</p> <p>A conservative approach has been adopted to reduce the likelihood of surface water run-off and perched groundwater (if present) migration off the designated surface irrigation area by reducing the DIR.</p> <p>The proposed land application area has been positioned above the 1 in 100 flood level.</p>	<p>Based on the peak design hydraulic load and the adopted DIR, an area of 1,000m² is required.</p> <p>The design has provided an irrigation area of 1,000m², by reducing the DIR to 2.7 L/m²/d during the peak day each month and significantly less than 2.7 L/m²/d for the remainder of each year outside the 12 peak days per year (one day a month proposed for a function at the site).</p> <p>A conservative design has been adopted to reduce the potential impact from the proposed system impacting on the receiving environmental water receptors. The lower DIR, which results in lower concentrations of nutrients over a larger area, provides greater opportunity for biological treatment of the effluent and reduces the potential for migration of contaminants from the designated irrigation area.</p> <p>Additionally, a lower DIR combined with the proposed engineering controls, which significantly reduce the potential for migration of wastewater from the proposed irrigation land application area, reduces the overall risk of significant gross impact on the nearby sensitive receptors (Onkaparinga River Catchment).</p> <p>There is additional available area adjacent the proposed surface irrigation area to be set aside as a contingency should additional or an alternative irrigation area be required.</p>

The irrigation area has been designed based on the peak loadings (which occur one day per month) at 100% occupancy. It is anticipated that the Bed and Breakfast will only operate at approximately 50% occupancy on average over a year. Therefore, the proposed design is considered conservative.

9. PROPOSED PLANT SPECIES AND MAINTENANCE

The proposed irrigation area will be planted out and harvested in accordance with the *Silver Lakes - Wastewater Irrigation Area – Planting Proposal*.

The plant species list for the proposed planting of the wastewater irrigation area has been developed in accordance with the *Water Sensitive SA – A guide to raingarden plant species and placement*. The proposed species to be included within the designated irrigation area are summarised in Table 5.

The conditions expected within the designated wastewater irrigation area is for regular application of secondary treated wastewater to the designated irrigation area and therefore, sustaining plants during dry summer periods.

The proposed vegetation will support the removal of nitrogen through the proliferation of biofilms on plant roots and stems to promote evapotranspiration process and encouraging infiltration by maintaining soil conductivity.

A diverse selection of plant species has also been chosen to support the diversity of bacteria which is supported by different plant species to promote nitrogen removal.

A Harvest Management Plan shall be provided to specify occasional mowing (harvesting events) to promote nutrient removal by stimulating growth.

Table 5 Summary of proposed plant species for the proposed on-site wastewater irrigation area

Species	Common Name	Height (cm)	Spreading	Nitrogen Removal ¹
<i>Baumea juncea</i>	Bare twig-rush	200 - 1000	Yes	Yes
<i>Carex appressa</i>	Tall sedge	1,000		Yes
<i>Carex bichenoviana</i>	Sedge	400	Yes	Yes
<i>Carex inversa</i>	Knob sedge	200	Yes	
<i>Carex tereticaulis</i>	Rush sedge	600 – 1,200		Yes
<i>Carex asiatica</i>	Centella	100	Yes	
<i>Chorizandra enodis</i>	Black bristle rush	550		
<i>Crassula helmsii</i>	Swamp crassula	50	Yes	
<i>Cyperus gymnocaulis</i>	Spiny sedge	700		Yes
<i>Dichondra repens</i>	Kidney weed	100	Yes	
<i>Eleocharis acuta</i>	Common spike rush	250 – 400	Yes	
<i>Ficinia nodosa</i>	Knobby club-rush			Yes
<i>Hydrocotyle verticillate</i>	Shield pennywort	30 – 100	Yes	
<i>Juncus amabilis</i>	Gentle rush	600 – 1,200		Yes
<i>Juncus flavidus</i>	Rush	350 – 1,500		Yes
<i>Juncus subsecundus</i>	Finger rush	300 – 1,000		Yes
<i>Marsilea drummondii</i>	Common nardoo	100 – 300	Yes	
<i>Microlaena stipoides</i>	Meadow rice-grass	500	Yes	

¹ – Species listed under *Nitrogen Removal* have elevated nutrient removal capability (nitrogen and phosphorus) and are recommended to be planted at a minimum of 50% of the total planting.

10. CONCLUSION & RECOMMENDATIONS

The proposed upgrade to the on-site wastewater management system is designed to manage an increase wastewater load based on the proposed expansion of the site to include a Bed and Breakfast facility and a monthly function.

The proposed surface irrigation land application area for the irrigation of secondary treated wastewater has been calculated based on the peak hydraulic and organic loadings, which occur one day per Month, 12 Months of the year.

The proposed on-site wastewater management system upgrade for the site is comprised of a 5kL pumping chamber/balance tank, housed with two sewage (macerator) pumps and controlled to distribute wastewater to the two proposed Ozzi Kleen RP10 A⁺ Advanced Nutrient Reduction AWTS, oscillating between each aeration cycle to distribute secondary treated wastewater to the irrigation header tank. From the irrigation header tank, the secondary treated wastewater is sent to the designated surface irrigation area. The aeration cycle of each of the two RP10 A⁺ Advanced Nutrient Reduction AWTS will be increased to limit the total daily

flow out of the 5kL Pump Chamber/Balance Tank to 1,911 L per day. The third and existing AWTS (Ri-Treat 4,250) is dedicated to servicing the wastewater load from the proposed residence and gardeners shed.

All three AWTS, the 5kL Balance /Pumping Chamber, the 1.5kL Irrigation Header Tank and the pump chamber (adjacent the gardeners shed) will be high water level alarmed. The system should be installed in the area denoted on the attached Drawings (Attachment 1).

Based on the above site and soil assessment, we consider the proposed system to be appropriate for the site.

Should the inputs to the system vary from that above, the minimum area should be adjusted accordingly in accordance with the Code.

Warning signs indicating recycled water is being used for irrigation shall be positioned within the proposed irrigation area so that they are clearly visible from all sides. The proposed surface irrigation areas should be fenced off to keep the public out and the mulch and vegetation cover should be managed in accordance with the proposed Irrigation Management Plan.

To further improve the capacity and efficacy of the proposed irrigation land application, we recommend the following soil improvements and planting be undertaken to enhance infiltration and nutrient uptake from the proposed surface irrigation:

- Ripping the surficial soils within the proposed surface irrigation area to a nominal depth of 150mm.
- The addition and mixing in of a gypsum treated mulch to the ripped soils within the proposed irrigation area.
- Planting of the proposed irrigation area with appropriate salt and high nutrient uptake plants to improve the nutrient uptake capacity of the proposed system in accordance with an Irrigation Management Plan. The Irrigation Management Plan should also consider the frequency of harvesting the vegetation to maintain optimum or near optimum nutrient and hydraulic uptake.
- Construction of a diversion trench set 3m from the proposed surface irrigation land application area to divert surface and any perched shallow groundwater around the proposed irrigation area.
- Construction of a retention bund down slope of the diversion trench to direct surface water flows into the diversion trench to by-pass the designated irrigation area.
- Construction of retention bunds adjacent the down-slope boundary of each irrigation row to retain secondary treated wastewater to within the designated irrigation area

The proposed on-site wastewater management system shall be installed and serviced by an appropriately qualified Plumber in accordance with:

- Legislative requirements (including AS3500, AS1547, the Code and the Plumbing Code of Australia); and
- The AWTS manufacturers operation, maintenance and installation requirement.

All wastewater is to be directed to the proposed on-site wastewater management system.

ENVIRONMENTAL BENEFIT:

The proposal provided herein provides a sustainable solution to facilitate the proposed wider Silver Lake Development project which will provide significant environmental benefit to the site. However, for the proposed development to be successful, a solution is required for the on-site management of the, inevitably increased, wastewater loading which will result from the development. The on-site wastewater management system proposed provides a sustainable solution which is considered to provide a neutral, if not beneficial impact, when compared to existing conditions.

The additional wastewater load resulting from the proposed Silver Lakes Development will be managed via two Ozzi Kleen RP10A⁺ Advanced Nutrient Reduction Aerated Wastewater Treatment Systems (AWTS). The advanced nutrient reduction AWTS model have been chosen over other SA Health approved AWTS's as the RP10A⁺ provides additional Alum dosing capacity to reduce nutrient concentrations in the secondary treated wastewater entering the surface irrigation area.

The proposed surface irrigation land application of secondary treated water is positioned approximately 240m to the west, and across Silver Lake Road, from the nearest watercourse (Onkaparinga River). The surface irrigation area is located above the 1 in 100-year flood level. The existing land application is positioned within the 1 in 50-year flood level and approximately 100m (approximately 140m closer) to the Onkaparinga River.

By increasing the area of the proposed surface irrigation, by reducing the DIR, the concentration of nutrients is reduced providing greater opportunity for attenuation and uptake by vegetation, thereby reducing the likelihood of lateral or vertical migration of contaminants.

The engineering controls summarised in this site and soil report will be implemented to remove or significantly reduce any potential surface water run-off from the proposed surface irrigation area.

The Environmental benefit which will result from the proposed Silver Lake Development includes:

- the removal of stock from site to be replaced by selected landscape planting and fruit and nut trees for domestic use,
- improvement to the Silver Lake through the removal of dumped fill and sludge,
- improvement of the water quality in Silver Lake by integration and re-circulation of water from Silver Lake with the proposed newly constructed wetland.

Positioned immediately down gradient of the proposed irrigation area is the proposed wetland system which has been designed to improve the water quality by circulating water from the existing Silver Lake. In the unlikely event of lateral migration of secondary treated water from the designated irrigation area, it would be captured by the proposed wetland providing additional contingency, retention and enhanced natural attenuation capacity to the proposed system providing a buffer zone between the land application area and the Onkaparinga River Catchment.

The proposed on-site wastewater management system provides additional net environmental benefit by facilitating the wider environmental benefit achieved through the proposed Silver Lake Development.

Additional contingency measures are provided in the form of additional surface irrigation area provided above the 1 in 100-year flood level and contingency storage volume for wastewater is in-built into the treatment system should wastewater be required to be carted off-site as a last resort.

11. CLOSURE

We trust this assessment is suitable for your purposes. Please contact me on 0439 034 900 should you have any queries.

Yours sincerely



Ross Fitzgerald BEng Civil/Environmental MIEAust NER
Principal Environmental Engineer

Attachments:

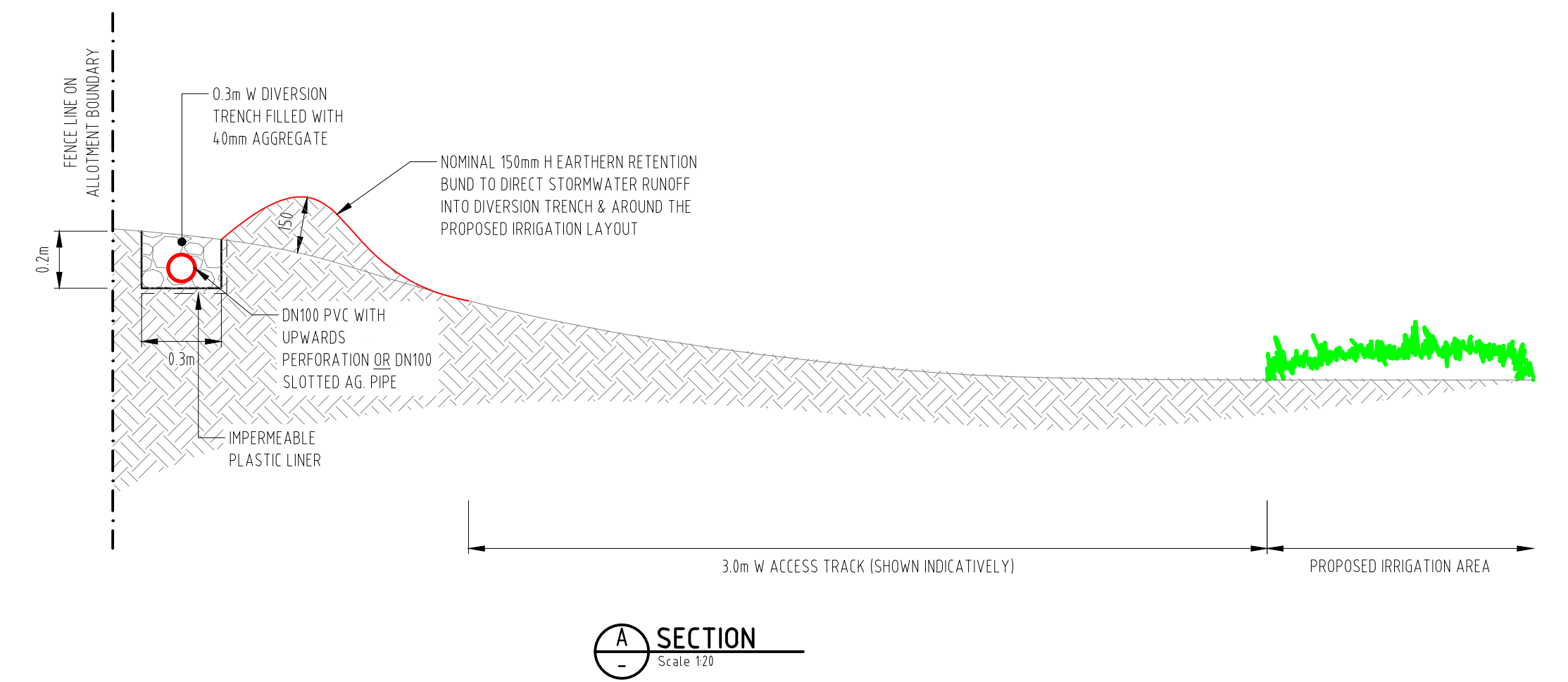
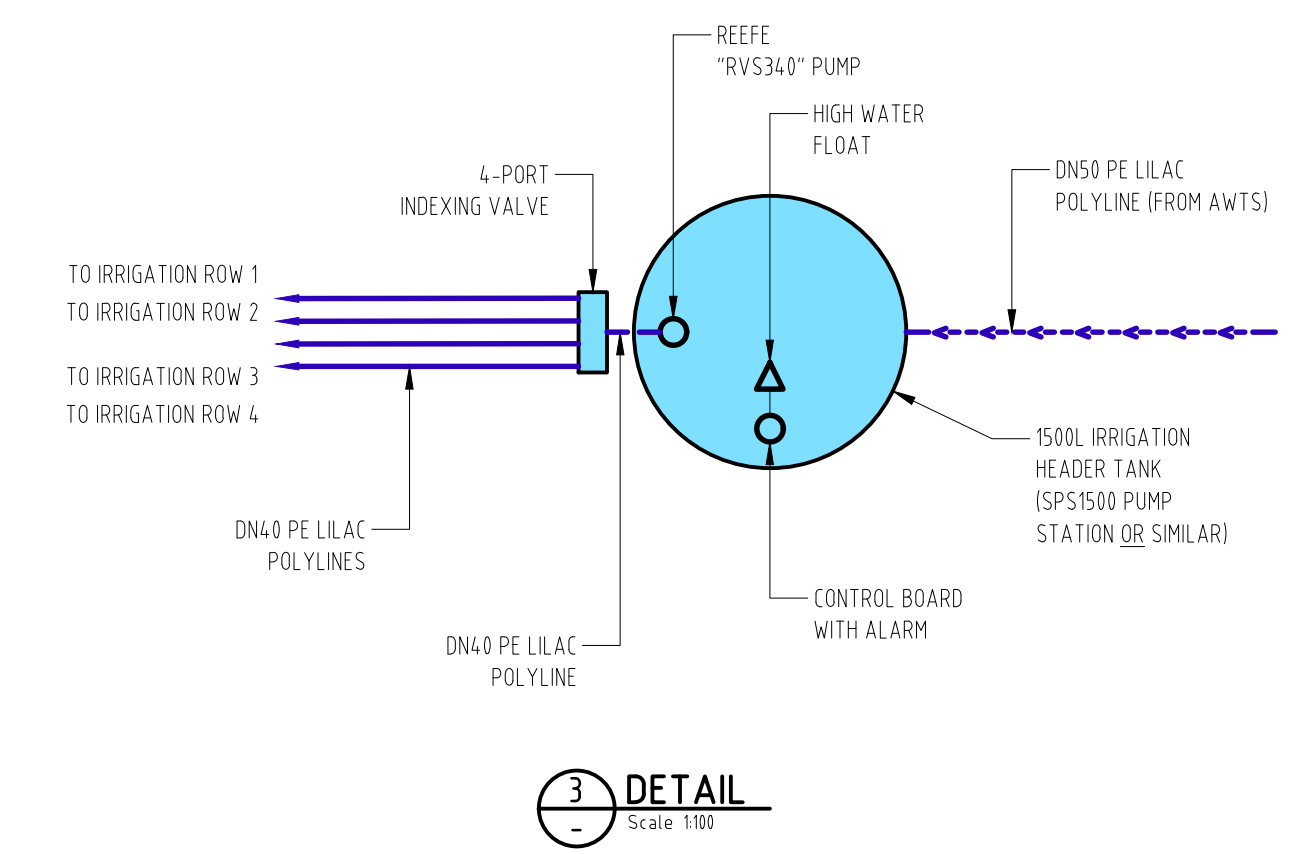
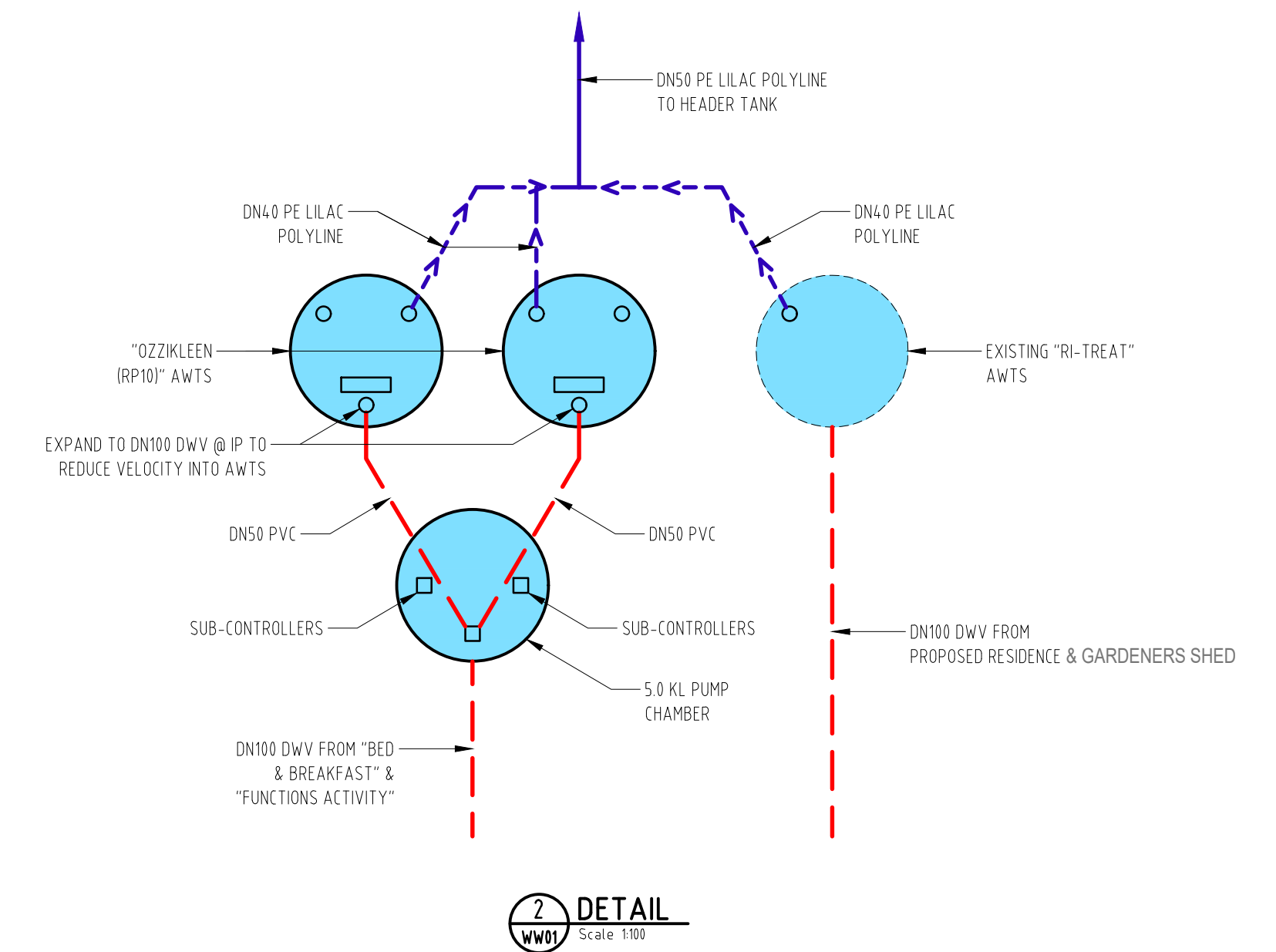
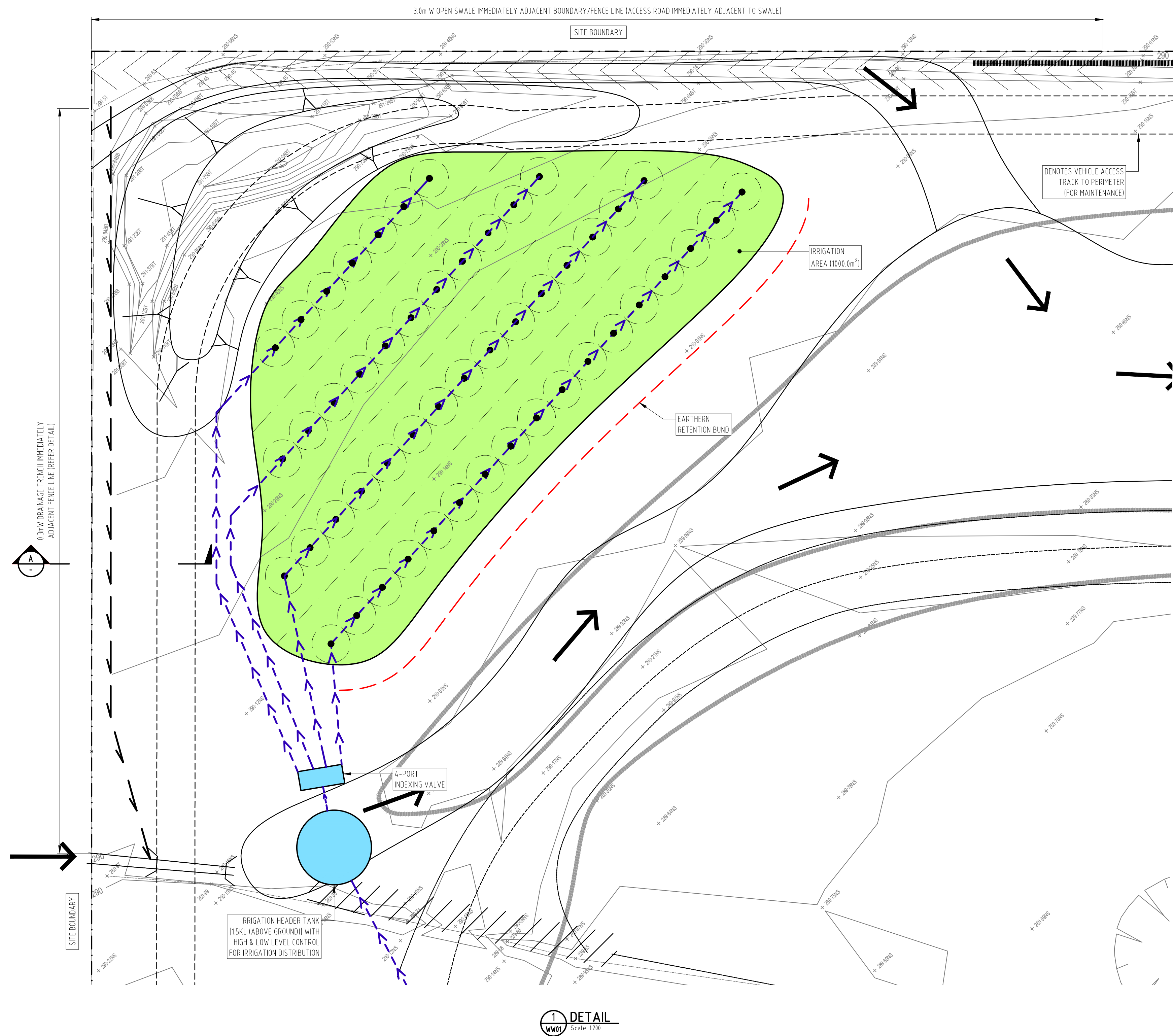
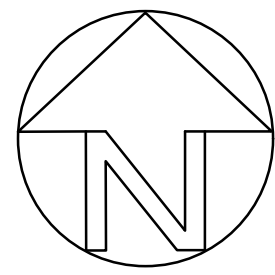
Attachment 1 – Figures

Attachment 2 – Design Loadings

Attachment 3 – Soil Borehole Logs (Extract from Water Tech Report)

Attachment 4 – Groundwater Database Search

Attachment 1 – Figures



REV	AMENDMENTS	DATE	BY
2	REVISED APPROVAL	14.02.20	MC
1	FOR APPROVAL	03.02.20	MC

SCALES:	AS SHOWN @ A1
DESIGNED:	RF
CHECKED:	RF
DRAWN:	MC
CHECKED:	RF
DATE:	14.02.20

PROJECT PARTNER

CLIENT:
MR. RUDY GOMEZ
ADDRESS:
118 SILVER LAKE ROAD,
MYLOR, SA 5153

PROJECT NAME:
PROPOSED ON-SITE WASTEWATER
MANAGEMENT SYSTEM

ON-SITE WASTEWATER
SILVER LAKE DEVELOPMENT
SITE LAYOUT PLAN

ORIGINAL DRAWING AT A1. DO NOT SCALE DIRECTLY OFF DRAWING.
DIRECT ANY QUERIES AND OR DISCREPANCIES TO RFE CONSULTING.
PROJECT NUMBER:
RFE0085
DRAWING NUMBER:
WW_02
REV:
2



Attachment 2 – Design Loadings

RFE0085 - Silver Lake Development

DIR Required	DIR Adopted
4.5	2.7

No. of Persons	Daily flow per person	Q (L/day)	BOD ₅ (g BOD ₅ /p/d)	BOD ₅ (g BOD ₅ /d)	BOD ₅ (g BOD ₅ /d) 40% loading applied as per the Code	Area Required	Comments
Existing Residential							
6	125	750	70	420	588	167	278
B & B							
14	100	1400	40	560	784	311	519
Function Activity							
40	30	1200	20	800	1120	267	444
Gardener							
1	40	40	25	25	35	9	15
SUB TOTAL:		3350		1780	2492	753	1256

Total System Capacity:

Proposed System Capacity:	Hydraulic Capacity (L/d)	BOD ₅ (g BOD ₅ /d)
RP10	2000	700
RP10	2000	700
Ri-Treat 4250	1200	400
	5200	1800

B & B + Function Centre Capacity:

Proposed System Capacity:	Hydraulic Capacity (L/d)	BOD ₅ (g BOD ₅ /d)
RP10	2000	700
RP10	2000	700
Sub Total:	4000	1400

Area Required Including reducing flow rate through 5kL Pumping Chamber / Balance Tank and 2 x RP10⁺ configuration

Hydraulic Flow (L/d)	BOD ₅ (g BOD ₅ /d)	BOD ₅ (g BOD ₅ /d) with 40% loading [#]	Max BOD ₅ (g BOD ₅ /d)	73.5% BOD ₅ Loading	73.5% Hydraulic Loading (L/d)	Residence Q (L/d)	Gardener Q (L/d)	Total Daily Q (L/d)	Area (based on conservative DIR = 2.7 L/m ² /d)
2600	1360	1904	1400	1399	1911	750	40	2701	1000

- 40% loading applies as per the Code to BOD₅ loading rates for raw sewage to AWTS (without septic tank pre-treatment).



Attachment 3 – Soil Borehole Logs (Extract from Water Tech Report)



LAB SA Construction Materials Testing, 30 Hudson Rd, Mawson
Lakes SA 5095

Telephone 08 8258 5594 – Facsimile 08 8258 9919
Email: admin@labsa.com.au ABN 12 113 330 073

SURFACE BORE LOG

DATE: 6/9/2019
JOB NO: 20030004

CR2
1 OF 1

DATE DRILLED: —

TO BE READ IN CONJUNCTION WITH CR2-1 & CR2-2

CLIENT: WATER TREAT

LOCATION: SILVER LAKE

		DEPTH IN METRES		VISUAL ASSESSMENT OF PROPERTIES							
	1	2	3	COLOUR	CONSISTENCY, TEXTURE & STRUCTURE	SOIL DESCRIPTION		U.S.C.	M.C.	BEARING	EST Ips (AVE)
	0.00 0.10			ORANGE BROWN	LOOSE, GRANULAR	Gravelly SAND	NP	SM/4M	B	4M	-
	0.10 0.30	0.00 0.20			—	NO SAMPLE					
	0.30 0.60		0.00 0.20	GREY BROWN	FRIZBLE, GRANULAR	clayey SAND some roots.	VLP	SC	A	L	0.005
		0.20 0.80	0.20 0.80	LIGHT BROWN	COARSE, GRANULAR	clayey SAND	VLP	SC	WA	L	0.005
	0.60 2.00	0.80 2.10	0.80 1.50	ORANGE GREY	HARD, STIFF GRANULAR	Silty sandy clay	HP	CH/MH	A	M	0.030
			1.50 1.80	ORANGE GREY BROWN	FIRM, GRANULAR	Silty sandy clay	MP	CL/ML	A	M	0.020
	2.00 3.00		1.80 2.10	GREY BROWN	HARD STIFF GRANULAR	Silty sandy clay	HP	CH/MH	A	M	0.030

REMARKS:	CLASSIFICATION:	TYPE: EMS	CLASSIFIER:
<p>1. **The classification nominated on this borelog relates to the site soil profile at the time of testing. It does not allow for future earthworks and does not incorporate any possible effects from trees, either existing or future.</p> <p>2. *The calcareous clay soils present within the soil profile may lose strength upon wetting and adequate site drainage is essential.</p>		<p>REFERENCES USED:</p> <p>SOIL MAPS:</p> <p>NEARBY BORELOGS:</p> <p>SAMPLE METHOD: Driven push tube using high pressure hydraulic hammer.</p>	
Logged By: LAB SA		Checked By: WF	



LAB SA Construction Materials Testing, 30 Hudson Rd, Mawson
Lakes SA 5095

Telephone 08 8258 5594 – Facsimile 08 8258 9919
Email: admin@labsa.com.au ABN 12 113 330 073

SURFACE BORE LOG

DATE: 6/9/2019
JOB NO: 20030004

CR2
1 OF 1

DATE DRILLED: —

TO BE READ IN CONJUNCTION WITH CR2-1 & CR2-2

CLIENT: WATER TECH

LOCATION: SILVER LAKE

		DEPTH IN METRES		VISUAL ASSESSMENT OF PROPERTIES							
		A	S	COLOUR	CONSISTENCY, TEXTURE & STRUCTURE	SOIL DESCRIPTION	U.S.C.	M.C.	BEAR- ING	EST Ips (AVE)	
		0.00 0.20	0.00 0.20		—	NO SAMPLE					
				GREY BROWN	FRIZBLE, GRANULAR	clayey SAND some roots.	VLP	SC	A	L	0.005
		0.20 0.50	0.20 1.00	LIGHT BROWN	COARSE, GRANULAR	clayey SAND	VLP	SC	WA	L	0.005
		0.50 1.00		ORANGE GREY	HARD, STIFF GRANULAR	Silty Sandy clay	HP	CH/MH	A	M	0.030
		1.00 1.70		ORANGE GREY BROWN	FINE, GRANULAR	Silty Sandy clay	MP	CL/ML	A	M	0.020
		1.70 2.10		GREY BROWN	HARD STIFF GRANULAR	Silty Sandy clay	HP	CH/MH	A	M	0.030

REMARKS:	CLASSIFICATION:	TYPE: EMS	CLASSIFIER:
<p>1. **The classification nominated on this borelog relates to the site soil profile at the time of testing. It does not allow for future earthworks and does not incorporate any possible effects from trees, either existing or future.</p> <p>2. *The calcareous clay soils present within the soil profile may lose strength upon wetting and adequate site drainage is essential.</p>		<p>REFERENCES USED:</p> <p>SOIL MAPS:</p> <p>NEARBY BORELOGS:</p> <p>SAMPLE METHOD: Driven push tube using high pressure hydraulic hammer.</p>	
Logged By: LAB SA	Checked By: WF	Page 1 of 1	



LAB SA Construction Materials Testing, 30 Hudson Rd, Mawson
Lakes SA 5095

Telephone 08 8258 5594 – Facsimile 08 8258 9919
Email: admin@labsa.com.au ABN 12 113 330 073

SURFACE BORE LOG

DATE: 6/9/2019
JOB NO: 2003 0004

CR2
1 OF 1

DATE DRILLED: —

TO BE READ IN CONJUNCTION WITH CR2-1 & CR2-2

CLIENT: WATER TECH

LOCATION: SILVER LAKE

		DEPTH IN METRES		VISUAL ASSESSMENT OF PROPERTIES							
				COLOUR	CONSISTENCY, TEXTURE & STRUCTURE	SOIL DESCRIPTION		U.S.C.	M.C.	BEARING	EST Ips (AVE)
			6								
			0.00	BROWN	LOOSE, GRANULAR	(FILL) Clayey SAND, Some Roots & Gravel.	VLP	SC G/M	B/N	L	0.005
			0.45								
			0.45	DARK BROWN	FRAGILE, GRANULAR	Gravelly clayey SAND	VLP	SC G/M	B/N	L	0.005
			0.70								
			0.70	BROWN	LOOSE, GRANULAR	clayey SAND	JLP	SC	N	M	0.005
			1.20								
			1.20	ORANGE, BROWN	FRAGILE, GRANULAR	Silty Sandy CLAY	LMP	CL/ML	N	M	0.015
			1.60								
			1.60	GREY	LOOSE, GRANULAR	SAND	NP	SP	N	M	0.000
			2.00								
			2.00	LIGHT BROWN	FRAGILE, GRANULAR	Silty Sandy CLAY	LP	CL/ML	A	M	0.010
			2.60								
			2.60	ORANGE BROWN	F.M., GRANULAR	Sandy CLAY	MHP	CL/CH	N	M	0.025
			3.00								

REMARKS:	CLASSIFICATION:	TYPE:	CLASSIFIER:
<p>1. **The classification nominated on this borelog relates to the site soil profile at the time of testing. It does not allow for future earthworks and does not incorporate any possible effects from trees, either existing or future.</p> <p>2. *The calcareous clay soils present within the soil profile may lose strength upon wetting and adequate site drainage is essential.</p>		<p>EMJ</p> <p>REFERENCES USED:</p> <p>SOIL MAPS:</p> <p>NEARBY BORELOGS:</p> <p>SAMPLE METHOD: Driven push tube using high pressure hydraulic hammer.</p>	

Logged By: LAB SA

Checked By: WF

Page 1 of 1



Attachment 4 – Groundwater Database Search

Browse Mode, centre -35.058591,138.75407

Unit No	Cased To (m)	Max Depth (m)	Latest Depth (m)	SWL (m)	SWL Date	Yield (L/sec)	Yield Date	TDS (mg/L)	TDS Date	Purpose	Aquifer	Status	Date	Permit No
6627-4213	33.53	39.62	39.62	39.34	14/01/1970	0.76	01/01/1983	259	28/01/1983	DOM	No	OPR		
6627-15404	73.5	78	78	4	01/04/2017	1	23/03/2017	457	01/04/2017	DOM			01/04/2017	258083

2 records



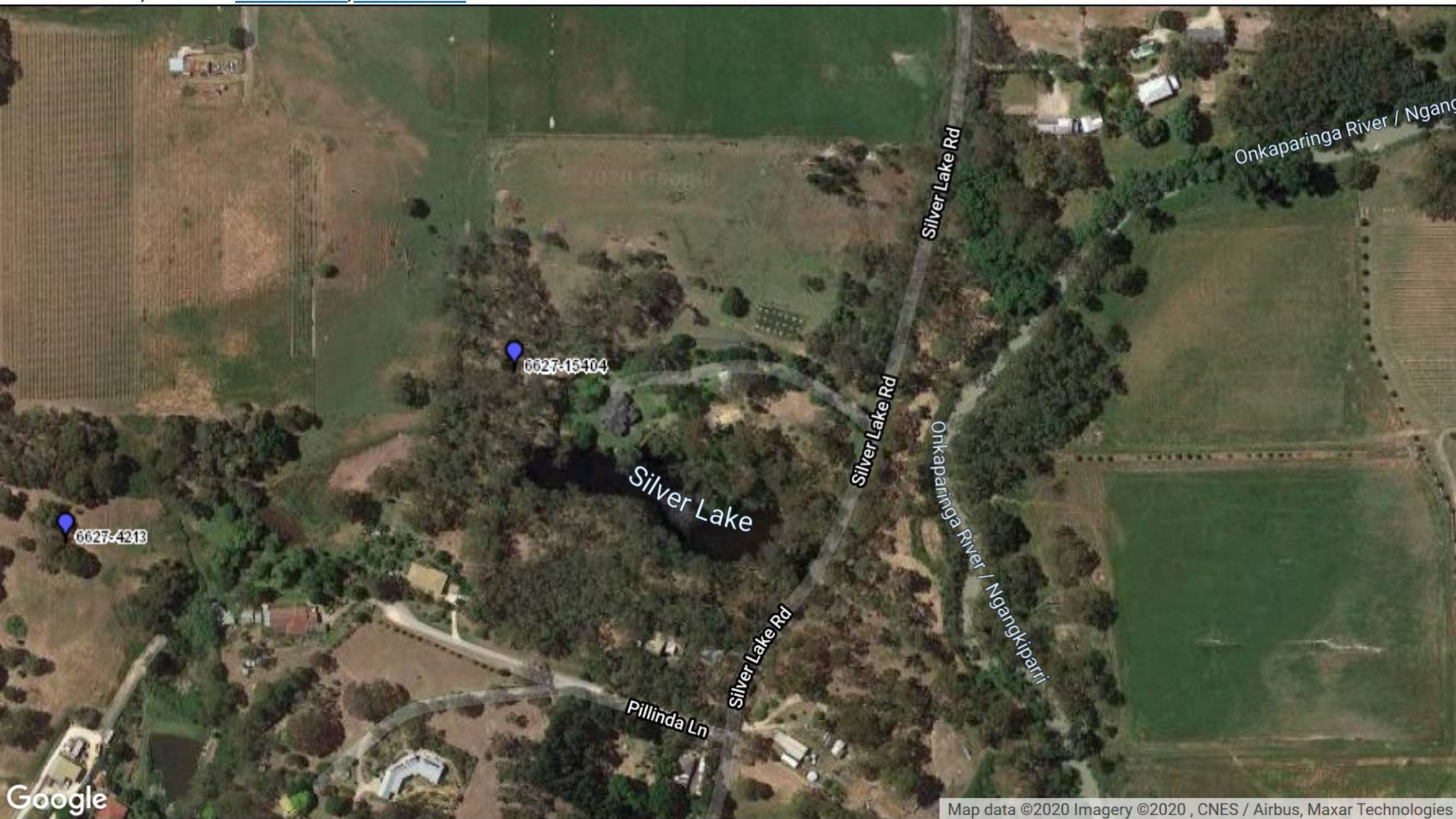
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Government
of South Australia

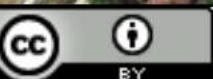
WaterConnect

Browse Mode, centre -[-35.058591,138.75407](#)



Google

Map data ©2020 Imagery ©2020 , CNES / Airbus, Maxar Technologies



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DHNO	Unit_No	completion_date	total_depth	final_depth	current_depth	permit_no	Bkf_ind	case_from	case_to	case_min_diameter	case_material	pcem	pz_from	pz_to	pz_type	pz_material	pz_apertu	drill_from	drill_to	drill_diam	drill_meth	well_dev_method	well_dev_duration	Comments
42633	6627-4213	14/01/1970	39.62	39.62	39.62		N	0	33.53	152		N	33.53	39.62	UKN									
292476	6627-15404	1/04/2017	78	78	78	258083	N	0	73.5	150	STL	N	73.5	77.5	S	SST	0.3	0	78	198	RTA	AIRL	5	New Well

RFE0085

Groundwater Database - Water Cut

Silver Lake Development

DHNO	UnitNumber	WaterCutDate	DepthFrom_m	DepthTo_m	WaterLevel_m	EstYeld_L_Sec	TestMethod	TDS_mg_L	EC_us_cm	SampleType
292476	6627-15404	23/03/2017	74.5	77	77.5	1	BUCK	400	727	S

RFE0085

Silver Lake Development

Water Level Summary

DHNO	Unit_Number	Aquifer	Easting	Northing	Zone	Unit_No	obs_date	dtw	swl	rswl	anom_ind	pump_ind	measured_during	data_source
42633	6627-04213	No	294787.4	6118067	54	6627-4213	14/01/1970	39.34	39.34	282	N	N	U	DEWNR
292476	6627-15404		295053.7	6118174	54	6627-15404	1/04/2017	4	4		N	N	D	DEWNR

RFE0085

Drillers Log for Bore 6627 - 15404

Proposed Silver Lake Development

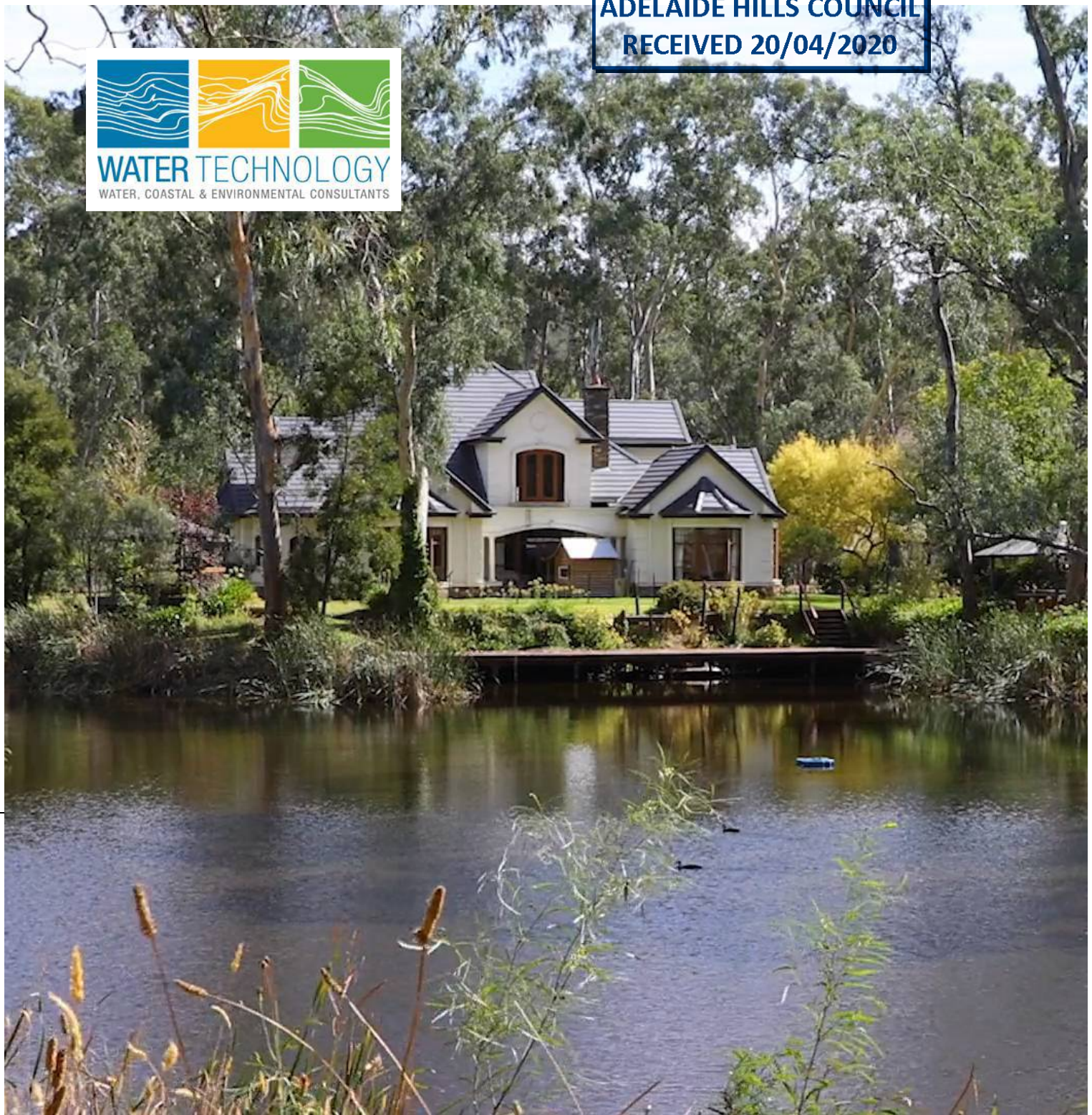
DHNO	Unit_No	log_date	logger_name	depth_from	depth_to	lith_code	description
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	0	4	CLYU	
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	4	8.5	SAND	
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	8.5	10	GRVL	varing in size, up to 50mm
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	10	30	SHLE	soft unstable
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	30	73.5	SHLE	more firm with soft layers/ breaking off in larger pieces
292476	6627-15404	01-Apr-17	STEVEN JAMES JUETT	73.5	78	SAND	shale with with fracture of sand, unformed in size , flowing in the fracture is fine silt, unable to stop fine silt entering the bore, as too fine to screen off

RFE0085

Silver Lake Development

Casing Information

DHNO	UnitNumber	DepthFrom_m	DepthTo_m	Diameter_mm	Material	COMMENTS	CementType	CementFrom_m	CementTo_m
42633	6627-4213	0	33.53	152					
292476	6627-15404	0	11.5	200	STL	Mild			
292476	6627-15404	0	73.5	150	STL	Mild	G	11	18
292476	6627-15404			125					



Water Resources Report

Silver Lake Development

Rudy Gomez

20 February 2020



Document Status

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EXECUTIVE SUMMARY

Cartwheel Resources Ltd requested a groundwater, surface water and wastewater assessment of a proposed development at Silver Lake, Mylor. This report assesses the potential water and wastewater quality and quantity impacts associated with the proposed development. The information included is intended to support a Development Application to Adelaide Hills Council.

The study includes a water balance assessment to ensure that there are no adverse effects from additional water supply, increased surface runoff, or increased wastewater generation.

It also contains high level advice about legislation and approvals but does not seek to support the relevant applications and licenses, as these will be appropriate when the design is more fully developed.

Water balance

It is intended that there will be no disposal off-site of any of the wastewater generated from the proposed development – all wastewater will be retained, treated and disposed of on-site above the 100-year flood line. The only water leaving the property will be that generated by rainfall, as runoff from natural grassed and vegetated land, as overflow from the lake, and possibly from roof runoff in excess of what is captured and stored for on-site uses. It can be demonstrated that the proposed works will, when compared with the existing use, increase wastewater generation in a negligible fashion only.

In addition, initial water balance calculations show that there is sufficient water available to support the development.

Lake

2

By treating the domestic wastewater, it will not be discharged directly to the lake, therefore water quality in the lake will not be adversely affected.

Environmental Impact

The report demonstrates that water quality impact and wastewater generation impact are within "acceptable" limits or improved.

Benefits and Opportunities

The following benefits may be realised by implementing this scheme:

- Re-engineering of current land drains –the changes proposed are in alignment only, which will not affect water balance. Benefits will be gained by improving habitat and aesthetics
- Improved lake water quality by providing additional "polishing" treatment and recirculation using the new wetlands
- Increased rainwater storage for domestic use



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Table 10-4 Total N balance	44



GLOSSARY AND ABBREVIATIONS

Activity	Part of the project, such as installing infrastructure in a certain manner, that may have an impact on receptors	
Acid Sulphate Soils	Acid sulphate soils are natural sediments that contain iron sulphides. However, if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulphides react with oxygen to form sulfuric acid	ASS
Adelaide Hills Council	Appropriate Development Approval council for Silver Lake	Council
Annual Exceedance Probability	The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year. 0.1% AEP is equivalent to a 1:100 year flood event.	AEP
Australian and New Zealand Environment and Conservation Council		ANZECC
Agriculture and Resource Management Council of Australia and New Zealand		ARMCANZ
Australian Height Datum	The datum that sets mean sea level as zero elevation.	AHD
Average Recurrence Interval	The average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration.	ARI
Design Flood	A significant event to be considered in the design process; various works within the floodplain may have different design event requirements. E.g. some roads may be designed to be overtopped in the 1 in 10 year or 10% AEP flood event.	
Digital Elevation Mode	A bare-earth elevation model of the earth's surface, with features such as vegetation, bridges and roads filtered out	DEM
Digital Terrain Model	A DTM is a mathematical representation of the ground surface. A DTM augments a DEM by including linear features of the bare-earth terrain	DTM
Development Approval		DA
Discharge	The rate of flow of water measured in terms of volume over time. It is to be distinguished from the speed or velocity of flow, which is a measure of how fast the water is moving rather than how much is moving.	
Environment Protection Authority	South Australia's independent environment protection regulator	EPA
Equivalent Population	The number expressing the ratio of the sum of the pollution load (in waste-water treatment) produced during 24 hours by industrial facilities and services to the individual pollution load in household sewage produced by one person.	EP
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or overland runoff before entering a watercourse and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.	
Flood Frequency Analysis	A technique to predict flow values corresponding to specific return periods or probabilities along a watercourse or flow path	FFA



Hydrograph	A graph that shows how discharge changes with time at any location.	
Hydrology	The term given to the study of the rainfall and runoff process as it relates to the derivation of hydrographs.	
Intensity Frequency Duration	An intensity-duration-frequency curve is a mathematical function that relates the rainfall intensity with its duration and frequency of occurrence	IFD
Light Detection and Ranging	A remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth	LiDAR
metres Australian Height Datum	Elevation of point relative to National datum	mAHD
metres below natural surface	Depth below the natural ground level	mBNS
Milligram per litre, Total Dissolved Solids	The measure of the salinity of water, by the conversion of the measured electrical conductivity of the water,	mg/L (TDS)
Office of the Technical Regulator		OTR
Peak Flow	The maximum discharge occurring during a flood event.	
Potential Acid Sulphate Soils	ASS which have not been oxidised by exposure to air	PASS
Primary Industries and Regions South Australia	key economic development agency within the South Australian Government, who is responsible for the prosperity of the State's primary industries and regions. With regards to non-drinking water, PIRSA has dedicated programs focusing on water resources, viticulture and irrigated crops, and are supportive of the use of alternative water supplies.	PIRSA
Reduced water level	The water level reported to a common datum; in this case mAHD	RWL
Regional Flood Frequency Estimation	Methods used to estimate design floods in ungauged and poorly gauged catchments. It is a data-based empirical procedure which attempts to compensate for the lack of temporal data at a given location by spatial data	RFEE
Runoff	The amount of rainfall that ends up as stream or pipe flow, also known as rainfall excess.	
Stakeholders	Entities potentially affected by the proposed activities	Stakeholders
Standing/ static water level	The natural potentiometric water level in a bore, measure as metres below natural surface	SWL
Watershed	The Mount Lofty Ranges drinking water catchments. They establish planning policies, based on the water quality risk hierarchy associated with the Mount Lofty Region Watershed Priority Areas, to ensure that new developments have a beneficial, or at least neutral, impact on water quality in the Watershed.	



1 INTRODUCTION

1.1 Purpose of Report

The purpose of this report is to assist Cartwheel Resources in preparation of a concept for the development of Silver Lake, in order to prepare a Development Application for submission to the Adelaide Hills Council under The Development Act 1993. There is a strong emphasis in the Adelaide Hills Council Development Plan on protecting and improving the water quality of the watershed and the Mount Lofty area generally.

This report will aid demonstration that the environmental impact of the proposed development, including water quality impact, and wastewater generation impact, is within "acceptable" limits. It will also identify where improvements to water quality and distribution are likely to be made.

1.2 Location

The 14-hectare property lies approximately 2 km south of Mylor on Silver Lake Road, and 1.5km west of the main Echunga Road. Silver Lake is situated east of the northern part of the property.

1.3 Proposed Development

The proposed concept development plan is included in Appendix A, and includes:

- The existing Cape Cod building (which presently functions as a dwelling) is to be converted for use as a bed and breakfast, and which may also be used to hold events such as weddings and community days;
- The bed-and-breakfast and meeting/conference facility will have seven ensuite accommodation rooms, and a capacity of 14EP;
- A new house, which will be the manager's domestic residence;
- Outside toilet for ground staff;
- A wetland will be incorporated into the project, intended for ecological benefit or treatment of lake water;
- An aquaponics system, to be used for the growing on of fish for consumption on-site, and to produce fish for stocking of the existing lake on the property, situated outside the 1 in 100 year flood line;
- A fowl breeding pen, situated outside the 1 in 100 year flood line; and
- The area of the small domestic avocado and persimmon orchards will be on the North Western part of the property, and are approximately 0.25 ha each.

1.4 Adelaide Hills Council

A Development Approval is required for this proposed development and it is important for the Development Application to be accompanied by a report demonstrating the development will protect and improve the water quality relates to the development. In particular, it is important to establish:

- How, and to what extent, the water quality of the lake may be improved;
- There will be sufficient water available to support the development;
- That the proposed development will manage wastewater effectively on site, and will have either negligible or beneficial impact;
- Demonstrate that environmental impact (including water quality impact, and wastewater generation impact) is within "acceptable" limits or improved; and
- There is no increase in surface water runoff from the property.



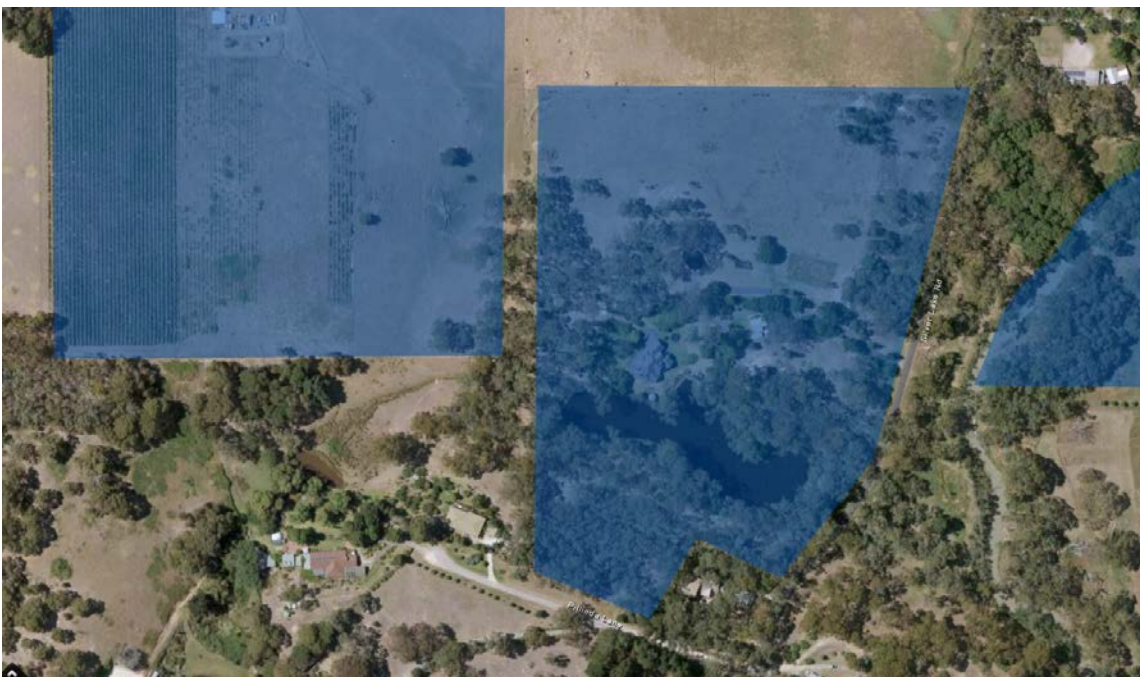
2 BACKGROUND

2.1 History of the site

The existing Silver Lake was excavated by hand in the early 1900's during alluvial gold mining operations, but shortly after was flooded by inflows from natural springs, and mining operations were abandoned. The lake has an area of approximately 8,400 m² and is reputed to be up to 6 m deep. Whilst a detailed bathymetry of the lake invert is not available, site observations and measurements confirm that the lake is very deep in places.

The property is currently listed as an area of Local Heritage significance as demonstrated by Figure 2-1 below.

Figure 2-1 Heritage Places



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2.2 Description of Property

2.2.1 House

There is a large residential property constructed in 1996, surrounded by landscaped gardens.

There is no mains water supply to the property, and the domestic water supply is from rainwater collection, supported by a 130,000 litre tank. The current septage arrangement for the property is a Ri package biological treatment plant to treat 4250L for existing irrigation use, with 4-yearly licenced pump-outs.

There is a 3 phase main irrigation system plus a single phase garden watering system, plus two emergency fire pumps & standalone fire protection to the house and studio.

2.2.2 Lake

The lake has historically been used for low key community recreation such as swimming, boating and fishing.

It is mainly surrounded by river red gums and other vegetation, and is fringed by a narrow margin of bulrush. It is believed that sediment and other debris, probably mainly organic in nature from the surrounding



vegetation, has accumulated over the last 100 years to a depth of up to 2 metres or more, possibly including fallen trees and branches. Water in the lake is coloured, most likely by tannins leached from the red gum leaf litter.

It is intended to dredge the lake to remove sediment and debris that has accumulated to make it more suitable for recreational activities. The desilting is proposed to be carried out by a suction dredge, to remove sediment and small debris, and to dispose of this material by spreading over the non-vegetated sections of the property, and cultivating this into the ground. Dewatering of the sediment will be necessary before the material will be spread over the disposal area.

2.3 Topography

It is a generally flat site, with grassed paddocks to the north, and is vegetated with scatter eucalypts to the south, around the house and lake. The property is reported to be badly drained outside the 1:100 year berm.

There are two land drains across the property, one along the northern boundary, and another running west to east across the property. There are a number of culverts that allow land drainage to cross Silver Lake Road, which runs along the east boundary of the property.

2.4 Legislation

Key legislation relating to this Development Application with respect to water is summarised below.

2.4.1 The Development Act 1993

An Act to provide for planning and regulate development in the State; to regulate the use and management of land and buildings, and the design and construction of buildings; to make provision for the maintenance and conservation of land and buildings where appropriate; and for other purposes.

An urban water harvesting and reuse scheme will generally be part of a larger development. However, whenever an urban water harvesting and reuse scheme is planned, it is advised that the local council be contacted to determine whether Development Approval is required under the Development Act 1993. The likely issues that a council may want covered in a development application involving an urban water harvesting and reuse scheme include:

- Compatibility of the proposed scheme with council's objectives, plans or strategies, including any relevant strategic water management plan or strategy;
- Compatibility of the proposed plan with surrounding land uses (compliance with zoning requirements);
- Anticipated benefits and impacts associated with scheme construction and operation (including social, environmental and economic aspects);
- Consideration of environmental impacts during construction and operation phases;
- How public health and safety risks are addressed;
- Management arrangements (including monitoring and maintenance) for the scheme;
- What (if any) risks and/or financial obligations would be transferred to council if it operates the scheme (e.g. operations, maintenance, monitoring and reporting costs); and
- A management plan for the scheme (including monitoring and maintenance).



2.4.2 The Environment Protection (Water Quality) Policy 2015

The Environment Protection (Water Quality) Policy 2015 (WQ Policy) provides water quality criteria for receiving waters in South Australia into which discharge is released.

To prevent an offence under the WQ Policy, wastewater irrigation must only be applied within the limits set by antecedent soil moisture levels, soil infiltration rates and likely rainfall conditions. Division 2 of the WQ Policy also imposes an obligation on particular industries to incorporate a wastewater management system. The development of a WIMP is a necessary component of the wastewater management system for any facility that irrigates wastewater on site.

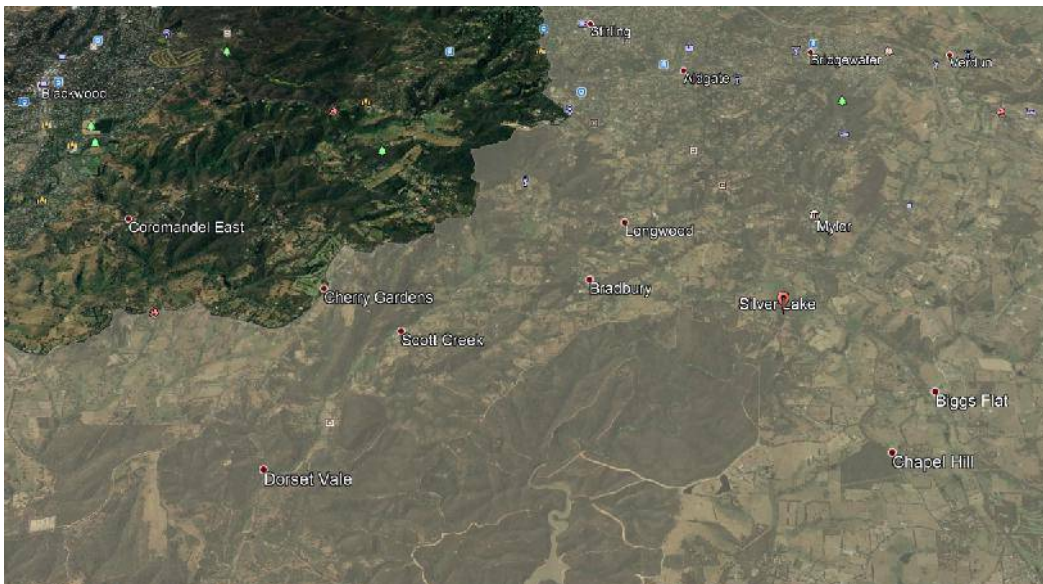
2.4.3 Environment Protection Act 1993 (SA)

The principal legislation that addresses pollution in South Australia is the Environment Protection Act 1993 (EPA). This is a regulatory framework to protect South Australia's environment, including land, air and water. A dredging licence may be required if silt removed from lake, or if excavated material is removed from the property.

In particular, section 25 of the Act imposes a general environmental duty on anyone who undertakes an activity that pollutes, or has the potential to pollute, to take all reasonable and practicable measures to prevent or minimise environmental harm. In addition, odour generation from wastewater irrigation may constitute environmental nuisance under section 82 of the Act.

The EPA license activities of environmental significance as defined in Schedule 1 of the Environment Protection Act 1993 defines wastewater treatment plants and community wastewater management systems as an activity of environmental significance. In some instances, a licence may not be required for a non-drinking water system, but is usually required for systems < 100EP in a water protection area, as shown in Figure 2-2 below.

Figure 2-2 Water Protection Area





2.4.4 Heritage Places Act 1993 (SA)

This Act makes provision for the identification, recording and conservation of places and objects of non-Aboriginal heritage significance. Silver Lake is listed under SA Heritage Places as "local" class. Local councils have their own requirements for development affecting local heritage places or contributory items.

2.4.5 Aquaculture Act 2001

This is an Act to regulate marine and inland aquaculture and is supported by the Aquaculture Regulations 2016. For land-based aquaculture, typically a licence would be required from PIRSA. Based on preliminary conversations with PIRSA, if the fingerlings were bought from a licensed facility and the fish were not sold, then a permit or licence from PIRSA may not be required. A permit would, however, be required to release fish into the lake because of potential connectivity with the Onkaparinga River

2.4.6 Natural Resources Management Act 2004

The Natural Resources Management (NRM) Act 2004 provides the statutory framework for water extraction from rivers, lakes and groundwater. Water resources in South Australia are primarily managed under the Natural Resources Management Act 2004. Where increased development causes stress on water resources and a higher level of management is warranted, the associated water resources can be prescribed under the Natural Resources Management Act 2004.

As Silver Lake is in a Prescribed Water Resources area, a licence is required to harvest or extract groundwater or surface water. In addition, a Water Affecting Activity Permit may be required. The extent of the Prescribed area is shown shaded in Figure 2-3 below.

Figure 2-3 - Prescribed Water Resources Area



Under the Act, any rain that falls on a roof is considered to be surface water. A water licence is required to 'take' surface water in an area where surface water is prescribed, such as the Western Mt Lofty Ranges. A licence is not required for:

- Stock and domestic purposes (see definition of domestic below);
- Firefighting;



- Chemical use on non-irrigated crops, non-irrigated pasture and for the control of pest plants and animals;
- Road making; and
- Specific exemptions (see below).

Roof runoff that is not 'taken' (collected and used) returns to the environment and does not require licensing. Commercial, industrial, environmental and recreational users are currently exempt from requiring a water licence to take roof runoff where the volume of water collected from the connected roof area is equal to or less than 500 kilolitres per year.

The NRM Act defines "domestic purpose" in relation to the taking of water as not including

- (a) taking water for the purpose of watering or irrigating land, other than land used solely in connection with a dwelling; or
- (b) taking water for the purpose of watering or irrigating more than 0.4 of a hectare of land; or
- (c) taking water to be used in carrying on a business (except for the personal use of persons employed in the business).

Domestic wastewater is defined as

- (a) water used in the disposal of human waste; and
- (b) water used for personal washing; and
- (c) water used for washing clothes or dishes; and
- (d) water used in a swimming pool.

2.4.7 Waterworks Act 1932 and Waterworks Regulations 1996

The Waterworks Act 1932 authorises the responsible Minister and SA Water to supply water to urban and regional communities and to provide safe drainage of wastewater, rating and pricing arrangements, and the construction of necessary infrastructure.

SA Water should be consulted regarding the conditions which need to be met to allow the transition between rainwater and mains water supply should the proposed rainwater harvesting system involve connection to mains supply. Specific issues addressed by SA Water include the need for installation by a licensed plumber, signage, certification of the materials used, certificates of compliance upon installation and the need for an automated switching device.

2.4.8 Public and Environmental Health Act 1987

The Department of Health (Environmental Health Branch) is responsible for the implementation of the Public and Environmental Health Act 1987 in South Australia. This agency provides the required information and assistance in establishing a rainwater harvesting and reuse system with regards to health issues.

2.5 National Guidelines

The legislation, policy and guidelines applicable to non-drinking water installations are listed in Appendix B, but can be summarised briefly as follows.



2.5.1 PIRSA

The Department of Primary Industries and Regions South Australia (PIRSA) is a key economic development agency within the South Australian Government, who is responsible for dedicated programs focusing on water resources, viticultural and irrigated crops, and are supportive of the use of alternative water supplies. Where aquaculture production can be used for the purpose of food for human consumption, such as bait, pet food or the aquarium trade, compliance with the requirements of the Primary Produce (Food Safety Schemes) Act 2004 and other relevant Regulations and Standards is necessary. It is recommended that advice is obtained from PIRSA and DHA with regards to the use of nondrinking water for agricultural (including hydroponics) and aquaculture purposes.

2.5.2 Office of the Technical Regulator

The Office of the Technical Regulator (OTR) promotes, audits and enforces the compliance of all installations with safety and technical standards. Overall, the responsibilities of the OTR in non-drinking water plumbing installations are in relation to:

- Ensuring all on-site non-drinking water services comply with the objective and performance requirements of the Plumbing Code of Australia;
- Auditing in-wall and in-ground non-drinking water installations;
- Auditing water industry entity/water supplier and appropriately licensed person (where applicable) for documentation but not limited to safety management plans, cross connection tests and site visits; and
- Performance reporting.

2.5.3 The Environment Protection and Heritage Council and the Natural Resource Management Ministerial Council

The Environment Protection and Heritage Council and the Natural Resource Management Ministerial Council have developed the Australian Guidelines for Water Recycling (Environment Protection and Heritage Council 2006). The guidelines comprise a risk management framework and specific guidance on managing the health risks and the environmental risks associated with the use of recycled water. The Guidelines include a process for a risk management plan for a recycled water scheme. The Guidelines replaced the 1999 South Australian Reclaimed Water Guidelines (Treated Effluent) 1999.



3 ASSUMPTIONS

3.1 Domestic Water & Wastewater

- The bed-and-breakfast facility (B&B) will not provide a restaurant or dining service. Overnight guests will have the opportunity to use facilities within the building to cook their own meals, or if preferred, bring their own chef;
- The B&B is based on 7 double rooms, 14 people occupancy, which will include accommodation only. The B&B building would be sized to accommodate up to 40 people attending the premises at any one time in a non-residential capacity for occasional events such as work functions, weddings and birthday parties. It is anticipated that additional mobile toilet facilities would be used for any larger events, but an equivalent water supply for catering and washing would be required. The B&B building will be used as a small conference centre once a month for each month of the year;
- The manager's residence occupancy is 6EP;
- There will be separate wastewater collection and treatment for the manager's residence, and for the B&B accommodation;
- There will be separate rainwater collection and storage for the manager's residence, and for the B&B accommodation;
- There is no mains water supply to the property, and potable water supply will be from rainwater collection; and
- Typical wastewater quantities and qualities are included in this report as a table in Appendix G.

3.2 Water Balance

- The water balance includes domestic use from the B&B and the manager's residence. Surface water is assumed to be used for irrigation, within the water licenced water allocation; and
- Currently the groundwater bore is not used due to high iron content and is not included in the water balance. There may be possible other opportunities for use.

3.3 Existing Lake

- The existing lake is assumed to be the main storage in the system;
- Only PIRSA approved fish will be stocked in the lake;
- Silver Lake is assumed to have a total area of 8,400 m² and including sediment the total depth is up to 6 m² when full. For a more accurate water balance modelled a detailed survey of the bathymetry of the lake can be obtained;
- Runoff from the catchment was modelled to 15 % of the rainfall, a rate which coincides with the runoff rate detailed in the Scott Catchment description report produced by Australian Surveying and Land Information Group, 1993;
- The rainfall threshold in the catchment was assumed at 2 mm/day; and
- Exfiltration rate of 0.017 mm/hr was assumed (equivalent to a clay lined system). The water table is assumed to be at the same level of the lake, and likely to infiltrate into Silver Lake.

3.3.1 Wetland

- Proposed uses are ecological benefit, treatment, and/or storage for irrigation/flood water balancing;



- The total area of wetlands is assumed to be 3,400 m² and the total depth is 1 m when full as detailed in the Development - Preparation of DA provided by Barrie Ormsby on 8 August 2019; and
- The wetland would be lined, so that there would be minimal exfiltration.

3.3.2 Irrigation

- Irrigation demand is based on a crop coefficients (Kc) for avocado and persimmons of 0.75 and 0.7 respectively;
- The application efficiency was assumed to be 0.8;
- The irrigation season was assumed to be from April to October; and
- Fruit, vegetables, fish and fowl produced on the site will not be for sale to the general public. It will be grown or produced essentially for the purposes of the landowner and his guests.

3.3.3 Aquaculture

- The volumes of water in and out of whole system will be considered to be a closed system, with minimal waste produced, and occasional “topping up” required;
- Waste from the aquaponics facility is anticipated to include permanganate (incoming quarantine), wastewater sludge (worms and grow beds), compost, salts (10g/L - purge prior to eating), cleaning of tanks;
- The aquaponics facility would include a 2000L fish tank, with a 10% water exchange per day. It is anticipated that 3kg of fish will provide nutrients for about 1 m² of veg in wicking beds; and
- 20kg capacity of fish in the tank, producing 20-30g sludge per day.

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3.4 Licences and Approvals

- Any licences and approvals required will be applied for by others, and this report does not guarantee that these will be successfully obtained.

3.5 Not Included in the Water Balance Assessment

- Fowl – not considered that this would impact on the water balance or water quality, as the small-scale penned facility would be located outside the 100 year flood line;
- Re-engineering of current land drains –the changes proposed are in alignment only, which will not affect water balance. Benefits may be gained by improving habitat and aesthetics;
- Consideration of stratification in the lake - currently only reporting on observations sampled during recent testing
- Fire management; and
- Design of irrigation system (only estimated rates for irrigation included in water balance).



4 EXISTING LAKE AND PROPERTY ISSUES

4.1 Review of Existing Lake Conditions

On the western end of the lake cattle have access and this is likely to affect water quality, and will also increase the risk of erosion. The eastern side is silted up and shallow, and iron staining was observed, which was considered to be an indication of high levels of iron in the groundwater, or of tannins from leaves. Samples of lake water and sediment were taken to assess the quality of this, and the results are discussed more fully in Section 5.

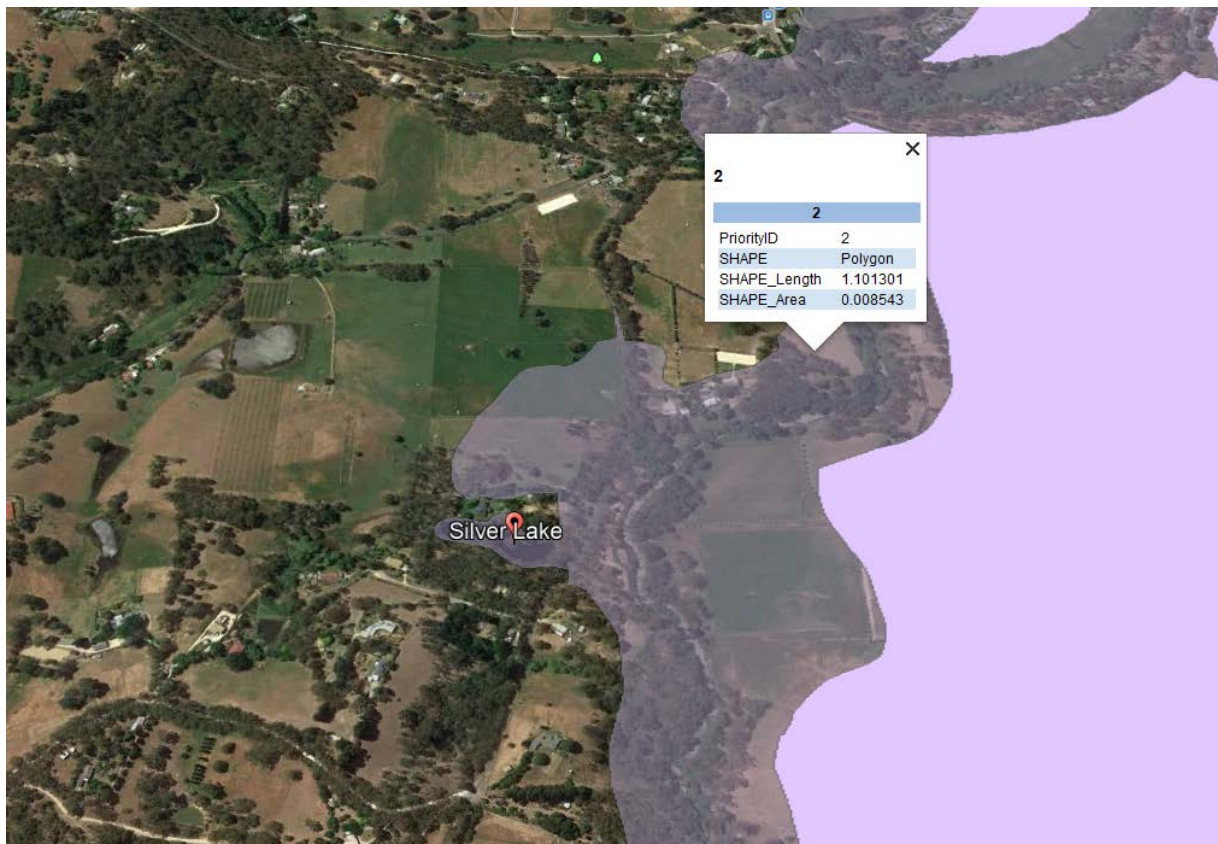
4.2 Lake Flow System

It is understood that the water level of the existing Silver Lake is maintained by both natural spring inflow, and by surface flows from the natural catchment of the lake during winter. The lake can be topped up if necessary from an on-site bore during summer. It is not intended, as part of the development proposal, to change or alter the natural inflow from the lake's local catchment into and through the lake. Water from the Onkaparinga River can also enter the lake during 1 in 100 year (and larger) flood events.

4.3 Priority 2 Area

The lake is within 100m of the Onkaparinga River, and in the EPA Priority Zone P2 zone which required that any development of this site will need to demonstrate benefit or negligible adverse effect.

Figure 4-1 Silver Lake as a Priority 2 Zone Area



The Onkaparinga River is the second major river within the Adelaide metropolitan area, and is a source of fresh water for Adelaide. Mount Bold Reservoir was constructed between 1932 and 1938 along a section of



its path approximately 20 kilometres (12 miles) inland. Much of its flow is diverted via a tunnel from the Clarendon Weir to the Happy Valley Reservoir, that in turn supplies some 40 per cent of Adelaide's water supply.

4.4 Ecosystem Type

The ecosystem is considered to be a 'slightly to moderately disturbed' as it includes rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism. The three recognised ecosystem types are:

- High conservation/ecological value systems — effectively unmodified or other highly-valued ecosystems, typically (but not always) occurring in national parks, conservation reserves or in remote and/or inaccessible locations;
- Slightly to moderately disturbed systems — ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. The biological communities remain in a healthy condition and ecosystem integrity is largely retained; and
- Highly disturbed systems. These are measurably degraded ecosystems of lower ecological value e.g. shipping ports and sections of harbours serving coastal cities, urban streams receiving road and stormwater runoff, or rural streams receiving runoff from intensive horticulture.



5 SAMPLING AND TESTING

Water and sediment samples were collected in the lake from a dinghy, generally in three locations, as indicated in Appendix I. In addition, field measurements of temperature (T) and Dissolved Oxygen (DO) were taken using a YSI85 meter, calibrated to 300m AHD. Sediment samples were retrieved using a piston tube sampler with extension handle to reach the lake floor in approximately 4m to 6m depth of water. Ambient air temperature on the day of sampling (30/08/2019) was recorded as 19.3°C, with no wind present.

Sediment samples were bagged and sent to ALS Laboratory for testing of two separate suites; EPA Waste Fill (P15/1 contamination suite), and NEPM metals and inorganics (W3 NEPM suite). Water samples were bottled and delivered to ALS for testing analytes and major ions (NT14 suite). The water bore was purged for approximately 3 hours (2L/min), and a grab sample then taken and tested for N14 suite constituents.

5.1 Lake water quality

The results of field testing are presented in Table 5-1.. Temperature was taken at increasing depths to determine whether stratification was evident. DO was tested to determine whether anoxic conditions were present at depth, and to determine the relative health to sustain aquatic ecology. Water sampling locations are included in Appendix H.

Table 5-1 Field test measurements

Sample location	Temperature at depths mbWL (°C)					DO (mg/l) at depths mbWL		Depth of water to lake floor (m)	Approx. depth of water (m)
	0.3m	0.6m	0.9m	1.5m	3.0m	0.9m	3.0m	NEPM	
A	11.7	10.5	10.1	9.7	9.5	1.38	1.9	5.5	4.5
B	11.3	9.7	9.5	9.3	9.3	1.32	1.42	5.2	5
C	11.4	10.8	10.1	9.8	9.6	2.71	2.7	3.8	3.8

The temperature remained relatively constant through the water column indicating a minor degree of stratification. Some temperature increase on the surface would be expected as ambient temperature increases (i.e. in summer, when stratification could worsen). The DO recorded is relatively low, and further testing is recommended. Additional aeration should be considered for stocking fish. Indicative fish species and recommended conditions for sustenance is provided in Appendix J. Water quality test results are provided in Table 5-2.

Table 5-2 Lake/Bore water quality results

Analyte grouping/Analyte	Units	LOR	Wa	Wb	Wb3	Bore
pH Value	pH Unit	0.01	6.96	6.94	6.85	9.19
Sodium Adsorption Ratio (SAR)		0.01	5.24	5.29	5.24	3.83
Electrical Conductivity @ 25°C	µS/cm	1	767	778	788	652
Total Dissolved Solids (Calc.)	mg/L	1	498	506	512	424
Total Hardness as CaCO ₃	mg/L	1	70	70	70	82
Hydroxide Alkalinity as CaCO ₃	mg/L	1	<1	<1	<1	<1



Analyte grouping/Analyte	Units	LOR	Wa	Wb	Wb3	Bore
Carbonate Alkalinity as CaCO ₃	mg/L	1	<1	<1	<1	28
Bicarbonate Alkalinity as CaCO ₃	mg/L	1	59	60	57	86
Total Alkalinity as CaCO ₃	mg/L	1	59	60	57	114
Sulfate as SO ₄ - Turbidimetric	mg/L	1	5	6	5	<1
Chloride	mg/L	1	202	227	203	137
Calcium	mg/L	1	10	10	10	5
Magnesium	mg/L	1	11	11	11	17
Sodium	mg/L	1	101	102	101	80
Potassium	mg/L	1	7	7	7	5
Fluoride	mg/L	0.1	0.2	0.2	0.2	0.3
Ammonia as N	mg/L	0.01	0.16	0.16	0.15	1.05
Nitrite as N	mg/L	0.01	0.01	0.01	0.01	<0.01
Nitrate as N	mg/L	0.01	0.03	0.03	0.03	<0.01
Nitrite + Nitrate as N	mg/L	0.01	0.04	0.04	0.04	<0.01
Total Kjeldahl Nitrogen as N	mg/L	0.1	1.3	1.7	1	1.3
Total Nitrogen as N	mg/L	0.1	1.3	1.7	1	1.3
Total Phosphorus as P	mg/L	0.01	0.13	0.15	0.06	0.05
Reactive Phosphorus as P	mg/L	0.01	<0.01	<0.01	<0.01	0.02
Total Anions	meq/L	0.01	6.98	7.73	6.97	6.14
Total Cations	meq/L	0.01	5.98	6.02	5.98	5.26
Ionic Balance	%	0.01	7.75	12.4	7.67	7.77

Highlighted cells in Table 5-2 represent elevated concentrations, with comments as follows:

- pH: Bore water is moderately alkaline. May cause calcium precipitation (i.e. >ESP);
- Sodium Adsorption Ratio (SAR): Between 3 to 6 - medium risk to soil structure and penetration on clayey soils (EC_w is < 1.5);
- Total Alkalinity: (>90 mg/L) - moderate risk of increasing sodicity;
- Chloride: (>175mg/L) - may affect citrus/ ornamentals if overhead irrigated.

The water quality profile of bore water is like lake water indicating there may be a connection between sources.

5.2 Lake sediment quality

5.2.1 NEPM sediment testing

Water Technology undertook a contamination assessment for the site based on soil samples collected and analysed. The analytical results from this investigation were compared against National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). The W3 NEPM suite classifies sediments



for metal contamination (due to its history as a mining site) and suitability for spreading as waste on the site. The results of the NEPM testing is provided in Table 5-3.

TABLE 5-3 SEDIMENT TEST RESULTS

Analyte grouping/Analyte	Units	LOR	Sa2	Sb2	Sc2
Moisture Content	%	1	21.7	29.6	35.8
Arsenic	mg/kg	5	<5	<5	8
Barium	mg/kg	10	50	50	40
Beryllium	mg/kg	1	<1	<1	<1
Boron	mg/kg	50	----	----	----
Cadmium	mg/kg	1	<1	<1	<1
Chromium	mg/kg	2	8	13	23
Cobalt	mg/kg	2	<2	2	3
Copper	mg/kg	5	8	22	99
Iron	mg/kg	50	8510	13500	22200
Lead	mg/kg	5	8	83	172
Manganese	mg/kg	5	50	35	73
Nickel	mg/kg	2	3	5	8
Selenium	mg/kg	5	----	----	----
Silver	mg/kg	2	<2	<2	<2
Zinc	mg/kg	5	6	14	43
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1
Hexavalent Chromium	mg/kg	0.5	<0.5	<0.5	<0.5
Total Cyanide	mg/kg	1	<1	<1	<1
Total Polychlorinated biphenyls (PCB)	mg/kg	0.1	<0.1	<0.1	<0.1
Organochlorine Pesticides (OC)	mg/kg	Below LOR			
Phenolic Compounds	mg/kg	Below LOR			
Polynuclear Aromatic Hydrocarbons	mg/kg	Below LOR			
Total Petroleum Hydrocarbons	mg/kg	Below LOR			
Total Recoverable Hydrocarbons - NEPM 2013 Fractions	mg/kg	Below LOR			
EP080: BTEXN	mg/kg	Below LOR			



A/NZ Guidelines for Fresh and Marine Water Quality provide Recommended Default Guideline values (DGV) for toxicants in sediment. Highlighted cells in Table 5-3 indicate high GV's; indicated by the GV range as follows:

- Lead 50 - 220 mg/kg
- Copper 65 – 270 mg/kg.
- All other values are below threshold values.

5.2.2 EPA Waste Derived Fill

The P15/1 testing is an EPA recognised method for classifying the level of contamination and treatment required should the lake sediment be dredged and removed from site. ALS provide a comparison of reported results against limit thresholds for the 'Waste Derived Fill', 'Intermediate Waste', and 'Low Level Contaminated Waste' Categories per Tables 1&2 of SA EPA Publication '4771346 Current Waste Criteria 2010'.

The results indicate that for all samples reported are below the upper threshold limits for Waste Derived Fill Material. The results of testing indicate the sediment may be suitable for use on site such as spreading, or removed from site as clean fill. A programme of testing would still be required under the Waste Derived Fill for any material removed from site, but the results of these tests do not indicate that there would be problems with contaminated fill.

The full ALS report is provided in Appendix I.



6 WATER BALANCE

6.1 Water Balance Objectives

Understanding the site water balance is strategic to developing management strategies to support the proposed development and quantify the size of the development that can be supported by the site. A water balance model was developed to understand the following:

- The different water sources and the percentage /reliability of each source;
- The daily water flows variability of catchment runoff into Silver Lake;
- The variability of water levels in Silver lake, throughout the different months of the year;
- The season variability and availability of storm water runoff from existing properties and proposed developments for drinking and domestic purposes;
- The season variability and availability of stormwater runoff for irrigation of fruit and vegetables;
- The water circulation from Silver Lake to the proposed wetland incorporated into the project and from the wetland back to Silver Lake;
- The variability of water levels in the proposed wetland; and
- The season variability and availability of stormwater runoff.

The model used dynamic calculations, meaning the water volumes were modelled based on time series of inflows from the catchments, direct rainfall; outflow, evaporation, exfiltration to groundwater and domestic and agricultural use. Each time step, (daily) is increased by the inflow coming into the system and reduced by the outflows the water balance model was over 21-years between 1 January 1997 and 31 December 2017.

Equation 1 $\Delta Volume = Catchment Inflow + Direct Rainfall - Overflow - Evaporation - Exfiltration - Consumption$

6.2 Domestic Use

6.2.1 Domestic Use Supply and Consumption

The water source for domestic supply is harvested rooftop runoff:

- Average Annual Demand: 810 m³/year
- Average Annual Supply: 1300 m³/year

On an average annual basis, runoff from rooftop exceeds the annual domestic demand, however, detailed design to optimal storage size as well as, distribution between rooftops and dwelling is recommended.

Table 6-1: Domestic Water Use

Source	Annual Use [m ³ /year]
B&B	530
Conference Centre	24
Managers Dwelling	220
Aquaculture	40



Table 6-2 Annual Roof Top Runoff

Source	Annual Runoff [m ³ /year]	Area of roof top (m ²)
Shed 1	125	200
Shed 2	125	200
Shed 3	75	150
Managers Dwelling	300	450
B&B/Conference Centre	300	450

6.2.2 Domestic Use Design Parameters and Methodology

- Daily and annual runoff rates from the roof tops were modelled using MUSIC software with the area of the roof top used as catchments as detailed in Table 6-2.
- Manager's residence will have a water consumption of 100 L/P/d
- Water consumption for residents staying overnight in the B&B is assumed to be 120L/p/d.
- Water consumption in the conference centre is assumed to be 40 L/p/d

6.3 Silver Lake and Wetland System

6.3.1 Silver Lake and Wetlands Supply and Consumption

The wetlands will be used to treat water catchment runoff water and water reticulated from Silver Lake to the wetlands, with the treated water either being returned to Silver Lake, or used to for the small aquaponics system. An estimated 430 m³ /day will be pumped from the lake to the wetlands to provide adequate turn over to the wetlands and to maintain permanent water in the wetlands (of at least 1200 m³), and an equivalent volume returned to the lake (effectively forming a closed circulation system between the lake and the wetland).

Table 6-3: Annual Catchment Runoff to the Silver Lake and Wetlands

Source	Annual Supply [m ³ /year]
Southern Catchment Runoff	24,300
Silver Lake Evaporation & Exfiltration losses	14,500
North Catchment Runoff	11,000
Wetland Evaporation & Exfiltration Losses	4,600

6.3.2 Design Parameters and Methodology

The assumed design parameters used with calculating the water balance are:

6.3.2.1 General

- Evaporation rates were constant for every day of the month for each month; based on monthly evaporation rates from BoM climatic maps

6.3.2.2 Silver Lake

- Inflow volumes from the catchment were modelled using MUSIC software, the input of rainfall was from data measured at the Onkaparinga River at Houlgrave station;(Gauge Station A5030504);



- The area of the catchment directly upstream of the lake is 15 ha, and is assumed to comprise of 10 % impervious surface and 90 % pervious surface; after development;
- The volume of Silver Lake is 40,000 m³ when full;
- The slopes of the lake's edge are assumed to be 1:2;
- Silver Lake is assumed to start completely full for the purposes of running the model;
- The rainfall threshold in the catchment was assumed at 2 mm/day; and
- It was assumed that evaporation rates changed each month and were constant throughout the month.

6.3.2.3 Wetlands

- Inflow volumes from the catchment were modelled using MUSIC software, the input of rainfall was from data measured at the Onkaparinga River at Houlgrave station; (Gauge Station No. A5030504);
- The area of the catchment up-stream of the wetland is 8.9 ha;
- The catchment was estimated to comprise 2 % impervious surface and 98% pervious surface;
- Silver Lake is assumed to start completely full for the purposes of running the model;
- Evaporation rates were constant for every day of the month for each month; based on monthly evaporation rates from BoM climatic maps;
- On average 430 m³/ day of water will be reticulated from the lake to the wetlands, and an equivalent amount returned to the lake from the wetlands;
- The wetlands will be maintained at a full capacity through the year. Hence pumping from the lake to the wetlands; and
- Flows through the wetland in excess of the capacity of the return pipe to the Lake would spill from the wetland and flow to the roadside swale, as is currently the case, but now with the benefit of treatment.

6.3.2.4 Irrigation

- Irrigation could be from wastewater and "topped up" with rainwater
- Irrigation Demand: 2000 m³ /year

Table 6-4: Estimated Supply and Demand

Use	Source	Supply [m ³ /year]	Demand [m ³ /year]	Supply meets the Demand [Y/N]
Domestic Use and Aquaculture	Roof top Runoff	925	810	Y
Silver Lake	South Catchment Runoff	24,300	14,500	Y
Wetland	North Catchment Runoff	11,000	4,600	Y
Irrigation	Treated wastewater	814	2,000	N
Contingency for Fire Safety	Bore Water	-	22	Y



7 WATER TREATMENT

7.1 Domestic Wastewater Treatment

Wastewater treatment parameters for the development can be derived from the *Department of Health Onsite Wastewater Management Code 2013*. The code provides design flow and organic loads for a variety of activities, from which treatment capacity and wastewater disposal systems can be designed. Typical Water Quality Criteria have been included in Appendix C, with further non-drinking quality criteria in Appendix D.

The proposed wastewater design parameters for Silver Lake development are provided in the following Table 7.1, and these will be confirmed during design of the system.

TABLE 7-1 WASTEWATER DESIGN PARAMETERS

Silver Lake - facility	B&B	Residence	Function Centre
DHA - Onsite Wastewater Systems Code - Appendix E. Description of activity generating wastewater/ parameters	Accommodation	Residence	Restaurant
S – Sludge rate (person/year)	48	80	35
Y - Desludging frequency	4	4	4
P1 - Average daily number over a 7-day period	7	6	6
P2 - Highest daily number over a 7-day period	14	6	40
DF - Daily flow (litres/person/day)	100	125	20
BOD ₅ - (g/pers/day)	40	50	20
Hydraulic Design Load (P2 x DF)	1400	750	800
BOD ₅ - (g/day)	560	300	800
Primary treatment capacity required: (S x Y x P1) + (P2 x DF)	2744	2670	1600
Total Hydraulic Load	2950 L/day		
Total BOD₅	1660 g BOD/ day		
Total septic treatment capacity	7014 L		
Sludge/scum accumulation	1016 L/year		
Design Loading Rate (DLR)/ Design Irrigation Rate (DIR)	DLR:10 mm/day; DIR:4mm/d - assessed from soils		
Dispersal zone basal area	295 m ²		
LPED irrigation area (m²)	738 m ²		

The soil infiltration rate has been assessed as 10mm/day for wastewater discharged in a subsurface trench system, and 4 mm/day for irrigation. The required disposal area required for the hydraulic load for each was calculated to be 295 m² and 738 m², respectively. Note that daily flows are based on design flows and not predicted use.

There is an existing Ri-Treatment facility of 4250L capacity for the existing dwelling, which has a capacity for up to 9 people if used for B&B accommodation (BOD capacity of 400g/d). The existing disposal irrigation is in a fenced paddock area on north side of entry. Relocation of the existing irrigation area should be considered to the north west side (north of existing channel), above the 100 year flood line.



7.2 Required Level of Treatment for Development

7.2.1 Domestic Wastewater

It is intended that all wastewater generated by the dwellings (existing and proposed) will be treated on-site in either separate or combined treatment systems, and the treated wastewater disposed of in areas above the extent of the 1 in 100 year ARI flood zone. Location of disposal to be determined following wastewater design and reporting.

7.2.2 Aquaponics

The proposed aquaponics/hydroponic system is intended to be a closed system, with the waste water from the fish tanks circulated to and through the hydroponic growing beds, where the pollutants will be removed by filtering through the growing medium and by the plants, and the cleaned water circulated back through the fish tanks. Any excess wastewater not contained within the system will be pumped into the wetland system for treatment and removal of pollutants.

7.2.3 Fowl

Any wastewater generated by the fowl breeding and growing facility (e.g., cleaning of troughs) will be treated by the wetland system.

7.2.4 Irrigation

The use of reclaimed water for hydroponics or food chain aquaculture is not specifically covered by the South Australian Reclaimed Water Guidelines. The minimum treatment for reclaimed water is primary sedimentation or an equivalent process for removal of solids, plus a stabilisation process such as lagooning or full secondary treatment.

7.2.5 Required Treatment Classes

Figure 7-1 is an extract from the South Australian Recycled Water Guidelines, and shows indicative minimum treatment required for various uses of recycled water. Additional treatment may be required if recycled water, other than rainwater, was to be used.



Figure 7-1 - Extract from the South Australian Recycled Water Guidelines

Indicative log removal (V, P, B) [‡]	Microbiological criteria [†] : <i>E. Coli</i> (median org/100mL)	Typical Treatment Process Train	Scheme Class/type
Dual reticulation	<1	Full secondary treatment plus tertiary filtration plus disinfection	Class A
Unrestricted municipal irrigation	< 10	Full secondary treatment plus tertiary filtration plus disinfection	Class A
Municipal use with restricted access and application	< 100	Full secondary plus disinfection	Class B
Municipal use, with enhanced restrictions on access and application	< 1000	Primary sedimentation plus lagooning, or Full secondary (disinfection if required to meet microbiological criteria)	Class C
Landscape irrigation	< 1000	Secondary treatment or primary treatment with lagoon detention	Class C
Non-food crops e.g. trees, turf, woodlots	< 10000	Primary sedimentation plus lagooning, or Full secondary	Class D

[†] Specific removal of viruses, protozoa and/or helminths will be required in addition to bacteria

[‡] V: Virus, P: Protozoa, B: Bacteria

Class A reclaimed water can be used for defined non-potable residential use including: • garden watering • toilet flushing • car washing • path/wall washing. The potential for exposure is high and only Class A reclaimed water can be used.

Figure 7-2 is an extract from the South Australian Reclaimed Water Guidelines and shows irrigation requirements for specific food crops. When designing the wastewater treatment requirements, the crop to be irrigated should be considered so that adequate treatment can be provided for safe irrigation.



Figure 7-2 Extract from the South Australian Reclaimed Water Guidelines

Type of crop	Application method	Harvesting controls	Reclaimed water
Large surface area grown on or near the ground and consumed raw (eg broccoli, cabbage, cauliflower, celery, lettuce)	Spray, flood	None	Class A
	Drip, furrow	None	Class B
	Subsurface	None	Class C
Root crops consumed raw (eg carrots, onions)	Spray, drip, flood, furrow	None	Class A
	Subsurface	Crop surface dry at harvest	Class B
Crops without ground contact (eg tomatoes, peas, beans, capsicums, non-citrus orchard fruit, non-wine grapes)	Spray	None	Class A
	Flood	Dropped produce not to be harvested	Class B
	Drip, furrow	Dropped produce not to be harvested	Class C
	Subsurface	None	Class D
Crops without ground contact and skin that is removed before consumption (eg citrus, nuts)	Spray	Produce should not be wet from irrigation with reclaimed water when harvested	Class B
	Flood	Dropped citrus not to be harvested	Class C
	Drip, furrow, subsurface	None	Class D
Crops with ground contact and skin that is removed before consumption (eg melons)	Spray	Produce should not be wet from irrigation with reclaimed water when harvested	Class B
	Drip, flood, furrow	Produce should not be wet from irrigation with reclaimed water when harvested	Class C
	Subsurface	None	Class D
Root crops processed before consumption (eg potatoes and beetroot)	Spray, drip, flood, furrow, subsurface	None	Class C
Surface crops processed before consumption (eg brussel sprouts, pumpkins, cereals, grapes for wine making)	Spray, drip, flood, furrow	None	Class C
	Subsurface	None	Class D
Crops not for human consumption Silviculture, turf growing	Any	Withholding period of 4 hours or until ground dry before public access	Class D
Irrigation of pasture and fodder for dairy animals	Any	Withholding period of 4 hours before pasture used for dairy animals; alternatively dry or ensile fodder before use	Class B
		Withholding period of 5 days before pasture used for dairy animals; alternatively dry or ensile fodder before use	Class C
Irrigation of pasture and fodder for non-dairy animals	Any	Withholding period of 4 hours before pasture used for non-dairy animals; alternatively dry or ensile fodder before use	Class C



7.3 Lake System

It is intended that water in the lake will be circulated by pumping to and through the proposed wetland, and returned to the lake. It is understood that the water quality of the lake is good, except for some tannin discoloration from leaf litter dropped by the surrounding red gum trees. Given the relative volumes of the lake and the proposed wetland, the turnover of the lake water through the wetland will be quite low, but should still provide further improvement in the lake water quality overall. Test results have been included in Appendix I.



8 SURFACE WATER

8.1 Regional Flooding

The property is close to the Onkaparinga River and much of it is subject to flooding during the 1 in 100 year ARI flood from the river, and to very limited flooding during the 1 in 10 year ARI flood event. Present knowledge of the extent of flooding and resultant water levels is based on a plan provided by Adelaide Hills Council (showing extent of inundation but no water levels), and the interpretation of this onto the detailed site survey plan prepared for the project, which is included in Appendix A. Flood maps from WaterConnect are given in Appendix E, and show a similar flood outline for the 1 in 100 year boundary.

As the lake is subject to flooding from the nearby Onkaparinga River during severe flooding events, this increases that risk that any fish in the lake can escape during these extreme flood events. It should be noted that fish can escape from the lake during any overflow event of the lake, not just from/during flood events that could flood the lake.

8.2 Surface Water (Inflow and Drainage)

The property receives surface water from the catchment runoff. The catchment is mostly south of the property. Water spills into the lake via the west, via a catchment of around 15 ha. In addition, the property receives water via direct rainfall, with an average annual rainfall of 740 mm.

The development of the property will increase the total impervious area of the property by 2 % from 8 % to 10 %, and the runoff source can be divided into two categories:

- Surface water runoff from the roof tops, (Aquaponics, managers dwelling, etc) expected to be harvested as domestic drinking water, (under the conditions of the South Australian Natural Resources Management Act 2004).
- Runoff from the carparks and driveways which is not planned to be harvested

The expansion in impervious area on the property will increase the peak daily runoff by a small amount, $7170 \frac{\text{m}^3}{\text{day}}$ to $7230 \frac{\text{m}^3}{\text{day}}$ (an increase of 60m^3), less than 1 % increase in peak runoff. The additional runoff, with appropriate management can be diverted to Silverlake and the Wetlands, which both have sufficient detention storage capacity.

- The additional impervious areas are
 - Private access and parking for new dwelling, 810 m^2 ;
 - Private access and parking for managers property, $1,295 \text{ m}^2$;
 - Parking and access for aquaponics shed: 170 m^2 ; and

The roof tops areas and runoff are detailed in Table 6-2.

- On average 1300 m^3 /year of additional runoff will be created

8.3 Mitigating flood risk

The proposed developments at the property are outside of the 1 in 100 year ARI flood zone, and any proposed treatment areas will be sited outside of the 1 in 100 year ARI flood envelope.



8.4 Increased Surface Water

The increase in surface water can be managed through the design of the wetland to attenuate the volume of water being discharged from the property, and the use of oil and petrol interceptors can manage any increased risk of contamination from temporarily increased parking at the site during events.



9 GROUNDWATER

9.1 Context

The site is located within the Western Mount Lofty Ranges Prescribed Water Resources Area (WMLR PWRA) within the Adelaide and Mount Lofty Ranges Natural Resources Management Region. The WMLR PWRA is a regional scale resource for which groundwater, surface water and watercourse water are prescribed under South Australia's Natural Resources Management Act 2004. A water allocation plan (WAP) provides for the sustainable use of the water resource.

9.2 Regional hydrogeology

Groundwater flow in the WMLR generally follows topography, flowing from higher points in the landscape towards lower areas where typically it discharges into rivers and streams (DEW, 2018). Within the vicinity of Silver Lake, groundwater is interpreted to flow from the topographic highs in the south and west towards the Onkaparinga River to the east. This is supported by the available groundwater elevation data illustrated in Figure 9-1.

Groundwater salinities in the area surrounding Silver Lake are generally low ranging from 111 to 6,638 $\mu\text{S}/\text{cm}$, with a median of 705 $\mu\text{S}/\text{cm}$ based on the wells presented in Figure 9-2. Most wells exhibit salinity values of less than 1,200 $\mu\text{S}/\text{cm}$ to the north, west, and south of Silver Lake, largely correlated to the Aldgate Sandstone and undifferentiated Tertiary and Quaternary host rocks. Whereas, wells located east of Silver Lake exhibit moderate EC values, many falling into the 3,000 to 7000 $\mu\text{S}/\text{cm}$ range, largely correlated to the Woolshed Flat Shale and Muldillio Subgroup (Figure 9-2). Groundwater salinities near Silver Lake are generally below 1,200 $\mu\text{S}/\text{cm}$.

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Groundwater yields are variable depending on proximity to water bearing structure such as fractures and faults. Yields range between 0.03 L/s and 31.6 L/s with a median of 1.9 L/s for the wells presented in Figure 9-3. There appears to be a concentration of high yielding wells (greater than 5 L/s) trending east to west approximately 1 km north of Silver Lake. This high yielding trend appears pervasive across undifferentiated Tertiary rocks, Woolshed Flat Shale, Muldillio Subgroup, Aldgate Sandstone, and correlative to a series of northeast trending faults (Figure 9-3). Closer to Silver Lake, yields are generally lower in the order of 1 L/s.

9.3 Site characteristics

The existing Silver Lake is reported to have been excavated by hand in the early 1900's during alluvial gold mining operations. It was reported that the shaft diggings had to be discontinued because of the occurrence and inflow of groundwater (Manowski, 1968), suggesting that the diggings were excavated below the water table. Based on these observations, it is likely that Silver Lake now represents a surface expression of the shallow alluvial aquifer. A historical groundwater Prospecting report from 1968 is included in Appendix F.

The closest groundwater well to Silver Lake (6527-15404) is located approximately 50 m northwest of the lake. This well encountered alluvial clay (0 to 4 m), sand (4 to 8.5 m) and gravel (8.5 to 10 m) to a depth of 10 m underlain by shales to 78 m, with sand reported to be flowing from fractures within the shale in the bottom 4.5 m. The water from well 6527-15404 is sourced from fractures in the lower portion of the well at depths of 73.5 to 77.5 m below groundwater level. The connectivity between the deeper fractured rock aquifer and the shallow alluvial aquifer is not known. A site visit was conducted on 30 August 2019 during which time the water level in the well was observed as being artesian. Groundwater quality testing was also undertaken with the salinity of the well reported to be 424 mg/L (652 $\mu\text{S}/\text{cm}$).

Water from a shallow aquifer/ groundwater is thought to drain into the lake from the west, whilst surface water outflow from the lake is currently via an existing road culvert. During summer, when rainfall and runoff inputs are low, it is possible that the lake is acting as a local discharge point whilst during winter, when rainfall and



runoff inputs are higher, recharge to the alluvial aquifer may occur. There is currently a lack of water level and water quality data to confirm this hypothesis.

9.4 Further investigation

Additional groundwater wells in the shallow alluvial aquifer would be required to better understand the connectivity between Silver Lake and the groundwater system. A well east and west of the Lake would allow the hydraulic gradient to be established and would allow for groundwater quality sampling to be conducted to assess groundwater-surface water connectivity. Quarterly groundwater level monitoring and quality testing would allow for seasonal changes to be assessed.

The need for further investigation should be driven by the outcomes of a future risk assessment. Where residual risks to groundwater are assessed as medium or high, additional investigations may be warranted.

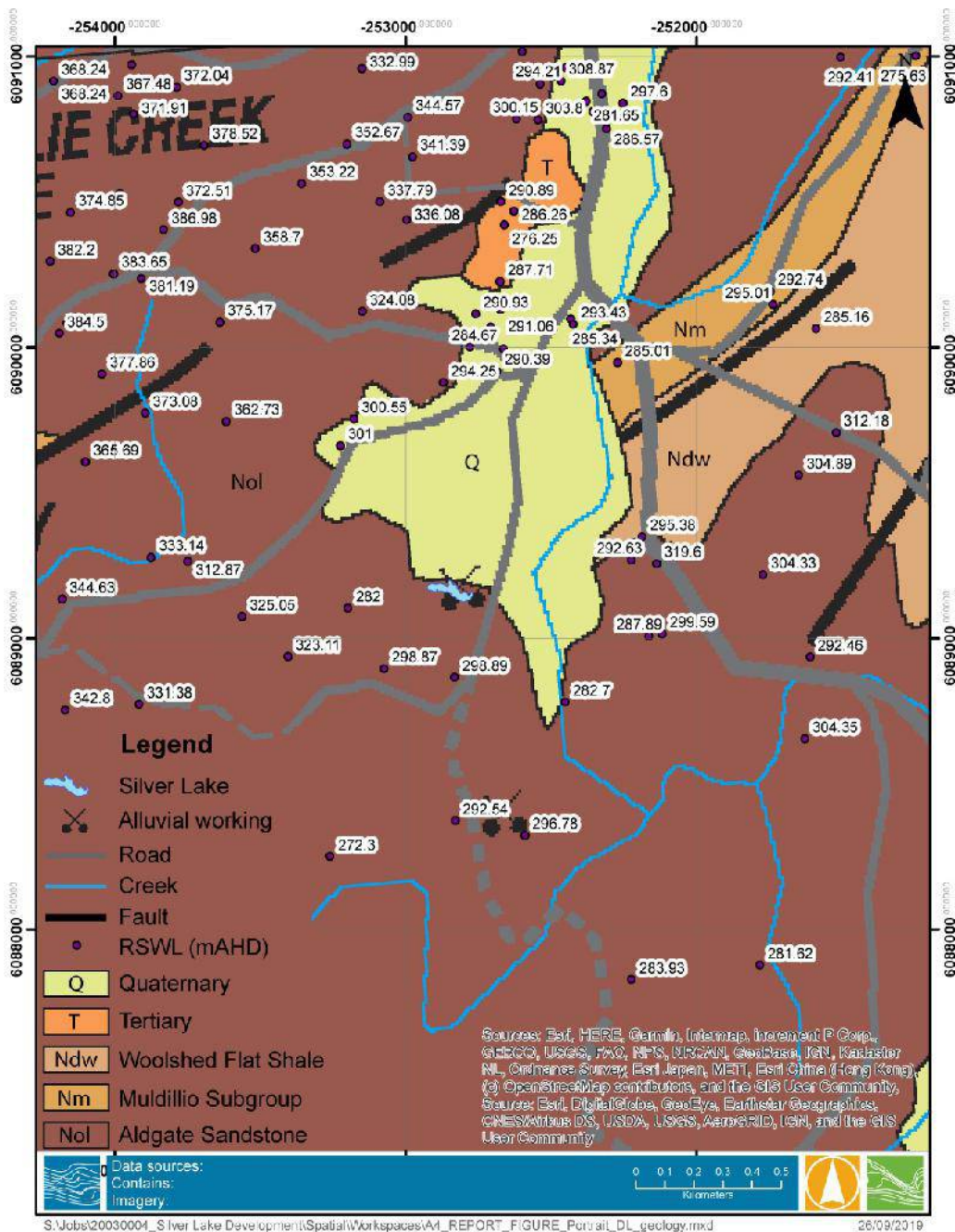


FIGURE 9-1 REGIONAL GROUNDWATER ELEVATION DATA

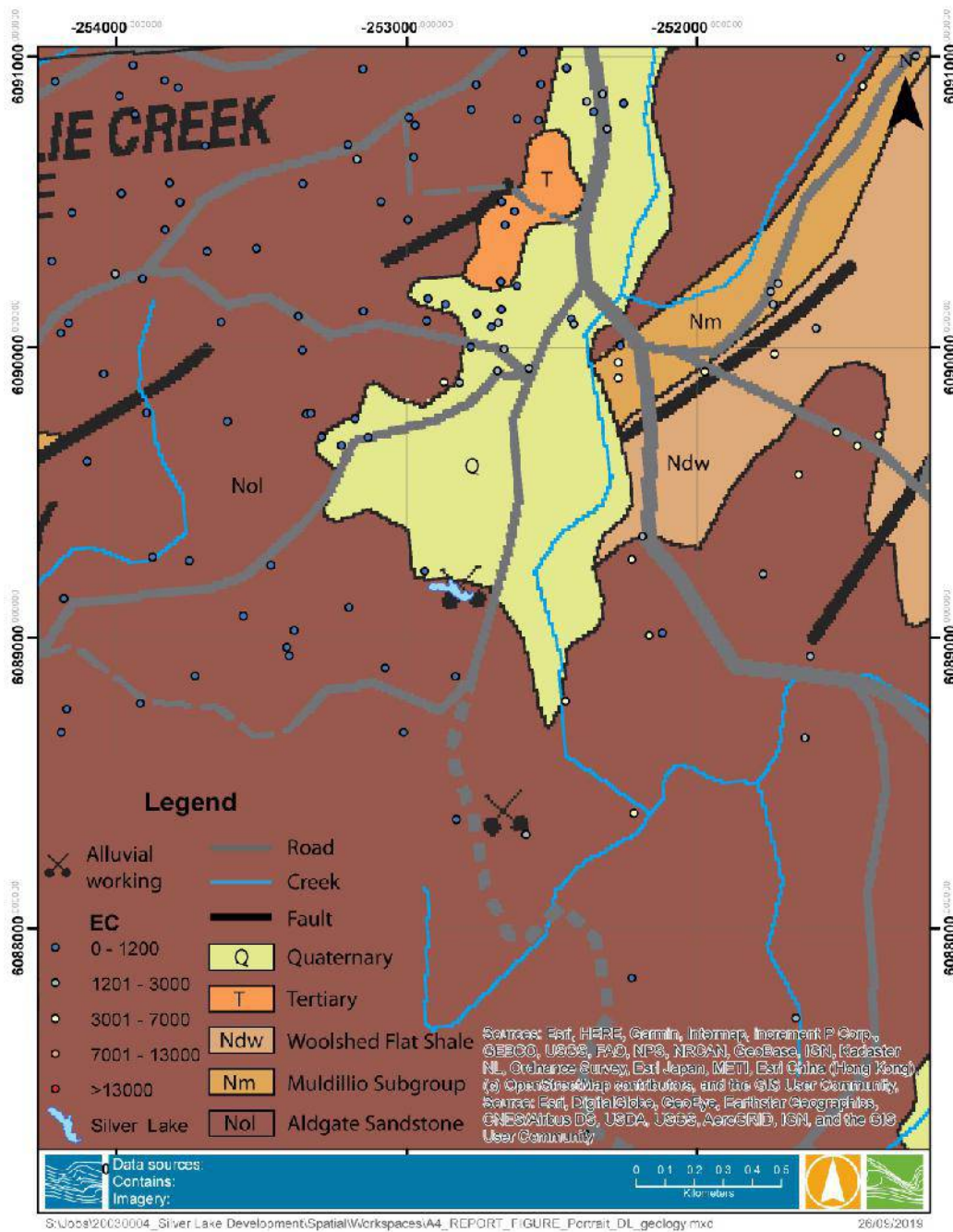


FIGURE 9-2 REGIONAL GROUNDWATER SALINITY DATA

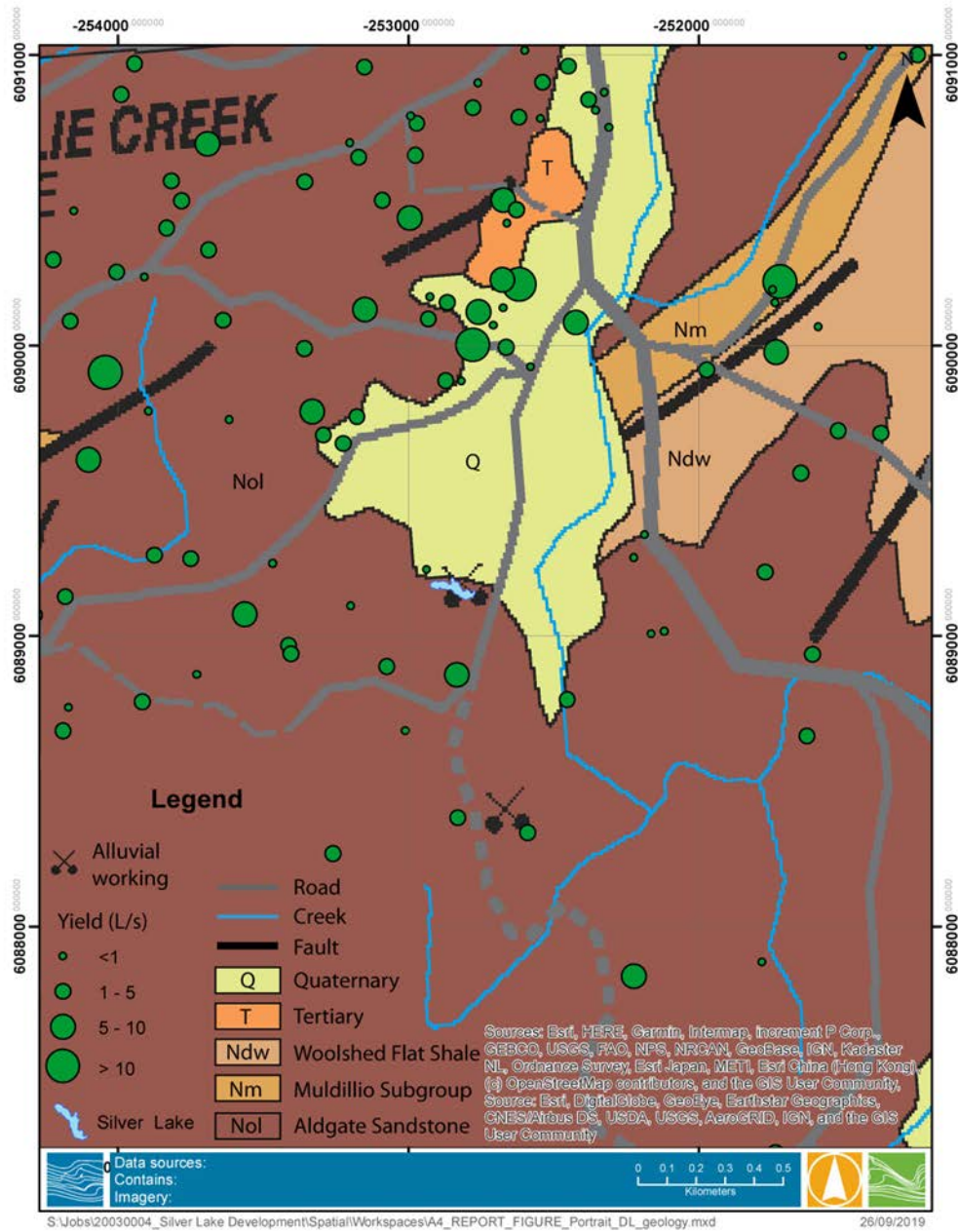


FIGURE 9-3 REGIONAL GROUNDWATER YIELD DATA



10 LAND CAPABILITY

The Land Capability assessment identifies environmental constraints for the development due to increased activity proposed on the site. Existing conditions which contribute to site contamination such as existing animal stock and residential use are considered in the nutrient balance of the overall land. To determine the capacity of the land to assimilate resulting land uses, an investigation of soil capacity has been undertaken based on current and proposed impacts.

10.1 Soil sampling and analysis

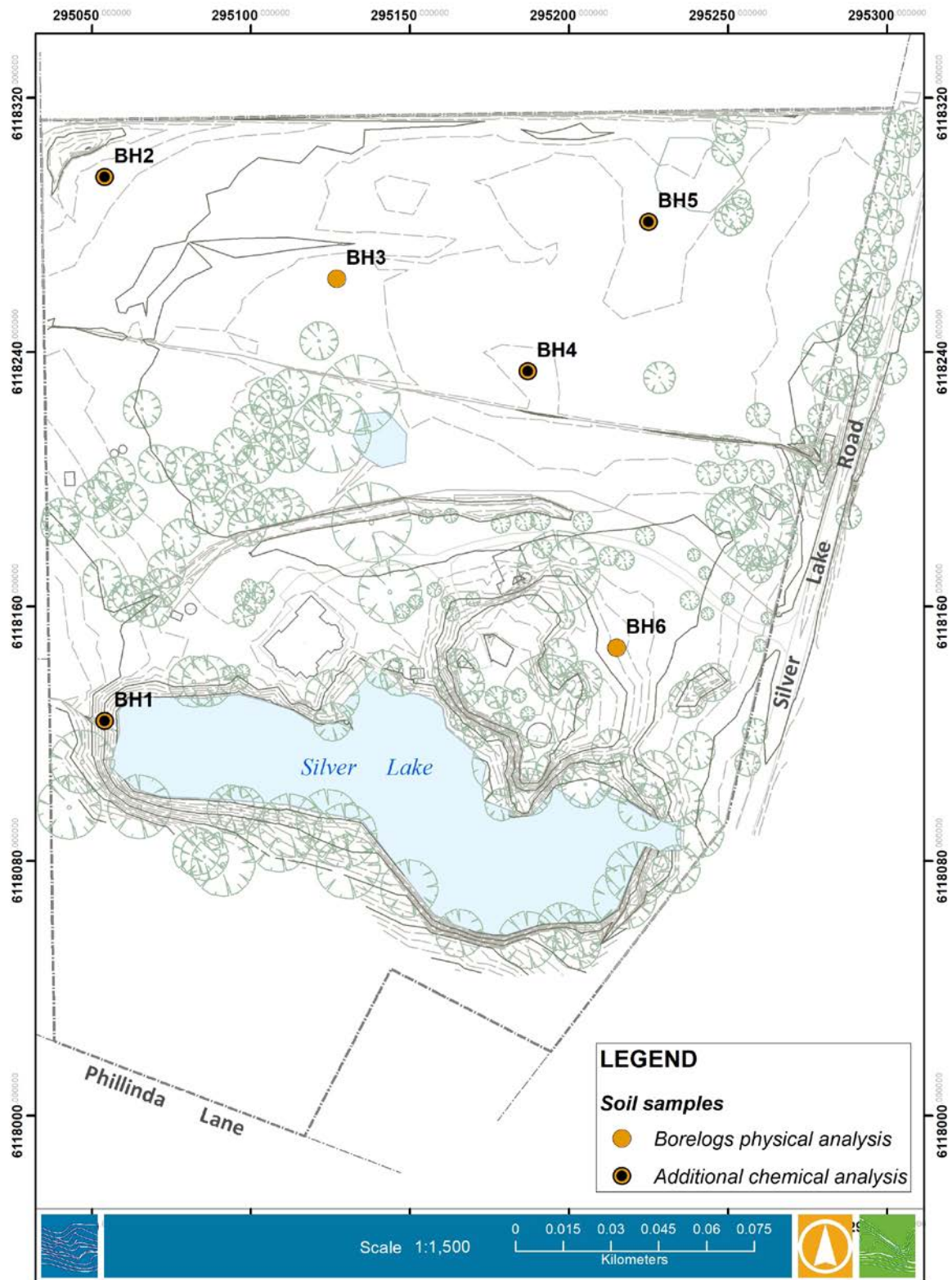
Soil sampling was undertaken on 27/08/2019 in six locations on the property. The locations were selected to:

- Provide a coverage over the key areas proposed for development;
- Identify depth to groundwater in lower lying areas;
- Identify soil types generally and variations across the site; and
- Determine physiochemical characteristics of the surface soils.

Core samples were obtained using portable push-tube equipment. Soils were placed in trays and logged. A portion of soil was removed from the tray and sent to APAL laboratories for further testing of chemical constituency. Bore logs and Waste Disposal Criteria are provided in Appendix L, and the soil sampling locations are in Figure 10-1.



Figure 10-1 Soil Sampling Locations





10.2 Soil physical characteristics

The typical physical characteristics are described in the following Table 10-1.

Table 10-1 Soil physical characteristics

Depth	Description	Saturated conductivity (Ksat) indicative	Clay content	Comment
0 - 0.2m	Gravelly sand	3 x 10 ⁻⁵	<5%	B1 and B6
0 - 0.8m	Clayey sand	2 x 10 ⁻⁵	5-10%	All bores
0.8 - 2.1m	Silty sandy clay	5 x 10 ⁻⁶	25-30%	Target depth B2 - B5
2.1 - 3.0m	Silty sandy clay	1 x 10 ⁻⁷	30-35%	B1 and B6

The results indicate similar soil type and lithography was encountered across most samples. Soil permeability is considered as well drained in the upper approximate 800mm layer with underlying clays draining poorly. The soil can be classified per ASC as loam over brown or dark clay (Group F).

Surface conditions at the time of sampling were moist, with rainfall over the prior two weeks up to 40mm causing boggy conditions. The water table was encountered in boreholes B2 to B5 at approximately 800mm bNGL in B2 to 350mm bNGL in B5, the perched water typically level across the northern paddock draining slowly eastwards towards Silver Lake Road, and filling drainage channels on the north and south side of the paddock.

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B1 was drilled in the embankment of the Lake on the western inlet side to characterise soils for possible future civil work to layback and bench the lake edge. The drill hole located approximately 3 metres from water's edge and approximately 1 metre above water level did not encounter groundwater to depth of core, indicating the soil at least to 2m below the water level on the embankment has a very low infiltration rate. Further geotechnical investigation would be required to inform any future civil works.

10.3 Soil chemistry

Soil samples to 250mm depth were retrieved from B1, B2, B4, and B5 for analysis by APAL Laboratory, results of testing provided in Table 10.1.2.

TABLE 10-2 APAL LABORATORY TEST RESULTS

Sample Depth (mm)	Units	100-300	0-200	0-200	0-200
pH 1:5 water	pH units	8.74	7.1	5.84	6.25
pH CaCl ₂ (following 4A1)	pH units	8.06	6.64	4.94	5.15
Organic Carbon (W&B)	%	0.89	1.46	2.64	0.89
MIR - Aus Soil Texture		Loam	Loamy sand	Silty loam	Loamy sand
Nitrate - N (2M KCl)	mg/kg	<1	<1	<1	<1
Ammonium - N (2M KCl)	mg/kg	<1	1.8	2.5	1.4
Colwell Phosphorus	mg/kg	96	6	16	<5



Sample Depth (mm)	Units	100-300	0-200	0-200	0-200
PBI + Col P		96	64	148	23
KCl Sulfur (S)	mg/kg	35	8	8	3.6
Calcium (Ca) - AmmAc	mg/kg	4160	764	668	201
Magnesium (Mg) - AmmAc	mg/kg	416	142	338	46
Potassium (K) - AmmAc	mg/kg	533	106	140	72
Sodium (Na) - AmmAc	mg/kg	307	45.1	51.4	9.3
Calcium (Ca) - AmmAc	cmol/kg	20.7	3.81	3.33	1
Magnesium (Mg) - AmmAc	cmol/kg	3.42	1.17	2.78	0.378
Potassium (K) - AmmAc	cmol/kg	1.36	0.271	0.357	0.184
Sodium (Na) - AmmAc	cmol/kg	1.34	0.196	0.224	0.04
Ca: Mg Ratio		6.1	3.3	1.2	2.7
K:Mg Ratio		0.4	0.23	0.13	0.49
GTRI		0.06	0.05	0.06	0.13
ECR		10	8.6	8.7	14
Exchangeable acidity	cmol/kg	<0.02	<0.02	0.14	<0.02
Exchangeable aluminium	cmol/kg	<0.02	<0.02	0.08	<0.02
Exchangeable hydrogen	cmol/kg	<0.02	<0.02	0.06	<0.02
ECEC	cmol/kg	26.9	5.45	6.83	1.6
Calcium	%	77.2	70	48.8	62.5
Magnesium	%	12.7	21.4	40.7	23.6
Potassium	%	5.1	5	5.2	11.5
Sodium	%	5	3.6	3.3	2.5
Aluminium	%	0	0	1.2	0
Hydrogen	%	0	0	0.9	0
Salinity EC 1:5	dS/m	0.277	0.143	0.058	0.027
Ece	dS/m	2.6	3.3	0.55	0.63
Boron	mg/kg	3.9	0.54	0.38	0.15
Iron (Fe)	mg/kg	7.7	260	470	92
Manganese (Mn)	mg/kg	6	16	30	3.8
Copper (Cu)	mg/kg	13	1.5	8.9	0.31
Zinc (Zn)	mg/kg	16	2.5	8.2	2.7



B1 sample adjacent the lake was included to identify typical variation to samples collected in the northern paddock, as evidenced by increased ammonium in B2-B5, where cows and alpacas reside. The wet soil conditions also skew readings between samples, particularly in B5; B2, and B4 considered more representative.

10.4 Phosphorus adsorption

Phosphorus leachate in subsurface flows is difficult to quantify in waterlogged conditions and soil hydrology rather than soil sorption capacity may be a better indicator of phosphorus transport. The removal of cows and alpacas would reduce the P load. Consideration in the design of wastewater disposal systems will need to factor in high seasonal groundwater to ensure nutrient load is retained in soil in the ET zone, even elevated in mounds to increase buffer distance to groundwater.

The P sorption in sandy clay loam and clay sands would be a limiting factor in calculating the area required for wastewater and waste application, and therefore has been considered alongside hydraulic load capacity.

Assume a Phosphorus P concentration of 0.5mg/person/day typical for domestic wastewater¹, and P load would be based on proposed number of visitors/ residents generating wastewater. Occupancy rates described previously include 14 guests at the B&B at 50% occupancy, 50 people at monthly functions (assume 30% load), and up to 6 people at the manager's residence. The P load would be as follows:

B&B = 3 mgP /d

Functions = 0.25 mgP /d

Residence = 3 mgP /d.

The following Table 10.3 summarises the area required for wastewater application for sustainable application of phosphorus. The assumption is application over a 50-year period is conservative, and effective depth of adsorption occurs in the top one metre of soil.

Table 10-3 Phosphorus (P) sorption area

#	Item	Value	Note
A	P application rate	2.3 kg P/a	P/d x 365
B	Plant uptake	30 kg/ha	typical
C	Soil bulk density	1400 kg/m ³	estimated
D	Soil P sorption capacity	100 mg/kg	Low PBI/soil structure
E	Soil P sorption	1400 kg/ha	(C x D)
F	Plant uptake (50 years)	1500 kg/ha	(B x 50)
G	Total P capacity (50 years)	2900 kg/ha	(E + F)
H	P application (50 years)	115 kg	(A x 50)
	Application area required	400 m²	(H / G)

An area of 400m² would be recommended for domestic wastewater disposal based on P sorption. As indicated in Table 7.1, 295m² is required for hydraulic loading; the actual area required would be the greater of the two. These recommendations are based on occupancy rate, treatment type and application method and rate. These can be further developed during detailed design to incorporate the parameters used.

¹ Based on 2 kg P/yr for average 4-person household (Environment Canterbury, 2012 – recent NZ data)/ R. Patterson



10.5 Nitrogen budget

Nitrogen has multiple oxidation states depending on soil and ambient conditions. A very brief summary of nitrogen contribution to the nutrient balance is provided in Table 10.1.4.

The assumptions for calculating Total Nitrogen are:

- Average N concentration in domestic wastewater – 80mg N/L;
- Daily design flow per Table 7-1. Existing design flow based on 6EP (750L/d) from existing dwelling;
- Existing cows/alpacas totalled as 15 animals generating manure at 95kg N/animal on approximately 3ha land; assumed cows/alpacas will be removed from site;
- Estimated crop/ turf uptake of 300kg N/ha/yr; and
- N mineralisation/ volatilisation conversion rate of 60%.

TABLE 10-4 TOTAL N BALANCE

N balance	Source	Total N (kg N/ha/year)
Input	Domestic wastewater	2250
Output	N conversion	1430
	Existing wastewater	645
	Animal manure	475
	Crop/ Orchard/ turf	300
Total N credit		300

While the values are general and subject to considerable variation depending on soil conditions and vegetation, the nutrient balance (both N and P) indicates that by removal of cows and establishment of suitable vegetation, the increase in nutrient load through human activity proposed by the development should be manageable on site with no additional impact to the receiving environment.



11 RECOMMENDATIONS

11.1 Risk Workshop

A number of initial risks have been considered, and these are included in Appendix K. A risk workshop could be held with the wider team to discuss and evaluate risks and identify any mitigating measures that may be taken.

11.2 Approvals and Permits

A thorough investigation of required approvals and permits should be undertaken as part of a conceptual design of an urban water harvesting and reuse scheme. This would include consultation with:

- Local council;
- Environment Protection Authority;
- Department of Health;
- SA Water;
- Department for Water; and
- Natural Resources Management Boards.

11.3 Further Work During Design

A number of estimates and assumptions have been made during the preparation of this report, and these should be revisited with the designer following a successful development application. Some of the considerations to be included in the detailed design include:

- The suitability of bore water and opportunities for use such as firefighting;
- The volume of rainwater collected for domestic use, to allow advice to be sought under the relevant guidance whether a licence or other constraints apply for the B&B (as a commercial enterprise), or for aquaculture and fowl etc. A licence will be required for using collected rainwater for irrigation, other than for domestic gardens;
- Confirmation of the predicted water quality and quantity parameters, which were based on identified constraints at this stage, as the final processes, uses and sizes are not yet fully decided
- The requirement for an Irrigation Management Plan, if this is required under South Australian Reclaimed Water Guidelines for use of reclaimed water;
- Establishment of minimum floor levels for any proposed buildings, structures, etc that will be within or close to areas subject to inundation during a 1 in 100 year ARI flood event (as shown in the concept plan);
- Usage patterns for the property, so that appropriately sized rainwater tanks can be provided;
- Determination of appropriate wastewater treatment (size and type), and onsite disposal design for domestic wastewater;
- Required treatment for harvested rainwater for domestic and potable use;
- Quantify aquaculture waste biomass and land capacity for reuse; and
- Consider the use of further mitigating quantities of surface water runoff, which could be seen as an additional benefit, by use of porous paving, green roofs etc.



11.4 Further survey work

Further survey work is not required to complete this assessment, but may be considered appropriate during detailed design. Additional survey work could include:

- Bathymetry to verify lake volume if this is considered to be beneficial
- Where residual risks to groundwater are assessed as medium or high, additional investigations may be warranted.



12 SUMMARY

12.1 Water balance

It is intended that there will be no disposal off-site of any of the wastewater generated from the proposed development – all wastewater will be retained, treated and disposed of on-site above the 1 in 100 year ARI flood line. The only water leaving the property will be that generated by rainfall, as runoff from natural grassed and vegetated land, as overflow from the lake, and possibly from roof runoff in excess of what is captured and stored for on-site uses. It can be demonstrated that the proposed works will, when compared with the existing use, increase wastewater generation in a negligible fashion only.

In addition, initial water balance calculations show that there is sufficient water available to support the development.

12.2 Environmental Impact

The above report demonstrates that water quality impact and wastewater generation impact are within "acceptable" limits or improved.

12.3 Benefits and Opportunities

The following benefits may be realised by implementing this scheme:

- Re-engineering of current land drains –the changes proposed are in alignment only, which will not affect water balance. Benefits may be gained by improving habitat and aesthetics
- Improved lake water quality by providing additional “polishing” treatment and recirculation using the new wetlands
- Increased rainwater storage for domestic use



REFERENCES

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- DEW (2018). Western Mount Lofty Ranges PWRA fractured rock aquifers 2017 Groundwater level and salinity status report, Government of South Australia, Department for Environment and Water, Adelaide. Government of South Australia (2015). *Environment Protection (Water Quality) Policy*. Government of South Australia
- Government of South Australia (2016). *Aquaculture Legislation in South Australia*. Primary Industries and Regions SA (PIRSA)
- Government of South Australia (July 2017). *Guidelines for Non-drinking Water in South Australia, Part 1: Infrastructure*. Office of the Technical Regulator
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- Government of South Australia (April 2013). *On-site Wastewater Systems Code*. Department of Health
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- Government of South Australia (October 2012). *South Australian Recycled Water Guidelines*. Environment Protection Agency
- Government of South Australia (December 2010). *Water Sensitive Urban Design Technical Manual, Greater Adelaide Region – Chapter 5 Rainwater Tanks*. Department of Planning and Local Government
- Government of South Australia (December 2010). *Water Sensitive Urban Design Technical Manual, Greater Adelaide Region – Chapter 8 Urban Water Harvesting and Reuse*. Department of Planning and Local Government
- Manowski, C. (1968) Groundwater prospects, Section 1292, 1386 and 1494 Hd Noarlunga - South Australia. Department of Mines. Report Book, 66/00165
- State Government of Victoria (June 1997). *Code of Practice for Small Wastewater Treatment Plants*. EPA Victoria



APPENDIX A - PROPOSED SITE DEVELOPMENT PLAN





# DATE AMENDMENTS 23.02.23 HANNAFORD		Project SILVER LAKE SITE REGENERATION & DEVELOPMENT SILVER LAKE RD, MYLOR, SA		For RUDY GOMEZ Designer Checked Data DEC 2019 Verify all dimensions on site prior to commencement of work.		Proj. Area SITE Scale 1:1000 (A3) Proj. J Draw. No: 1817 DA201		Drawing PROPOSED SITE & LANDSCAPE PLAN	
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APPENDIX B - LEGISLATION, POLICY AND GUIDELINES RELATING TO NON-DRINKING WATER



Environment Protection Act 1993	General and specific obligations under this legislation apply to the operation of non-drinking water systems.
Environment Protection (Water Quality) Policy 2015	General and specific obligations apply to non-drinking water systems relating to the discharge of water and waste to ensure that no environmental harm occurs.
Livestock Act 1997	Specific obligations under this legislation prohibit the use of contaminated water (with faecal matter) unless to an appropriate quality.
Livestock Regulations 2013	Specific obligations under this legislation prohibit livestock being fed with contaminated stock food (with faecal matter).
Local Government Act 1999	General and specific obligations under this legislation apply to the operation of non-drinking water systems in that the Council's need to provide appropriate services and facilities to meet the present and future needs of the associated local community. In addition, a provision is made in Schedule 1A for the implementation of Stormwater Management Agreement.
Natural Resources Management Act 2004	General and specific obligations under this legislation apply to the management of water, soils, pest animals and plant control. This legislation is applicable to the operation of non-drinking water systems to ensure management in a sustainable and integrated manner, and where the system incorporates or impacts on prescribed watercourses, surface water or groundwater resources.
Plumbers, Gas Fitters and Electricians Act 1995	General and specific obligations under this legislation stipulate who can perform plumbing work. The legislation also includes requirements associated with licensing of contractors and registration of workers.
Plumbers, Gas Fitters and Electricians Regulations 2010	Specific obligations under this legislation include licensing of contractors and registration of workers, including work which is exempt.
South Australian Public Health Act 2011	General and specific obligations under this legislation apply to protecting individuals or communities from risks to public health, including those related to non-drinking water.
South Australian Public Health (Wastewater) Regulations 2013	General and specific obligation under this legislation apply to the operation of recycled water systems; including installation or alteration of collection, treatment of reuse of its recycled water.
Water Industry Act 2012	General and specific obligations under this legislation apply to the installation and operation of non-drinking water systems, including: water demand and supply planning; licensing; price regulation; customer service standards; and technical standards for infrastructure and plumbing installations, including the National Construction Code Volume Three (Plumbing Code of Australia).
Water Industry Regulations 2012	General and specific obligations under this legislation apply to the installation and operation of non-drinking water systems.
Wastewater Overflow Management Code of Practice	The Code of Practice is administered by the Environment Protection Authority, and provides directives and advice on the management of wastewater systems, including non-drinking water systems.
Code of Practice for Aquifer Storage and Recovery	The Code of Practice is administered by the Environment Protection Authority, and provides guidance on the management of managed aquifer recharge schemes including planning, installation and operation.
Code of Practice for Milking Shed Effluent	The Code of Practice is administered by the Environment Protection Authority, and provides advice on the management of wastewater, including non-drinking water, derived from milking activities.
Recycled Water Connections Procedure	This procedure outlines the minimum requirements that must be met in order to allow recycled water connections for irrigation purposes at Department for Education and Child Development (DECD) schools and preschools in South Australia. It identifies key requirements and responsible parties, and sets forth the process that must be followed for schools and preschools to connect to recycled water.

Legislation listed above is available at <http://www.legislation.sa.gov.au/index.aspx>.



APPENDIX C - WATER QUALITY CRITERIA



Table 3.2.2 Water quality issues and recommended biological indicators for different ecosystem types: S = streams and rivers, W = wetlands, L = lakes and M = estuarine/marine. Letters or indicator in italics denote that while the indicator is not presently available, it could be developed relatively quickly with additional resourcing.

Code	Issue	Suitable biological indicator or assessment approach	Protocol ¹	Ecosystem type
1A, B	General inorganic (including metals) and organic contaminants: Early detection of short- or longer-term changes from substances in solution/water column	1A Instream/riverside assays measuring sublethal 'whole-body' responses of invertebrate and/or fish species; 1B Biomarkers (chemical/biochemical changes in an organism) Direct toxicity assessment	1A(i), (ii) 1B(i), (ii) sec 8.3.6 (Vol 2)	S S, W, L, M S, W, L, M
2A, B	General inorganic (including metals) and organic contaminants: Early detection of short- or longer-term changes from substances deposited (sediments)	2A 'Whole-sediment' laboratory toxicity assessment (where sediment tests are available) 2B Bioaccumulation/biomarkers (for organisms that feed through ingestion of sediment); other sublethal incl. behavioural responses where protocols developed	2A, sec 8.3.6 2B(i), (ii)	S, W, L, M S, W, L, M
3	General inorganic (including metals) and organic contaminants: Changes to biodiversity and/or ecosystem processes	Structure of macroinvertebrate and/or fish populations ^{2, 3} /communities ³ using rapid, broad-scale (RBA ⁴) or quantitative (Q) methods Stream community metabolism	3A(i)–(v) 3B	S, W S
4	Suspended solids in the water column	Structure of macroinvertebrate and/or fish populations ² /communities using RBA ⁴ or Q methods Seagrass depth distribution	3A(i)–(v) 6	S M
5	Sedimentation of river bed	As for 4 as well as stream community metabolism	3A(i)–(v), 3B	S
6	Effects of organotins	Imposex in marine gastropods	9	M
7	Salinity: Changes to biodiversity	Structure of macroinvertebrate and/or fish populations ^{2, 3} /communities ³ (RBA ⁴ or Q methods); remote sensing (changes to vegetation structure);	3A(i)–(v), 5	W, S?
8	Herbicide inputs: Changes to biodiversity	Structure of phytoplankton or benthic algal communities; remote sensing (changes to vegetation structure).	4(i), (ii), 5	W, S
9	Nutrient inputs: Early detection of short- or longer-term changes from substances deposited or in solution/water column	Structure and/or biomass of benthic algal or phytoplankton communities Stream community metabolism	4(i)–(iii) 3B	S, W S
10	Nutrient inputs: Changes to biodiversity and/or ecosystem processes	Structure and or biomass of phytoplankton, benthic algal and/or macroinvertebrate populations ² /communities (Q or RBA ⁴) Stream community metabolism	3A(i)–(v), 4(i), (ii) 3B	S, W S
11	Nutrient inputs	11a Seagrass depth distribution 11b Frequency of algal blooms 11c Density of capitellids 11d In-water light climate 11e Filter feeder densities 11f Sediment nutrient status 11g Coral reef trophic status	6 7 8	M M M
12	General effluents (non-specific) and effects of hypoxia	Structure of macroinvertebrate communities (Q or RBA ⁴)	3A(i), (ii)	S, W
13	Broad-scale assessment of ecosystem 'health' (non-specific degradation)	13A Composition of macroinvertebrate communities using RBA methods 13B Habitat distributions 13C Assemblage distributions	3A(i), (ii) M M	S, W M M

1. The codes listed in this column refer to protocols that are listed by title in [Section 8.1.3 of Volume 2](#). Summary descriptions of these protocols, with references to important source documents, are provided in [Appendix 3, Volume 2](#). 2. Populations could serve as biodiversity surrogates if a 'keystone' role could be established for a species. 3. For pesticides, study of non-target organisms. 4. Cautionary notes on use of RBA methods for site-specific assessments are provided in various sections of these Guidelines.

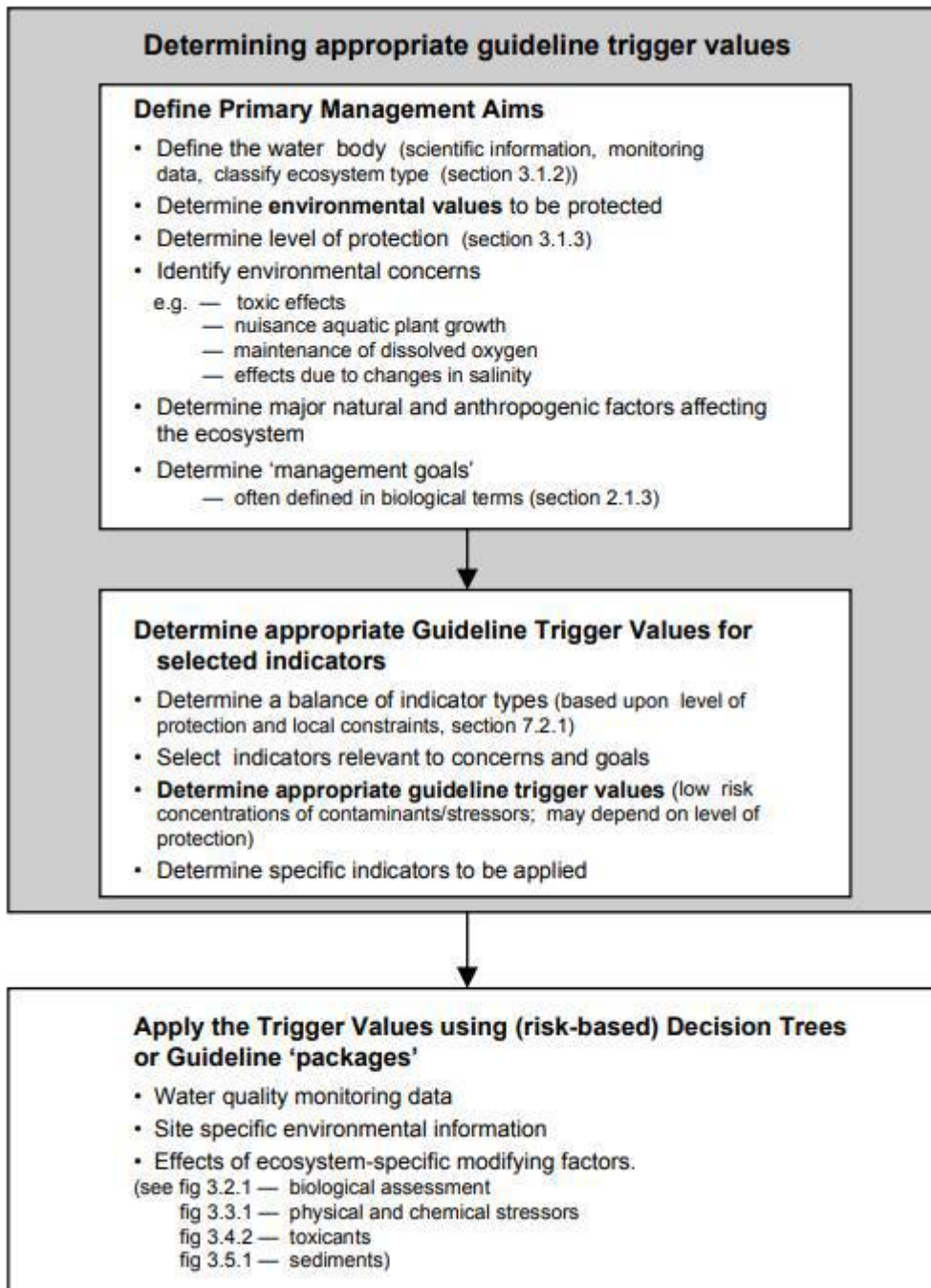


Table 3.3.8 Default trigger values for physical and chemical stressors for south central Australia — low rainfall areas — for slightly disturbed ecosystems. Trigger values are used to assess risk of adverse effects due to nutrients, biodegradable organic matter and pH in various ecosystem types. Data derived from trigger values supplied by South Australia. Chl *a* = chlorophyll *a*, TP = total phosphorus, FRP = filterable reactive phosphate, TN = total nitrogen, NO_x = oxides of nitrogen, NH₄⁺ = ammonium, DO = dissolved oxygen.

Ecosystem type	Chl <i>a</i>	TP	FRP	TN	NO _x	NH ₄ ⁺	DO (% saturation)		pH	
	(µg L ⁻¹)	(µg P L ⁻¹)	(µg P L ⁻¹)	(µg N L ⁻¹)	(µg N L ⁻¹)	(µg N L ⁻¹)	Lower limit	Upper limit	Lower limit	Upper limit
Upland river	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Lowland river	no data	100	40	1000	100	100	90	no data	6.5	9.0
Freshwater lakes & reservoirs	no data	25	10	1000	100	25	90	no data	6.5	9.0
Wetlands	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Estuaries	5	100	10	1000	100	50	90	no data	6.5	9.0
Marine	1	100	10	1000	50	50	no data	no data	8.0	8.5

Table 3.3.9 Ranges of default trigger values for conductivity (EC, salinity), turbidity and suspended particulate matter (SPM) indicative of slightly disturbed ecosystems in south central Australia — low rainfall areas. Ranges for turbidity and SPM are similar and only turbidity is reported here. Values reflect high site-specific and regional variability. Explanatory notes provide detail on specific variability issues for groupings of ecosystem type.

Ecosystem types	Salinity (µS _{cm} ⁻¹)	Explanatory notes
Lowland rivers	100–5000	Salinity can be highly variable depending on flow.
Lakes, reservoirs & wetlands	300–1000	Wetlands can have substantially higher salinity due to saline groundwater intrusion and evaporation.
Turbidity (NTU)		
Upland & lowland rivers	1–50	Turbidity and SPM are highly variable and dependent on seasonal rainfall runoff.
Lakes & reservoirs/ wetlands	1–100	Shallow lakes and reservoirs may have higher turbidity naturally due to wind-induced resuspension of sediments. Lakes and reservoirs in catchments with highly dispersible soils will have high turbidity.
Estuarine & marine	0.5–10	Higher values are representative of estuarine waters.





APPENDIX D - Non-Drinking Water Supply Approval and Licence Requirements



Table 4-1 Non-drinking water systems/supply approval and licence requirements

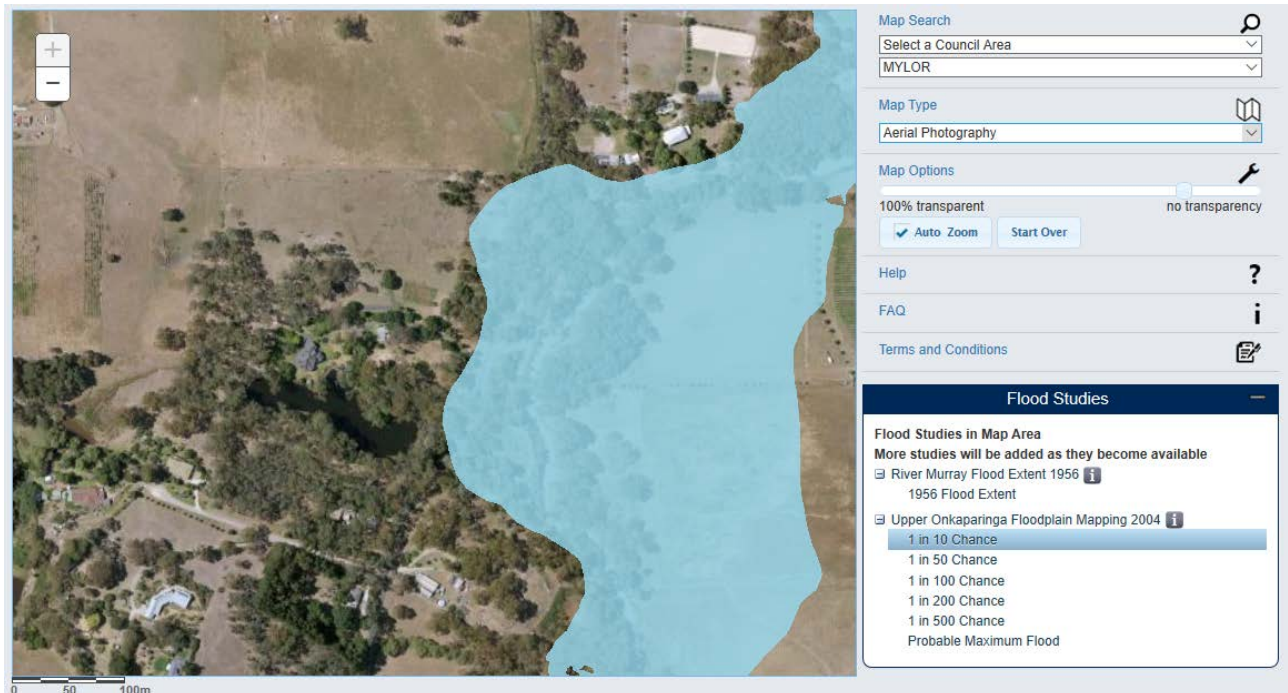
Type of non-drinking water system	Relevant authority requiring approval or licence
Recycled water system (treated wastewater only and mixed source incl. treated wastewater)	DHA** ESCOSA (only for retail service by a reticulated system) EPA (only for systems <100 EP (in water protection area) or >1000EP elsewhere) PIRSA (only where end use involves stock watering/pasture irrigation) OTR* (commercial/industrial/residential irrigation installations) DECD***
Non-drinking water supply (carted)	DHA (for treated wastewater / greywater only) OTR* (commercial/industrial/residential irrigation installations)
Non-drinking water system (groundwater)	ESCOSA (only for retail service by a reticulated system) DEWNR (only for take of groundwater from wells within a prescribed wells area or prescribed water resources area) OTR* (commercial/industrial/residential irrigation installations) EPA (only for take of groundwater from certain aquifer systems identified within a SA EPA Groundwater Prohibition Area)
Non-drinking water system (surface water)	ESCOSA (only for retail service by a reticulated system) DEWNR (only for surface water take from a prescribed watercourse or from prescribed resources within a prescribed water resources area; and may be required for systems that import surface water as per NRM Act 2004 imported water permit requirements) OTR* (commercial/industrial/residential irrigation installations)
Non-drinking water supply (bulk water)	ESCOSA (only for retail service by a reticulated system) DEWNR (may be required for systems that import water as per NRM Act 2004 imported water permit requirements) PIRSA (only where end use involves stock watering/pasture irrigation) OTR* (commercial/industrial/residential irrigation installations)
Greywater system	DHA** DEWNR (may be required for systems that import water as per NRM Act 2004 imported water permit requirements) OTR* (commercial/industrial/residential irrigation installations)
Stormwater system	ESCOSA (only for retail service by a reticulated system) DEWNR (may be required for systems that import water as per NRM Act 2004 imported water permit requirements) OTR* (commercial/industrial/residential irrigation installations) DECD*** DHA (no formal approval required. However, proponents encouraged to contact)
MAR system	ESCOSA (only for retail service by a reticulated system) EPA Licence to inject as per EP Act requirements DEWNR permit to drain or discharge as per NRM Act requirements OTR* (commercial/industrial/residential irrigation installations) DECD***

See notes over page

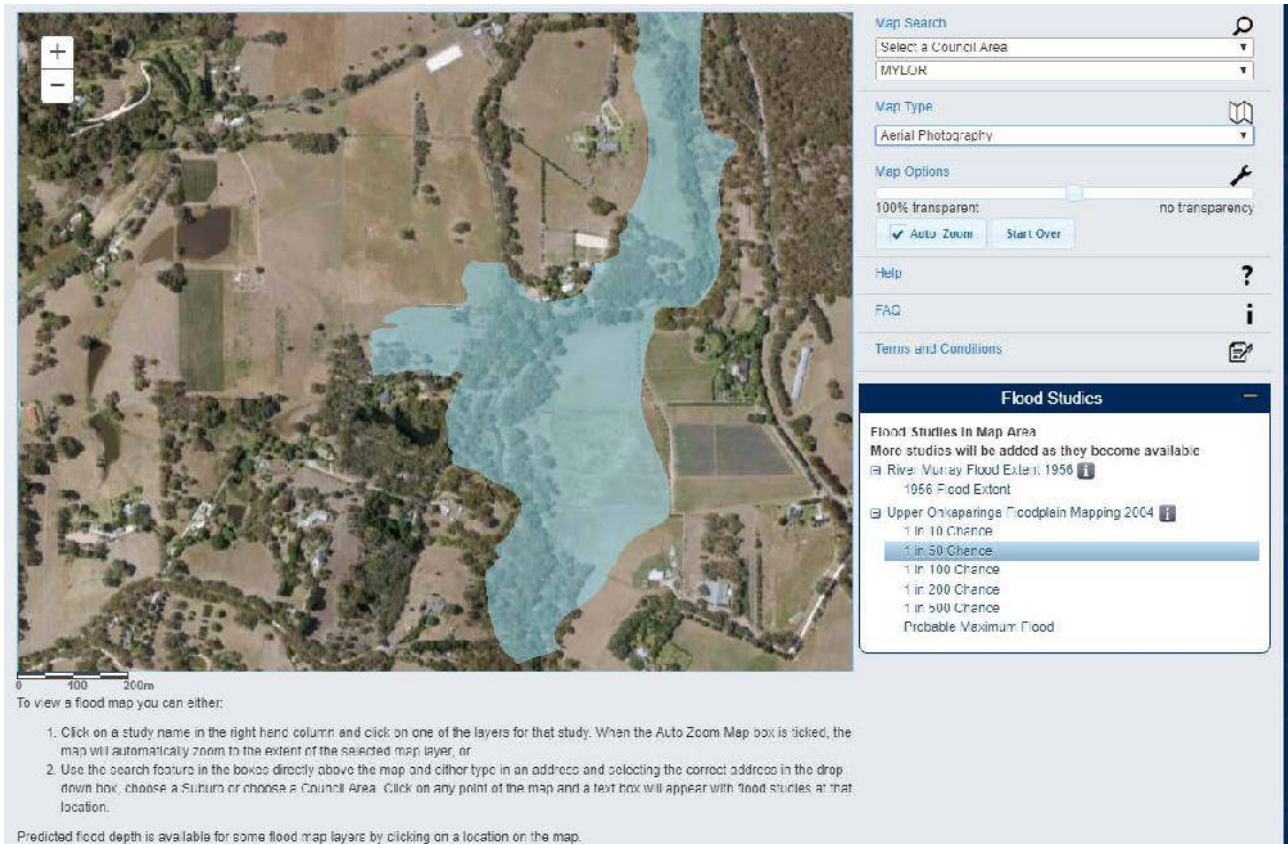




APPENDIX E - FLOOD MAPS



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0 100 200m

To view a flood map you can either:

1. Click on a study name in the right hand column and click on one of the layers for that study. When the Auto Zoom Map box is ticked, the map will automatically zoom to the extent of the selected map layer, or
2. Use the search feature in the boxes directly above the map and either type in an address and selecting the correct address in the drop down box, choose a Suburb or choose a Council Area. Click on any point of the map and a text box will appear with flood studies at that location.

Predicted flood depth is available for some flood map layers by clicking on a location on the map.

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Important, please be aware of the assumptions and limitations of flood maps. For further information refer to the [FAQ link](#) link on this page. Limits of flooding shown on this map are not a boundary between flood prone and flood free land.

0 100 200m

To view a flood map you can either:

1. Click on a study name in the right hand column and click on one of the layers for that study. When the Auto Zoom Map box is ticked, the map will automatically zoom to the extent of the selected map layer, or
2. Use the search feature in the boxes directly above the map and either type in an address and selecting the correct address in the drop down box, choose a Suburb or choose a Council Area. Click on any point of the map and a text box will appear with flood studies at that location.

Predicted flood depth is available for some flood map layers by clicking on a location on the map.



APPENDIX F - HISTORICAL GROUNDWATER REPORT



DEPARTMENT OF MINES
SOUTH AUSTRALIA

Section
RB 66/165

Regt. Bk. No. 66/165
S.S. No. 4025
Hyd. No. 2046
D.M. 298/68

GROUNDWATER PROSPECTS

Secs. 1292, 1356 & 1499 Hd. Neaplunga

- G. Nanowski -

INTRODUCTION

A request was received for advice on the possibility of obtaining a supply of groundwater for domestic use and an irrigation and stock supply. The maximum supply required was not indicated. Applicant's property lies approximately 2½ road miles southwest of Myler and one mile west of the Main road to Neaplunga. An old gold mine Silverlake, now used as a swimming pool, is situated just east of the northern part of the property.

An inspection was made by Mr. A.A. Gibson, Senior Geologist in company with the owner on 4th June, 1968.

This report has been prepared from notes obtained from Mr. Gibson.

TOPOGRAPHY AND GEOLOGY

Onkaparinga River and its valley form the main topographic feature in the area. It is flanked by low rounded hills. Surface runoff from these is collected in watercourses, tributary to the river. Just north of applicant's property the river valley is some ½ mile wide and Section 1363 lies almost wholly in this flat part of the area.

Torrensian phyllites and slates of the Adelaide system, form the basement rocks. They are dipping 40° to the southeast. During earth movements these rocks have been faulted and the orientation of these faults is northeast in the southern part of



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the area and east north east in the northern part, as shown on the attached map.

Evidence of the fault, lying across the southeastern part of Section 1494 indicated on the 1 mile Geological Map Echunga is concealed in this area.

The basement rocks are blanketed with a thin veneer of soil cover most of the area.

On the river flat the basement rocks are covered by some 160ft. of recent sediments probably consisting of sandy clays with gravels at 160ft. depth. These sediments were worked in the past for alluvial gold by means of shafts and were discontinued in the gravel beds.

HYDROGEOLOGY

Annual rainfall is probably 30 inches.

Torrensian phyllites and slates generally are poor aquifers because they are fine grained and not permeable. Therefore groundwater can be stored only in the joints and cracks which were developed during folding and faulting. However these openings are often filled with the clayey weathering products of the basement rocks. Therefore the movement of groundwater in joints is restricted. If these clayey weathering products did not occur the groundwater potentials would be good because annual recharge of the aquifer from the runoff in Onkaparinga River would be high.

Boreholes penetrating the Torrensian phyllites and slates obtained supplies up to 3000 gallons per hour in other parts of the State. However such supplies often can not be maintained because of the restricted open joints in the basement rocks. That the phyllites and slates yield small supplies is indicated by a 140ft. deep borehole located on Sec. 1386 which yields 400 gallons per hour.

It is reported that the shaft digging had to be discontinued because of the occurrence of groundwater. The pumps



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available could not handle the supply. There is no distinct evidence but it is believed that the gravels encountered at approximately 160ft. are connected with the gravels in the Onkaparinga River. It is also believed that the water level in Silver Lake is the same as in Onkaparinga River. It is considered that the gravel beds of the recent sediments are potentially the best aquifers in this area. Therefore it is recommended that a borehole is drilled on a site as shown to the owner. This hole should fully penetrate the gravel bed. Because of the difficulties which may arise in penetrating the gravels it may be advantageous to drill an 8 inch hole which if necessary can be reduced to 6 inch in the gravel beds.


SUMMARY AND CONCLUSIONS

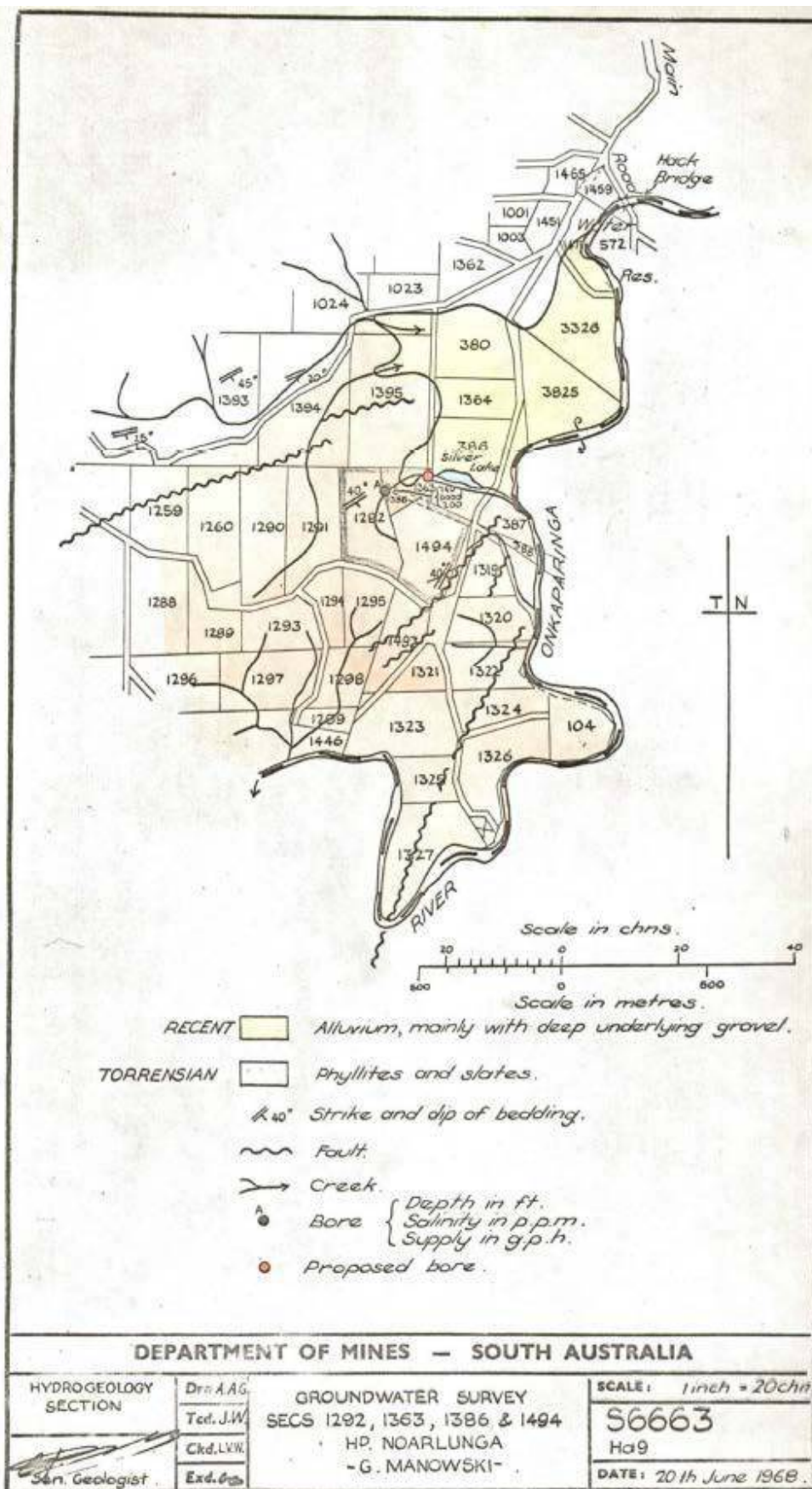
Torrensian rocks contain good to excellent quality water in areas where the local recharge is high. They produce limited supplies of water because of the limestone open joints which occur in these fine grained rocks. Drilling on a site where these rocks would be penetrated therefore is not recommended.

The gravels underlying the Valley flats are potentially the best aquifers in the area. Drilling of an approximately 160ft. deep borehole on the suggested site is recommended. It is expected that a yield of some, 5,000 gallons per hour, or a little more, could be obtained.

The groundwater quality is expected to be good and suitable for all purposes. Recommended is however that a 26 fluid oz. sample be forwarded to the Department for determination of the assumed total salts before use.

CH:OB:RW
19.6.1968


C. BLEY
SENIOR GEOLOGIST
HYDROGEOLOGY SECTION







APPENDIX G - DOMESTIC WATER USAGE



This Appendix includes information from the On-site Wastewater Systems Code

Table 5-1: Design flows (expressed in litres per person per day (L/p/d))

	Water supply	Daily flow (DF) (L/p/d)
All wastewater	Mains water (includes bore water or any other reticulated supply)	150
	Roof catchment and storage	125
Greywater	Mains water (includes bore water or any other reticulated supply)	100
	Roof catchment and storage	75
Blackwater	Mains water (includes bore water or any other reticulated supply)/roof catchment and storage	50



Premises	Fixtures	Sludge/scum rate		Daily flow rate		BOD ₅ loading	
		Number of persons (P1)	Rate: L/p/y (S)	Number of persons (P2)	Rate: L/p/d (DF)	Rate: g/p/d	
HOTELS / MOTELS / LIVE IN CONFERENCE CENTRES							
Accommodation	W.C./urinal, basin, bath/shower, laundry, kitchen sink	total number of beds (single equivalents)	48	total number of beds (single equivalents)	100	40	
Resident staff	W.C./urinal, basin, bath/shower, laundry, kitchen sink	total number of live in staff	80	total number of live in staff	150	50	
Bar trade	W.C./urinal, basin, kitchen sink, glass washer	average daily number over a 7 day period	5	highest daily number over a 7 day period	10	10	
Dining room lounge area non-resident use	W.C./urinal, basin, kitchen sink, dishwasher	average daily number over a 7 day period	10	highest daily number over a 7 day period	15	10	
						20	
Non-resident staff	W.C./urinal, basin, kitchen sink (tea service area only) shower	number of staff per shift x number of shifts	25	number of staff per shift x number of shifts	30	20	
				number of staff per shift x number of shifts	10	5	

Based on the On-site Wastewater Systems Code





Premises	Fixtures	Sludge/scum rate		Daily flow rate		BOD ₅ loading	
		Number of persons (P1)	Rate: L/p/y (S)	Number of persons (P2)	Rate: L/p/d (DF)	Rate: g/p/d	
MEDICAL CONSULTING ROOMS							
Doctors, dentists, staff	W.C./urinal, basin, kitchen sink (tea service area only)	number of persons using system per shift x number of shifts	40	number of persons using system per shift x number of shifts	30	20	
	shower			number of persons using system per shift x number of shifts	10	5	
Consulting rooms		per consulting room	80 L/consulting room/year	per consulting room	100 L/consulting room/day	40 g/consulting room/day	
PUBLIC SWIMMING POOLS							
Including kiosk e.g. take away food	W.C./urinal, shower, basin, kitchen sink (tea service area only)	average daily number over a 7 day period plus staff	20	highest daily number over a 7 day period plus staff	20	15	
PUBLIC TOILETS							
	W.C./urinal, basin	average daily number over a 7 day period	20	highest daily number over a 7 day period	5	10	
	shower			highest daily number over a 7 day period	10	5	



Premises	Fixtures	Sludge/scum rate		Daily flow rate		BOD ₅ loading	
		Number of persons (P1)	Rate: L/p/y (S)	Number of persons (P2)	Rate: L/p/d (DF)	Rate: g/p/d	
SEMINAR/CONFERENCE ROOMS (maximum capacity)							
No meals	W.C./urinal, basin, kitchen sink (tea service area only)	total seating capacity plus staff	25	total seating capacity plus staff	30	20	
Meals, no liquor licence	W.C./urinal, basin, kitchen sink, dishwasher	total seating capacity plus staff	35	total seating capacity plus staff	35	25	
Meals with liquor licence	W.C./urinal, basin, kitchen sink, dishwasher, glass washer	total seating capacity plus staff	35	total seating capacity plus staff	40	30	
SHOPPING CENTRES							
Staff	W.C./urinal, basin, kitchen sink (tea service area only)	number of staff per shift x number of shifts	25	number of staff per shift x number of shifts	30	20 or 150 g per day per 100 m ²	
Public	W.C./urinal, basin	average daily number over a 7 day period	20	highest daily number over a 7 day period	5	10	
Shop facilities	double bowl sink basin	per shop	20 L/shop/y	Per shop	40 L/shop/d		
Supermarket	double bowl sink basin, cleaners	per supermarket	40 L/super-market/y	Per supermarket	500 L/super-market/d		



APPENDIX H - WATER TESTING LOCATIONS



- Water sample—900mm
- Temperature at 300/600/900/1500/3000mm
- DO— 900/3000
- Sediment sample— 3 locations
- Water sample—bore (purge 30mins)- measure flow





APPENDIX I - WATER AND SEDIMENT TEST RESULTS



APPENDIX J - INDICATIVE FISH SPECIES



Indicative fish species and recommended conditions for sustenance is provided as a guide.

Species	Salinity Levels	pH	Oxygen	Temp	Free Ammonia	Notes
Barramundi	Can grow in both fresh water and saltwater environments		4-9ppm, 3ppm can be tolerated for short periods of time	26-28	< 1 mg/l	Above 10 year flood height
Fresh Water Cray fish	Tolerate half of that of seawater/ not exceed 2ppt	7-8.5	6ppm	25		
Murray Cod	Murray cod are entirely a freshwater species and will not tolerate high salinity levels	6-8.0	>3 mg/l	24-25	< 0.1 mg/l	Site must be above the 100 year flood level
Yabby	Salinity of 12 ppt does not affect yabbies, will die at 25 ppt	7-10.5	can tolerate very low dissolved oxygen (DO) and has been found in ponds where the DO was below 1-% saturation	0-35	-	The water must be hard enough (as dissolved calcium) to maintain strength in the shell, although some calcium is recycled when yabbies eat moulted cast

Source: NSW Dept of Primary Industries



APPENDIX K – IDENTIFICATION OF RISKS



Risk No.	Impact Pathway		Project Phase	Existing mitigating measures
	Activity	Description of Consequences		
1	Dredging the quarry	Silt may be contaminated, and dredging this may release contaminants to lake water, and will disturb biofilm	Implementation	
2	Dredging the quarry	Would tree roots become exposed, affecting health or stability of the trees?	Implementation	
3	Using lake water as supply	Heavy metal contamination e.g. arsenic, as the lake used to be a gold mine	Implementation	Water and silt being tested
4	Development Approval rejected a second time	Limited opportunities for different outcome	Planning	Broader team collaborating on aspects of concept design
5	Affect heritage value of lake	Affect planning outcome	Planning	Optioneering is identifying benefits, and also seeking to demonstrate no adverse effect
6	Lake recharge estimation	Can't accurately estimate Groundwater volumes (would need additional wells and time spanning seasons to monitor)	Planning	Estimates being made
7	Diversion of land drains through wetland system	Water from off site could be contaminated from cattle and other contaminants – if these end up in the wetland system they could affect water quality and treatment effectiveness	Planning	Consider regulating structure so that flow from drains could either bypass or winter the wetland system
8	Wetland operation affected by waterlogged ground	Problems with access for water and silt sampling due to waterlogged ground, during typically dry season – could this indicate a problem for access for ongoing running and maintenance?	Construction and operation	
9	Use of wastewater to irrigate edible crops	Uptake of pathogens using wastewater to irrigate edible crops	Design	Appropriate treatment classes and application methods identified for different crops
10	Operation of package sewage treatment plant	If there is intermittent use of the B&B facility, this may not allow adequate "feeding" of biological treatment process	Operation	Established existing package treatment plant, although change in usage patterns to be considered during design
	Wetland overflow will pollute lake water	In winter, the overflow from the wetland will need to be managed to ensure risk of contaminants entering the lake is reduced	Operation	





APPENDIX L - SOIL LOGS AND WASTE DERIVED FILL CRITERIA



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Silver Lakes Development

Landscape Development and Maintenance Report

Prepared by: - *Barrie Ormsby Landscape Architect* FAILA February 2020

Prepared for: - Rudy Gomez

(Final Draft 05.03.2020)

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INTRODUCTION

Barrie Ormsby Landscape Architect has been engaged to assist in the preparation of a development proposal for the Silver Lakes property, located on Silver Lake Road, near Mylor.

This report details and assesses the present site conditions, particularly in relation to the heritage listed Silver Lake (an artefact of past alluvial gold mining in the district), existing vegetation (native and exotic), and water related issues (natural runoff/water flows into and through the property, surface drainage, 1 in 100 year ARI flooding levels, and water quality).

The proposed landscape works as detailed in this report have a focus on: -

- Maintaining and protecting the heritage characteristics of the Silver Lake site, while enhancing its visual and habitat values, and water quality,
- Maintaining and improving the quality of all water discharged from the property to the nearby Onkaparinga River,
- Maintaining and enhancing the extent of existing habitat and increasing habitat diversity in the property, both aquatic and terrestrial,
- Creating and maintaining a visually attractive and interesting landscape, compatible with and integrated into the character of the broader landscape,
- Developing a landscape that, as much as possible, reduces bush fire hazards and risks to the developed infrastructure and its residents, and,
- Development of a landscape that can be maintained in a practical and systematic manner, so that the above objectives can be achieved and sustained into the future.

The major elements of the existing site are shown in Figure 1 – Existing Site/Survey Plan (Drawing DA 0.1).

Please note that not all trees on the site have been surveyed, particularly south of the lake, and in the northern part of the property. The site plan (Figure 1 – Existing Site/Survey Plan (Drawing DA 0.1)) also shows several elements that are proposed to be removed – fence, solar panels, shed, that may not be referred to elsewhere in this report.

1.0 SILVER LAKE

1.1 Existing Condition

The lake was originally excavated by hand during alluvial gold mining operations in 1906-08, and naturally filled from ground water when mining operations ceased in 1911.

The lake has a surface area of approx 8,400 m², and is reported to have a maximum depth in the order of 6 m; the volume could thus be in the order of 25,000 to 40,000 m³, depending on its average depth (bathymetry of lake invert not known).

The lake margins are well vegetated mainly with Bulrush (*Typha* spp). It would be expected that the banks below the water level would be quite steep; this is reflected in the narrow width of the bulrush around the water edge. The lake is surrounded by mature river red gums, which would shed leaf, bark and twigs into the lake throughout the year.

The water level of the lake is maintained by groundwater inflow, and by inflow during winter and spring from an upstream rural catchment of about 15 ha. From the recent survey of the property, the water level of the lake appears to be at about RL 289.00 (AHD). The water level is controlled by a culvert (approx diam 500 mm) under the retaining bank at the east end of the lake; this drains through a culvert under Silver Lake Road, then to the Onkaparinga River. It is reported that the water level can drop during summer due to evaporation losses.

Water quality testing carried out by Water Technology (refer to Appendix A) indicated that water quality is good, with no pollutant parameters of concern. The lake water is moderately discoloured by tannins which leach from the eucalyptus leaf and bark debris that would continually fall into the lake from the surrounding mature River red gum woodland. This discolouration is mainly an aesthetic issue, and is typical of streams and ponds in eucalypt forest environments.

There are some fish in the lake; carp are reported to be present, and other species may also be present. Some water birds such as water hen use the bulrush for nesting; native duck and other species are also present at times.

1.2 Heritage Listing

The lake was originally excavated by hand during alluvial gold mining operations in 1906-08, and naturally filled from ground water when mining operations ceased in 1911.

The lake and surrounding land was named "Silver Lake" and was used for boating and picnics and sporting activities such as cricket and tennis. (From Stirling District Heritage Survey, date not known, the lake recommended for inclusion on Local Heritage Register). It was also exploited commercially as a swimming pool in the 1920's, and a dance hall was erected near the lake, with dances held on Saturday and Sunday nights. This continued until about the 1960's.

Its heritage significance is related to both as an artefact of early gold mining activities in the area, and its long use by the community for recreational activities.

In recognition of its heritage significance, the layout and general appearance of the lake will not be changed or altered.

1.3 Water Sources and Water Quality

The water level of the lake is maintained by surface runoff from a rural catchment of about 15 ha, and by groundwater inflow, and can be topped up if necessary during summer from a bore. It is reported that the water level can drop during summer.

The lake overflows through a culvert (approx 500 mm diam) under the eastern bank, to a culvert under Silver Lake Road and then to the Onkaparinga River. Water from the Onkaparinga River can enter the lake through the culvert during 1 in 100 ARI flood events.

Water quality testing carried out by Water Technology (refer to Appendix A) indicated that water quality is good, with no parameters of concern.

It is intended to circulate water from the lake to a constructed wetland, which may provide some improvement in the water quality of the lake, and possibly reduce the discolouration of the water by tannins from the river red gum litter.

1.4 Sediment Removal

It is reported that there is up to 2 m of sediment on the invert of the lake, which has accumulated over more than 100 years. It is intended to remove this sediment by a suction dredge, and dispose of this material after dewatering, by spreading and cultivating into the soil in some of the northern sections of the property, generally in areas above the 1 in 100 year flood level.

The sediment has been assessed for any possible contamination for a wide range of parameters by Water Technologies (refer to Appendix A). The results show that all samples are below the upper threshold limits for Waste Derived Fill Material, and so are suitable for site based disposal.

1.5 Lake (Aquatic) Vegetation

1.5.1 Background

The water edge of Silver Lake is fringed with a narrow band of *Typha domingensis* (bulrush or cumbungi), which grows up to 2 m or more tall. It is winter deciduous, dying off completely in winter and so can look very unattractive. Birds such as coots, waterhen, etc, create nests in the dense vegetation of the bulrush, but in the process trample the leaves and stems, adding to its untidy appearance.

Typha can dominate the vegetation of a lake or wetland, competing with and suppressing other emergent wetland plants, and severely reducing diversity and habitat value. Old stands of bulrush build up a mass of dead material, which inhibits its own growth and prevents other species from establishing.

Both because of its unattractive appearance and the low habitat value that the existing stands of bulrush provide in the lake, a staged program to reduce its extent in the lake and the planting of additional species to replace the *Typha* is proposed to be carried out.

1.5.2 Control and Reduction/Removal of *Typha*

Typha can be controlled and eventually eradicated if desired by simply by cutting the stems below water level, which causes the plant to drown and die. Like all emergent wetland plants, they rely on air (oxygen) transported from the leaves down through the stems into the roots, in order to be able to grow and survive in the saturated anaerobic soils of a wetland or lake.

Cutting should desirably be carried out in winter, when the plants are dormant and the plants more vulnerable.

In Silver Lake, because the banks around the lake are very steep, it may be necessary to carry out this operation from a boat or raft. It is desirable to remove as much of the cut material from the water as possible, which would decompose and consume oxygen in the water, which would be undesirable.

Removal of the *Typha* by excavation using large machinery to completely remove roots and rhizomes would be detrimental, as this would remove the soil below water level that any new planting would be carried out into, making it difficult if not impossible to establish any new plants at all, and possibly leaving the banks open to erosion.

1.5.3 *Typha* Removal and Replanting Methodology

The removal of *Typha* and replanting needs to be carried out progressively, so that habitat particularly for water birds can be retained and not unduly disrupted. Not more than approx 20 to 25% of the *Typha* should be cut in any one year, in small patches of not more than 5 to 10 m in length or less.

Each patch where *Typha* has been cut must then be planted, preferably in spring, with the mainly taller species that will replace the habitat and visual function of the *Typha*, together with a selection of the minor smaller species that will add to the diversity of the vegetation. If the water level of the lake can be maintained throughout summer (from the bore), then planting could be carried out in summer.

Sections of the water edge where *Typha* has not been cut can be planted at any time with a range of smaller species suited to the water edge; these may then be able to establish before the *Typha* is eventually cut.

It is essential that all species of wetland plants, except submergent species, be planted in water depths that are less than half the height of the seedling being planted, otherwise the seedlings will drown. It may be an advantage to use larger than normal sized seedlings.

1.5.4 Replanting Species List

The following species list provides a comprehensive selection of plants that can achieve the desired appearance and the creation of a more diverse habitat.

Spreading species, large and small, will spread and establish in any area that is suited to that species, particularly in regard to water depth, and so can be regularly spaced in the planting area. Clumping species should be more randomly spaced to achieve a more natural look.

Table A – Lake Planting Species List

GROWTH HABIT	SPECIES	COMMON NAME	DESCRIPTION
Tall, spreading	<i>Phragmites australis</i>	Common reed	2 – 3 m tall, will compete with <i>Typha</i>
	<i>Schoenoplectus validus</i>	River club-rush	To 2 m tall, green foliage
	<i>Baumea articulata</i>	Twig rush	1 -2 m tall
	<i>Eleocharis sphacelata</i>	Tall spike-rush	To 2 m, green foliage
Smaller, spreading	<i>Eleocharis acuta</i>	Common spike-rush	To 0.5 m, grassy appearance
	<i>Baumea juncea</i>	Bare twig-rush	0.5 to 1.0 m, wiry grassy appearance
	<i>Carex bichenoviana</i>	Sedge	Up to 0.5 m, at water edge, spreads well, can form green grassy swards up banks
	<i>Schoenoplectus pungens</i>	American club-rush	To 0.3 to 0.6 m, vigorous spread
Low, spreading	<i>Centella cordifolia</i>	Centella	Plant at water edge
	<i>Cotula coronopifolia</i>	Waterbuttons	Plant at water edge
	<i>Hydrocotyle verticillata</i>	Shield pennywort	Plant at water edge
	<i>Ranuncularis amphitrichus</i>	River buttercup	Plant at water edge
Tall, clumping	<i>Juncea pallidus</i>	Pale rush	To 1.5 to 2.0 m
	<i>Gahnia seiberiana</i>	Saw sedge	To 1.5 m, at or just above water edge
	<i>Carex appressa</i>	Tall sedge	To 1.0 m, at water edge
Smaller clumping	<i>Baumea juncea</i>	Bare twig-rush	To 0.5 m, at water edge
	<i>Cyperus vaginatus</i>	Flat sedge	Up to 1.5 m, dense wide tussock, very hardy, in shallow water or above water level
	<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	Up to 0.8 m, very hardy, in shallow water or above water level
	<i>Juncus</i> spp	Rushes	Many local species, up to 1.0 – 1.5 m, upright tussocks
Submergent species	<i>Triglochin procerum</i>	Water ribbons	Linear floating leaves, good habitat plant, attractive, will grow in water to 0.5 m
	<i>Myriophyllum</i> spp	Pond weeds	Feathery submerged foliage, good habitat plant
Shrubs	<i>Callistemon sieberii</i>	River bottlebrush	Nectar producing, attractive shrub, could be scattered sparsely around

			water edge
	<i>Lythrum salicaria</i>	Loose-strife	Plant at water edge, upright small shrub, showy purple flowers

2.0 CONSTRUCTED WETLAND

It is proposed to construct a wetland with areas of open water, shallow reedbeds, and shallow marsh areas, located just to the north of the main entrance roadway.

The wetland will receive water pumped from the lake, which will then be recirculated back to the lake. It will also receive runoff from the northern part of the property, as well as runoff from neighbouring properties that drain through the Silver Lakes property, and is intended to be kept full throughout the year.

2.1 Purpose and Function

The proposed wetland and reedbed filter system, as shown in Figure 2 will provide a number of functions and purposes: -

- Provide a significant area of wetland and marsh habitat for water birds, particularly species that require shallow water/marsh areas for feeding (waders, egrets, ibis, herons, etc); this habitat is not present in the existing lake.
- As a water quality treatment wetland, it will be able to filter water flowing through the wetland, improving water quality by filtering out suspended matter, and removing nutrients, heavy metals and other contaminants from the water.
- If needed, it can receive any excess waste water from the aquaponics system that is not used by the hydroponic vegetable and herb growing beds, and treat and clean this water as it passes through the wetland reedbeds.
- Act as a filter that may remove some of the tannins and reduce the discolouration of the lake water,
- By interacting with water pumped from the lake and returning this water to the lake, transfer some of the macro and micro invertebrates, etc, that the wetland will produce, to the lake, so improving the biology of the lake (in effect, the wetland becomes an integral part of the ecology of lake and wetland system),
- To create a visually attractive and interesting landscape feature which can be experienced and enjoyed by visitors, etc. A bird hide will enable bird watching to be undertaken and enjoyed with minimal disturbance to bird life.

2.2 Design

The proposed wetland as shown has a surface area of approx 3300 m² and a total static water volume of approx 1300 m³. There are three deeper, open water areas, connected by two areas of reedbed. The northern side of the wetland is fringed by a shallow area of "marsh". An existing shallow pond/dam is incorporated into the layout.

The concept design of the wetland and a typical cross section is shown in Figure 2.

All wetland banks will have batters not steeper than 1:5. Open water areas will generally have a depth of 1.0 m, and the two designated reedbeds will be 100 mm in depth. The “marsh” areas will have depths varying from 50 mm to 00 mm at the water edge. The design static water level will be RL 189.25 AHD.

Water pumped from the lake will discharge into the western end of the wetland, then flow from west to east, passing through the two reedbeds, and flooding over the areas of very shallow “marsh”. The wetland outlet will consist of a notched weir pit, discharging into a pipe to return water to the lake (under gravity).

The deeper open water areas act as distribution and collection channels, for water flowing through the two reedbeds. (It is important for flows through the reedbeds to be as evenly distributed across the width of the reedbed as possible, to maximise the effectiveness of the reedbeds in cleaning the water).

The wetland will also receive runoff through the overland flow areas to the north of the wetland (refer Section 3.2 Existing Drainage Ditches and Surface Drainage). To cater for flows into the wetland resulting from large storm events in the contributing catchment that exceed the capacity of the outlet/return pipe to the lake, a flood overflow/spillway on natural surface at the eastern end of the wetland will provide an outlet. This will flow to an existing culvert under Silver Lake Road and then to the Onkaparinga River.

A three day detention time for flows through the wetland is considered adequate to remove pollutants that may be present in water discharged into the wetland from both lake and surface runoff. With a static wetland volume in the order of 1300 m³, an inflow in the order of 430 m³ per day from the lake will provide a detention time of three days.

At times, particularly in winter, the wetland will receive inflow from the overland flow area, in addition to pumped inflow from the lake. A water level sensing switch in the wetland will control the solar pump at the lake, stopping pumping from the lake when the water level in the wetland reaches a pre-determined level. This will prevent excessive surcharging of the wetland and possible loss of water over the overflow/spillway.

It is intended that a modified Unipolar Water Disinfection unit (as developed by Rudy Gomez) will be set up to neutralise the high iron content of the lake and bore water. This will be located close to where the lake water will discharge into the western end of the wetland.

The wetland is located in an area which is subject to flooding from the Onkaparinga River during a 1 in 100 year ARI flood event. The water level of the wetland at RL 289.25 is generally below the existing natural surface level, and no mounding or filling will be involved, other than a low bank (not more than 150 to 250 mm in height) at the eastern end of the wetland. The depth of excavation, from natural surface to the design water level, will vary from 00 mm to a maximum in the order of 400 mm at its western end. The net result will be an increase in flood storage in the Silver Lakes property over and above the water surface of the wetland of approx 470 m³, which will more than offset any minor filling or adjustment of natural surface levels elsewhere on the site.

2.3 Lake/Wetland Recirculation System

The wetland will receive water pumped from the lake, using a solar powered pump (operating during daylight hours only), which will discharge into the western end of the wetland. This will maintain the water level of the wetland throughout the year. Water will return to the lake from an outlet weir pit at the eastern end of the wetland, with the return flow pipe located to the east of the proposed sheds and new residence.

The three suction inlets on the invert of the lake, the routes of the pump main and the outlet/return flow pipe, and the discharge points into the wetland and the outlet weir pit are shown in Figure 3 (Drawing No 1817 DA1.1). The solar powered pump will be located near the edge of the lake.

The wetland outlet which will return water to the lake will consist of a notched weir in a weir pit, at the eastern end of the wetland. The notch in the weir sill will be sized to allow the wetland to drain down to its design static water level over a twenty-four hour period, but while pumping or other inflow is occurring, the notch will cause the wetland to surcharge above its design static water level, with overflow over the full width of the weir beginning once the water level has reached a predetermined surcharge level (possibly a maximum surcharge in the order of 75 to 100 mm). (The detail sizing of the outlet weir and notch and size/capacity of the return pipe from wetland to lake will be carried out as part of the final design of the wetland system).

A regular, daily surcharge of the wetland will provide several benefits: -

- By creating a temporary increase in wetland volume, the effective rate of flow through the wetland and reedbeds is reduced, and as the depth increases, the duration and amount of contact between water and the surfaces of the vegetation increases, which enhances the pollutant removal processes of the wetland.
- The temporary increase in water level will inundate a small part of the adjacent low-lying overland flow areas, providing enhanced feeding habitat for wading birds.

At times, particularly in winter, the wetland will receive inflow from the north from the overland flow area, in addition to water pumped from the lake. A water level sensing switch in the wetland will control the pump at the lake, stopping pumping when the water level reaches a pre-determined level. This will prevent excessive surcharging of the wetland, which could result in discharge over the spillway and water being lost to the system.

2.4 Wetland Habitat

The wetland as shown will provide three different habitats, particularly for waterbirds, but also for a range of other fauna, native fish, frogs and aquatic invertebrates: -

- Deeper open water pools and channels, generally up to 1.0 m depth. The open water areas and channels provide for the needs of waterbirds that prefer and use that habitat. Native fish will also use open water areas, as well as the shallow reedbeds.

- Shallow reedbeds, generally 100 to 150 mm depth, planted densely with selected wetland plant species that will maximise contact between the water flow and the surface of the plant stems and leaves (much of the action in the removal of pollutants takes place at this interface between plant surfaces and water). Many species of waterbirds will use these shallow reedbeds, for grazing and feeding, for refuge and nesting.
- Very shallow marsh areas around the edges of the wetland, generally not more than 50 mm depth. These areas are specifically intended to provide shallow feeding areas for wading waterbirds.

It would be desirable to introduce selected native fish species, as present in the nearby Onkaparinga River, into the wetland. The wetland and its “marsh” areas will merge into the very similar habitats of the adjacent overland flow areas, which will abut the northern edge of the wetland, and will be planted with very similar wetland plants.

2.5 Wetland Planting

The wetland will be planted with a range of wetland plant species suited to a small wetland. Species that produce amounts of seasonal dry material (eg, *Phragmites*) will not be used in the planting. There will be minimal maintenance of the vegetation required once established, but it will be necessary to remove seedlings of *Typha* as they appear (every three months).

TABLE B – Wetland Planting Species

				WETLAND		
				WATER EDGE	REED- BEDS	MARSH
SPECIES	COMMON NAME	GROWTH/ HABIT	HEIGHT (M)			
Taller Sedges, Rushes, etc						
<i>Baumea juncea</i>	Bare twig-rush	spreading	0.5	+	+	+
<i>Carex appressa</i>	Tall sedge	clumping	1.0	+		+
<i>Carex bichenoviana</i>	Sedge	spreading	0.5	+		
<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	clumping	To 0.6	+		
<i>Cyperus vaginatus</i>	Flat-sedge	clumping	0.3 to 1.0	+		+
<i>Eleocharis acuta</i>	Common spike-rush	spreading	To 0.6	+	+	+
<i>Juncus species (local)</i>	Rushes	clumping	1.0 to 1.5	+		
<i>Microlaena stipoides</i>	Weeping rice-grass		To 0.5	+		
<i>Schoenoplectus pungens</i>	American club-rush	spreading	0.3 – 0.5	+	+	+
Low Plants, Groundcovers						
<i>Centella cordifolia</i>	Centella	spreading	Prostrate	+		+
<i>Crassula helmsii</i>	Swamp crassula	spreading	Prostrate	+		+
<i>Dichondra repens</i>	Tom thumb	spreading	Prostrate			
<i>Hydrocotyle verticillata</i>	Pennywort	spreading	Prostrate	+	+	+
<i>Lilaeopsis polyantha</i>		spreading	Prostrate	+		+
<i>Marsilea drummondii</i>	Nardoo	spreading		+	+	+
<i>Myoporum parvifolium</i>	Creeping boobialla	spreading	Prostrate			
<i>Ranunculus inundatus</i>	River buttercup	spreading	Prostrate	+	+	+

<i>Samolus repens</i>	Creeping brookweed	spreading	Prostrate			
Submergent Species						
<i>Myriophyllum species</i>	Watermilfoil	submerged			+	+
<i>Triglochin procerum</i>	Water ribbons	submerged		+	+	+

3.0 DEVELOPMENT OF NORTHERN AREA

This section describes the proposed development of that part of the Silver Lakes property, north of the area that contains the existing house and proposed facilities, and is essentially the area that is currently grazed by livestock. The existing site is shown in Figure 1 Existing Site/Survey Plan (Drawing No 1817 DA0.1)

The proposed landscape development of this area is shown in the attached Figure 3 (Drawing No 1817 DA1.1).

3.1 Site Description

Except for an eighty metre wide strip parallel to Silver Lake Road and adjacent to the eastern boundary, this area is at present grazed by several cattle and four llamas. Consequently, the grazed area contains very little native vegetation, and what native plants and shrubs are present in the site are impacted by grazing, trampling and pugging of the soil in wet weather.

The fenced area (not grazed) adjacent to the eastern boundary contains some native vegetation, including mature and regenerating river red gums and blackwood (*Acacia melanoxylon*), and an understory consisting of patches of shrubby tea tree (*Leptospermum continentale*), and some rushes and sedges, as well as grasses and some weeds.

There is a small copse of planted pines near the north boundary, and a small number of various exotic trees, including willow, in the south-east corner. The south-western corner (west of the proposed wetland) contains scattered river red gums, with a grassy understory.

Two drainage ditches, running from west to east, across the property, one close to the northern fence line, and the other across the middle of the area, carry runoff from adjoining properties to the north and west, which appear to be mainly used for grazing cattle. A further shallow ditch provides some surface drainage along the eastern boundary fence line.

There is a small area of very shallow, ephemeral “swamp” in a localised depression, as shown, on the north side of a low mound or ridge; this ridge or high ground extends from near the west boundary to about two-thirds of the way across the property. This swamp contains a single species of a rush (*Juncus* species), which is being severely grazed by the livestock.

A permanent wetland, with open water and shallow reedbeds, is proposed to be constructed in the location as shown in Figure 2 (refer Section 2.0 Constructed Wetland).

A large portion of this northern area is subject to shallow flooding in the event of a 100 year ARI flood in the nearby Onkaparinga River; the approximate extent of flooding is indicated by a line following the RL 290.00 AHD contour, as shown in Figure 3 (Drawing No 1817 DA1.1).

It is intended that the livestock will be removed from the property in the future, and grass, etc, will be managed by mowing.

3.2 Existing Drainage Ditches and Surface Drainage

Two drainage ditches cross the property from west to east, one along the northern fence line, and the other through the middle of the property. Both carry natural surface runoff from the adjoining properties, which appear to be mainly used for cattle grazing.

Once livestock is removed from Silver Lakes, the shape and form of the existing ditches will make them very difficult to maintain or mow. It is proposed that all new drainage ditches or swales and any remaining existing ones will be regraded to wide shallow swales that can be readily maintained by mowing.

It is intended that the two main drainage ditches will be diverted as shown in Figure 3, and graded out to flow out on the existing natural surface, on the north side of the low ridge. The diverted inflow from the drains will spread over a wide area as dictated by existing contours as a slow-moving, very shallow flow. This will initially flow into an existing shallow 'swamp' area as shown, which will then overflow to the east around the end of the low mound and then to the south, finally discharging into the proposed wetland as a widespread shallow flow. A low wide bank, not more than 100 to 250 mm high, to be formed at the east end of the wetland as shown, will ensure all this surface flow will discharge into the wetland.

With water flowing through it for a considerable part of the year, these wide shallow overland flow areas, as shown in Figure 3, will become an ephemeral marsh (winter wet, summer dry), which when planted with suitable marsh and wetland vegetation, will create a significant area of marsh habitat for waterbirds and wildlife. This low perennial vegetation will remain green for much of the year, and many of the species, even in summer, will remain green, thus creating an extensive firebreak that will retard the spread of a fire.

The extent of this marsh habitat will depend on the rate of flow and volume of water flowing through this area, and dictated by the existing natural surface contours. The actual area of this habitat will change over time, as different plant species spread or reduce in extent, and as seasonal conditions (wet or dry) vary over time. Many plant species will survive extended dry seasons.

Subject to the availability of a water supply (eg, from a bore), it would be possible to occasionally discharge some water into the top of the overland flow area, to maintain the vegetation in a greener state during summer, than if it has to rely on natural rainfall and runoff. However, this has not been considered in any detail at this stage, and would be subject to the availability of water.

3.2.1 Planting of Overland Flow Areas

A list of species suitable for planting in this "marsh" area is shown in Table C. Most species are perennial, and many will spread naturally into any area that is suited to their survival and growth. The actual extent of the area to be planted will depend on the extent and width of the overland flow, as controlled by existing contours and levels, as flow occurs during winter.

The clumping species should be planted in a sparsely spaced, random natural manner. Spreading species can be planted in a more regular pattern, and over time will create a dense ground cover.

TABLE C – Species for Planting Overland Flow Areas

SPECIES	COMMON NAME	GROWTH/HABIT	HEIGHT (M)
Taller Sedges, Rushes, etc			
<i>Baumea juncea</i>	Bare twig-rush	spreading	0.5
<i>Carex appressa</i>	Tall sedge	clumping	1.0
<i>Carex bichenoviana</i>	Sedge	spreading	0.5
<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	clumping	To 0.6
<i>Cyperus vaginatus</i>	Flat-sedge	clumping	0.3 to 1.0
<i>Eleocharis acuta</i>	Common spike-rush	spreading	To 0.6
<i>Juncus species (local)</i>	Rushes	clumping	1.0 to 1.5
<i>Microlaena stipoides</i>	Weeping rice-grass		To 0.5
<i>Schoenoplectus pungens</i>	American club-rush	spreading	0.3 – 0.5
Low Plants, Groundcovers			
<i>Centella cordifolia</i>	Centella	spreading	Prostrate
<i>Crassula helmsii</i>	Swamp crassula	spreading	Prostrate
<i>Dichondra repens</i>	Tom thumb	spreading	Prostrate
<i>Hydrocotyle verticillata</i>	Pennywort	spreading	Prostrate
<i>Lilaeopsis polyantha</i>		spreading	Prostrate
<i>Marsilea drummondii</i>	Nardoo	spreading	20 – 30 cm
<i>Myoporum parvifolium</i>	Creeping boobialla	spreading	Prostrate
<i>Ranunculus inundatus</i>	River buttercup	spreading	Prostrate
<i>Samolus repens</i>	Creeping brookweed	spreading	Prostrate

3.3 Overland Flow and Water Quality

Runoff from the adjoining properties (which are used mainly for livestock grazing) will carry pollutants such as sediment and nutrients (from fertilisers and manure from cattle).

Areas of dense grasses and sedges, etc, such as will be established in these overland flow areas, are very effective at trapping and retaining any sediments and pollutants that may be present in the runoff.

All overland flow will discharge into the wetland, which will provide further water quality improvement. The overflow from the wetland will then flow into the Silver Lake, and the lake will overflow to the Onkaparinga River. The wetland will remain full throughout the year by pumping and recirculating water from Silver Lake, so all inflow from overland flow will not be used to maintain the wetland, but will simply be diverted through the wetland

and lake and to the river, as it does now, with possibly a significant improvement in water quality.

If there are substantial flows into the wetland from the overland flows, which may exceed the capacity of the wetland return drain to the lake, then the wetland can overflow via a spillway on a natural surface at the east end of the wetland, making its way to the existing culvert under Silver Lake Road and thence into the river.

3.4 Weeds, Removal of Pines

There are some small scattered patches of pest plants present in this northern area (broom, gorse, etc), mainly along fence lines, and which have been subject to previous control/eradication work. Regular treatment to control and desirably eradicate all pest plants will continue to be carried out as part of regular maintenance.

A small area of pines in the north-east corner of the area will be removed.

3.5 Waste Water (Irrigation) Disposal Area

An area is required for the disposal of treated domestic waste water from the two residential buildings; the area required has been sized at a minimum of 1,000 m² (refer to Appendix C). A suitable area, located above the 100 year ARI flood level, in the north-west corner of the property, is shown in Figure 3.

Waste water will be applied to the disposal area by a sprinkler system. Assuming some continuity of use of the effluent treatment system, there should be some regular application of waste water to the site, which will sustain planted vegetation during dry summer periods.

The irrigated area will be isolated from runoff from the surrounding areas by a low bund around the perimeter of the planted area, and a gravel-filled cut-off trench on the high side of the irrigated area. The bund on the low side of the irrigated area will contain any possible runoff from the irrigated area.

3.5.1 Planting of Waste Water Irrigation Area

The irrigated area will be planted with native plant species, selected from the species listed in Table D. The species listed are all native to the Greater Adelaide Region, and most are able to tolerate normal dry summer conditions. The proposed plant species list has been derived from "*Water Sensitive SA – A guide to raingarden plant species and placement.*"

Many of the species listed will be common to the proposed planting of the overland flow areas (refer Section 3.2.1 Planting of Overland Flow Areas).

Some of the species can spread by rhizome growth, so will be able to spread and provide a dense sward, competing with weeds. Others will set seed, and so are able to self-seed when conditions are suitable.

Table D - Species for Planting Waste Water Irrigation Area

SPECIES	COMMON NAME	HEIGHT	SPREADING	NITROGEN REMOVAL
<i>Baumea juncea</i>	Bare twig-rush	200 – 1000	Yes	Yes
<i>Carex appressa</i>	Tall sedge	1000		Yes
<i>Carex bichenoviana</i>	Sedge	400	Yes	Yes
<i>Carex inversa</i>	Knob sedge	200	Yes	
<i>Carex tereticaulis</i>	Rush sedge	600 - 1200		Yes
<i>Centella asiatica</i>	Centella	100	Yes	
<i>Chorizandra enodis</i>	Black bristle rush	550		
<i>Crassula helmsii</i>	Swamp crassula	50	Yes	
<i>Cyperus gymnocaulis</i>	Spiny sedge	700		Yes
<i>Dichondra repens</i>	Kidney weed	100	Yes	
<i>Eleocharis acuta</i>	Common spike rush	250 – 400	Yes	
<i>Ficinia nodosa</i>	Knobby club-rush			Yes
<i>Hydrocotyle verticillata</i>	Shield pennywort	30 - 100	Yes	
<i>Juncus amabilis</i>	Gentle rush	600 - 1200		Yes
<i>Juncus flavidus</i>	Rush	350 - 1500		Yes
<i>Juncus subsecundus</i>	Finger rush	300 - 1000		Yes
<i>Marsilea drummondii</i>	Common nardoo	100 - 300	Yes	
<i>Microlaena stipoides</i>	Meadow rice-grass	500	Yes	

Note: Species listed as “Yes” under “NITROGEN REMOVAL” heading are particularly effective at nutrient removal (nitrogen and phosphorus), and are recommended to be planted at a minimum of 50% of the total planting.

3.5.2 Function of Waste Water Area Planting

The proposed planting will provide a number of functions including supporting the removal of nitrogen and phosphorus via the proliferation of biofilms on plant roots and stems, promoting evapotranspiration and maintaining soil conductivity.

Increased nutrient-removal capacity is made possible when there is a diversity within the microbial community. As different plants support different species of bacteria, a diverse selection of plant species is recommended, with a range of plants effective at nitrogen removal (as listed Table D) to make up at least 50% of the total planting.

3.5.3 Maintenance of Waste Water Area Planting

The plants listed are all perennial, growing through all seasons provided some soil moisture is available. As much of the nutrient-removal capacity is dependent on the microbial community on root systems, deliberate harvesting and removal of leaf and stem material is not essential for the continued effectiveness of the system. However, occasional mowing will be desirable to stimulate growth, and to remove any build-up of dry material, which could be a fire hazard in summer.

Any weeds should be regularly removed by any suitable method, whether by spot spraying, hand pull, etc. Any bulrush (*Typha* species) germinating in the irrigated area should be hand pulled or spot sprayed by an approved herbicide.

3.6 Productive Orchard Plantings

It is intended to develop some plantings of avocado and persimmon, for on-site use by visitors and the family.

The extent and location of any plantings has not been finalised at this stage, but two areas that may be suitable are shown in Figure 3. Both areas are located on relatively high ground; the western area is above the 100 year ARI flood level, the other is slightly below that level, but on relatively higher ground.

3.7 Landscape Maintenance

Appropriate and considered maintenance of this redeveloped northern area will be required to sustain and enhance its aesthetic appeal, to develop and maintain habitats, and to reduce fuel loads and bushfire hazard. Greater detail of the proposed maintenance of specific areas and landscape elements is provided in Section 5. 0 - Silver Lakes Landscape Management and Maintenance.

Generally, in order to maintain low fuel levels and to remove dry material before the start of summer to minimise fire risk, the landscape generally will be maintained by regular mowing, using suitably sized machinery.

The area that is at present grazed by livestock, after removal of animals, will generally be mown to maintain a low grassy woodland and grassland. It is not proposed to carry out any planting of woody vegetation (except for the screen planting as shown), so that the existing very low woody fuel levels that are present over much of this area is maintained.

The overland flow “swamp” areas, as discussed previously, will generally not require regular mowing, but may need occasional mowing of selected areas to remove any build-up of dry material.

The eastern area (along the frontage to Silver Lake Road) that is not grazed at present, contains a number of established trees (mainly river red gum and blackwood, with a few stringybark), with scattered patches of tea tree (*Leptospermum* species), some rushes and sedges (*Juncus* species), and grasses (refer Figure 3).

To reduce and minimise fire fuel load in this area, while maintaining existing native species and habitat, it is proposed that mowing be regularly carried to create a mosaic pattern of mown and un-mown areas, retaining areas with substantial stands of the sedges, rushes and tea tree, while minimising annual grasses, etc, that contribute to the fuel load. Small and seedling red gums that are present are to be removed and regrowth controlled, to minimise any increase in woody fuel load. Existing weeds along the fence line are to be removed.

This approach to maintenance of this area will minimize the fuel load, while retaining native species, habitat and biodiversity, and at the same time creating a visually attractive, varied and interesting landscape when viewed from the roadway.

3.8 Environmental Benefits - Summary

A number of environmental benefits will result from the proposed development and maintenance regime for this northern part of the Silver Lakes property, summarised as follows: -

- Water quality – all runoff from this area of the property and that flowing into the property from adjoining rural areas to the north and west of Silver Lakes will pass through large areas of grass and sedge vegetation, as a slow shallow overland flow, so that sediment and possible nutrient loads in the runoff will be significantly reduced. This runoff will then flow into and through the proposed wetland, undergoing further treatment, before flowing into the Silver Lake and ultimately into the nearby Onkaparinga River.
- Removal of livestock from the property will eliminate the present nutrient load from animal manure, and the production of sediment through soil disturbance, which would have an impact on water quality of runoff from the property.
- There are a small number of remnant native plants that can be found on the site, that are at present severely impacted by grazing and trampling. Removal of livestock and the implementation of a selective mowing regime as proposed, will allow these plants to survive and spread, increasing biodiversity and habitat values of the site.
- The diversion of drainage ditches to discharge onto the natural surface, in place of confining runoff to faster flowing ditches, will create significant areas of native “swamp” vegetation and habitat, with considerable benefit to water quality and the creation of habitat for wild life. These areas will provide an opportunity to plant and

establish a range of local swamp and wetland species that are at present not found on the site, to supplement the few remnant species that can be found on the site.

- The proposed selective mowing of the area, while minimising fire fuel loads, will allow low flammability native vegetation, such as perennial sedges and groundcovers, to survive, establish and spread.

Visually and habitat-wise, this area will become an attractive and interesting landscape of open woodland with mown understory, significant open areas of rush, sedge and wetland landscape, and some orchard plantings.

4.0 MINOR LANDSCAPE ELEMENTS

Several other works will be undertaken in the development of the property, as follows: -

4.1 Lake Walking Trail

A walking trail will be constructed around the perimeter of the lake for the use of visitors to the B & B residence, and to other visitors and residents. This will allow waterfowl on the lake to be observed, and the lake and woodland landscape to be viewed and enjoyed.

The location of the trail will be as shown in Figure 3.

4.2 Property Perimeter Access Track

A track suitable for use by small vehicles and mowing machinery will be constructed around the perimeter of the property, as shown in Figure 3, to provide access mainly for maintenance activities.

It will also provide a longer distance walking trail, linking with the lake trail.

It will be maintained by regular close mowing, to minimise grass cover, or kept clear of grass – in this way, it will also provide a fire break around the property that could be useful to help control low intensity grass fires from spreading into the property.

4.3 Screen Planting

Some limited screen planting will be undertaken, as shown in Figure 3, to provide a visual screen of the proposed new residence, sheds, etc, from passing traffic on Silver Lake Road.

The plants to be used for this planting will be selected from a list of low flammability small trees, shrubs and understory species, as listed in Table E below (taken from South Australian State Flora lists). The screen planting will assist to inhibit the spread of fire in the property, should a fire front coming from the east occur.

It would be desirable to provide some form of permanent irrigation to any screen planting, if water is available, particularly close to buildings, so that the plantings can be kept well-watered during summer to maintain plants in a healthy green condition, which will help to reduce flammability.

Table E – Screen Planting Species List - Fire Resistant Native Plants –

<i>Acacia melanoxylon</i>	<i>Hymenosporum flavum</i>
<i>Acacia sophorae</i>	<i>Lophostemon confertus</i>
<i>Atriplex nummularia</i>	<i>Myoporum insularae</i>
<i>Correa spp</i>	<i>Myoporum montanum</i>
<i>Dianella revoluta</i>	<i>Myoporum viscosum</i>
<i>Dianella tasmanica</i>	<i>Prostanthea ovalifolia</i>
<i>Enchylaena tomentosa</i>	<i>Rhagodia candolleana</i>
	<i>Rhagodia spinescens</i>

5.0 SILVER LAKES LANDSCAPE MANAGEMENT AND MAINTENANCE

This section describes the management and maintenance regimes that are proposed to be implemented for the Silver Lake property. The maintenance undertaken for different areas/zones relates to the purpose or function of each area, the long term land management objectives, habitat values, and amenity. Each different zone is numbered 1 to 8 and shown in Figure 4 (Drawing No 1817 DA6.1).

5.1 Management/Maintenance Objectives

The management of the landscape of the Silver Lakes property will have the following main objectives: -

- To create, establish and maintain a visually attractive and interesting landscape which can be experienced and enjoyed.
- To establish a low maintenance landscape where habitat and species diversity is maintained and maximised.
- To develop a functioning landscape.
- To reduce fire risk by minimising the overall fire fuel load and the ability of fire to carry and spread through the landscape.
- To establish a landscape containing native and introduced species which are designed to assist with the protection of buildings and infrastructure in the event of a bushfire.

5.2 Existing Landscape

As a general overview, the Silver Lake property is a mix of naturally regenerating local native species dominated by *Eucalyptus camaldulensis* (River Red Gum), found around and south of the lake, and to the west and to the north of the existing house, with small areas of mainly *Eucalyptus obliqua* (stringy bark) and *Acacia melanoxylon* (blackwood) to the east.

Exotic trees and shrubs are located at the entry of the property along the driveway and around the house and existing infrastructure.

A mix of introduced grasses such as Yorkshire Fog grass and Phalaris with woody weeds, blackberry and gorse form the groundcover of much of the more natural areas.

The native trees have significant habitat value and are very important to the natural landscape and aesthetic values of the site, however this woody vegetation may increase the heat intensity of a bushfire if combined with dry exotic grasses and poor maintenance.

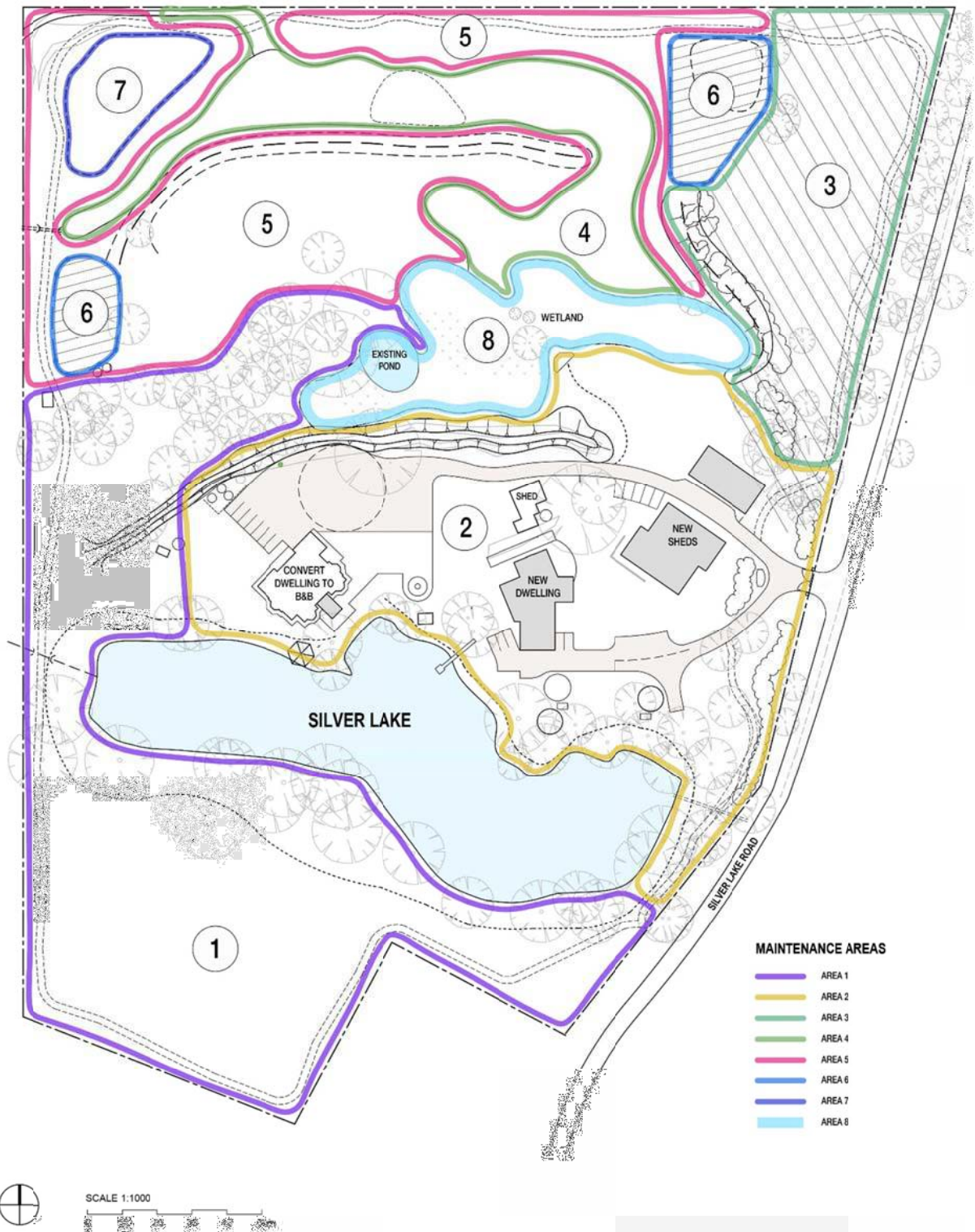


Figure 4 Proposed Landscape Maintenance Areas (refer also to Architectural Drawing Set)

It will be important that fuel loads are not allowed to increase by deliberate plantings of highly flammable native species, however desirable this may be from a habitat perspective. A reduction in highly flammable exotic ground cover (grasses particularly) by establishing less flammable native vegetation, such as *Microlaena stipoides* (Weeping rice-grass) and *Bothriochloa macra* (Red-leg grass), is also a very highly desirable long term objective.

The proposed mowing/slashing regime and fuel reduction actions, such as pruning of low branches and control of excessive natural regeneration of *Eucalyptus camaldulensis*, along with other landscape management actions, are aimed at assisting with bushfire management, should a fire occur, and reducing the potential impacts on human life and the built environment from the spread of a bushfire.

5.3 Managing and Replanting the Landscape

Splitting the property into manageable zones will enable the owner to develop and schedule a maintenance program.

The landscape design and the selection of suitable plant species to be used in developing the property will assist to achieve the maintenance objectives. Key considerations in the selection of species for planting of the landscape are;

1. Low flammable species within a minimum of 20m around the built environment.
2. Replacement of highly flammable introduced grasses with native grasses.
3. Careful selection of suitable wetland species for planting of the lake, wetland, overland flow and waste water irrigation areas.
4. Strategic layout, design and maintenance of existing species within the landscape.

Definitions relating to maintenance and planting, as follows: -

1. Mowing - Typically mowing refers to the use of a hand push mower or small ride on mower. This equipment can cut low to the ground and turn materials into fine particles, reducing flammability.
2. Slashing - Typically slashing refers to the use of a PTO from a tractor to provide the energy to drive the slasher. This equipment leaves a coarser residue than a mower and is usually used for larger areas.
3. Brush cutter - Is a hand held device which uses a blade or plastic line to cut the desired material. Usually used on grasses, however can be used on small plants and woody weeds.
4. Fire retardant species - refer to fire management report.
5. Wetland species - refer to various wetland species lists.

5.4 Maintenance Zones/Areas

The proposed maintenance regimes and methods for specific areas of the property as numbered and shown in the attached drawing Figure 4, are detailed as follows: -

Zone 1 – River Red Gum Woodland.

Generally areas with existing established and mature river red gum woodland, with little native understory, however the existing ground cover is mostly introduced grasses and may be infested with blackberry or gorse woody weeds.

Located to the south of the lake, along part of the west boundary and immediately north of the existing residence.

Control Activities

- To be maintained by regular slashing and mowing.
- Reduce the natural regeneration of *Eucalyptus camaldulensis*.
- Regular removal of fallen branches from the areas after drop.
- Prune up lower limbs to increased foliage height above ground level.
- During winter, grass can be allowed to grow to an appropriate height, however in spring and before the grassy cover dries off, close mowing is to be carried out, so that all grass and leaf, bark and twig litter is finely mulched to minimise its combustibility.

Zone 2 – Building Surrounds (Asset Protection Zone)

The landscape of this area will be more “manicured”, in keeping with residential building surrounds and the presentation of the visitor facilities. Existing large Eucalyptus trees to remain and be protected.

Located around the built infrastructure with a minimum of a 20m separation distance from the infrastructure to other zones.

Control Activities

- The buildings to be surrounded by irrigated introduced lawn grass.
- Removal of wood mulches and replace with gravel where required.
- Exotic, less flammable trees to be used in landscape design.
- Minimal ground covers planted.
- Use of fire retardant species in landscape design.
- Remaining regulated or significant trees to have a bushfire sprinkler installed on trunks.
- Regularly mown to provide a tidy landscape.
- Regular mowing will extend out to the property boundary fence along Silver Lake Road, and along the verge between fence and road pavement of Silver Lake Road.
- Existing deciduous trees to be planted no closer than 20m from structures.
- Canopy of existing Eucalyptus trees to be lightly pruned.

Zone 3 – North-Eastern Sedge and Tea-tree Area

As well as scattered river red gums (*Eucalyptus camaldulensis*), and some blackwood (*Acacia melanoxylon*), there are patches of low shrubby tea tree (*Leptospermum continentale*) and various sedges scattered through this area. An area of relatively high conservation value, it also contains introduced grasses and other exotic weed species as part of the mix.

Located along the eastern road boundary, running from the entrance road to the northern boundary, approx 80 m wide.

Control Activities

- Mowing/slashing to create an informal mosaic of regularly mown grass with clumps of the existing tea tree and sedges retained, designed to preserve the habitat values associated with the native species found here.
- Use bush care strategies to control Watsonia, Blackberry and Gorse.
- Remove fallen branches to further reduce fuel loads, prune lower branches of larger trees.
- Reduce introduced grasses via appropriate bush care control measures and replace with perennial native grasses such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass).

Zone 4 – Overland Flow Areas

This area will receive runoff from adjoining properties, with two existing ditches/drains diverted as shown in Figure 3. This water flow will keep the area wet/moist for most of the year (depending on rainfall), which will aid in the creation of habitat and improve water quality.

A significant area of ephemeral marsh/wetland habitat will be created, suitable for a number of wetland bird species, frogs, etc, merging with and complementing the habitat created by the permanent wetland.

Located to the north of the built environment and the constructed wetland, roughly in the middle of the northern part of the property.

The extent of this marsh habitat will depend on the duration, the rate of flow and volume and of water over and through this area, and natural surface contours, and will be surrounded by dryland areas with annual grasses. The exact area of this habitat will change over time, as different plant species spread or reduce in extent, and as seasonal conditions (wet or dry) vary.

Control Activities

- Plant this area with a wide range of suitable wetland and marsh plants that will generally remain green for most if not all the year (species will be selected that do not produce much dry material).
- Remove introduced grasses yearly (spring), to improve habitat quality and reduce flammability of mixed species.
- Control introduced woody weeds such as blackberry, gorse and Spanish broom.
- Selective mowing should only be required for patches where there is a build-up of dry material.
- Replace areas of introduced grasses or areas of soil disturbance with native perennial grasses such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass).

Zone 5 – Dryland Annual Grass Areas

This area consists of all open areas that are at present grazed by livestock, and is dominated by introduced pasture grasses and is generally without tree cover.

Located to the north of the built environment, the area surrounds the overland water flow area, wetland, red gum woodland and orchards.

Control Activities

- Slashing in spring once the ground begins to dry and again in early summer, to reduce/minimise fuel loads.
- Maintain low grass growth throughout the summer and autumn, which will likely require slashing once a month (on days of reduced fire risk).
- Over time replace areas of introduced grasses with *Microlaena stipoides* (Weeping rice-grass) and *Bothriochloa macra* (Red-leg grass), with an aim to reducing reliance on slashing.

Zone 6 - Orchard Areas.

The orchards will produce high quality produce therefore they will be regularly maintained and kept well-watered. The actual locations and extent of the proposed orchard plantings have not been finalised at this stage.

Two possible suitable areas have been shown in the landscape plan in the north-eastern corner and near the western boundary of the property.

Controls Activities

- Irrigated tree crops - drippers and micro sprays.
- Close mowing of groundcover between rows or regular cultivation.
- Limestone based access path around the edge of the planting.

Zone 7 – Waste Water Irrigation Area

This area will be planted with perennial vegetation that will be regularly irrigated via sprinklers with waste water. The plants will be instrumental in removing nitrogen and phosphorus from the waste water and the soil, particularly through bacterial biofilm on plant roots, and will utilise the waste water through evapotranspiration. Occasional mowing will stimulate growth, supporting and enhancing nutrient removal.

Many of the species planted will spread by rhizome growth, so will be able to spread and provide a dense sward, competing with weeds. Others will set seed, and so are able to self-seed when conditions are suitable. Similar to the overland flow areas, only occasional mowing will be necessary to remove any build-up of dry material and to stimulate growth.

Control Activities

- Planting with the desired/correct species from the start, and replanting as necessary to maintain the desired mix of species.
- Use bush care methods to control any introduced grasses or weeds from the area.
- Occasional mowing to stimulate growth, and to remove any build-up of dry material.

Zone 8 - Wetland

The wetland has been designed to assist with water cleansing of the Silver Lake. It will be planted with a range of smaller wetland plant species that produce low amounts of seasonal dry material. Larger species like common reed (*Phragmites australis*) will not be used in the planting, and any regeneration of Bulrush (*Typha* spp) will be controlled.

Control Activities

- Planting with the correct species from the start.
- Design the wetland to enable easy maintenance.
- Use bush care methods to control any introduced grasses or weeds from the site.
- No large wetland species such as common reed (*Phragmites australis*) used in the planting program.
- Yearly inspection and removal of Blackberries or other woody plants.
- Regular inspection and removal of Bulrush (*Typha* species).
- Brush cutting and mowing around the perimeter of the wetland.

Zone - Silver Lake

The lake edge is dominated by Bulrush (*Typha* species), which is excellent habitat for waterbirds but is unsightly in winter and is also difficult to control and can dominate in this environment, excluding other desirable wetland species.

Red Gum (*Eucalyptus camaldulensis*) may naturally regenerate on the banks.

Increasing the diversity of the wetland species in the lake will further enhance its habitat and water filtration values.

Control Activities

- Removal of livestock from the edge of the lake.
- Brush cutting of Bulrush (*Typha* species) from the northern edge of the lake during growth over summer (refer Section 1.5).
- Strategic planting of other wetland species in suitable areas (as described elsewhere).
- Control/limit the natural regeneration of Red Gum (*Eucalyptus camaldulensis*) seedlings.
- Control blackberries and other introduced species using bush care processes.

Zone - Paths and Mineral Breaks

Access paths and mineral breaks within the landscape will provide a walking trail, ease of small equipment access, enable delineation of areas where required and assist to reduce the potential spread of grass fires.

Control Activities

- Use limestone based quarry rubble, minimum width of 2m.
- Eradicate any grass or weed growth on paths, access tracks and mineral breaks.
- Designed to enable mowing along the edge of the path, tracks, etc.

Zone - Weeds and Pest Plants

There are a number of existing proclaimed woody weed species present on the site including blackberry, gorse, Spanish broom and *Watsonia*, all requiring ongoing controls. Their complete eradication may not be possible.

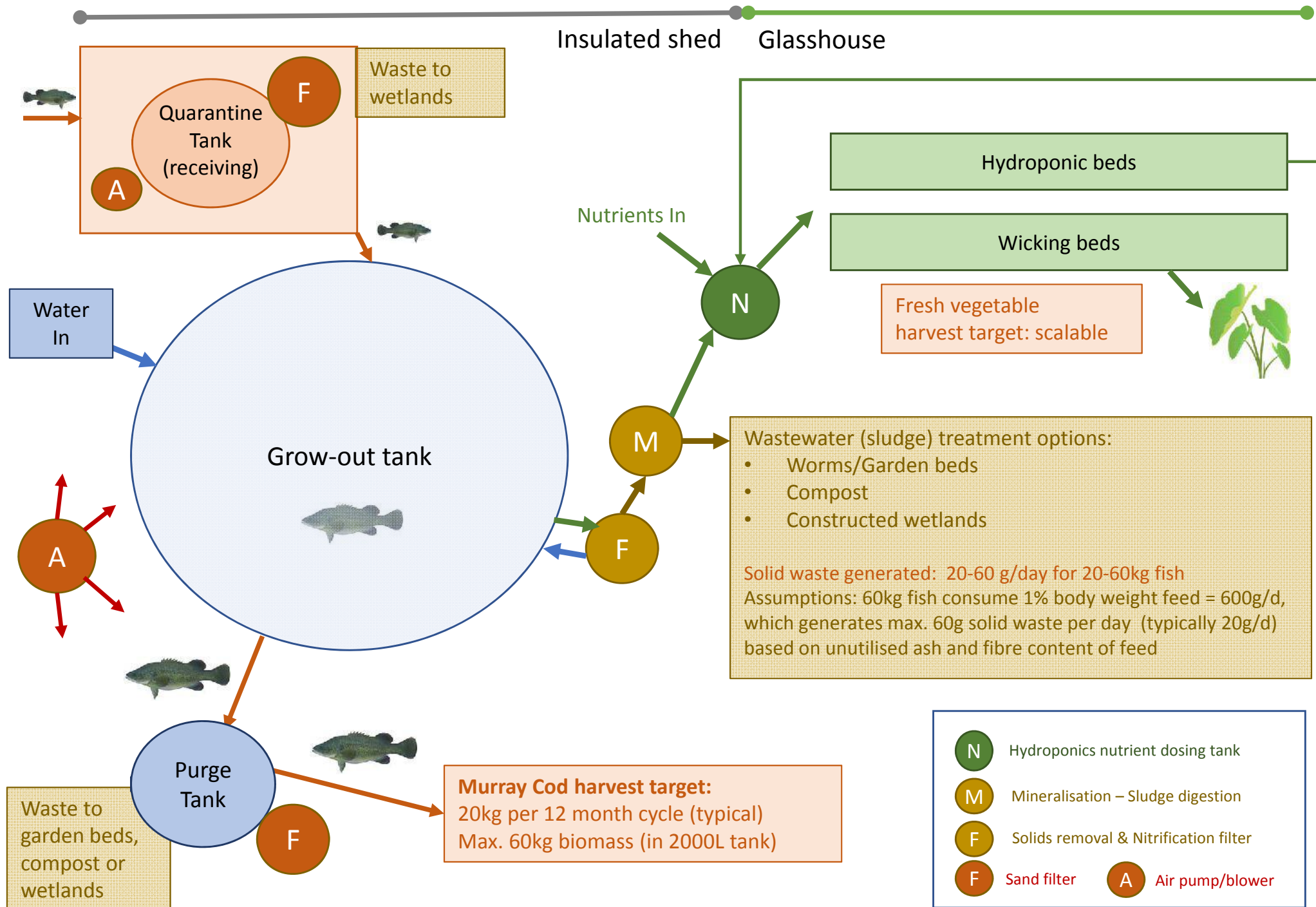
There are also introduced grasses requiring ongoing controls to reduce fuel loads.

Control Activities

- Initial use of approved chemicals to control existing woody weeds.
- Yearly reviews to identify and mark regrowth of woody weeds.
- Use of bush care processes to continue yearly controls of woody weeds.
- Maintain brush cutting, mowing or slashing of the different zones, as discussed above.
- Implement a native grass replacement program when reseeding any disturbed sites.
- Implement a native grass replacement program with perennial species such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass), to reduce aggressive exotic grasses such as Phalaris, Fog grass and Ryegrass.

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Decoupled domestic-scale aquaponics system (two recirculating loops)



Silver Lakes Development

Landscape Development and Maintenance Report

Prepared by: - *Barrie Ormsby Landscape Architect* FAILA

5 March 2020, Revised 22 February 2021

Prepared for: - Rudy Gomez

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INTRODUCTION

Barrie Ormsby Landscape Architect has been engaged to assist in the preparation of a development proposal for the Silver Lakes property, located on Silver Lake Road, near Mylor.

This report details and assesses the present site conditions, particularly in relation to the heritage listed Silver Lake (an artefact of past alluvial gold mining in the district), existing vegetation (native and exotic), and water related issues (natural runoff/water flows into and through the property, surface drainage, 1 in 100 year ARI flooding levels, and water quality).

The proposed landscape works as detailed in this report have a focus on: -

- Maintaining and protecting the heritage characteristics of the Silver Lake site, while enhancing its visual and habitat values, and water quality,
- Maintaining and improving the quality of all water discharged from the property to the nearby Onkaparinga River,
- Maintaining and enhancing the extent of existing habitat and increasing habitat diversity in the property, both aquatic and terrestrial,
- Creating and maintaining a visually attractive and interesting landscape, compatible with and integrated into the character of the broader landscape,
- Developing a landscape that, as much as possible, reduces bush fire hazards and risks to the developed infrastructure and its residents, and,
- Development of a landscape that can be maintained in a practical and systematic manner, so that the above objectives can be achieved and sustained into the future.

The major elements of the existing site are shown in Figure 1 – Existing Site/Survey Plan (Drawing DA 0.1).

Please note that not all trees on the site have been surveyed, particularly south of the lake, and in the northern part of the property. The site plan (Figure 1 – Existing Site/Survey Plan (Drawing DA 0.1)) also shows several elements that are proposed to be removed – fence, solar panels, shed, that may not be referred to elsewhere in this report.

1.0 SILVER LAKE

1.1 Existing Condition

The lake was originally excavated by hand during alluvial gold mining operations in 1906-08, and naturally filled from ground water when mining operations ceased in 1911.

The lake has a surface area of approx 8,400 m², and is reported to have a maximum depth in the order of 6 m; the volume could thus be in the order of 25,000 to 40,000 m³, depending on its average depth (bathymetry of lake invert not known).

The lake margins are well vegetated mainly with Bulrush (*Typha* spp). It would be expected that the banks below the water level would be quite steep; this is reflected in the narrow width of the bulrush around the water edge. The lake is surrounded by mature river red gums, which would shed leaf, bark and twigs into the lake throughout the year.

The water level of the lake is maintained by groundwater inflow, and by inflow during winter and spring from an upstream rural catchment of about 15 ha. From the recent survey of the property, the water level of the lake appears to be at about RL 289.00 (AHD). The water level is controlled by a culvert (approx diam 500 mm) under the retaining bank at the east end of the lake; this drains through a culvert under Silver Lake Road, then to the Onkaparinga River. It is reported that the water level can drop during summer due to evaporation losses.

Water quality testing carried out by Water Technology (refer to Appendix A) indicated that water quality is good, with no pollutant parameters of concern. The lake water is moderately discoloured by tannins which leach from the eucalyptus leaf and bark debris that would continually fall into the lake from the surrounding mature River red gum woodland. This discolouration is mainly an aesthetic issue, and is typical of streams and ponds in eucalypt forest environments.

There are some fish in the lake; carp are reported to be present, and other species may also be present. Some water birds such as water hen use the bulrush for nesting; native duck and other species are also present at times.

1.2 Heritage Listing

The lake was originally excavated by hand during alluvial gold mining operations in 1906-08, and naturally filled from ground water when mining operations ceased in 1911.

The lake and surrounding land was named "Silver Lake" and was used for boating and picnics and sporting activities such as cricket and tennis. (From Stirling District Heritage Survey, date not known, the lake recommended for inclusion on Local Heritage Register). It was also exploited commercially as a swimming pool in the 1920's, and a dance hall was erected near the lake, with dances held on Saturday and Sunday nights. This continued until about the 1960's.

Its heritage significance is related to both as an artefact of early gold mining activities in the area, and its long use by the community for recreational activities.

In recognition of its heritage significance, the layout and general appearance of the lake will not be changed or altered.

1.3 Water Sources and Water Quality

The water level of the lake is maintained by surface runoff from a rural catchment of about 15 ha, and by groundwater inflow, and can be topped up if necessary during summer from a bore. It is reported that the water level can drop during summer.

The lake overflows through a culvert (approx 500 mm diam) under the eastern bank, to a culvert under Silver Lake Road and then to the Onkaparinga River. Water from the Onkaparinga River can enter the lake through the culvert during 1 in 100 ARI flood events.

Water quality testing carried out by Water Technology (refer to Appendix A) indicated that water quality is good, with no parameters of concern.

It is intended to circulate water from the lake to a constructed wetland, which may provide some improvement in the water quality of the lake, and possibly reduce the discolouration of the water by tannins from the river red gum litter.

1.4 Sediment Removal

It is reported that there is up to 2 m of sediment on the invert of the lake, which has accumulated over more than 100 years.

The sediment has been assessed for any possible contamination for a wide range of parameters by Water Technologies (refer to Appendix A). The results show that all samples are below the upper threshold limits for Waste Derived Fill Material, and so are suitable for site based disposal.

It is considered desirable that as much of this accumulated sediment and organic matter be removed from the lake as possible to improve its suitability for fish and its aquatic biodiversity, but this will be addressed in a future and separate Development Application.

1.5 Lake (Aquatic) Vegetation

1.5.1 Background

The water edge of Silver Lake is fringed with a narrow band of *Typha domingensis* (bulrush or cumbungi), which grows up to 2 m or more tall. It is winter deciduous, dying off completely in winter and so can look very unattractive. Birds such as coots, waterhen, etc, create nests in the dense vegetation of the bulrush, but in the process trample the leaves and stems, adding to its untidy appearance.

Typha can dominate the vegetation of a lake or wetland, competing with and suppressing other emergent wetland plants, and severely reducing diversity and habitat value. Old stands of bulrush build up a mass of dead material, which inhibits its own growth and prevents other species from establishing.

Both because of its unattractive appearance and the low habitat value that the existing stands of bulrush provide in the lake, a staged program to reduce its extent in the lake and the planting of additional species to replace the *Typha* is proposed to be carried out.

1.5.2 Control and Reduction/Removal of *Typha*

Typha can be controlled and eventually eradicated if desired by simply by cutting the stems below water level, which causes the plant to drown and die. Like all emergent wetland plants, they rely on air (oxygen) transported from the leaves down through the stems into the roots, in order to be able to grow and survive in the saturated anaerobic soils of a wetland or lake.

Cutting should desirably be carried out in winter, when the plants are dormant and the plants more vulnerable.

In Silver Lake, because the banks around the lake are very steep, it may be necessary to carry out this operation from a boat or raft. It is desirable to remove as much of the cut material from the water as possible, which would decompose and consume oxygen in the water, which would be undesirable.

Removal of the *Typha* by excavation using large machinery to completely remove roots and rhizomes would be detrimental, as this would remove the soil below water level that any new planting would be carried out into, making it difficult if not impossible to establish any new plants at all, and possibly leaving the banks open to erosion.

1.5.3 *Typha* Removal and Replanting Methodology

The removal of *Typha* and replanting needs to be carried out progressively, so that habitat particularly for water birds can be retained and not unduly disrupted. Not more than approx 20 to 25% of the *Typha* should be cut in any one year, in small patches of not more than 5 to 10 m in length or less.

Each patch where *Typha* has been cut must then be planted, preferably in spring, with the mainly taller species that will replace the habitat and visual function of the *Typha*, together with a selection of the minor smaller species that will add to the diversity of the vegetation. If the water level of the lake can be maintained throughout summer (from the bore), then planting could be carried out in summer.

Sections of the water edge where *Typha* has not been cut can be planted at any time with a range of smaller species suited to the water edge; these may then be able to establish before the *Typha* is eventually cut.

It is essential that all species of wetland plants, except submergent species, be planted in water depths that are less than half the height of the seedling being planted, otherwise the seedlings will drown. It may be an advantage to use larger than normal sized seedlings.

1.5.4 Replanting Species List

The following species list provides a comprehensive selection of plants that can achieve the desired appearance and the creation of a more diverse habitat.

Spreading species, large and small, will spread and establish in any area that is suited to that species, particularly in regard to water depth, and so can be regularly spaced in the planting area. Clumping species should be more randomly spaced to achieve a more natural look.

Table A – Lake Planting Species List

GROWTH HABIT	SPECIES	COMMON NAME	DESCRIPTION
Tall, spreading	<i>Phragmites australis</i>	Common reed	2 – 3 m tall, will compete with <i>Typha</i>
	<i>Schoenoplectus validus</i>	River club-rush	To 2 m tall, green foliage
	<i>Baumea articulata</i>	Twig rush	1 -2 m tall
	<i>Eleocharis sphacelata</i>	Tall spike-rush	To 2 m, green foliage
Smaller, spreading	<i>Eleocharis acuta</i>	Common spike-rush	To 0.5 m, grassy appearance
	<i>Baumea juncea</i>	Bare twig-rush	0.5 to 1.0 m, wiry grassy appearance
	<i>Carex bichenoviana</i>	Sedge	Up to 0.5 m, at water edge, spreads well, can form green grassy swards up banks
	<i>Schoenoplectus pungens</i>	American club-rush	To 0.3 to 0.6 m, vigorous spread
Low, spreading	<i>Centella cordifolia</i>	Centella	Plant at water edge
	<i>Cotula coronopifolia</i>	Waterbuttons	Plant at water edge
	<i>Hydrocotyle verticillata</i>	Shield pennywort	Plant at water edge
	<i>Ranuncularis amphitrichus</i>	River buttercup	Plant at water edge
Tall, clumping	<i>Juncea pallidus</i>	Pale rush	To 1.5 to 2.0 m
	<i>Gahnia seiberiana</i>	Saw sedge	To 1.5 m, at or just above water edge
	<i>Carex appressa</i>	Tall sedge	To 1.0 m, at water edge
Smaller clumping	<i>Baumea juncea</i>	Bare twig-rush	To 0.5 m, at water edge
	<i>Cyperus vaginatus</i>	Flat sedge	Up to 1.5 m, dense wide tussock, very hardy, in shallow water or above water level
	<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	Up to 0.8 m, very hardy, in shallow water or above water level
	<i>Juncus</i> spp	Rushes	Many local species, up to 1.0 – 1.5 m, upright tussocks
Submergent species	<i>Triglochin procerum</i>	Water ribbons	Linear floating leaves, good habitat plant, attractive, will grow in water to 0.5 m
	<i>Myriophyllum</i> spp	Pond weeds	Feathery submerged foliage, good habitat plant
Shrubs	<i>Callistemon sieberii</i>	River bottlebrush	Nectar producing, attractive shrub, could be scattered sparsely around water edge
	<i>Lythrum salicaria</i>	Loose-strife	Plant at water edge, upright small shrub, showy purple flowers

2.0 CONSTRUCTED WETLAND

It is proposed to construct a wetland with areas of open water, shallow reedbeds, and shallow marsh areas, located just to the north of the main entrance roadway.

The wetland will receive water pumped from the lake, which will then be recirculated back to the lake. It will also receive runoff from the northern part of the property, as well as runoff from neighbouring rural properties that drain through the Silver Lakes property. It is intended that the lake be kept full throughout the year.

2.1 Purpose and Function

The proposed wetland and reedbed filter system, as shown in Figure 2 will provide a number of functions and purposes: -

- Provide a significant area of wetland and marsh habitat for water birds, particularly species that require shallow water/marsh areas for feeding (waders, egrets, ibis, herons, etc); this habitat is not present in the existing lake.
- As a water quality treatment wetland, it will be able to filter water flowing through the wetland, improving water quality by filtering out suspended matter, and removing nutrients, heavy metals and other contaminants from the water.
- Act as a filter that may remove some of the tannins and reduce the discolouration of the lake water,
- By interacting with water pumped from the lake and returning this water to the lake, transfer some of the macro and micro invertebrates, etc, that the wetland will produce, to the lake, so improving the biology of the lake (in effect, the wetland becomes an integral part of the ecology of lake and wetland system),
- To create a visually attractive and interesting landscape feature which can be experienced and enjoyed by visitors, etc. A bird hide will enable bird watching to be undertaken and enjoyed with minimal disturbance to bird life.

2.2 Design

The proposed wetland as shown has a surface area of approx 3300 m² and a total static water volume of approx 1300 m³. There are three deeper, open water areas, connected by two areas of reedbed. The northern side of the wetland is fringed by a shallow area of “marsh”. An existing shallow pond/dam is incorporated into the layout.

The concept design of the wetland and a typical cross section is shown in Figure 2. (Note revisions 4.02.2021)

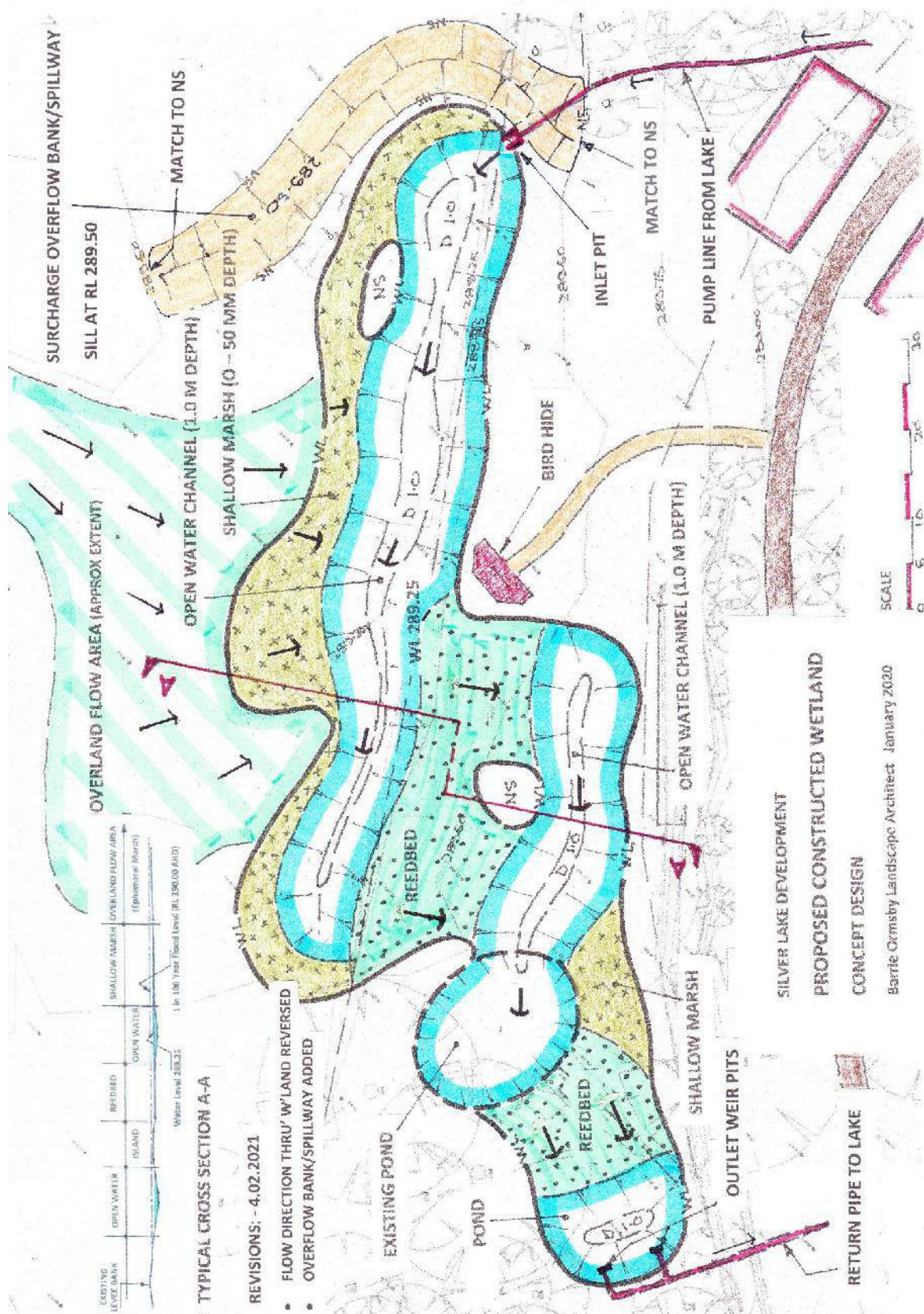


Figure 2 – Constructed Wetland Concept Design (revised 4.02.2021)

All wetland banks will have batters not steeper than 1:5. Open water areas will generally have a depth of 1.0 m, and the two designated reedbeds will be 100 mm in depth. The “marsh” areas will have depths varying from 50 mm to 00 mm at the water edge. The design static water level will be RL 189.25 AHD.

Water pumped from the lake will discharge into the eastern end of the wetland, then flow from east to west, passing through the two reedbeds, and flooding over the areas of very shallow “marsh”. The wetland outlet will consist of a notched weir pit(s), discharging into a pipe to return water to the lake (under gravity).

The deeper open water areas act as distribution and collection channels, for water flowing through the two reedbeds. (It is important for flows through the reedbeds to be as evenly distributed across the width of the reedbed as possible, to maximise the effectiveness of the reedbeds in cleaning the water). Open water areas in a wetland also allow for sunlight/UV disinfection of the water, helping to remove bacteria such as *E. coli*. and other pathogens.

The wetland will also receive runoff through the overland flow areas to the north of the wetland (refer Section 3.2 Existing Drainage Ditches and Surface Drainage). To cater for flows into the wetland resulting from large storm events in the contributing catchment that exceed the capacity of the outlet/return pipe to the lake, a flood overflow/spillway bank approximately 60 m in length will provide an outlet that will allow a flood to bypass much of the wetland. This will flow to an existing culvert under Silver Lake Road and then to the Onkaparinga River (as occurs at present).

A three day detention time for flows through the wetland is considered adequate to remove pollutants that may be present in water discharged into the wetland from both lake and surface runoff. With a static wetland volume in the order of 1300 m³, an inflow in the order of 430 m³ per day from the lake will provide a detention time of three days.

At times, particularly in winter, the wetland will receive inflow from the overland flow area, in addition to pumped inflow from the lake. A water level sensing switch in the wetland will control the solar pump at the lake, stopping pumping from the lake when the water level in the wetland reaches a pre-determined level. This will prevent excessive surcharging of the wetland and possible loss of water over the overflow/spillway.

It is intended that a modified Unipolar Water Disinfection unit (as developed by Rudy Gomez) will be set up to neutralise the high iron content of the lake and bore water. This will be located close to where the lake water will discharge into the western end of the wetland.

The wetland is located in an area which is subject to flooding from the Onkaparinga River during a 1 in 100 year ARI flood event. The water level of the wetland at RL 289.25 is generally below the existing natural surface level, and no mounding or filling will be involved, other than a low overflow bank at the eastern end of the wetland. The depth of excavation, from natural surface to the design water level, will vary from 00 mm to a maximum in the order of 400 mm at its western end. The net result will be an increase in flood storage in the Silver Lakes property over and above the water surface of the wetland of approx 470 m³, which will more than offset any minor filling or adjustment of natural surface levels elsewhere on the site.

2.3 Lake/Wetland Recirculation System

The wetland will receive water pumped from the lake, using a solar powered pump (operating during daylight hours only), which will discharge into the eastern end of the wetland. This will maintain the water level of the wetland throughout the year. Water will return to the lake from an outlet weir pit(s) at the western end of the wetland, with the return flow pipe located to the west of the existing residence.

The three suction inlets on the invert of the lake, the routes of the pump main and the outlet/return flow pipe, and the discharge point into the wetland and the outlet weir pits are shown in Figure 3 (Drawing No 1817 DA1.1) (page 15). The solar powered pump will be located as shown where shading from existing large trees is minimised.

The wetland outlet which will return water to the lake will consist of a notched weir in a weir pit (or pits), at the western end of the wetland. The notch in the weir sill will be sized to allow the wetland to drain down to its design static water level over a twenty-four hour period, but while pumping or other inflow is occurring, the notch will cause the wetland to surcharge above its design static water level, with overflow over the full width of the weir beginning once the water level has reached a predetermined surcharge level (possibly a maximum surcharge in the order of 75 to 100 mm). (The detail sizing of the outlet weir and notch and size/capacity of the return pipe from wetland to lake will be carried out as part of the final design of the wetland system).

A regular, daily surcharge of the wetland will provide several benefits: -

- By creating a temporary increase in wetland volume, the effective rate of flow through the wetland and reedbeds is reduced, and as the depth increases, the duration and amount of contact between water and the surfaces of the vegetation increases, which enhances the pollutant removal processes of the wetland.
- The temporary increase in water level will inundate a small part of the adjacent low-lying overland flow areas, providing enhanced feeding habitat for wading birds.

At times, particularly in winter, the wetland will receive inflow from the north from the overland flow area, in addition to water pumped from the lake. A water level sensing switch in the wetland will control the pump at the lake (possibly including a rainfall sensor), stopping pumping when the water level reaches a pre-determined level. This will prevent or reduce excessive surcharging of the wetland, which could result in discharge over the spillway and water being lost to the system.

2.4 Wetland Habitat

The wetland as shown will provide three different habitats, particularly for waterbirds, but also for a range of other fauna, native fish, frogs and aquatic invertebrates: -

- Deeper open water pools and channels, generally up to 1.0 m depth. The open water areas and channels provide for the needs of waterbirds that prefer and use that habitat. Native fish will also use open water areas, as well as the shallow reedbeds.
- Shallow reedbeds, generally 100 to 150 mm depth, planted densely with selected wetland plant species that will maximise contact between the water flow and the surface of the plant stems and leaves (much of the action in the removal of pollutants

takes place at this interface between plant surfaces and water). Many species of waterbirds will use these shallow reedbeds, for grazing and feeding, for refuge and nesting.

- Very shallow marsh areas around the edges of the wetland, generally not more than 50 mm depth. These areas are specifically intended to provide shallow feeding areas for wading waterbirds.

It would be desirable to introduce selected native fish species, as present in the nearby Onkaparinga River, into the wetland. The wetland and its “marsh” areas will merge into the very similar habitats of the adjacent overland flow areas, which will abut the northern edge of the wetland, and will be planted with very similar wetland plants.

2.5 Wetland Planting

The wetland will be planted with a range of wetland plant species suited to a small wetland. Species that produce amounts of seasonal dry material (eg, *Phragmites*) will not be used in the planting. There will be minimal maintenance of the vegetation required once established, but it will be necessary to remove seedlings of *Typha* as they appear (every three months).

TABLE B – Wetland Planting Species

				WETLAND		
				WATER EDGE	REED- BEDS	MARSH
SPECIES	COMMON NAME	GROWTH/ HABIT	HEIGHT (M)			
Taller Sedges, Rushes, etc						
<i>Baumea juncea</i>	Bare twig-rush	spreading	0.5	+	+	+
<i>Carex appressa</i>	Tall sedge	clumping	1.0	+		+
<i>Carex bichenoviana</i>	Sedge	spreading	0.5	+		
<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	clumping	To 0.6	+		
<i>Cyperus vaginatus</i>	Flat-sedge	clumping	0.3 to 1.0	+		+
<i>Eleocharis acuta</i>	Common spike-rush	spreading	To 0.6	+	+	+
<i>Juncus species (local)</i>	Rushes	clumping	1.0 to 1.5	+		
<i>Microlaena stipoides</i>	Weeping rice-grass		To 0.5	+		
<i>Schoenoplectus pungens</i>	American club-rush	spreading	0.3 – 0.5	+	+	+
Low Plants, Groundcovers						
<i>Centella cordifolia</i>	Centella	spreading	Prostrate	+		+
<i>Crassula helmsii</i>	Swamp crassula	spreading	Prostrate	+		+
<i>Dichondra repens</i>	Tom thumb	spreading	Prostrate			
<i>Hydrocotyle verticillata</i>	Pennywort	spreading	Prostrate	+	+	+
<i>Lilaeopsis polyantha</i>		spreading	Prostrate	+		+
<i>Marsilea drummondii</i>	Nardoo	spreading		+	+	+
<i>Myoporum parvifolium</i>	Creeping boobialla	spreading	Prostrate			
<i>Ranunculus inundatus</i>	River buttercup	spreading	Prostrate	+	+	+
<i>Samolus repens</i>	Creeping brookweed	spreading	Prostrate			
Submergent Species						
<i>Myriophyllum species</i>	Watermilfoil	submerged			+	+
<i>Triglochin procerum</i>	Water ribbons	submerged		+	+	+

3.0 DEVELOPMENT OF NORTHERN AREA

This section describes the proposed development of that part of the Silver Lakes property, north of the area that contains the existing house and proposed facilities, and is essentially the area that is currently grazed by livestock. The existing site is shown in Figure 1 Existing Site/Survey Plan (Drawing No 1817 DA0.1)

The proposed landscape development of this area is shown in the attached Figure 3 (Drawing No 1817 DA1.1).

3.1 Site Description

Except for an eighty metre wide strip parallel to Silver Lake Road and adjacent to the eastern boundary, this area is at present grazed by several cattle and four llamas. Consequently, the grazed area contains very little native vegetation, and what native plants and shrubs are present in the site are impacted by grazing, trampling and pugging of the soil in wet weather.

The fenced area (not grazed) adjacent to the eastern boundary contains some native vegetation, including mature and regenerating river red gums and blackwood (*Acacia melanoxylon*), and an understory consisting of patches of shrubby tea tree (*Leptospermum continentale*), and some rushes and sedges, as well as grasses and some weeds.

There is a small copse of planted pines near the north boundary, and a small number of various exotic trees, including willow, in the south-east corner. The south-western corner (west of the proposed wetland) contains scattered river red gums, with a grassy understory.

Two drainage ditches, running from west to east, across the property, one close to the northern fence line, and the other across the middle of the area, carry runoff from adjoining properties to the north and west, which appear to be mainly used for grazing cattle. A further shallow ditch provides some surface drainage along the eastern boundary fence line.

There is a small area of very shallow, ephemeral “swamp” in a localised depression, as shown, on the north side of a low mound or ridge; this ridge or high ground extends from near the west boundary to about two-thirds of the way across the property. This swamp contains a single species of a rush (*Juncus* species), which is being severely grazed by the livestock.

A permanent wetland, with open water and shallow reedbeds, is proposed to be constructed in the location as shown in Figure 2 (refer Section 2.0 Constructed Wetland).

A large portion of this northern area is subject to shallow flooding in the event of a 100 year ARI flood in the nearby Onkaparinga River; the approximate extent of flooding is indicated by a line following the RL 290.00 AHD contour, as shown in Figure 3 (Drawing No 1817 DA1.1).

It is intended that the livestock will be removed from the property in the future, and grass, etc, will be managed by mowing.

3.2 Existing Drainage Ditches and Surface Drainage

Two drainage ditches cross the property from west to east, one along the northern fence line, and the other through the middle of the property. Both carry natural surface runoff from the adjoining properties, which appear to be mainly used for cattle grazing.

Once livestock is removed from Silver Lakes, the shape and form of the existing ditches will make them very difficult to maintain or mow. It is proposed that all new drainage ditches or swales and any remaining existing ones will be regraded to wide shallow swales that can be readily maintained by mowing.

It is intended that the two main drainage ditches will be diverted as shown in Figure 3, and graded out to flow out on the existing natural surface, on the north side of the low ridge. The diverted inflow from the drains will spread over a wide area as dictated by existing contours as a slow-moving, very shallow flow. This will initially flow into an existing shallow 'swamp' area as shown, which will then overflow to the east around the end of the low mound and then to the south, finally discharging into the proposed wetland as a widespread shallow flow. A low wide bank, not more than 100 to 250 mm high, to be formed at the east end of the wetland as shown, will ensure all this surface flow will discharge into the wetland.

With water flowing through it for a considerable part of the year, these wide shallow overland flow areas, as shown in Figure 3, will become an ephemeral marsh (winter wet, summer dry), which when planted with suitable marsh and wetland vegetation, will create a significant area of marsh habitat for waterbirds and wildlife. This low perennial vegetation will remain green for much of the year, and many of the species, even in summer, will remain green, thus creating an extensive firebreak that will retard the spread of a fire.

The extent of this marsh habitat will depend on the rate of flow and volume of water flowing through this area, and dictated by the existing natural surface contours. The actual area of this habitat will change over time, as different plant species spread or reduce in extent, and as seasonal conditions (wet or dry) vary over time. Many plant species will survive extended dry seasons.

Subject to the availability of a water supply (eg, from a bore), it would be possible to occasionally discharge some water into the top of the overland flow area, to maintain the vegetation in a greener state during summer, than if it has to rely on natural rainfall and runoff. However, this has not been considered in any detail at this stage, and would be subject to the availability of water.

3.2.1 Planting of Overland Flow Areas

A list of species suitable for planting in this "marsh" area is shown in Table C. Most species are perennial, and many will spread naturally into any area that is suited to their survival and growth. The actual extent of the area to be planted will depend on the extent and width of the overland flow, as controlled by existing contours and levels, as flow occurs during winter.

The clumping species should be planted in a sparsely spaced, random natural manner. Spreading species can be planted in a more regular pattern, and over time will create a dense ground cover.

TABLE C – Species for Planting Overland Flow Areas

SPECIES	COMMON NAME	GROWTH/HABIT	HEIGHT (M)
Taller Sedges, Rushes, etc			
<i>Baumea juncea</i>	Bare twig-rush	spreading	0.5
<i>Carex appressa</i>	Tall sedge	clumping	1.0
<i>Carex bichenoviana</i>	Sedge	spreading	0.5
<i>Cyperus gymnocaulis</i>	Spiny flat-sedge	clumping	To 0.6
<i>Cyperus vaginatus</i>	Flat-sedge	clumping	0.3 to 1.0
<i>Eleocharis acuta</i>	Common spike-rush	spreading	To 0.6
<i>Juncus species (local)</i>	Rushes	clumping	1.0 to 1.5
<i>Microlaena stipoides</i>	Weeping rice-grass		To 0.5
<i>Schoenoplectus pungens</i>	American club-rush	spreading	0.3 – 0.5
Low Plants, Groundcovers			
<i>Centella cordifolia</i>	Centella	spreading	Prostrate
<i>Crassula helmsii</i>	Swamp crassula	spreading	Prostrate
<i>Dichondra repens</i>	Tom thumb	spreading	Prostrate
<i>Hydrocotyle verticillata</i>	Pennywort	spreading	Prostrate
<i>Lilaeopsis polyantha</i>		spreading	Prostrate
<i>Marsilea drummondii</i>	Nardoo	spreading	20 – 30 cm
<i>Myoporum parvifolium</i>	Creeping boobialla	spreading	Prostrate
<i>Ranunculus inundatus</i>	River buttercup	spreading	Prostrate
<i>Samolus repens</i>	Creeping brookweed	spreading	Prostrate

3.3 Overland Flow and Water Quality

Runoff from the adjoining properties (which are used mainly for livestock grazing) may carry pollutants such as sediment and nutrients (from fertilisers and manure from cattle).

Areas of dense grasses and sedges, etc, such as will be established in these overland flow areas, are very effective at trapping and retaining any sediments and some pollutants that may be present in the runoff.

All overland flow will discharge into the wetland, which will provide further water quality improvement, if necessary. The overflow from the wetland will then flow into the Silver Lake, and the lake will overflow to the Onkaparinga River. The wetland will remain full throughout the year by pumping and recirculating water from Silver Lake, so all inflow from overland flow will not be used to maintain the wetland, but will simply be diverted through the wetland and lake and to the river, as it does now, with possibly some improvement in water quality.

If there are substantial flows into the wetland from the overland flows, which may exceed the capacity of the wetland return drain to the lake, then the wetland can overflow via an overflow/spillway bank at the east end of the wetland (refer Figure 2), making its way to the existing culvert under Silver Lake Road and thence into the river.

3.4 Weeds, Removal of Pines

There are some small scattered patches of pest plants present in this northern area (broom, gorse, etc), mainly along fence lines, and which have been subject to previous control/eradication work. Regular treatment to control and desirably eradicate all pest plants will continue to be carried out as part of regular maintenance.

A small area of pines in the north-east corner of the area will be removed.

3.5 Waste Water (Irrigation) Disposal Area

An area is required for the disposal of treated domestic waste water from the two residential buildings; the area required has been sized at a minimum of 1,000 m² (refer to Appendix C). A suitable area, located above the 100 year ARI flood level, in the north-west corner of the property, is shown in Figure 3.

Waste water will be applied to the disposal area by a sprinkler system. Assuming some continuity of use of the effluent treatment system, there should be some regular application of waste water to the site, which will sustain planted vegetation during dry summer periods.

The irrigated area will be isolated from runoff from the surrounding areas by a low bund around the perimeter of the planted area, and a gravel-filled cut-off trench on the high side of the irrigated area. The bund on the low side of the irrigated area will contain any possible runoff from the irrigated area.

3.5.1 Planting of Waste Water Irrigation Area

The irrigated area will be planted with native plant species, selected from the species listed in Table D. The species listed are all native to the Greater Adelaide Region, and most are able to tolerate normal dry summer conditions. The proposed plant species list has been derived from *“Water Sensitive SA – A guide to raingarden plant species and placement.”*

Many of the species listed will be common to the proposed planting of the overland flow areas (refer Section 3.2.1 Planting of Overland Flow Areas).

Some of the species can spread by rhizome growth, so will be able to spread and provide a dense sward, competing with weeds. Others will set seed, and so are able to self-seed when conditions are suitable.

Table D - Species for Planting Waste Water Irrigation Area

SPECIES	COMMON NAME	HEIGHT	SPREADING	NITROGEN REMOVAL
<i>Baumea juncea</i>	Bare twig-rush	200 – 1000	Yes	Yes
<i>Carex appressa</i>	Tall sedge	1000		Yes
<i>Carex bichenoviana</i>	Sedge	400	Yes	Yes
<i>Carex inversa</i>	Knob sedge	200	Yes	
<i>Carex tereticaulis</i>	Rush sedge	600 - 1200		Yes
<i>Centella asiatica</i>	Centella	100	Yes	
<i>Chorizandra enodis</i>	Black bristle rush	550		
<i>Crassula helmsii</i>	Swamp crassula	50	Yes	
<i>Cyperus gymnocaulis</i>	Spiny sedge	700		Yes
<i>Dichondra repens</i>	Kidney weed	100	Yes	
<i>Eleocharis acuta</i>	Common spike rush	250 – 400	Yes	
<i>Ficinia nodosa</i>	Knobby club-rush			Yes
<i>Hydrocotyle verticillata</i>	Shield pennywort	30 - 100	Yes	
<i>Juncus amabilis</i>	Gentle rush	600 - 1200		Yes
<i>Juncus flavidus</i>	Rush	350 - 1500		Yes
<i>Juncus subsecundus</i>	Finger rush	300 - 1000		Yes
<i>Marsilea drummondii</i>	Common nardoo	100 - 300	Yes	
<i>Microlaena stipoides</i>	Meadow rice-grass	500	Yes	

Note: Species listed as “Yes” under “NITROGEN REMOVAL” heading are particularly effective at nutrient removal (nitrogen and phosphorus), and are recommended to be planted at a minimum of 50% of the total planting.

3.5.2 Function of Waste Water Area Planting

The proposed planting will provide a number of functions including supporting the removal of nitrogen and phosphorus via the proliferation of biofilms on plant roots and stems, promoting evapotranspiration and maintaining soil conductivity.

Increased nutrient-removal capacity is made possible when there is a diversity within the microbial community. As different plants support different species of bacteria, a diverse selection of plant species is recommended, with a range of plants effective at nitrogen removal (as listed Table D) to make up at least 50% of the total planting.

3.5.3 Maintenance of Waste Water Area Planting

The plants listed are all perennial, growing through all seasons provided some soil moisture is available. As much of the nutrient-removal capacity is dependent on the microbial community on root systems, deliberate harvesting and removal of leaf and stem material is not essential for the continued effectiveness of the system. However, occasional mowing will be desirable to stimulate growth, and to remove any build-up of dry material, which could be a fire hazard in summer.

Any weeds should be regularly removed by any suitable method, whether by spot spraying, hand pull, etc. Any bulrush (*Typha* species) germinating in the irrigated area should be hand pulled or spot sprayed by an approved herbicide.

3.6 Productive Orchard Plantings

It is intended to develop some plantings of avocado and persimmon, for on-site use by visitors and the family.

The extent and location of any plantings has not been finalised at this stage, but two areas that may be suitable are shown in Figure 3. Both areas are located on relatively high ground; the western area is above the 100 year ARI flood level, the other is slightly below that level, but on relatively higher ground.

3.7 Landscape Maintenance

Appropriate and considered maintenance of this redeveloped northern area will be required to sustain and enhance its aesthetic appeal, to develop and maintain habitats, and to reduce fuel loads and bushfire hazard. Greater detail of the proposed maintenance of specific areas and landscape elements is provided in Section 5.0 - Silver Lakes Landscape Management and Maintenance.

Generally, in order to maintain low fuel levels and to remove dry material before the start of summer to minimise fire risk, the landscape generally will be maintained by regular mowing, using suitably sized machinery.

The area that is at present grazed by livestock, after removal of animals, will generally be mown to maintain a low grassy woodland and grassland. It is not proposed to carry out any planting of woody vegetation (except for the screen planting as shown), so that the existing very low woody fuel levels that are present over much of this area is maintained.

The overland flow “swamp” areas, as discussed previously, will generally not require regular mowing, but may need occasional mowing of selected areas to remove any build-up of dry material.

The eastern area (along the frontage to Silver Lake Road) that is not grazed at present, contains a number of established trees (mainly river red gum and blackwood, with a few stringybark), with scattered patches of tea tree (*Leptospermum* species), some rushes and sedges (*Juncus* species), and grasses (refer Figure 3).

To reduce and minimise fire fuel load in this area, while maintaining existing native species and habitat, it is proposed that mowing be regularly carried to create a mosaic pattern of mown and un-mown areas, retaining areas with substantial stands of the sedges, rushes and tea tree, while minimising annual grasses, etc, that contribute to the fuel load. Small and seedling red gums that are present are to be removed and regrowth controlled, to minimise any increase in woody fuel load. Existing weeds along the fence line are to be removed.

This approach to maintenance of this area will minimize the fuel load, while retaining native species, habitat and biodiversity, and at the same time creating a visually attractive, varied and interesting landscape when viewed from the roadway.

3.8 Environmental Benefits - Summary

A number of environmental benefits will result from the proposed development and maintenance regime for this northern part of the Silver Lakes property, summarised as follows: -

- Water quality – all runoff from this area of the property and that flowing into the property from adjoining rural areas to the north and west of Silver Lakes will pass through large areas of grass and sedge vegetation, as a slow shallow overland flow, so that sediment and possible nutrient loads in the runoff will be significantly reduced. This runoff will then flow into and through the proposed wetland, undergoing further treatment, before flowing into the Silver Lake and ultimately into the nearby Onkaparinga River.
- Removal of livestock from the property will eliminate the present nutrient load from animal manure, and the production of sediment through soil disturbance, which would have an impact on water quality of runoff from the property.
- There are a small number of remnant native plants that can be found on the site, that are at present severely impacted by grazing and trampling. Removal of livestock and the implementation of a selective mowing regime as proposed, will allow these plants to survive and spread, increasing biodiversity and habitat values of the site.

-
- The diversion of drainage ditches to discharge onto the natural surface, in place of confining runoff to faster flowing ditches, will create significant areas of native “swamp” vegetation and habitat, with considerable benefit to water quality and the creation of habitat for wild life. These areas will provide an opportunity to plant and establish a range of local swamp and wetland species that are at present not found on the site, to supplement the few remnant species that can be found on the site.
 - The proposed selective mowing of the area, while minimising fire fuel loads, will allow low flammability native vegetation, such as perennial sedges and groundcovers, to survive, establish and spread.

Visually and habitat-wise, this area will become an attractive and interesting landscape of open woodland with mown understory, significant open areas of rush, sedge and wetland landscape, and some orchard plantings.

4.0 MINOR LANDSCAPE ELEMENTS

Several other works will be undertaken in the development of the property, as follows: -

4.1 Lake Walking Trail

A walking trail will be constructed around the perimeter of the lake for the use of visitors to the B & B residence, and to other visitors and residents. This will allow waterfowl on the lake to be observed, and the lake and woodland landscape to be viewed and enjoyed.

The location of the trail will be as shown in Figure 3.

4.2 Property Perimeter Access Track

A track suitable for use by small vehicles and mowing machinery will be constructed around the perimeter of the property, as shown in Figure 3, to provide access mainly for maintenance activities.

It will also provide a longer distance walking trail, linking with the lake trail.

It will be maintained by regular close mowing, to minimise grass cover, or kept clear of grass – in this way, it will also provide a fire break around the property that could be useful to help control low intensity grass fires from spreading into the property.

4.3 Screen Planting

Some limited screen planting will be undertaken, as shown in Figure 3, to provide a visual screen of the proposed new residence, sheds, etc, from passing traffic on Silver Lake Road.

The plants to be used for this planting will be selected from a list of low flammability small trees, shrubs and understory species, as listed in Table E below (taken from South Australian State Flora lists). The screen planting will assist to inhibit the spread of fire in the property, should a fire front coming from the east occur.

It would be desirable to provide some form of permanent irrigation to any screen planting, if water is available, particularly close to buildings, so that the plantings can be kept well-watered during summer to maintain plants in a healthy green condition, which will help to reduce flammability.

Table E – Screen Planting Species List - Fire Resistant Native Plants –

<i>Acacia melanoxylon</i>	<i>Hymenosporum flavum</i>
<i>Acacia sophorae</i>	<i>Lophostemon confertus</i>
<i>Atriplex nummularia</i>	<i>Myoporum insularae</i>
<i>Correa spp</i>	<i>Myoporum montanum</i>
<i>Dianella revoluta</i>	<i>Myoporum viscosum</i>
<i>Dianella tasmanica</i>	<i>Prostanthea ovalifolia</i>
<i>Enchylaena tomentosa</i>	<i>Rhagodia candolleana</i>
	<i>Rhagodia spinescens</i>

5.0 SILVER LAKES LANDSCAPE MANAGEMENT AND MAINTENANCE

This section describes the management and maintenance regimes that are proposed to be implemented for the Silver Lake property. The maintenance undertaken for different areas/zones relates to the purpose or function of each area, the long term land management objectives, habitat values, and amenity. Each different zone is numbered 1 to 8 and shown in Figure 4 (Drawing No 1817 DA6.1).

5.1 Management/Maintenance Objectives

The management of the landscape of the Silver Lakes property will have the following main objectives: -

- To create, establish and maintain a visually attractive and interesting landscape which can be experienced and enjoyed.
- To establish a low maintenance landscape where habitat and species diversity is maintained and maximised.
- To develop a functioning landscape.
- To reduce fire risk by minimising the overall fire fuel load and the ability of fire to carry and spread through the landscape.
- To establish a landscape containing native and introduced species which are designed to assist with the protection of buildings and infrastructure in the event of a bushfire.

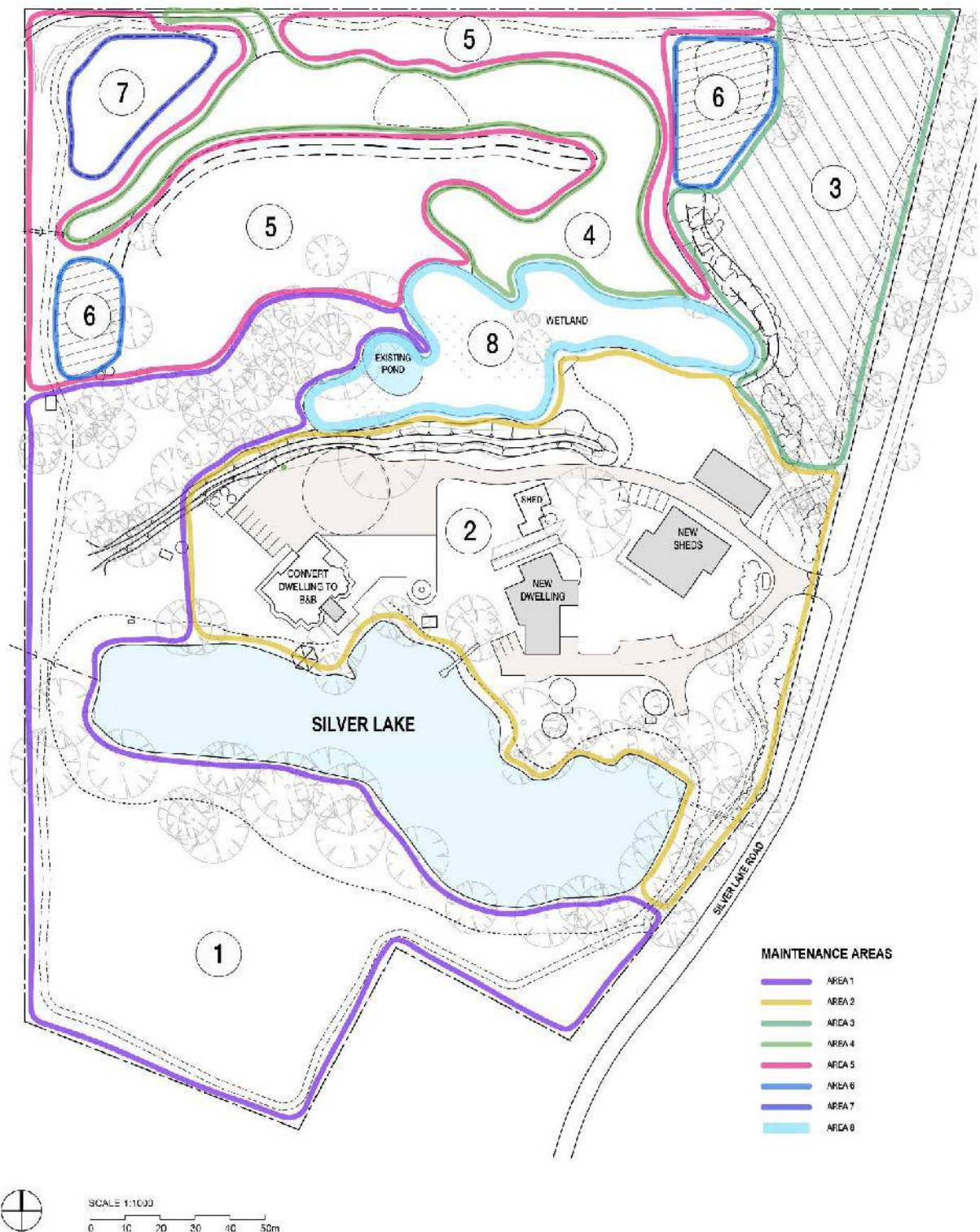
5.2 Existing Landscape

As a general overview, the Silver Lake property is a mix of naturally regenerating local native species dominated by *Eucalyptus camaldulensis* (River Red Gum), found around and south of the lake, and to the west and to the north of the existing house, with small areas of mainly *Eucalyptus obliqua* (stringy bark) and *Acacia melanoxylon* (blackwood) to the east.

Exotic trees and shrubs are located at the entry of the property along the driveway and around the house and existing infrastructure.

A mix of introduced grasses such as Yorkshire Fog grass and Phalaris with woody weeds, blackberry and gorse form the groundcover of much of the more natural areas.

The native trees have significant habitat value and are very important to the natural landscape and aesthetic values of the site, however this woody vegetation may increase the heat intensity of a bushfire if combined with dry exotic grasses and poor maintenance.



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SILVER LAKE
SITE REGENERATION & DEVELOPMENT

by RUIYI GOMEZ

SILVER LAKE RD MYLOR SA Scale: 1:1000 (A3) Proj./Draw No: 1817 DA6.1

PROPOSED LANDSCAPING
MAINTENANCE AREAS

Proj./Area: SITE

25.02.2020 Rev:

6.1

Figure 4 Proposed Landscape Maintenance Areas (refer also to Architectural Drawing Set)

It will be important that fuel loads are not allowed to increase by deliberate plantings of highly flammable native species, however desirable this may be from a habitat perspective. A reduction in highly flammable exotic ground cover (grasses particularly) by establishing less flammable native vegetation, such as *Microlaena stipoides* (Weeping rice-grass) and *Bothriochloa macra* (Red-leg grass), is also a very highly desirable long term objective.

The proposed mowing/slashing regime and fuel reduction actions, such as pruning of low branches and control of excessive natural regeneration of *Eucalyptus camaldulensis*, along with other landscape management actions, are aimed at assisting with bushfire management, should a fire occur, and reducing the potential impacts on human life and the built environment from the spread of a bushfire.

5.3 Managing and Replanting the Landscape

Splitting the property into manageable zones will enable the owner to develop and schedule a maintenance program.

The landscape design and the selection of suitable plant species to be used in developing the property will assist to achieve the maintenance objectives. Key considerations in the selection of species for planting of the landscape are;

1. Low flammable species within a minimum of 20m around the built environment.
2. Replacement of highly flammable introduced grasses with native grasses.
3. Careful selection of suitable wetland species for planting of the lake, wetland, overland flow and waste water irrigation areas.
4. Strategic layout, design and maintenance of existing species within the landscape.

Definitions relating to maintenance and planting, as follows: -

1. Mowing - Typically mowing refers to the use of a hand push mower or small ride on mower. This equipment can cut low to the ground and turn materials into fine particles, reducing flammability.
2. Slashing - Typically slashing refers to the use of a PTO from a tractor to provide the energy to drive the slasher. This equipment leaves a coarser residue than a mower and is usually used for larger areas.
3. Brush cutter - Is a hand held device which uses a blade or plastic line to cut the desired material. Usually used on grasses, however can be used on small plants and woody weeds.
4. Fire retardant species - refer to fire management report.
5. Wetland species - refer to various wetland species lists.

5.4 Maintenance Zones/Areas

The proposed maintenance regimes and methods for specific areas of the property as numbered and shown in the attached drawing Figure 4, are detailed as follows: -

Zone 1 – River Red Gum Woodland.

Generally areas with existing established and mature river red gum woodland, with little native understory, however the existing ground cover is mostly introduced grasses and may be infested with blackberry or gorse woody weeds.

Located to the south of the lake, along part of the west boundary and immediately north of the existing residence.

Control Activities

- To be maintained by regular slashing and mowing.
- Reduce the natural regeneration of *Eucalyptus camaldulensis*.
- Regular removal of fallen branches from the areas after drop.
- Prune up lower limbs to increased foliage height above ground level.
- During winter, grass can be allowed to grow to an appropriate height, however in spring and before the grassy cover dries off, close mowing is to be carried out, so that all grass and leaf, bark and twig litter is finely mulched to minimise its combustibility.

Zone 2 – Building Surrounds (Asset Protection Zone)

The landscape of this area will be more “manicured”, in keeping with residential building surrounds and the presentation of the visitor facilities. Existing large Eucalyptus trees to remain and be protected.

Located around the built infrastructure with a minimum of a 20m separation distance from the infrastructure to other zones.

Control Activities

- The buildings to be surrounded by irrigated introduced lawn grass.
- Removal of wood mulches and replace with gravel where required.
- Exotic, less flammable trees to be used in landscape design.
- Minimal ground covers planted.
- Use of fire retardant species in landscape design.
- Remaining regulated or significant trees to have a bushfire sprinkler installed on trunks.
- Regularly mown to provide a tidy landscape.
- Regular mowing will extend out to the property boundary fence along Silver Lake Road, and along the verge between fence and road pavement of Silver Lake Road.
- Existing deciduous trees to be planted no closer than 20m from structures.
- Canopy of existing Eucalyptus trees to be lightly pruned.

Zone 3 – North-Eastern Sedge and Tea-tree Area

As well as scattered river red gums (*Eucalyptus camaldulensis*), and some blackwood (*Acacia melanoxylon*), there are patches of low shrubby tea tree (*Leptospermum continentale*) and various sedges scattered through this area. An area of relatively high conservation value, it also contains introduced grasses and other exotic weed species as part of the mix.

Located along the eastern road boundary, running from the entrance road to the northern boundary, approx 80 m wide.

Control Activities

- Mowing/slashing to create an informal mosaic of regularly mown grass with clumps of the existing tea tree and sedges retained, designed to preserve the habitat values associated with the native species found here.
- Use bush care strategies to control Watsonia, Blackberry and Gorse.
- Remove fallen branches to further reduce fuel loads, prune lower branches of larger trees.
- Reduce introduced grasses via appropriate bush care control measures and replace with perennial native grasses such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass).

Zone 4 – Overland Flow Areas

This area will receive runoff from adjoining properties, with two existing ditches/drains diverted as shown in Figure 3. This water flow will keep the area wet/moist for most of the year (depending on rainfall), which will aid in the creation of habitat and improve water quality.

A significant area of ephemeral marsh/wetland habitat will be created, suitable for a number of wetland bird species, frogs, etc, merging with and complementing the habitat created by the permanent wetland.

Located to the north of the built environment and the constructed wetland, roughly in the middle of the northern part of the property.

The extent of this marsh habitat will depend on the duration, the rate of flow and volume and of water over and through this area, and natural surface contours, and will be surrounded by dryland areas with annual grasses. The exact area of this habitat will change over time, as different plant species spread or reduce in extent, and as seasonal conditions (wet or dry) vary.

Control Activities

- Plant this area with a wide range of suitable wetland and marsh plants that will generally remain green for most if not all the year (species will be selected that do not produce much dry material).
- Remove introduced grasses yearly (spring), to improve habitat quality and reduce flammability of mixed species.
- Control introduced woody weeds such as blackberry, gorse and Spanish broom.
- Selective mowing should only be required for patches where there is a build-up of dry material.
- Replace areas of introduced grasses or areas of soil disturbance with native perennial grasses such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass).

Zone 5 – Dryland Annual Grass Areas

This area consists of all open areas that are at present grazed by livestock, and is dominated by introduced pasture grasses and is generally without tree cover.

Located to the north of the built environment, the area surrounds the overland water flow area, wetland, red gum woodland and orchards.

Control Activities

- Slashing in spring once the ground begins to dry and again in early summer, to reduce/minimise fuel loads.
- Maintain low grass growth throughout the summer and autumn, which will likely require slashing once a month (on days of reduced fire risk).
- Over time replace areas of introduced grasses with *Microlaena stipoides* (Weeping rice-grass) and *Bothriochloa macra* (Red-leg grass), with an aim to reducing reliance on slashing.

Zone 6 - Orchard Areas.

The orchards will produce high quality produce therefore they will be regularly maintained and kept well-watered. The actual locations and extent of the proposed orchard plantings have not been finalised at this stage.

Two possible suitable areas have been shown in the landscape plan in the north-eastern corner and near the western boundary of the property.

Controls Activities

- Irrigated tree crops - drippers and micro sprays.
- Close mowing of groundcover between rows or regular cultivation.
- Limestone based access path around the edge of the planting.

Zone 7 – Waste Water Irrigation Area

This area will be planted with perennial vegetation that will be regularly irrigated via sprinklers with waste water. The plants will be instrumental in removing nitrogen and phosphorus from the waste water and the soil, particularly through bacterial biofilm on plant roots, and will utilise the waste water through evapotranspiration. Occasional mowing will stimulate growth, supporting and enhancing nutrient removal.

Many of the species planted will spread by rhizome growth, so will be able to spread and provide a dense sward, competing with weeds. Others will set seed, and so are able to self-seed when conditions are suitable. Similar to the overland flow areas, only occasional mowing will be necessary to remove any build-up of dry material and to stimulate growth.

Control Activities

- Planting with the desired/correct species from the start, and replanting as necessary to maintain the desired mix of species.
- Use bush care methods to control any introduced grasses or weeds from the area.
- Occasional mowing to stimulate growth, and to remove any build-up of dry material.

Zone 8 - Wetland

The wetland has been designed to assist with water cleansing of the Silver Lake. It will be planted with a range of smaller wetland plant species that produce low amounts of seasonal dry material. Larger species like common reed (*Phragmites australis*) will not be used in the planting, and any regeneration of Bulrush (*Typha* spp) will be controlled.

Control Activities

- Planting with the correct species from the start.
- Design the wetland to enable easy maintenance.
- Use bush care methods to control any introduced grasses or weeds from the site.
- No large wetland species such as common reed (*Phragmites australis*) used in the planting program.
- Yearly inspection and removal of Blackberries or other woody plants.
- Regular inspection and removal of Bulrush (*Typha* species).
- Brush cutting and mowing around the perimeter of the wetland.

Zone - Silver Lake

The lake edge is dominated by Bulrush (*Typha* species), which is excellent habitat for waterbirds but is unsightly in winter and is also difficult to control and can dominate in this environment, excluding other desirable wetland species.

Red Gum (*Eucalyptus camaldulensis*) may naturally regenerate on the banks.

Increasing the diversity of the wetland species in the lake will further enhance its habitat and water filtration values.

Control Activities

- Removal of livestock from the edge of the lake.
- Brush cutting of Bulrush (*Typha* species) from the northern edge of the lake during growth over summer (refer Section 1.5).
- Strategic planting of other wetland species in suitable areas (as described elsewhere).
- Control/limit the natural regeneration of Red Gum (*Eucalyptus camaldulensis*) seedlings.
- Control blackberries and other introduced species using bush care processes.

Zone - Paths and Mineral Breaks

Access paths and mineral breaks within the landscape will provide a walking trail, ease of small equipment access, enable delineation of areas where required and assist to reduce the potential spread of grass fires.

Control Activities

- Use limestone based quarry rubble, minimum width of 2m.
- Eradicate any grass or weed growth on paths, access tracks and mineral breaks.
- Designed to enable mowing along the edge of the path, tracks, etc.

Zone - Weeds and Pest Plants

There are a number of existing proclaimed woody weed species present on the site including blackberry, gorse, Spanish broom and *Watsonia*, all requiring ongoing controls. Their complete eradication may not be possible.

There are also introduced grasses requiring ongoing controls to reduce fuel loads.

Control Activities

- Initial use of approved chemicals to control existing woody weeds.
- Yearly reviews to identify and mark regrowth of woody weeds.
- Use of bush care processes to continue yearly controls of woody weeds.
- Maintain brush cutting, mowing or slashing of the different zones, as discussed above.
- Implement a native grass replacement program when reseeding any disturbed sites.
- Implement a native grass replacement program with perennial species such as *Microlaena stipoides* (Weeping rice grass) and *Bothriochloa macra* (Red-leg grass), to reduce aggressive exotic grasses such as *Phalaris*, *Fog grass* and *Ryegrass*.